LHS Broadcasting and Video Production Course of Study

(Information Technology/Interactive Media)

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Career-tech.education.ohio.gov
Information Technology
Career Field Technical Content Standards

Lancaster High School
Stanbery Campus
Broadcasting Studio

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# Table of Contents

Acknowledgments
Vision/Mission Statement
Educational Philosophy
Goals and Objectives
Philosophy of Broadcasting and Video Production
Career Field Pathways and Course Structure
Career Field Technical Content Standards
Unit 1: Information Technology Basics
Unit 2: Operating Systems
Unit 3: Software Systems Management
Unit 4: Computer User Support
Unit 5: Programming Theory
Unit 6: Applied Programming Languages
Unit 7: Software Development Overview
Unit 8: Application Development Life Cycle
Unit 9: Web Site Development & Management
Unit 10: Web Site Development & Management – HTML
Unit 11: Web Site Development: Content Dev. & Tech. Analysis
Unit 12: Web Site Dev. & Design Web Applications & Sites
Unit 13: Implement & Maintain Applications
Unit 14: Multimedia Dev.: Performance Testing & Quality Assurance
Unit 15: Basic Mainframe Concepts
Unit 16: Hardware Design, Operation & Maintenance
Unit 17: Fundamentals of Electronics Technology
Unit 18: Networking
Unit 19: Network Architectures
Unit 20: Network Operating Systems
Unit 21: Wide-Area Networks
Unit 22: Network Management
Unit 23: Security Fundamentals
Unit 24: Secure Network Management
Unit 25: Wireless
Unit 26: Telecommunications
Unit 27: Information Systems (IS) Theory
Unit 28: Information Systems
Unit 29: Information System Analysis & Design
Unit 30: System Installation and Maintenance
Unit 31: System Administration & Control
Unit 32: Database Management System Basics
Unit 33: Application Database Administration
Unit 34: Database Administration
Unit 35: Data Warehousing
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Interactive media state competencies
Career-tech.education.ohio.gov
Lancaster City Schools

The Vision

Lancaster City Schools will prepare, inspire, and empower all students to be life-long learners and socially responsible citizens who are able to communicate and meet the challenges of an ever-changing global society.

The Mission

Lancaster City Schools, the Place to Be for Learning, Caring, Succeeding
Lancaster City Schools
Educational Philosophy

The School Board believes in the dignity and uniqueness of each student and recognizing their inherent differences, endeavors to provide a broad curriculum enabling students to reach their maximum potential.

Success in education necessitates a curriculum that considers multiple learning styles and which encompasses a variety of teaching methods.

Mental and emotional development begins at birth and continues throughout life. Each of our schools must strive to create an atmosphere which fosters healthy and productive attitudes toward education and which encourages a life-long interest in learning.

The Lancaster City Schools are committed to:

1. teaching 21st century skills pertaining to reading, writing, mathematics, historical perspective, scientific inquiry, technology, arts, culture, health and wellness, social and vocational areas to meet or exceed a mastery level so that students continue intellectual growth and development;

2. providing experiences which enable students to develop critical thinking, reasoning, problem solving and decision making skills;

3. stimulating creativity, encouraging personal enrichment,

4. and providing approaches to wellness that enable students to define their individuality;

5. fostering attitudes of acceptance and respect for the ideas, beliefs and goals of others;

6. fostering attitudes of social responsibility so that every student contributes to their community in a positive way;

Our ultimate goal is to generate graduates of the Lancaster City Schools who, as adults, will stand confidently, participate fully, learn continually and contribute meaningfully to our world.
Lancaster City Schools
Goals and Objectives

The goal of this school system is to accept responsibility for the development of each child into an adult who can stand confidently, participate fully, learn continually and contribute meaningfully to our world.

To achieve the desired goal, five equally important objectives with desired outcomes will be incorporated into our curriculum planning:

1. To ensure that each student develops mastery in academic skills.

2. To ensure that each student develops the capacity to recognize and analyze current and future challenges and opportunities.

3. To ensure the development of meaningful interpersonal relationships among students, staff and the community.

4. To ensure that staff, students and parents are afforded maximum feasible participation in the development and evaluation of programs and policies that meet the educational needs of all stakeholders.

5. To ensure maximum efficiency in the allocation of human and material resources.
LHS Broadcasting and Video Production
Philosophy

This program will prepare students for careers using multimedia technology to develop products for business, training, entertainment, communications and marketing. Students will gain the necessary technical and academic skills to create, design and produce interactive media products and services.

The goal of the Broadcasting class is to introduce students to multimedia production, and the uses of the medium to accomplish a wide range of tasks. This program is designed to provide students with an opportunity to develop sound interpersonal, persuasive, creative writing, computer and video production skills. Using teamwork, the student will complete the diverse tasks expected of a video professional. These scholastic and technical skills will be utilized to create useful programming for Lancaster High School and the Lancaster City School district.

Students will become competent in creating, designing and producing interactive multimedia products and services. This program of study emphasizes the development of digitally-generated or computer-enhanced media. Students will use multimedia technology to develop products and programs for business, training, entertainment, communications and marketing.

Careers for which this pathway prepares students include:

- Videographer
- Producer/Director
- Photographer
- Video Editor
- Director of Photography
- Animator
- Audio/Visual Specialist
- Media Designer
- Multimedia Specialist
- Production Assistant
- Interactive Digital Media Specialist
- Web Designer
- Graphic Designer
- Multimedia Programmer
- Writer
- News Reporter/Anchor

Postsecondary majors for which this pathway prepares students include:

- Digital Communication and Media/Multimedia
- Digital/Multimedia and Information Resources Design
- Prepress/Desktop Publishing and Digital Imaging Design
- Web/Multimedia Management and Webmaster
**Career Field Pathways and Course Structure**

**Video and Sound**  
Subject Code: 145110  
Students will create professional video and audio productions for distribution in traditional and new media channels. Students will plan, produce, edit, and launch media products. Students will develop scripts and storyboards, compose shots and operate cameras, capture sounds using microphone hardware, apply special effect techniques, and edit to achieve the final product. Students will be able to use animation and graphic design for video.

**Design Techniques**  
Subject Code: 145095  
Students will learn techniques for transforming photographic images, through use of digital cameras, computers, and mobile devices. To accomplish this, they will learn software photo editing techniques including layering, color correction, masking, and special effects using current commercial and open source programs and applications.

**Creating and Editing Digital Graphics**  
Subject Code: 145100  
Students will learn to design, develop, and produce interactive media projects, web sites, and social media contexts. Students will demonstrate methods of creating professional quality media using commercial and open source software.

**Multimedia and Image Management Techniques**  
Subject Code: 145105  
Students will apply principles of image creation, management procedures, and multimedia techniques as they create, revise, optimize, and export graphics for video, print, and web publishing. The course will address issues related to web based publishing, social media, and security. Students will utilize current commercial and open source languages, programs, and applications.

**Web Design**  
Subject Code: 145010  
Students will learn the dynamics of the Web environment while pursuing an in-depth study of both Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS). Web based protocols such as FTP, TCP/IP, and HTTP will be addressed. Students will create a website with tag text elements, special characters, lines, graphics, hypertext links, and graphical tables.
CAREER FIELD TECHNICAL CONTENT STANDARDS

Strand 1 Business Operations/21st Century Skills
Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.

Outcome 1.1. Employability Skills
Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competencies
1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers.
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience.
1.1.3. Develop a career plan that reflects career interests, pathways, and secondary and post-secondary options.
1.1.4. Describe the role and function of professional organizations, industry associations, and organized labor and use networking techniques to develop and maintain professional relationships.
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, resume writing, interviewing skills, portfolio development).
1.1.6. Explain the importance of work ethic, accountability, and responsibility and demonstrate associated behaviors in fulfilling personal, community, and workplace roles.
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
1.1.8. Identify the correlation between emotions, behavior, and appearance and manage those to establish and maintain professionalism.
1.1.9. Give and receive constructive feedback to improve work habits.
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits, and abusive behavior.

Outcome 2.4. Emerging Technologies
Identify trending technologies, their fundamental architecture, and their value in the marketplace.

Competencies
2.4.1. Investigate the scope and the impact of mobile computing environments on society.
2.4.2. Describe the differences, advantages, and limitations of cloud computing (e.g., public cloud, private cloud, hybrid cloud) and on-premises computing.
2.4.3. Utilize cloud computing applications (e.g., services, applications, virtual environments).

Outcome 2.5. Operating Systems
Maintain operating systems (OSs).

Competencies
2.5.1. Compare and contrast OSs for computer hardware (e.g., personal computers, servers, mainframes, and mobile devices).
2.5.2. Describe virtual machines and why they are used.
2.5.3. Identify the properties of open and proprietary systems.
2.5.4. Maintain file structures in an OS.
2.5.5. Use system utilities to maintain an OS.
2.5.6. Describe OS interfaces (e.g., command line, Graphic User Interface [GUI]).
2.5.7. Install and test updates and patches to OSs.

**Outcome 2.6. Installation and Configuration**

Install and configure hardware and software.

**Competencies**

2.6.1. Comply with license agreements for software and hardware and describe the consequences of noncompliance.
2.6.2. Identify hardware requirements for software applications.
2.6.3. Verify software compatibility and troubleshoot any software incompatibility.
2.6.4. Install and test new software and software upgrades on stand-alone, mobile, and networked systems.
2.6.5. Preserve, convert, or migrate existing data files to a new format.
2.6.6. Determine compatibility of software and hardware and resolve any conflicts.
2.6.7. Install and test hardware peripherals.
2.6.8. Document the installation and configuration of hardware and software.

**Outcome 2.7. Web Architecture**

Explain the fundamentals of delivering information and applications using web architecture.

**Competencies**

2.7.1. Describe methods of securely transmitting data.
2.7.2. Describe ways to present data (e.g., mobile applications, desktop applications, web applications).
2.7.3. Differentiate between a client and a server.
2.7.4. Identify how the use of different browsers and devices affects the look of a webpage.
2.7.5. Explain the relationship between data transmission volumes, bandwidth, and latency.
2.7.6. Describe the characteristics and use of browser plug-ins.
2.7.7. Compare the advantages and disadvantages of running an in-house server or using a service provider.
2.7.8. Describe the difference between static and dynamic sites and the reasons for using each.

**Outcome 2.8. Databases**

Describe the fundamentals of databases.

**Competencies**

2.8.1. Identify emerging database technology (e.g., Not only Structured Query Language [NoSQL], New Structured Query Language [New SQL], graph databases).
2.8.2. Identify the purpose and uses of a database.
2.8.3. Compare and contrast databases (e.g., flat file, hierarchical, relational).
2.8.4. Describe the elements of a database (e.g., table, record/trow, field, relationships, transactions).
2.8.5. Describe the elements of a database user interface (e.g., form, queries, filters, reports).
2.8.6. Describe the uses of a Database Management System (DBMS).
2.8.7. Describe how data can be stored in and extracted from a database.
2.8.8. Explain the importance of data integrity and security.
2.8.9. Differentiate between a front-end interface and a back-end database.

**Outcome 2.9. Project Concept Proposal**

Develop a project concept proposal.

**Competencies**

2.9.1. Identify and incorporate branding strategies.
2.9.2. Determine the scope and purpose of the project.
2.9.3. Determine the target audience, client needs, expected outcomes, objectives, and budget.
2.9.4. Develop a conceptual model and design brief for the project.
2.9.5. Develop a timeline, a communication plan, a task breakdown, costs (e.g., equipment, labor), deliverables, and responsibilities for completion.
2.9.6. Develop and present a comprehensive proposal to stakeholders.

**Outcome 2.10 Equipment**
Select, operate, and maintain equipment.

**Competencies**
2.10.1. Identify hardware platforms, configurations, and support models.
2.10.2. Identify processor, memory, and storage requirements.
2.10.3. Identify architecture requirements.
2.10.4. Identify software application requirements.
2.10.5. Prepare and operate equipment per project design specifications.
2.10.6. Monitor equipment operation and troubleshoot issues and problems.
2.10.7. Backup, archive, and manage data.
2.10.8. Prepare equipment for storage or decommissioning.
2.10.9. Perform routine maintenance per manufacturer specifications.

**Outcome 2.11. Troubleshooting**
Select and apply troubleshooting methodologies for problem solving.

**Competencies**
2.11.1. Identify the problem.
2.11.2. Select troubleshooting methodology (e.g., top down, bottom up, follow the path, spot the differences).
2.11.3. Investigate symptoms based on the selected methodology.
2.11.4. Gather and analyze data about the problem.
2.11.5. Design a solution.
2.11.6. Test a solution.
2.11.7. Implement a solution.
2.11.8. Document the problem and the verified solution.

**Outcome 2.12. Performance Tests and Acceptance Plans**
Develop performance tests and acceptance plans.

**Competencies**
2.12.1. Create a written procedure agreed by the stakeholders and project team for determining the acceptability of the project deliverables.
2.12.2. Develop a test system that accurately mimics external interfaces.
2.12.3. Develop test cases that are realistic, compare with expected performance, and include targeted platforms and device types.
2.12.4. Develop, perform, and document usability and testing integration.
2.12.5. Make corrections indicated by test results.
2.12.6. Seek stakeholder acceptance upon successful completion of the test plan.

**Outcome 2.13. Rollout and Handoff**
Plan rollout and facilitate handoff to customer.

**Competencies**
2.13.1. Include overall project goals and timelines in the rollout plan.
2.13.2. Communicate rollout plans to key stakeholders in a timely manner.
2.13.3. Conduct final review and approvals according to company standards.
2.13.4. Identify support staff, training needs, and contingency plans in the rollout plan.
2.13.5. Test delivered application to assure that it is fully functional for the customer or user and meets all requirements.
2.13.6. Deliver support and training materials.
Outcome 6.1 Web pages
Create basic web pages.

Competencies
6.1.1. Describe the basic principles of Hypertext Markup Language (HTML) and its functional relationship with web browsers.
6.1.2. Plan a web page considering subject, devices, audience, layout, color, links, graphics, and Americans With Disabilities Act (ADA) requirements.
6.1.3. Format the text of a web page in a WYSIWYG (What You See Is What You Get) editor and in a text editor using HTML formatting tags (e.g., hyperlink, e-mail, table formatting, graphic attributes).
6.1.4. Use writing process techniques (i.e., drafting, revising, editing, proofreading) to check the web page for format and text accuracy.
6.1.5. Create and format ordered and unordered lists on a web page using HTML list formatting tags.
6.1.6. Create and format a table in a web page using HTML table formatting tags and attributes.
6.1.7. Integrate styles (e.g., inline or external Cascading Style Sheets [CSS]).

Outcome 6.2. Links and Multimedia
Add links to a web page and insert multimedia files.

Competencies
6.2.1. Create absolute links and relative links.
6.2.2. Write a Hypertext Markup Language (HTML) anchor that links to another section of the same web page.
6.2.3. Create hyperlinks that send e-mail messages and download files.
6.2.4. Insert image and wrap text around the image using Cascading Style Sheets (CSS).
6.2.5. Resize a graphic image in a web page using CSS.
6.2.6. Insert audio and video files into a web page using HTML tags.
6.2.7. Build a hover or mouse over effect to change the style of a link.

Outcome 6.3. Scripting
Integrate scripting into a web page.

Competencies
6.3.1. Select and apply scripting languages used in web development.
6.3.2. Insert client-side script into a web page.
6.3.3. Insert comments into client-side scripts.

Outcome 6.4. Web Forms
Integrate forms into a web page.

Competencies
6.4.1. Design a data entry form from specifications that will accept a variety of user inputs, (e.g., radio buttons, text entry fields, check boxes, drop-down menus).
6.4.2. Write the Hypertext Markup Language (HTML) code to add a form to a web page.
6.4.3. Write the HTML code to add text entry fields, radio buttons, check boxes, drop-down menus, and other user inputs to a form.
6.4.4. Explain the concept of a form action.
6.4.5. Write the HTML code to add a working button (e.g., submit, reset) to a form.
6.4.6. Format a completed form using HTML and Cascading Style Sheets (CSS) (e.g., field set, tab index).
6.4.7. Code scripting to interact with data sources (e.g., database, web services).

Outcome 6.5. Websites
Create and update a website.

Competencies
6.5.1. Implement web programming standards and protocols (e.g., World Wide Web Consortium [W3C], Hypertext Markup Language [HTML] 5).
6.5.2. Plan a website’s structure for navigation and usability.
6.5.3. Utilize standard web programming languages (e.g., markup, scripting languages) in website
development.
6.5.4. Install and configure a content management system (CMS).
6.5.5. Select an integrated development environment (IDE).
6.5.6. Create and edit a web page template.
6.5.7. Create and attach Cascading Style Sheets (CSS).
6.5.8. Format website layout (e.g., targeted platforms, text formatting, background color, text,
tables, lists, iframes).
6.5.9. Incorporate audio and video, forms, and links on a website.
6.5.10. Develop and execute usability tests on a completed website, checking for information
accessibility, ease of use, and navigation.
6.5.11. Code a website for cross-platform and cross-browser compatibility and validation.
6.5.12. Publish the completed website to a web server.

Strand 7. Digital Media
Learners apply principles of digital media to produce interactive media; develop and produce multimedia
applications; integrate typography into media; create 3D models and 2D and 3D
animation; and create digital video, audio, and photographs.

Outcome 7.1. Interactive Media
Describe and explain interactive media and interactive media production.
Competencies
7.1.1. Identify the types and uses of interactive media environments (e.g., web-based, kiosks, games,
mobile devices, video, print).
7.1.2. Describe the components of interactive media.
7.1.3. Identify the major characteristics of interactive media presentations.
7.1.4. Identify important historical developments and future trends in interactive media.
7.1.5. Identify the major interactive media genres.
7.1.6. Perform critical review of interactive media products in different genres.
7.1.7. Identify the intellectual property rights, responsibilities, and controls related to interactive
media.
7.1.8. Analyze the social and cultural implications of interactive media.
7.1.9. Identify major applications for interactive media (e.g., sales and marketing, interactive
advertising, education, corporate training, corporate communications, distance learning, news, entertainment).
7.1.10. Identify specific uses for interactive media in each potential market.

Outcome 7.2. Multimedia Tools
Develop navigational structures, scripts, storyboards, and flowcharts for multimedia applications.
Competencies
7.2.1. Choose a navigational menu structure (e.g., rollovers, drop-downs, disjointed).
7.2.2. Construct and place navigational units.
7.2.3. Build in interactive elements.
7.2.4. Determine uses and needs for site maps, multimedia scripts, storyboards, and flowcharts.
7.2.5. Make preliminary sketches showing placement of images and text on screen.
7.2.6. Show placement of buttons and navigational graphics.
7.2.7. Provide information on color schemes.
7.2.8. Describe music, video, and special effects to be used.
7.2.9. Provide a sample layout to stakeholders for review.
7.2.10. Select and create visual design elements appropriate for the intended audience and use.
7.2.11. Develop characters and narrative to support intended outcomes.

Outcome 7.3. Production
Produce interactive media.
Competencies
7.3.1. Select the media elements to be used (e.g., sound, video, graphics, text, animation).
7.3.2. Generate text for multi-image presentations (e.g., title graphics, charts, graphs).
7.3.3. Incorporate graphics (e.g., digital, hand-drawn, photographic).
7.3.4. Incorporate computer animation.
7.3.5. Prepare and integrate photographic images and special effects with graphic images.
7.3.6. Incorporate video footage.
7.3.7. Edit video footage.
7.3.8. Record and/or acquire sound tracks (e.g., narrative, voiceover, sound effects, music).
7.3.9. Integrate sound with visuals.
7.3.10. Produce, test, debug, and archive a final product.

**Outcome 7.4. Graphics**
Construct and manipulate digital graphics.

**Competencies**
7.4.1. Identify the purpose and intended audience of graphics.
7.4.2. Select color, shape, size, and texture of objects.
7.4.3. Create or acquire graphics.
7.4.4. Manipulate and layer objects.
7.4.5. Differentiate between vector and raster images.
7.4.6. Select an appropriate graphic file format and resolution.
7.4.7. Optimize and export graphics files for intended use.
7.4.8. Select graphic software applications.
7.4.9. Manipulate graphic objects.
7.4.10. Compress and decompress graphic files.
7.4.11. Describe and select color profiles (e.g., Red Green Blue [RGB], Cyan Magenta Yellow Key [CMYK], Pantone).

**Outcome 7.5. Typography**
Integrate typography in media.

**Competencies**
7.5.1. Identify typographic measurements (e.g., picas, points, pixels, ems).
7.5.2. Mix families of type within a project.
7.5.3. Select appropriate kerning, leading, tracking, and other related formatting.
7.5.4. Identify appropriate typefaces (e.g., serif, sans serif, Web Safe, screen, print).
7.5.5. Prepare a type style guide.

**Outcome 7.6. Animation**
Create 2D and 3D animation.

**Competencies**
7.6.1. Develop a plan and storyboard for an animation.
7.6.2. Import 2D or 3D assets.
7.6.3. Create key frames and apply tweens and paths.
7.6.4. Create special effects and virtual navigation.
7.6.5. Create 2D or 3D environments.
7.6.6. Render and export animations.

**Outcome 7.7 Video**
Create a video production.

**Competencies**
7.7.1. Identify equipment and other production needs.
7.7.2. Analyze the script and storyboard to develop a production schedule.
7.7.3. Set up audio, lighting, and scenery for the shoot.
7.7.4. Select a video recording format and shoot the video.
7.7.5. Select a linear or nonlinear editing system and edit the video.
7.7.6. Add transitions (e.g., dissolves, wipes, cuts), titles, special effects, and digital effects.
7.7.7. Add a sound track, narration, and/or voiceover.
7.7.8. Export video to the desired medium.
Outcome 7.8. Audio
Create an audio production.
Competencies
7.8.1. Evaluate performance needs and technical resources.
7.8.2. Identify sound requirements based on script analysis.
7.8.3. Design score appropriate to production and post-production needs.
7.8.4. Determine microphone and speaker placement.
7.8.5. Select and incorporate Foley mechanical and electrical sound effects.
7.8.6. Set up and operate audio-for-video recording devices.
7.8.7. Set up and operate a time code system for audio-video synchronization.
7.8.8. Perform audio mixing.

Outcome 7.9. Photographs
Create photographs.
Competencies
7.9.1. Select and set up lighting needed (e.g., electronic flash units, reflectors, bounce, spot, daylight).
7.9.2. Select a digital file format or film format and camera.
7.9.3. Select and attach lenses (e.g., wide-angle, telephoto, zoom) and filters (e.g., color compensating, polarizing, special effects).
7.9.4. Determine composition, formal qualities, scale, and use of space.
7.9.5. Shoot photographs.
7.9.6. Edit photographs (e.g., color corrections, cropping, enhancements).

Certification Competencies
At the end of the course, students will be required to complete and pass the Ohio Department of Education Interactive Media WEBEXAM Interactive media 140240 Modules 84MC-(60)

Information Technology Basics
Industry Concepts
Interactive Media Production
Media Design
Business Processes

Apple Certification
Selected students may have the opportunity to participate in a three-day, hands-on course teaching advanced editing functions while becoming Apple certified with the Final Cut Pro platform. Students work with real-world media to learn the practical techniques used daily in editing projects.
Unit 1: Information Technology Basics
Students should have basic proficiency in the competencies outlined in this unit prior to entry into a program focusing on Information Support and Services, Network Systems, Programming and Software Development, and Interactive Media.

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS P
NS P
PSD P
IM P R R

Competency 1.1: Demonstrate basic knowledge of information technology history
Descriptors:
1.1.1 Identify significant advances in the development of computer hardware and software
1.1.2 Identify major milestones in the development of information technology
1.1.3 Identify major individuals and their contributions to the information technology field
1.1.4 Discuss the speed with which computer technology has evolved (i.e., evolution time line)

Correlated English Language Arts Academic Content Benchmarks
• Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). [Reading Process B, 8-10; Reading Process B, 11-12]
• Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 8-10)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS P
NS P
PSD P
IM P R R

Competency 1.2: Demonstrate basic knowledge of the information technology impact on society
Descriptors:
1.2.1 Discuss how information technology impacts people and is used in business/industry/government and other institutions
1.2.2 Discuss the impact of information technology on career pathways in business/industry (e.g., how computers have both eliminated and created jobs)
1.2.3 Describe the psychological, physical, and health risks associated with information technology (e.g., Web addiction, carpal tunnel syndrome, gaming)
1.2.4 Discuss possible security risks posed by the use of information technology and associated safeguards
1.2.5 Discuss possible effects of natural disasters on business operations
1.2.6 Discuss the evolution of international telecommunications standards and trends
1.2.7 Discuss the impact of computers on access to information and information exchange worldwide
1.2.8 Identify issues and trends affecting computers, information and personal privacy
1.2.9 Identify ethical issues that have surfaced in the information age
1.2.10 Explain how information technology affects the natural environment (e.g., disposal of equipment, energy use, use of natural resources)
1.2.11 Discuss how IT innovation has impacted society and corporate efficiency (e.g., RFID, eServices)
1.2.12 Discuss legislation that relates to information security (e.g., Gramm-Leach-Bliley, Sarbanes-Oxley, Patriot Act, DMCA, HIPAA)

Correlated English Language Arts Academic Content Benchmarks
- Organize information from various resources and select appropriate sources to support central ideas, concepts and themes. (Research C, 8-10)
- Communicate findings, reporting on the substance and process orally, visually and in writing, or through multimedia. (Research E, 8-10; Research E, 11-12)
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS P
NS P
PSD P
IM P R R

Competency 1.3: Demonstrate knowledge of information technology basics
Descriptors:
1.3.1 Identify classifications of computing platforms
1.3.2 Identify the elements of the information processing cycle (i.e., input, process, output, and storage)
1.3.3 Identify major hardware components and their functions
1.3.4 Identify types of computer storage devices
1.3.5 Identify types of processing (e.g., batch, interactive, event-driven)
1.3.6 Identify major operating system fundamentals and components
1.3.7 Identify the role of the binary system in information technology
1.3.8 Explain the role of number systems and internal data representation in information
1.3.9 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts, Internet/Intranet resources)
1.3.10 Discuss the need for asset management (e.g., hardware, software licensing)
1.3.11 Differentiate between asset tracking and asset management

**Correlated Mathematics Academic Content Benchmarks**
- Identify subsets of the real number system. (Number B, 8-10)
- Apply properties of operations and the real number system, and justify when they hold for a set of numbers. (Number C, 8-10)
- Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers. (Number D, 8-10)
- Compare, order and determine equivalent forms of real numbers. (Number E, 8-10)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD
ISS P
NS P
PSD P
IM P R R

**Competency 1.4: Demonstrate knowledge of software associated with information technology**

**Descriptors:**
- 1.4.1 Describe the key functions of systems software
- 1.4.2 Classify widely used software applications (e.g., word processing, database management, spreadsheet development)
- 1.4.3 Describe the range of languages used in software development
- 1.4.4 Explain relationship between data and software development (e.g., basic data structures, XML, relational databases)
- 1.4.5 Identify new and emerging classes of software
- 1.4.6 Explain intellectual property (e.g., software, images, open-source, documentation)
- 1.4.7 Explain the historical difference between packaged software and custom/in house developed software

**Correlated English Language Arts Academic Content Benchmarks**
- Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). [Reading Process B, 8-10; Reading Process B, 11-12]

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD
ISS P
NS P
PSD P
IM P R R

**Competency 1.5: Evaluate career opportunities in information technology**

**Descriptors:**
- 1.5.1 Identify entry-level positions
- 1.5.2 Identify possible career pathways within regions in Ohio, the United States and globally
1.5.3 Compare the types of positions included in Information Support and Services, Network Systems, Programming and Software Development, and Interactive Media (e.g., compensation, benefits, travel, quality of life)
1.5.4 Identify types of administration/management positions available and the nature of each
1.5.5 Research job opportunities
1.5.6 Compile occupational profile
1.5.7 Identify factors influencing employment opportunities (e.g., outsourcing, offshore)
1.5.8 Identify education and training requirements for selected career pathway
1.5.9 Design a career path for a personal career in information technology (i.e., personal goal setting)
1.5.10 Design a time line for a personal career advancement in the information technology field
1.5.11 Identify professional organizations in the area of information technology
1.5.12 Identify benefits derived from membership in specific professional organizations
1.5.13 Identify alternative resources related to career development (e.g., trade journals, user groups, newsgroups)
1.5.14 Discuss the occupational trends historically and in the future.

Correlated English Language Arts Academic Content Benchmarks
• Use documented textual evidence to justify interpretations of literature or to support a research topic. (Writing Applications D, 8-10)
• Use style guides to produce oral and written reports that give proper credit for sources (e.g., words, ideas, images and information) and include an acceptable format for source acknowledgment. (Research D, 8-10, Research D, 11-12)
• Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 8-10, Research E, 11-12)
• Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product. (Writing Process F, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS P
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IM P R R

Competency 1.6: Explore the future of information technologies
Descriptors:
1.6.1 Identify new technologies relevant to information technology
1.6.2 Discuss the future impact of information technology on business operations (i.e., productivity, global competitiveness)
1.6.3 Examine the importance of new technologies to future developments and to the future knowledge of worker productivity
1.6.4 Identify new and emerging drivers and inhibitors of information technology change

Correlated English Language Arts Academic Content Benchmarks
• Demonstrate comprehension of print and electronic text by responding to questions (e.g. literal, inferential, evaluative and synthesizing). [Reading Process B, 8-10; Reading Process B, 11-12]

BIL: Essential: ISS, NS, PSD, IM
Competency 1.7: Create documents using word processing software

Descriptors:
1.7.1 Create documents and tables
1.7.2 Format text using basic and advanced formatting functions
1.7.3 Locate/replace text using search and replace functions
1.7.4 Create new forms, style sheets, and templates
1.7.5 Employ word processing utility tools (e.g., spell checker, grammar checker, and Thesaurus)
1.7.6 Create tables, columns, outlines, footnotes and endnotes
1.7.7 Create and run macros
1.7.8 Assemble documents using merge functions (e.g., merge address files with letters and envelopes)
1.7.9 Print materials using print functions
1.7.10 Edit documents (i.e., version control)
1.7.11 Access needed information using word processing help screens

Correlated English Language Arts Academic Content Benchmarks
• Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product. (Writing Process F, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Competency 1.8: Create relational databases

Descriptors:
1.8.1 Create a database table
1.8.2 Edit fields and records
1.8.3 Modify the design of a database table
1.8.4 Sort and retrieve data
1.8.5 Perform single- and multiple-table queries (e.g., create, run, save)
1.8.6 Create calculated fields
1.8.7 Generate customized reports for database files
1.8.8 Process data using database functions (e.g., structure, format, attributes, relationships, and keys)
1.8.9 Locate/replace data using search and replace functions
1.8.10 Sort data using multiple-field sorts
1.8.11 Add/remove filters
1.8.12 Create multiple criteria expressions
1.8.13 Create adjoined files and sub-forms
1.8.14 Create graphs and reports
1.8.15 Print forms, reports, and results of queries
1.8.16 Identify the relationship between database components
1.8.17 Design a database to meet the needs of an actual situation or business problem
1.8.18 Evaluate database design and functionality

**Correlated English Language Arts Academic Content Benchmarks**
- Apply knowledge of roots and affixes to determine the meanings of complex words and subject area vocabulary. (Vocabulary E, 8-10)
- Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

**Correlated Mathematics Academic Content Benchmarks**
- Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability. (Data A, 8-10)
- Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose. (Data B, 8-10)
- Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Algebra C, 8-10)
- Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU: 10 12 AD**
ISS P
NS P
PSD P
IM P

**Competency 1.9: Create spreadsheets**

**Descriptors:**
1.9.1 Design a spreadsheet in accordance with written and/or oral specifications
1.9.2 Retrieve existing spreadsheets
1.9.3 Format spreadsheets using basic formatting functions (e.g., page setup)
1.9.4 Perform calculations using simple formulas
1.9.5 Edit spreadsheets (i.e., delete, move, and copy within spreadsheets)
1.9.6 Create charts and graphs from spreadsheets
1.9.7 Group worksheets
1.9.8 Input/process data using spreadsheet functions
1.9.9 Improve spreadsheet display using enhancement features
1.9.10 Protect data using spreadsheet protection features
1.9.11 Run macros
1.9.12 Troubleshoot spreadsheet problems
1.9.13 Resolve function errors as needed
1.9.14 Apply advanced spreadsheet formulas
1.9.15 Create spreadsheet solutions to business problems
1.9.16 Make “what if—” business decisions using spreadsheets as a tool
1.9.17 Save and print spreadsheets
1.9.18 Access needed information using online help features

**Correlated Mathematics Academic Content Benchmarks**

- **Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.** (Algebra D, 8-10)
- **Use recursive functions to model and solve problems; e.g., home mortgages, annuities.** (Algebra C, 11-12)
- **Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.** (Data A, 8-10)
- **Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose.** (Data B, 8-10)
- **Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.** (Data A, 11-12)
- **Apply reasoning processes and skills to construct logical verifications or counterexamples to test conjectures and to justify and defend algorithms and solutions.** (Math. Process D, 8-10)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD
ISS P
NS P
PSD P
IM P R R

**Competency 1.10: Create presentations using presentation graphics**

**Descriptors:**
1.10.1 Identify hardware items that support presentation software
1.10.2 Compare/contrast various presentation software packages
1.10.3 Create computer presentation and handouts in accordance with basic principles of graphics design and visual communication
1.10.4 Edit presentations
1.10.5 Copy from one presentation to another
1.10.6 Insert clip art in a slide
1.10.7 Create WordArt objects
1.10.8 Create/modify a graph on a slide
1.10.9 Add/delete a template to a presentation
1.10.10 Create graphics documents using drawing and painting software programs
1.10.11 Add transitions to slide shows
1.10.12 Run slide shows manually and automatically
1.10.13 Save slide show presentations

**Correlated English Language Arts Academic Content Benchmarks**

- **Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.** (Research E, 8-10, Research E, 11-12)
- **Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly.** (Writing Applications. C, 11-12)
- **Give presentations using a variety of delivery methods, visual displays and technology.**
Competency 1.11: Apply computer office tools
Descriptors:
1.11.1 Analyze problems requiring solutions involving the integration of computer applications
1.11.2 Select appropriate productivity tool for solving specific problem
1.11.3 Select source application and destination application
1.11.4 Move/copy information between integrated applications
1.11.5 Link objects between applications
1.11.6 Embed information in applications

Competency 1.12: Demonstrate knowledge of basic data communications components and trends
Descriptors:
1.12.1 Identify key communications procedures
1.12.2 Identify the hardware associated with telecommunications functions
1.12.3 Identify the uses of data communication equipment
1.12.4 Identify types of communications media
1.12.5 Identify data transmission codes and protocols
1.12.6 Distinguish between local area networks, wide-area networks, and other networks (e.g., wireless)
1.12.7 Identify data communication trends
1.12.8 Identify major current issues in data communications
1.12.9 Identify security issues

Competency 1.13: Evaluate and access information using electronic sources
Descriptors:
1.13.1 Explain how to conduct searches using electronic sources (e.g., selection of search terms)
1.13.2 Access information using telecommunications software
1.13.3 Access information using teleconferencing/video conferencing techniques
1.13.4 Access information using portable or virtual storage technology
1.13.5 List the uses of simulation/modeling as an information source
1.13.6 Evaluate the quality and usability of electronic information
1.13.7 Download information

**Correlated English Language Arts Academic Content Benchmarks**

- **Formulate open-ended research questions suitable for investigation and adjust questions as necessary while research is conducted.** (Research A, 8-10; Research A, 11-12)
- **Evaluate the usefulness and credibility of data and sources.** (Research B, 8-10; Research C, 11-12)
- **Organize information from various resources and select appropriate sources to support central ideas, concepts and themes.** (Research C, 8-10)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS P
NS P
PSD P
IM P

**Competency 1.14: Demonstrate proficiency with electronic mail and instant messaging**

**Descriptors:**
1.14.1 Explain the basic purposes of e-mail systems
1.14.2 Identify basic e-mail features and options
1.14.3 Discuss security issues and guidelines for legal usage of e-mail
1.14.4 Identify contamination protection strategies for e-mail (e.g., Spam)
1.14.5 Identify available e-mail systems and the characteristics/features of each
1.14.6 Access e-mail system using login and password functions
1.14.7 Access e-mail messages received
1.14.8 Access e-mail attachments
1.14.9 Demonstrate e-mail etiquette
1.14.10 Create e-mail messages in accordance with established business standards (e.g., grammar, word usage, spelling, sentence structure, clarity, e-mail etiquette)
1.14.11 Send e-mail messages
1.14.12 Assign priority levels to messages
1.14.13 Create distribution lists
1.14.14 Employ e-mail options such as "reply requested" and "out-of-office reply"
1.14.15 Reply to and forward e-mail messages
1.14.16 Attach documents to messages
1.14.17 Create folders for organizing messages and documents
1.14.18 Save, print and delete e-mail messages/attachments
1.14.19 Access needed information using e-mail help facilities and tools
1.14.20 Discuss governance and acceptable use policy regarding email

**Correlated English Language Arts Academic Content Benchmarks**

- **Produce letters (e.g., business, letters to the editor, job applications) that follow the conventional style appropriate to the text, include appropriate details and exclude extraneous details and inconsistencies.** (Writing Applications C, 8-10)
- **Produce functional documents that report, organize and convey information and ideas**
accurately foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

• Edit to improve sentence fluency, grammar and usage. (Writing Process D, 8-10)

BIL: Essential: ISS, NS, PSD, IM

EDU: 10 12 AD
ISS P
NS P
PSD P
IM P

Competency 1.15: Install/configure software programs

Descriptors:
1.15.1 Identify hardware requirements (e.g., processor, memory, disk space, communications, printers, monitors)
1.15.2 Determine compatibility of hardware and software
1.15.3 Install given application/system software on various platforms in accordance with manufacturers’ and business procedures
1.15.4 Access manufacturers’ technical support resources.
1.15.5 Disable/uninstall software that may interfere with installation of new software
1.15.6 Verify compliance to licensing agreement
1.15.7 Differentiate between procedures for an upgrade and for a new installation
1.15.8 Differentiate between stand-alone and network installation procedures
1.15.9 Select appropriate installation options (e.g., default, customized)
1.15.10 Configure software to appropriate operating system settings
1.15.11 Troubleshoot unexpected results
1.15.12 Document step-by-step installation and configuration procedures
1.15.13 Verify software installation and operation
1.15.14 Convert data files if required
1.15.15 Configure macros, tools, and packages to accomplish simple organizational and personal tasks
1.15.16 Demonstrate backup, recovery, and restoration techniques

BIL: Essential: ISS, NS, PSD, IM

EDU: 10 12 AD
ISS P
NS P
PSD P
IM P R R

Competency 1.16: Demonstrate basic knowledge of the Internet

Descriptors:
1.16.1 Identify the key characteristics of the Internet
1.16.2 Discuss the ownership/administration of the Internet
1.16.3 Trace the development of Internet technology
1.16.4 Identify current issues related to the Internet
1.16.5 Identify services and tools offered on the Internet
1.16.6 Identify the specific strengths, weaknesses, and special features of available search engines
1.16.7 Explain bookmarks and their functions
1.16.8 Explain accepted Internet etiquette (i.e., netiquette)
1.16.9 Identify current uses and applications of the Internet

**BIL: Essential: ISS, NS, PSD, IM**

**EDU: 10 12 AD**

ISS P
NS P
PSD P
IM P R R

**Competency 1.17: Access the Internet**

Descriptors:
1.17.1 Connect to the Internet
1.17.2 Test Internet connection
1.17.3 Identify the components of Internet software
1.17.4 Install Internet software
1.17.5 Explore browser features
1.17.6 Download software upgrades from the Internet
1.17.7 Unpack files using compression software
1.17.8 Demonstrate acute awareness of virus protection techniques
1.17.9 Install/update firewalls and malware protection
1.17.10 List uses of mobile devices to access the Internet

**BIL: Essential: ISS, NS, PSD, IM**

**EDU: 10 12 AD**

ISS P
NS P
PSD P
IM P R R

**Competency 1.18: Utilize Internet services**

Descriptors:
1.18.1 Access business and technical information using the Internet
1.18.2 Select search engine(s) to use
1.18.3 Select appropriate search procedures and approaches
1.18.4 Locate information using search engine(s) and Boolean logic
1.18.5 Navigate Web sites using software functions (e.g., forward, back, go to, bookmarks)
1.18.6 Evaluate Internet resources (e.g., accuracy of information)
1.18.7 Access library catalogs on the Internet
1.18.8 Access commercial, government, and education resources
1.18.9 Bookmark Web addresses (URLs)
1.18.10 Download files from FTP archives
1.18.11 Communicate via e-mail using the Internet
1.18.12 Subscribe to mailing lists
1.18.13 Recognize the value of special interest groups and forums (e.g., blogs)
1.18.14 Retrieve online tools
1.18.15 Download/convert Internet programming files
1.18.16 Install/configure Web browser
1.18.17 Explore the multimedia capabilities of the World Wide Web
1.18.18 Evaluate plug-ins and helpers to the Web browser
1.18.19 Explore collaboration tools
1.18.20 Participate in online audio and video conferencing
1.18.21 Archive files
1.18.22 Compile a collection of business sites (e.g., finance and investment)
1.18.23 Explore electronic commerce

**Correlated English Language Arts Academic Content Benchmarks**

- Evaluate the usefulness and credibility of data and sources. (Research B, 8-10)
- Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources. (Research C, 11-12)
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS P
NS P
PSD P
IM P R R

**Competency 1.19: Demonstrate knowledge of Web page basics**

**Descriptors:**
1.19.1 Differentiate between a client and a server
1.19.2 Explain the role of browsers in reading files on the World Wide Web (e.g., text only, hypertext)
1.19.3 Identify how different browsers affect the look of a Web page
1.19.4 Compare/contrast the features and functions of software editors available for designing Web pages
1.19.5 Explain how bandwidth affects data transmission and on-screen image
1.19.6 Discuss the characteristics and uses of plug-ins
1.19.7 Compare the advantages and disadvantages of running one’s own server vs. using a server provider

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS P
NS P
PSD P
IM P

**Competency 1.20: Install computer system (e.g., monitor, keyboard, disk drive, and printer)**

**Descriptors:**
1.20.1 Identify primary PC components and the functions of each
1.20.2 Discuss how hardware components interact and how conflicts arise
1.20.3 Access needed information using manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)
1.20.4 Secure supplies and resources
1.20.5 Respond to error messages and symptoms of hardware failure
1.20.6 Install boards to support peripherals
1.20.7 Connect peripherals to CPU
1.20.8 Employ appropriate safety precautions when working with PCs
1.20.9 Configure system
1.20.10 Verify system operation
1.20.11 Document system installation activities
1.20.12 Backup system configuration
1.20.13 Test all applications

**Unit 2: Operating Systems**

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD
ISS I R P
NS P R
PSD I P
IM I P

**Competency 2.1: Explain operating systems**

_Descriptors:_

2.1.1 Compare and contrast operating systems (ISS, PSD, IM)
2.1.2 Differentiate between microcomputer, minicomputer, and mainframe operating systems including handheld devices (e.g., tablets, PDA, pocket PC) [ISS, IM]
2.1.3 Define the role of memory management in an operating system (ISS, PSD)
2.1.4 Describe the system utilities used for file management
2.1.5 Analyze operating system interfaces
2.1.6 Differentiate the features among file systems (e.g., NTFS, FAT32) [ISS]

**Correlated English Language Arts Academic Content Benchmarks**

- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary.* (Vocabulary D, 11-12)
- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10)

**BIL: Essential: ISS, PSD, IM**

**Recommended:** NS

**EDU:** 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

**Competency 2.2: Describe computer memory utilization**

_Descriptors:_

2.2.1 Differentiate among memory types for PCs, mainframes, minicomputers, and networks (ISS, PSD, IM)
2.2.2 Differentiate among the functions of extended memory, expanded memory, and cache memory (ISS, IM)
2.2.3 Describe the role of the relationship between memory and software applications (ISS, PSD, IM)
2.2.4 Describe memory management functions (e.g., contiguous allocation, paging, segmentation, virtual memory)
2.2.5 Describe the role of physical memory and registers
2.2.6 Describe the role of overlays, swapping, and partitions
2.2.7 Describe the role of pages and segments
2.2.8 Describe the role of free lists, layout, servers, interrupts and recovery from failures

Correlated English Language Arts Academic Content Benchmarks

• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

**BIL: Essential: ISS, NS, PSD**

**EDU:** 10 12 AD

ISS I P

NS I P

PSD I P

IM

**Competency 2.3: Implement and maintain security compliance**

*Descriptors:*

2.3.1 Implement security procedures in accordance with government standards, and business ethics (NS, ISS)

2.3.2 Ensure compliance with security rules, regulations, and codes (NS, ISS)

2.3.3 Analyze security risks (e.g., networking, software) [ISS]

2.3.4 Assess exposure to security issues (NS, ISS)

2.3.5 Implement countermeasures

2.3.6 Install and update virus detection and protection software (NS, PSD, ISS)

2.3.7 Identify sources of virus infections and remove viruses (NS, PSD, ISS)

2.3.8 Implement backup and disaster recovery procedures (NS, PSD, ISS)

2.3.9 Follow disaster plan (NS, ISS)

2.3.10 Provide for user authentication (e.g., assign passwords, access level) [NS, PSD, ISS]

2.3.11 Document security procedures (NS, ISS)

**BIL: Essential: ISS, NS**

**EDU:** 10 12 AD

ISS I P

NS I P

PSD

IM

**Competency 2.4: Apply systems operations procedures**

*Descriptors:*

2.4.1 Apply basic commands of operating system software (ISS, NS)

2.4.2 Apply appropriate file and disk management techniques (NS)

2.4.3 Access needed information using appropriate reference materials (NS)

2.4.4 Review automated scheduling software (NS)

2.4.5 Follow power-up and logon procedures (ISS, NS)

2.4.6 Interact with/respond to system messages using console device (NS)

2.4.7 Run applications/jobs in accordance with processing procedures (NS)

2.4.8 Identify scheduling priority in programming (NS)

2.4.9 Utilize audit trails (NS)

2.4.10 Initiate system software command structures using operating system macro facilities for computer systems

2.4.11 Follow logoff and power-down procedure(s) [ISS, NS]

**BIL: Essential: ISS, NS**

**Recommended: PSD**

**EDU:** 10 12 AD
Competency 2.5: Maintain and respond to system needs

Descriptors:
2.5.1 Access needed information using appropriate reference materials (ISS, NS)
2.5.2 Monitor system status and performance (NS)
2.5.3 Run diagnostics and respond to system messages (NS)
2.5.4 Document computer system malfunction(s) and software malfunction(s) [NS]
2.5.5 Install and upgrade software packages (ISS, NS)
2.5.6 Restore system (NS)
2.5.7 Review automated scheduling software (NS)
2.5.8 Create a query to extract information from a file or multiple files and create reports (NS)

Correlated English Language Arts Academic Content Benchmarks

• Produce functional documents that report, organize and convey information and ideas accurately foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

BIL: Essential: ISS, IM
Recommended: NS, PSD

Competency 2.6: Perform standard computer backup procedures

Descriptors:
2.6.1 Recognize the need for regular backup procedures (IM)
2.6.2 Plan a backup process (IM)
2.6.3 Install backup software (IM)
2.6.4 Perform restore operation using backup software (IM)
2.6.5 Run compression drive backup software and restore operation using compression drive backup software (IM)
2.6.6 Identify and maintain uninterruptible battery backup equipment (IM)
2.6.7 Install surge suppression protection (IM)
2.6.8 Compare/contrast full, incremental and differential backups

Unit 3: Software Systems Management

BIL: Essential: ISS, NS, PSD
EDU: 10 12 AD

Competency 3.1: Perform configuration management activities

Descriptors:
3.1.1 Describe identification and control functions (ISS, PSD)
3.1.2 Explain version management and interface control (ISS, PSD)
3.1.3 Select appropriate tools for configuration management
3.1.4 Determine standards to be applied (e.g., international, industry, military)
3.1.5 Specify baseline and software life-cycle phases (PSD)
3.1.6 Assess the impact of changes that affect interfaces (PSD)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS P
PSD I P
IM I P

**Competency 3.2: Evaluate application software packages**

**Descriptors:**
3.2.1 Perform work flow analysis to determine user needs (PSD)
3.2.2 Compare/contrast ease of learning, use, and interfacing for different software packages (ISS, IM)
3.2.3 Compare/contrast performance and features of different software packages (e.g., speed of retrieval, copying, saving, speller, thesaurus, moving, sorting) [ISS, PSD, IM]
3.2.4 Compare/contrast ease of technical support for different software packages
3.2.5 Compare/contrast clarity of documentation for different software packages
3.2.6 Compare/contrast licensing agreements for different software packages
3.2.7 Document results of the software evaluation (ISS, PSD)
3.2.8 Perform a software audit for the purpose of asset management
3.2.9 Perform a physical audit for the purpose of asset management
3.2.10 Evaluate appropriateness of software for specific projects (ISS, IM)
3.2.11 Prepare a cost-benefit analysis for a software package
3.2.12 Develop a method for evaluation
3.2.13 Test the functionality of proposed software configuration (IM)

**Correlated English Language Arts Academic Content Benchmarks**

- Analyze the features and structures of documents and critique them for their effectiveness. (Reading: Informational Text A, 11-12)
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
- Model and solve problems situations involving direct and inverse variation. (Algebra I, 8-10)
- Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Apply mathematical modeling to workplace and consumer situations, including problem
formulation, identification of a mathematical model, interpretations of solution within
the model, and validations to original problem situation. (Math. Process J, 11-12)

2 1

Unit 4: Computer User Support

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS I P
PSD I
IM

Competency 4.1: Analyze technical support needed

Descriptors:
4.1.1 Identify support requirements (ISS, NS)
4.1.2 Apply information and data analysis techniques using problem solving and
critical thinking skills (NS)
4.1.3 Identify support risks (i.e., security, downtime) [NS]
4.1.4 Examine present data and system configuration (NS)
4.1.5 Formulate a support plan including service-level agreements
4.1.6 Utilize technical assistance resources (e.g., knowledge-bases, remote control
services, TAC centers, Web-based tools, and built-in help functions) [ISS, NS]

Correlated English Language Arts Academic Content Benchmarks

• Produce functional documents that report, organize and convey information and ideas
accurately, foresee readers’ problems or misunderstandings and include formatting
techniques that are user friendly. (Writing Applications C, 11-12)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS I P
NS I P
PSD
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Competency 4.2: Perform customer service

Descriptors:
4.2.1 Provide technical support (ISS)
4.2.2 Respond to user questions (ISS, NS)
4.2.3 Provide troubleshooting for hardware/software (ISS, NS)
4.2.4 Communicate and document technical support provided (ISS, NS)
4.2.5 Optimize system performance (NS)
4.2.6 Diagnose problems within system (ISS, NS)
4.2.7 Perform technical functions required by customer/user within the knowledge set
of the technician (NS)
4.2.8 Employ technical and computer tools to perform task in the most cost-effective
manner (NS)
4.2.9 Meet customer expectation in service delivery (e.g., SLA) [NS]
4.2.10 Demonstrate effective customer satisfaction skills throughout the service event
life cycle (NS)

Correlated English Language Arts Academic Content Benchmarks
• Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)
• Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)
• Give informational presentations that contain a clear perspective, present ideas from multiple sources in logical sequence and include a consistent organizational structure. (Communication E, 11-12)

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
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Competency 4.3: Provide support and training
Descriptors:
4.3.1 Operate help desk
4.3.2 Support computer users (ISS) [NS]
4.3.3 Train computer users (NS)
4.3.4 Manage user accounts (NS)
4.3.5 Update and maintain training and users manuals (soft or hard copies) [NS]
4.3.6 Demonstrate ability to guide end-users through a support solution process (NS)

Correlated English Language Arts Academic Content Benchmarks
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Unit 5: Programming Theory
BIL: Essential: PSD
Recommended: ISS, IM
EDU: 10 12 AD
ISS I R
NS
PSD I P R
IM I P

Competency 5.1: Demonstrate knowledge of programming language concepts
Descriptors:
5.1.1 Describe the concept of problem solving through programming languages
5.1.2 Describe the concepts of data management through programming languages
5.1.3 Analyze the strength and weaknesses of a language to solve a specific problem
5.1.4 Describe the function and operation of compilers and interpreters
5.1.5 Describe the basics of procedural/structured, object-oriented, and event-driven programming

Correlated English Language Arts Academic Content Benchmarks
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
• Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources. (Research C, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

• Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)

**BIL:** Essential: PSD  
**Recommended:** ISS, IM  
EDU: 10 12 AD  
ISS I R  
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PSD I P  
IM I P

**Competency 5.2: Apply software design techniques**

Descriptors:

5.2.1 Provide an overview of problem to be solved (PSD)  
2 4

5.2.2 Establish basic input and output structures and business rules (PSD)  
5.2.3 Model solution using both graphical tools (e.g., UML, flowchart) and pseudocode techniques

**Correlated Mathematics Academic Content Benchmarks**

• Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Algebra C, 8-10)

**BIL:** Essential: PSD  
**Recommended:** ISS, IM  
EDU: 10 12 AD  
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PSD I P R  
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**Competency 5.3: Identify models of application**

Descriptors:

5.3.1 Identify structured/modular programming  
5.3.2 Identify the characteristics and uses of batch processing  
5.3.3 Identify the characteristics and uses of interactive processing  
5.3.4 Identify the characteristics and uses of event-driven processing  
5.3.5 Identify the characteristics and uses object-oriented processing

**Correlated English Language Arts Academic Content Benchmarks**

• Distinguish the relationship of word meanings between pairs of words encountered in analogical statements. (Vocabulary B, 11-12)  
2 5

**Unit 6: Applied Programming Languages**

Each competency must be addressed in at least two of the following language types:  
- Structural/Procedural (e.g., Basic, - Data Description (e.g., IOL, SQL)  
  C, Visual Basic, RPG, COBOL) - Machine Level (e.g., Assembly)  
- Object-Oriented (e.g., Java, C++ - Mark-up (e.g., HTML, SML, SGML)  
  .NET Framework)  
- Scripting/Control (e.g., JCL, Perl)
Competency 6.1: Demonstrate knowledge of computational and String operations

Descriptors:
6.1.1 Develop code blocks that use arithmetic operations
6.1.2 Develop programs that use subtotals and final totals
6.1.3 Develop code blocks applying string operations (concatenation, pattern matching, substring, etc.)

Correlated Mathematics Academic Content Benchmarks
• Apply properties of operations and the real number system, and justify when they hold for a set of numbers. (Number C, 8-10)
• Use recursive functions to model and solve problems; e.g., home mortgages, annuities. (Algebra C, 11-12)
• Evaluate a mathematical argument and use reasoning and logic to judge its validity. (Math. Process E, 11-12)

Competency 6.2: Demonstrate knowledge of logical operations and control structures

Descriptors:
6.2.1 Solve a truth table
6.2.2 Explain the concepts of the if/then/else control structure
6.2.3 Develop code blocks that use relational operators and compounds
6.2.4 Develop code blocks using sequential control structures
6.2.5 Develop code blocks using repetition control structures (e.g., while, for)
6.2.6 Develop code blocks using selection control structures (e.g., case, switch)

Competency 6.3: Use integrated development environment to build a program

Descriptors:
6.3.1 Configure preferences and options within a development environment
6.3.2 Use editors
6.3.3 Utilize design tool from the integrated development environment (IDE) and third
party
6.3.4 Compile or interpret program into runnable form
6.3.5 Run program
6.3.6 Use tools contained within an IDE

**BIL: Essential: PSD**
**Recommended: ISS**
**EDU:** 10 12 AD
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**PSD** I P R
**IM**

**Competency 6.4: Debug programs**

*Descriptors:*
6.4.1 Test/run program
6.4.2 Correct syntax errors
6.4.3 Correct run-time errors
6.4.4 Debug logic errors

**Correlated Mathematics Academic Content Benchmarks**


**BIL: Recommended: ISS, PSD**
**EDU:** 10 12 AD
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**PSD** I P
**IM**

**Competency 6.5 Develop programs by applying specialized techniques and tools**

*Descriptors:*
6.5.1 Develop programs using data-validation techniques
6.5.2 Develop programs using reuse libraries
6.5.3 Develop programs using operating system calls

**Unit 7: Software Development Overview**

**BIL: Essential: PSD**
**Recommended: ISS**
**EDU:** 10 12 AD
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**PSD** I P
**IM**

**Competency 7.1: Demonstrate knowledge of software development methodology**

*Descriptors:*
7.1.1 Compare various system development life cycles (e.g., waterfall, RUP, iterative) [PSD]
7.1.2 Apply the principles of program design (e.g., structured, object-oriented, event driven) [PSD]
7.1.3 Describe how to resolve program implementation issues (e.g., debugging,
7.1.4 Describe the need for requirements specification documentation
7.1.5 Explain the implication of nonfunctional requirements (e.g., security, integrity, response time, and reliability) on solution design

**Correlated English Language Arts Academic Content Benchmarks**
- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)

**BIL:** Essential: PSD
**Recommended:** ISS

**EDU:** 10 12 AD
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**Competency 7.2: Demonstrate knowledge of basic software systems design**

**Descriptors:**
7.2.1 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)
7.2.2 Analyze documentation, forms, notes, and source data (PSD)
7.2.3 Identify constraints
7.2.4 Identify system processing requirements
7.2.5 Identify input and output (I/O) requirements (PSD)
7.2.6 Design system inputs, outputs, and processes
7.2.7 Prepare logic using program flowchart
7.2.8 Define variables (PSD)
7.2.9 Select programming language
7.2.10 Create design documentation (PSD)
7.2.11 Design implementation plan
7.2.12 Design project plan
7.2.13 Prepare dataflow diagram (PSD)
7.2.14 Present system design to management
7.2.15 Present system design to users
7.2.16 Select computer-aided software engineering (CASE) tools
7.2.17 Review design (e.g., peer and/or user walkthrough) [PSD]

**Correlated English Language Arts Academic Content Benchmarks**
- *Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure.* (Communication E, 8-10)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communication C, 11-12)
- *Give presentations using a variety of delivery methods, visual displays and technology.* (Communication G, 8-10; Communication F, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting*
techniques that are user friendly. (Writing Applications C, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

- Identify subsets of the real number system. (Number B, 8-10)
- Apply properties of operations and the real number system, and justify when they hold for a set of numbers. (Number C, 8-10)
- Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers. (Number D, 8-10)
- Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Algebra C, 8-10)
- Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

**30**

**BIL: Essential: ISS, PSD**

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**Competency 7.3: Develop software requirements/specifications**

**Descriptors:**

7.3.1 Identify the business/organizational problem/objective (PSD)
7.3.2 Access needed information using company references (e.g., procedural manuals, documentation, standards, work flowcharts)
7.3.3 Analyze requirements/specifications using current approaches (e.g., structured analysis, object-oriented analysis, prototyping, Jackson System Development)
7.3.4 Clarify specifications using questioning techniques
7.3.5 Follow specifications or drawings (PSD)
7.3.6 Record business process (e.g., using flowchart, step-by-step narrative, case analysis)
7.3.7 Record data (PSD)
7.3.8 Gather information using interviewing strategies
7.3.9 Develop informal specifications (PSD)
7.3.10 Develop formal specifications
7.3.11 Identify documentation needs
7.3.12 Identify computing standards and methodologies
7.3.13 Identify security measures
7.3.14 Present software requirements to users

**Correlated English Language Arts Academic Content Benchmarks**

- Utilize multiple sources pertaining to a singular topic to critique the various ways authors develop their ideas (e.g., treatment, scope and organization). (Reading: Informational Text E, 8-10)
- Synthesize the content from several sources on a single issue or written by a single author, clarifying ideas and connecting them to other sources and related topics. (Reading: Informational Text D, 11-12)
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly (Writing Applications C, 11-12)
- Use revision strategies to improve the style, variety of sentence structure, clarity of
controlling idea, logic, effectiveness of word choice and transitions between paragraphs, passages or ideas. (Writing Process C, 8-10)

* Use a variety of strategies to revise content, organization and style, and to improve word choice, sentence variety, clarity and consistency of writing. (Writing Process C, 11-12)

* Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

* Give informational presentations that contain a clear perspective, present ideas from multiple sources in logical sequence and include a consistent organizational structure. (Communication E, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

* Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)

**BIL: Essential: PSD**

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**Competency 7.4: Code programs**

Descriptors:

7.4.1 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)

7.4.2 Prepare detailed flowchart for coding program (PSD)

7.4.3 Generate source code using programming tools in accordance with established standards

7.4.4 Code and integrate security measures into source code

7.4.5 Code error-handling techniques

7.4.6 Interface program with data repository

7.4.7 Design reports in accordance with system design and user specifications

7.4.8 Write code to instantiate and print report objects upon user request

7.4.9 Generate executable code

7.4.10 Debug compilation errors (PSD)

7.4.11 Review code with peers or design team (PSD)

7.4.12 Report progress based on time line (PSD)

**Correlated Mathematics Academic Content Benchmarks**

* Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)


* Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

**BIL: Essential: PSD**

Recommended: ISS
Competency 7.5: Execute software testing, validation, change control, defect tracking, and documentation

Descriptors:
7.5.1 Access needed information
7.5.2 Develop comprehensive test plan
7.5.3 Develop test system
7.5.4 Develop test procedures
7.5.5 Perform tests (PSD)
7.5.6 Document errors (PSD)
7.5.7 Perform regression tests
7.5.8 Update design documentation
7.5.9 Prepare program documentation (PSD)
7.5.10 Prepare user documentation
7.5.11 Perform user acceptance test
7.5.12 Validate user documentation
7.5.13 Review results with customer/user
7.5.14 Report progress based on time line (PSD)

Correlated English Language Arts Academic Content Benchmarks
- Select and use an appropriate organizational structure to refine and develop ideas for writing. (Writing Process B, 11-12)
- Use revision strategies to improve the style, variety of sentence structure, clarity of controlling idea, logic, effectiveness of word choice and transitions between paragraphs, passages or ideas. (Writing Process C, 8-10)
- Use a variety of strategies to revise content, organization and style, and to improve word choice, sentence variety, clarity and consistency of writing. (Writing Process C, 11-12)
- Apply editing strategies to eliminate slang and improve conventions. (Writing Process D, 11-12)
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
- Produce informational essays or reports that establish a clear and distinctive perspective on the subject, include relevant perspectives, take into account the validity and reliability of sources and provide a clear sense of closure. (Writing Applications D, 11-12)
- Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure. (Communication E, 8-10)
- Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

BIL: Essential: PSD
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**Competency 7.6: Demonstrate knowledge of data structures**

Descriptors:
7.6.1 Explain techniques for data abstraction
7.6.2 Discuss program design using abstraction
7.6.3 Explain data structures (e.g., arrays and records, lists, trees, hashing, priority queues and heaps, equivalence relations, and graphs) as they apply to simulation (PSD)
7.6.4 Analyze mathematically the efficiency of algorithms that manipulate and use data structures in searching, sorting, dictionary operations, and graphing
7.6.5 Estimate algorithm efficiency using data structure concepts

**Correlated Mathematics Academic Content Benchmarks**
- Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measure of center and variability. (Data A, 8-10)
- Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)

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**Unit 8: Application Development Life Cycle**

*This unit is based upon the integration of multiple programs, components, and data tables into an application or system. Related competencies may be found in “Software Development” which focuses on the development of a single program application.*

**BIL:** Essential: ISS, PSD

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**Competency 8.1: Conduct requirements analysis**

Descriptors:
8.1.1 Determine development methodology (e.g., waterfall, XP, RUP)
8.1.2 Define business problem to be solved by the application (e.g., through interview process) [PSD]
8.1.3 Access needed information using company procedural manuals, references, documentation, and standards (PSD)
8.1.4 Define business information requirements (PSD)
8.1.5 Determine computer hardware and software needs (PSD)
8.1.6 Interpret source data, charts, and graphs
8.1.7 Review organizational structure
8.1.8 Interpret existing operating documents and procedures for the system
8.1.9 Observe existing procedures
8.1.10 Document existing procedures
8.1.11 Document possible alternative solutions
8.1.12 Identify processing requirements
8.1.13 Define high-level specifications (PSD)
8.1.14 Complete a requirements analysis document
8.1.15 Present findings and recommendations to users and management (e.g., confirm cost-benefit analysis, risk assessment, high-level work plan, project estimate)

**Correlated English Language Arts Academic Content Benchmarks**
- Analyze the features and structures of documents and critique them for their effectiveness. (Reading: Informational Text A, 11-12)
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
- Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted. (Research A, 11-12)
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)

**Correlated Mathematics Academic Content Benchmarks**
- Construct convincing arguments based on analysis of data and interpretations of graphs. (Data F, 8-10)
- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
- Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences. (Math. Process F, 11-12)

**BIL: Essential: PSD**
- EDU: 10 12 AD
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**Competency 8.2: Develop system framework**
**Descriptors:**
8.2.1 Identify constraints (e.g., political, financial, time, hardware, and systems)
8.2.2 Select programming language (PSD)
8.2.3 Select hardware platform (PSD)
8.2.4 Identify and utilize standards and policies as required to govern the development of organizational information technology
8.2.5 Select tool sets (e.g., code libraries, downloadable classes, testing tools, frameworks) [PSD]
8.2.6 Identify source code control (PSD)
8.2.7 Identify communication plan (PSD)

**BIL: Essential: PSD**
- EDU: 10 12 AD
- ISS
- NS
- PSD I P
- IM

**Competency 8.3: Design applications**
**Descriptors:**
8.3.1 Identify processing requirements (PSD)
8.3.2 Create specs with development team (PSD)
8.3.3 Divide design specifications into logical blocks (e.g., flowchart, dataflow diagram, process flow, UML) [PSD]
8.3.4 Establish input and output (I/O) requirements (e.g., initiative user interface, report designs, menus, data communications, handhelds, robotics) [PSD]
8.3.5 Design system input/output processes
8.3.6 Define configuration data
8.3.7 Integrate approved data model into design process
8.3.8 Prepare logic using program flowchart (PSD)
8.3.9 Differentiate between system documentation and user documentation
8.3.10 Integrate data model
8.3.11 Define test scenarios to be developed
8.2.12 Organize and present system design deliverables

Correlated English Language Arts Academic Content Benchmarks
• Formulate writing ideas and identify a topic appropriate to the purpose and audience. (Writing Process A, 8-10; Writing Process A, 11-12)
• Select and use an appropriate organizational structure to refine and develop ideas for writing. (Writing Process B, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

BIL: Essential: PSD
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Competency 8.4: Develop a series of programs that interact with one another in accordance with programming theory and software development techniques to solve the business problem

Descriptors:
8.4.1 Apply established operating system development tools, commands, utilities, and standards (e.g., naming conventions, indicative data names)
8.4.2 Evaluate operating system and network system constraints
8.4.3 Implement a simple hierarchy chart /design flowchart (PSD)
8.4.4 Utilize standards when writing source code (PSD)
8.4.5 Develop programs utilizing appropriate software development techniques (e.g., looping, arrays, functions)
8.4.6 Develop programs using file-handling techniques (e.g., config files, .ini files, text files)
8.4.7 Develop user interfaces (PSD)
8.4.8 Develop programs that interface with a data store
8.4.9 Implement temporary files, e.g., views, cursor files
8.4.10 Design reports in accordance with system design and user specifications
8.4.11 Write code to instantiate and print report objects upon user request
8.4.12 Code error-handling techniques
8.4.13 Review/Update system level documentation
8.4.14 Write callable subroutines, components, and classes

**Correlated Mathematics Academic Content Benchmarks**

- Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Algebra C, 8-10)

**BIL: Essential: PSD**

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**Competency 8.5: Develop a system test plan**

*Descriptors:*

8.5.1 Design/confirm system test plan
8.5.2 Create test data/results (PSD)
8.5.3 Execute the system test plan
8.5.4 Validate results (PSD)
8.5.5 Make changes as required (PSD)
8.5.6 Obtain user signoff

**Correlated Mathematics Academic Content Benchmarks**

- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
- Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population. (Data G, 8-10)
- Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (Data B, 11-12)

**BIL: Essential: ISS, PSD**

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**Competency 8.6: Develop user application documentation**

*Descriptors:*

8.6.1 Identify documentation needs (ISS, PSD)
8.6.2 Prepare user documentation (e.g., user manuals, help screens) [ISS]
8.6.3 Prepare system/process flow diagrams (PSD)
8.6.4 Establish documentation-update method

**Correlated English Language Arts Academic Content Benchmarks**

- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

**BIL: Essential: ISS, PSD**

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**Competency 8.7: Install application**

Descriptors:

8.7.1 Review organizational structure
8.7.2 Create and test deployment media
8.7.3 Design implementation plan (PSD)
8.7.4 Present implementation plan to users and management
8.7.5 Perform implementation or changeover to new system
8.7.6 Perform post-implementation evaluation of new system
8.7.7 Correct deficiencies
8.7.8 Train personnel
8.7.9 Identify ongoing support requirements (PSD)

**Correlated English Language Arts Academic Content Benchmarks**

- **Give presentations using a variety of delivery methods, visual displays and technology.** (Communication G, 8-10; Communication F, 11-12)
- **Analyze the features and structures of documents and critique them for their effectiveness.** (Reading: Informational Text A, 11-12)
- **Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly.** (Writing Applications C, 11-12)

**BIL: Essential: PSD**

**Recommended: ISS, NS**

**EDU: 10 12 AD**

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**NS I P**

**PSD I P**

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**Competency 8.8: Execute software product release and follow-up**

Descriptors:

8.8.1 Obtain user acceptance
8.8.2 Participate in development of release plan
8.8.3 Train technical support staff
8.8.4 Facilitate transition to the new system release
8.8.5 Participate in development of a user-training plan (PSD)
8.8.6 Evaluate defects (PSD)
8.8.7 Repair defects (PSD)
8.8.8 Document defects and repairs (PSD)
8.8.9 Implement enhancements
8.8.10 Evaluate enhancements
8.8.11 Document enhancements
8.8.12 Obtain user feedback
8.8.13 Evaluate users' concerns
8.8.14 Respond to users' concerns

**Correlated English Language Arts Academic Content Benchmarks**

- **Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly.** (Writing Applications C, 11-12)
• Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure. (Communication E, 8-10)
• Give presentations using a variety of delivery methods, visual displays and technology. (Communication G, 8-10; Communication G, 11-12)
• Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)
• Give informational presentations that contain a clear perspective, present ideas from multiple sources in logical sequence, and include a consistent organizational structure. (Communication E, 11-12)

BIL: Recommended: ISS, NS, PSD
EDU: 10 AD
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Competency 8.9: Complete team software engineering project
Descriptors:
8.9.1 Discuss the principles and applications of the software development organizational team
8.9.2 Gather data to identify customer requirements
8.9.3 Estimate product life or customer application
8.9.4 Evaluate functional requirements
8.9.5 Interpret functional requirements analysis
8.9.6 Define scope of work to meet customer requirements
8.9.7 Identify time, technology, and resource constraints
8.9.8 Estimate project costs
8.9.9 Apply project planning and scheduling techniques to project development
8.9.10 Generate design alternatives
8.9.11 Evaluate design alternatives
8.9.12 Define system and software requirements
8.9.13 Validate system requirements
8.9.14 Establish measurable performance requirements
8.9.15 Develop software product and project documentation
8.9.16 Perform software product and project document composition and evaluation
8.9.17 Conduct software product testing and debugging
8.9.18 Conduct technical review

Correlated English Language Arts Academic Content Benchmarks
• Analyze the features and structures of documents and critique them for their effectiveness. (Reading: Informational Text A, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. (Measurement F, 8-10)
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)

**BIL:** Essential: PSD
**Recommended:** ISS, NS

**EDU:** 10 12 AD
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**Competency 8.10: Apply quality standards**

Descriptors:
8.10.1 Identify metrics for measurement (PSD)
8.10.2 Establish baseline performance (PSD)
8.10.3 Measure actual performance and baseline performance (PSD)

**Correlated Mathematics Academic Content Benchmarks**

• Solve increasingly complex non-routine measurement problems and check for reasonableness of results. (Measurement A, 8-10)
• Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
• Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)

**Unit 9: Web Site Development and Management**

**BIL:** Essential: PSD

**EDU:** 10 12 AD
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**Competency 9.1: Demonstrate knowledge of HTML fundamentals**

Descriptors:
9.1.1 Create a basic HTML document that includes graphics and multimedia
9.1.2 Link Web documents
9.1.3 Utilize forms in an HTML document
9.1.4 Create and format a table in an HTML document

**BIL:** Essential: PSD

**EDU:** 10 12 AD
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**Competency 9.2: Develop an Internet program**

Descriptors:
9.2.1 Integrate scripting into an HTML document (PSD)
9.2.2 Employ object oriented techniques in Internet programming
9.2.3 Utilize volatile data storage techniques in Internet programming
9.2.4 Employ control structures in Internet programming
9.2.5 Create and call functions and procedures in Internet programming

**BIL: Essential: PSD**
EDU: 10 12 AD
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**Competency 9.3: Demonstrate knowledge of content management**
Descriptors:
9.3.1 Test site/application after content is updated to ensure integrity
9.3.2 Perform updates in a timely manner
9.3.3 Perform updates in accordance with application requirements
9.3.4 Update content only on appropriate pages in relevant objects of the database
9.3.5 Update and review links
9.3.6 Utilize appropriate tools to identify and update content
9.3.7 Backup site/application and data before performing updates
9.3.8 Log all update activities

**BIL: Essential: PSD**
EDU: 10 12 AD
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PSD I P
IM

**Competency 9.4: Demonstrate knowledge of Web application management**
Descriptors:
9.4.1 Plan rollout and facilitate handoff to customer
9.4.2 Integrate customer feedback
9.4.3 Perform application maintenance (PSD)
9.4.4 Recommend optimization and facilitate upgrades and improvements
9.4.5 Monitor Web site performance metrics (PSD)

**BIL: Recommended: NS, PSD**
EDU: 10 12 AD
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**Competency 9.5: Integrate scripting into an HTML document**
Descriptors:
9.5.1 Explain the concept of scripting technologies
9.5.2 Identify scripting languages (e.g., Java script, VB script)
9.5.3 Explain client-side scripting
9.5.4 Insert a client-side script into a Web page
9.5.5 Insert comments into client-side script
9.5.6 Explain server-side script
9.5.7 Compare and contrast the server-side script to client-side script
9.5.8 Identify “server page” development technologies (e.g., JSP, ASP)
9.5.9 Insert server-side script into a Web page
9.5.10 Insert comments into server-side scripts
9.5.11 Develop criteria for selecting server-side or client-side script, given a Web page development task

**Correlated English Language Arts Academic Content Benchmarks**

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)
- *Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product.* (Writing Process F, 11-12)

**Unit 10: Web Site Development and Management – HTML Fundamentals**

**BIL:** Recommended: ISS, NS
**EDU:** 10 12 AD
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**Competency 10.1: Create a basic HTML document**

*Descriptors:*

- 10.1.1 Explain the need for developers to create and maintain HTML script when utilizing Web document authoring tools that generate HTML script (e.g., ASP, .NET, Dreamweaver)
- 10.1.2 Discuss the basic principles of HTML, HTTP, and TCP/IP and their functional relationship with browsers
- 10.1.3 Plan a basic HTML document considering subject, audience, layout, color, links and graphics
- 10.1.4 Utilize HTML tags that display and format Web content to create a basic Web page in a text editor (e.g., <h1>, <p>, <br>)
- 10.1.5 Add documentation to the HTML document
- 10.1.6 Print an HTML document
- 10.1.7 Display a basic Web page on a browser that was created in a text editor
- 10.1.8 Evaluate functionality and features of downloadable freeware HTML authoring IDEs to create basic Web sites (e.g., Homesite, CuteHTML)

**BIL:** Recommended: ISS, NS
**EDU:** 10 12 AD
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**Competency 10.2: Demonstrate knowledge of graphics and multimedia**

*Descriptors:*
10.2.1 Insert and align inline graphics into an HTML document using the `<img src=...>` tag and the ALIGN attribute
10.2.2 Resize a graphic image in an HTML document utilizing the HEIGHT and WIDTH attributes
10.2.3 Explain the concept of an image map
10.2.4 Locate downloadable freeware that generates an image map for a given graphic (e.g., Map This!, MapIt)
10.2.5 Create an image map for a given graphic utilizing image map generation freeware, and insert the generated HTML into an HTML document
10.2.6 Insert audio into an HTML document by linking an image to an audio file utilizing a combination of the `<a href="file:..."/>` tag with the `<img src=.../>` tag

**BIL: Recommended: ISS, NS**
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**Competency 10.3: Link Web documents**
Descriptors:
10.3.1 Link HTML document to other Web sites utilizing the `<a href="http:..."/>` tag configuration
10.3.2 Link HTML document to other HTML documents utilizing the `<a href="file:..."/>` tag configuration
10.3.3 Write an HTML anchor that links to another section of the same document
10.3.4 Link one Web page to another by clicking a graphic image utilizing a combination of the `<a href="file:..."/>` tag with the `<img src=.../>` tag

**BIL: Recommended: ISS, NS**
EDU: 10 12 AD
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**Competency 10.4: Utilize forms in an HTML document**
Descriptors:
10.4.1 Discuss the concept of a form on a Web document and the various input tags that can be contained within the form (e.g., text entry fields, radio buttons)
10.4.2 Design a basic data entry HTML document containing forms from given specifications, with a variety of user input controls (e.g., text entry fields, radio buttons)
10.4.3 Write the HTML code to add a form to an HTML document by using the `<form>` tag and the selected ACTION or METHOD attributes
10.4.4 Write the HTML code for a text entry field contained within a form on an HTML document utilizing the `<input type="text".../>` tag and relevant attributes
10.4.5 Write the HTML code for radio buttons contained within a form on an HTML document utilizing the `<input type="radio".../>` tag and relevant attributes
10.4.6 Write the HTML code for a check box button(s) contained within a form on an HTML document utilizing the `<input type="checkbox".../>` tag and relevant
attributes
10.4.7 Write the HTML code for a pull-down menu contained within a form on an HTML document utilizing the `<select name…>` tag and `<option select…>` tag and relevant attributes
10.4.8 Write the HTML code for a scroll box contained within a form on an HTML document utilizing the `<select name…size=…>` tag and `<option select…>` tag and relevant attributes
10.4.9 Code selected default values for all input tags
10.4.10 Write the HTML code for a pull-down menu contained within a form on an HTML document utilizing the `<select name…>` tag and `<option select…>` tag and relevant attributes
10.4.11 Discuss the concept and function of a push (submit) button
10.4.12 Write the HTML code for a submit button contained within a form on an HTML document utilizing the `<input type=”submit”…>` tag and relevant attributes

**BIL: Recommended: ISS, NS**
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**Competency 10.5: Create and format a table on an HTML document**

**Descriptors:**
10.5.1 Write the HTML code to insert a table in an HTML document utilizing the `<table>` tag
10.5.2 Utilize the `<tr>` and `<td>` tags to create table rows and columns on a Web document
10.5.3 Enlarge a row to several columns by utilizing the ROWSPAN attribute on an HTML document
10.5.4 Enlarge a column on a table by combining it with adjacent cells with the COLSPAN attribute on an HTML document
10.5.5 Enlarge a row on a table by combining it with adjacent cells with the ROWSPAN attribute on an HTML document
10.5.6 Format a border on a table utilizing the BORDER= and BORDERCOLOR= table attributes on an HTML document
10.5.7 Align text on a table utilizing the ALIGN = attribute of the `<td>` and `<tr>` tags on an HTML document
10.5.8 Add color to table rows utilizing the BGCOLOR= attribute of the `<tr>` tag on an HTML document
10.5.9 Discuss the concept of table sizing on an HTML document
10.5.10 Control the dimensions of a table by utilizing the CELLPADDING= and WIDTH=table attributes of an HTML document

**Unit 11: Web Site Development: Content Development and Technical Analysis**
(Based on NSSB Information & Communications Technology Skill Standards)

**BIL: Essential: IM**
**EDU: 10 12 AD**

49
Competency 11.1: Gather data and identify customer requirements and scope of work

Descriptors:
11.1.1 Define audience and mission in accordance with client procedures
11.1.2 Utilize affordable, reliable and relevant sources and methods for gathering requirements
11.1.3 Specify requirements and scope of work assuring they are accurate, complete, documented, updated on a regular basis and stored in an accessible and readable knowledge base for future reference
11.1.4 Gather information regarding global considerations (e.g., time zones, language, cultural sensitivities)

Correlated English Language Arts Academic Content Benchmarks
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
• Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources. (Research C, 11-12)

BIL: Essential: IM
EDU: 10 12 AD

Competency 11.2: Review technical information and restraints

Descriptors:
11.2.1 Consider technical factors (e.g., server load, screen resolution, hard drive space, bandwidth, database performance) [IM]
11.2.2 Consider and address feasibility, usability, extensibility and maintenance issues (IM)
11.2.3 Assess budget and equipment constraints and approvals (IM)
11.2.4 Research and compare software tools as to their effectiveness for the work to be done and ability to integrate into the existing organization system (IM)
11.2.5 Research and consider accessibility laws, privacy laws, and regulatory issues (IM)
11.2.6 Assess implementation risk and communicate to appropriate personnel (IM)
11.2.7 Research and address system performance and availability requirements (IM)

Correlated English Language Arts Academic Content Benchmarks
• Organize information from various resources and select appropriate sources to support central ideas, concepts and themes. (Research C, 8-10)
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
• Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources. (Research C, 11-12)

BIL: Essential: IM
EDU: 10 12 AD
Competency 11.3: Develop, present, and assess concept alternatives

Descriptors:
11.3.1 Present an appropriate number of concepts to all relevant stakeholders (IM)
11.3.2 Resolve conflicts among key stakeholders (IM)
11.3.3 Present concept alternatives for developing an effective solution (IM)
11.3.4 Consider and document technology alternatives (IM)
11.3.5 Choose and document the appropriate solution (IM)
11.3.6 Evaluate the alternatives against the selection criteria (IM)

BIL: Essential: IM
EDU: 10 12 AD
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Competency 11.4: Prepare preliminary application

Descriptors:
11.4.1 Organize content information in order to meet application objectives (IM)
11.4.2 Gather a consensus among all stakeholders regarding the organization of information and the look and feel of the product (IM)
11.4.3 Follow company guidelines and practices in preparation of the preliminary application (IM)

BIL: Essential: IM
EDU: 10 12 AD
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Competency 11.5: Prepare functional, content, testing and technical specifications

Descriptors:
11.5.1 Prepare functional, content, testing and technical specifications to include detail on all product features (IM)
11.5.2 Present functional, content, testing and technical specifications in a clear and precise manner (IM)
11.5.3 Publish and regularly update functional, content, testing and technical specifications (IM)
11.5.4 Describe the operating system in functional, content, testing and technical specifications (IM)
11.5.5 Integrate and analyze customer and end-user needs into technical specifications (IM)
11.5.6 Describe software, communication protocols and programming languages in technical specifications (IM)

Correlated Mathematics Academic Content Benchmarks

- Use of variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas. (Math. Process E, 8-10)
- Communicate mathematical ideas orally and in writing with a clear purpose and
appropriate for a specific audience.  (Math. Process I, 11-12)

BIL: Essential: IM
EDU: 10 12 AD
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Competency 11.6: Create and refine preliminary design or prototype
Descriptors:
11.6.1 Represent all required design features in a prototype (IM)
11.6.2 Include representative functional features in a prototype (IM)
11.6.3 Review and refine the prototype based on customer feedback, new information and technical considerations (IM)
11.6.4 Evaluate the effectiveness of the software tools chosen for the project in the prototype (IM)
11.6.5 Complete prototype on schedule (IM)

BIL: Essential: IM
EDU: 10 12 AD
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IM I P

Competency 11.7: Develop project plan
Descriptors:
11.7.1 Identify key stakeholder requirements in the project plan (IM)
11.7.2 Include project schedules, resource allocations, dependencies, milestones, functional and technical specifications, all data models, site maps, constraints and risks in the project plan (IM)
11.7.3 Include thorough testing of the solution and presentation of testing results in the project plan (IM)
11.7.4 Include all specifications in the project plan (IM)
11.7.5 Determine how documentation will be conducted in the project plan (IM)
11.7.6 Document and regularly update the project plan throughout the project life cycle in a previously determined format (IM)
11.7.7 Distribute project plan according to company procedures (IM)

Correlated English Language Arts Academic Content Benchmarks
• Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product.  (Writing Process F, 11-12)
• Compile, organize and evaluate information, take notes and summarize findings.  (Research B, 11-12)

Unit 12: Web Site Development: Develop and Design Web Applications and Sites
(Based on NSSB Information & Communications Technology Skill Standards)

BIL: Recommended: IM
EDU: 10 12 AD
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Competency 12.1: Develop Web site architecture, application models and user interface specifications

Descriptors:
12.1.1 Develop consensus among all relevant key stakeholders regarding the organization of information and the look and feel of the end product
12.1.2 Develop system interactions and sequence diagrams
12.1.3 Develop site map, application models, image and page templates to meet project goals, user needs and application objectives
12.1.4 Develop site maps and application models in accordance with company standards and industry best practices
12.1.5 Review existing documentation
12.1.6 Employ file management procedures in accordance with organization protocols
12.1.7 Obtain approvals on final site map prior to implementing any design

BIL: Recommended: IM
EDU: 10 12 AD
ISS
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IM 1 P

Competency 12.2: Choose an architecture

12.2.1 Research, document and rate main alternatives according to best match with current project
12.2.2 Outline and present alternative technical and design scenarios
12.2.3 Analyze tradeoffs and risks of all alternatives
12.2.4 Seek review and approval of selected alternative by management and all members of the team
12.2.5 Assure selected alternative meets functionality, timeline and budget requirements
12.2.6 Document selected alternative in a clear and detailed form

BIL: Recommended: IM
EDU: 10 12 AD
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Competency 12.3: Select programming languages, design tools and applications

Descriptors:
12.3.1 Select tools and applications based on functional requirements and technical and company specifications (e.g., frameworks, graphics designers, code generators)
12.3.2 Properly assess and evaluate third-party applications
12.3.3 Survey existing employee skill sets to determine tool and programming language selection
12.3.4 Test new tools and program languages to assure compatibility with pre-existing tools and existing company computing equipment
12.3.5 Determine and document the selected programming language compatibility with the browser, existing devices and operating system
12.3.6 Determine and document the selected programming language’s ability to support object orientation according to industry standards

**BIL: Recommended: IM**

**EDU:** 10 12 AD

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**Competency 12.4: Write supporting code**

**Descriptors:**

12.4.1 Determine if code meets project objectives, functional specifications, best practices and in-house coding guidelines
12.4.2 Design code that promotes efficient application performance and is easily maintained and debugged
12.4.3 Document code to ensure maintainability and upgradeability
12.4.4 Stub test and document code in accordance with company procedures
12.4.5 Research, test and document user interface usability
12.4.6 Analyze and resolve any errors in a timely and cost-effective manner
12.4.7 Construct large-scale test scenarios

**BIL: Recommended: IM**

**EDU:** 10 12 AD

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**Competency 12.5: Analyze major subsystems and interfaces**

**Descriptors:**

12.5.1 Define and delineate all major subsystems and interfaces
12.5.2 Minimize overlap and interaction between major subsystems
12.5.3 Test for compatibility of application subsystems and interfaces
12.5.4 Document major subsystems and interfaces
12.5.5 Document interactions with subsystems and interfaces

**BIL: Recommended: IM**

**EDU:** 10 12 AD

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**Competency 12.6: Develop models**

**Descriptors:**

12.6.1 Define scope and purpose of models
12.6.2 Develop models that are cost-effective and completed on schedule
12.6.3 Develop models that are representative of design and functionality
12.6.4 Exercise models and test for performance
12.6.5 Document model development procedures, test results and recommendations
12.6.6 Develop models to reflect all aspects of the project including the business, interface and data

**BIL: Recommended: IM**
Competency 12.7: Develop design and interface specifications

Descriptors:
12.7.1 Seek approval of design and interface specifications by all relevant parties
12.7.2 Check and correct design and interface specifications for conflicts
12.7.3 Assess design and interface specifications for ease and quality of implementation
12.7.4 Document design and interface specifications
12.7.5 Develop and diagram entity relationships

BIL: Recommended: IM

Competency 12.8: Identify system platform components and dependencies

Descriptors:
12.8.1 Clearly delineate system platform components and dependencies
12.8.2 Document reasons for constraints
12.8.3 Delineate all components and interfaces to ensure a minimum of overlap and interaction between components
12.8.4 Identify and document long-term usability and future upgrade requirements

BIL: Recommended: IM

Competency 12.9: Link and develop supporting database

Descriptors:
12.9.1 Establish and define links between Web applications and associated databases
12.9.2 Develop protocols in accordance with company procedures
12.9.3 Assist database developers in meeting project specifications
12.9.4 Develop database functionality to meet project specifications
12.9.5 Utilize fundamental database concepts

Unit 13: Implement and Maintain Applications
(Based on NSSB Information & Communications Technology Skill Standards)

BIL: Recommended: ISS

Competency 13.1: Plan rollout and facilitate handoff to customer

Descriptors:
13.1.1 Include overall project goals and timelines in rollout plan
13.1.2 Communicate rollout plans to key stakeholders in a timely manner
13.1.3 Conduct final review and approvals according to company standards
13.1.4 Identify support staff, training needs, and contingency plans in the rollout plan
13.1.5 Document contingency plan that is user-friendly
13.1.6 Test project for errors and seek all approvals prior to delivery to customer
13.1.7 Test delivered application to assure that it is fully functional for the customer/user and meets all requirements
13.1.8 Deliver support and training materials

Correlated English Language Arts Academic Content Benchmarks

- Give informational presentations that contain a clear perspective, present ideas from multiple sources in logical sequence and include a consistent organizational structure. (Communication E, 11-12)

BIL: Recommended: ISS
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Competency 13.2: Integrate customer feedback

Descriptors:
13.2.1 Gather and document customer feedback on a continuous basis
13.2.2 Act upon user feedback after analysis, prioritization and review for interdependencies
13.2.3 Document changes
13.2.4 Inform customers of applications changes and updates
13.2.5 Execute change orders in accordance with company procedures to determine project costs and communicate to client

Correlated English Language Arts Academic Content Benchmarks

- Use a variety of strategies to enhance listening comprehension. (Communication A, 11-12)
- Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

BIL: Recommended: ISS
EDU: 10 12 AD
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Competency 13.3: Perform application maintenance

Descriptors:
13.3.1 Identify, research, document and resolve problems in a timely manner
13.3.2 Modify changes to applications in a timely and cost-effective manner and track in application life cycle
13.3.3 Enhance applications without interruption of service
13.3.4 Meet customer internal, external and global expectations in a timely manner
13.3.5 Back up applications and related data
13.3.6 Prepare a plan for disaster recovery
13.3.7 Document modifications to applications
13.3.8 Archive older versions of applications
13.3.9 Document interactions resulting in applications changes

**BIL: Recommended: ISS**

**EDU:** 10 12 AD
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**Competency 13.4: Recommend optimization and facilitate upgrades and improvement**

**Descriptors:**
13.4.1 Gather and document customer feedback and evaluate for feasibility
13.4.2 Develop recommendation for on-site improvements along with associated budget considerations
13.4.3 Present recommendations to key stakeholders in accordance with company procedures
13.4.4 Identify and consider risk assessment
13.4.5 Test system operation specifications under heavy traffic and load conditions
13.4.6 Apply performance metrics to system optimization
13.4.7 Document installation and configuration procedures to aid maintainability and repetition

**Correlated English Language Arts Academic Content Benchmarks**

- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
- Use a variety of strategies to enhance listening comprehension. (Communication A, 11-12)
- Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

- Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)
- Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

**BIL: Recommended: ISS**

**EDU:** 10 12 AD
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**Competency 13.5: Administer content**

**Descriptors:**
13.5.1 Test site/application after content is updated to ensure integrity
13.5.2 Perform updates in a timely manner
13.5.3 Perform updates in accordance with application requirements
13.5.4 Update content only on appropriate pages in relevant objects of the database
13.5.5 Update and review links
13.5.6 Utilize appropriate tools to identify and update content
13.5.7 Backup site/application and data before performing updates
13.5.8 Log all update activities

**BIL: Recommended: ISS**
**EDU:** 10 12 AD
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**Competency 13.6: Document application and site changes as it applies to the system environment and application version**

Descriptors:
13.6.1 Document all changes in accordance with documentation procedures and standards
13.6.2 Distribute change documentation in a timely manner to relevant personnel and/or departments
13.6.3 Develop and follow change procedures
13.6.4 Include backup versions with documented site changes

**BIL: Recommended: ISS**
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**Competency 13.7: Monitor performance metrics**

Descriptors:
13.7.1 Minimize system down time
13.7.2 Collect and document systematic and ongoing measurement data
13.7.3 Identify and update metrics
13.7.4 Monitor and print usage logs on a regular basis in accordance with company procedures
13.7.5 Monitor system for intrusions and denial-of-service attacks
13.7.6 Measure performance statistics using a variety of hardware systems and internal connections
13.7.7 Documents and archive metrics on a regular basis

**Correlated Mathematics Academic Content Benchmarks**

- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlations and variability. (Data B, 11-12)
- Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

**Competition 13.8: Implement and support changes in new technology**

Descriptors:
13.8.1 Implement changes in a timely manner
13.8.2 Test site/application to establish baseline before changes are incorporated
13.8.3 Evaluate appropriate browser and device types for functionality and compatibility with new technology
13.8.4 Verify changes in database functionality
13.8.5 Test site/application for performance, functionality and reliability after changes are completed
13.8.6 Document changes in accordance with company standards
13.8.7 Monitor site page bandwidth usage and customer feedback on a consistent basis and make adjustments accordingly
13.8.8 Archive older versions of applications

**Unit 14: Multimedia Development: Performance Testing and Quality Assurance**

(Based on NSSB Information & Communications Technology Skill Standards)

**Competency 14.1: Develop test and acceptance plan**

Descriptors:
14.1.1 Create a written procedure agreed by the customer and the project team for determining the acceptability of the project deliverables
14.1.2 Develop test and acceptance plan that is completed and documented in accordance with applicable policies and baseline tests
14.1.3 Develop a test plan that is relevant to the application and assure requirements are in compliance with legal and customer requirements
14.1.4 Develop a test system that accurately mimics external interfaces
14.1.5 Develop realistic test cases that compare with expected performance and include all browser and device types
14.1.6 Identify testing resources and establish a schedule
14.1.7 Seek customer acceptance upon successful completion of the test plan

Correlated English Language Arts Academic Content Benchmarks
Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

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Competency 14.2: Develop test procedures and performance assessment requirements
Descriptors:
14.2.1 Develop test procedures that explicitly verify specifications
14.2.2 Develop test procedures that define test conditions
14.2.3 Document testing procedures
14.2.4 Develop appropriate tests for individual components and end-to-end operations

Correlated Mathematics Academic Content Benchmarks
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)

BIL: Essential: IM
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Competency 14.3: Develop and perform usability and testing integration
Descriptors:
14.3.1 Provide individuals from the representative user community opportunities to interact with product (IM)
14.3.2 Observe and document user while using the product (IM)
14.3.3 Convey information of usability test to development team or have development team attend usability testing sessions (IM)
14.3.4 Resolve any problems that are indicated from usability test results (IM)
14.3.5 Maintain test data and documentation over time for accessibility to the development team (IM)
14.3.6 Describe test routines and procedures for applicability efficiency (IM)
14.3.7 Identify appropriate metrics for the tests based on user task analysis findings (IM)
14.3.8 Repeat usability testing as necessary after product revisions (IM)

Correlated Mathematics Academic Content Benchmarks
• Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population. (Data G, 8-10)

BIL: Essential: IM
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Competency 14.4: Complete performance test process
Descriptors:
14.4.1 Identify appropriate team members in test process (IM)
14.4.2 Test system according to plan and schedule (IM)
14.4.3 Document test results and communicate as appropriate (IM)
14.4.4 Perform system integration testing and volume/performance testing when appropriate (IM)
14.4.5 Repeat testing after all major program modifications (IM)

BIL: Recommended: IM
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Competency 14.5: Recommend and implement performance improvement
14.5.1 Codify and analyze performance metrics for effective decision support
14.5.2 Actively solicit customer feedback to be maintained and applied to performance reviews
14.5.3 Prepare application improvement plans based on performance reviews and business goals
14.5.4 Compare performance analysis to previous tests after implementing performance improvements

Correlated Mathematics Academic Content Benchmarks
- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
- Construct convincing arguments based on analysis of data and interpretation of graphs. (Data F, 8-10)

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Competency 14.6: Provide quality customer service
Descriptors:
14.6.1 Manage customer relationship and communications so that customers are satisfied with current level of service
14.6.2 Meet internal, external and global customer expectations in a timely manner
14.6.3 Identify problems and refer to appropriate personnel in a timely manner
14.6.4 Adjust communications to fit the audience
14.6.5 Evaluate customer feedback to determine the source of any confusion or concerns
14.6.6 Address and resolve customer concerns concerning site/applications to avoid repeated complaints
14.6.7 Communicate customer service contact information clearly to customers in a timely manner

Correlated English Language Arts Academic Content Benchmarks
- Use a variety of strategies to enhance listening comprehension. (Communication, A, 8-10; Communication A, 11-12)
• Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques. (Communication D, 8-10)
• Give presentations using a variety of delivery methods, visual displays and technology. (Communication G, 8-10; Communication F, 11-12)
• Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

Unit 15: Basic Mainframe Concepts

BIL: Essential: PSD
Recommended: ISS
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Competency 15.1: Demonstrate knowledge of enterprise systems
Descriptors:
15.1.1 Identify types of mainframe memory storage techniques architecture
15.1.2 Identify data storage techniques used by mainframe operation (PSD)
15.1.3 Explain how data is stored in mainframe computer memory (PSD)
15.1.4 Explain how a mainframe computer system executes program instructions
15.1.5 Discuss mainframe storage capacity

BIL: Recommended: PSD
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Competency 15.2: Design multi-tiered applications
15.2.1 Discuss the features, functions, and architectures of client/server computing
15.2.2 Define the objectives of a client/server application
15.2.3 Analyze design requirements
15.2.4 Perform a logical design
15.2.5 Specify needed technology
15.2.6 Identify appropriate migration strategies
15.2.7 Implement online transition processing (OLTP)
15.2.8 Design online analytical processing (OLAP) for data warehousing
15.2.9 Design static and dynamic online processing systems (OLIP/OLAP)
15.2.10 Employ interface techniques

BIL: Recommended: PSD
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Competency 15.3: Set up mainframe database systems
Descriptors:
15.3.1 Create client application resources (e.g., icons, menus, windows, dialogs)
15.3.2 Set up/modify database
15.3.3 Build a help system
15.3.4 Connect heterogeneous databases
15.3.5 Prepare reports using mainframe database

**Correlated English Language Arts Academic Content Benchmarks**

- Use a variety of strategies to revise content, organization and style, and to improve word choice, sentence variety, clarity and consistency of writing. (Writing Process C, 11-12)
- Produce informational essays or reports that establish a clear and distinctive perspective on the subject, include relevant perspectives, take into account the validity and reliability of sources and provide a clear sense of closure. (Writing Applications D, 11-12)

**BIL: Recommended: ISS, PSD**

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PSD I
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**Competency 15.4: Operate mainframe computer systems**

**Descriptors:**
15.4.1 Interpret terminology associated with mainframe computer operation
15.4.2 Identify data requirements
15.4.3 Access needed information using standard references and sources
15.4.4 Perform logon procedures
15.4.5 Respond to system messages
15.4.6 Follow processing procedures for each application/job
15.4.7 Determine scheduling priority
15.4.8 Develop audit trails
15.4.9 Develop a test system plan
15.4.10 Handle materials and equipment in a responsible manner
15.4.11 Define user interface standards
15.4.12 Build a job scheduler
15.4.13 Determine resources required to distribute the application

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD
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PSD I
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**Competency 15.5: Maintain mainframe computer systems**

**Descriptors:**
15.5.1 Solve recoverable problems
15.5.2 Maintain security
15.5.3 Maintain computer log
15.5.4 Perform backup procedure(s)
15.5.5 Follow logoff procedure(s)
15.5.6 Establish quality control standards
Unit 16: Hardware Design, Operation, and Maintenance

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS P R
NS P R
PSD
IM

Competency 16.1: Demonstrate proficiency in working with microcomputer systems

Descriptors:
16.1.1 Identify the essential components of microcomputers and the functions of each
16.1.2 Discuss the principles and operation of bus concepts (e.g., VESA, EISA)
16.1.3 Discuss the operating systems (e.g., Windows, *NIX, DOS)
16.1.4 List types of input and output devices and peripherals
16.1.5 Discuss the principles and operation of storage devices
16.1.6 Connect input and output ports to peripherals

BIL: Essential: ISS
Recommended: NS
EDU: 10 12 AD
ISS P R
NS P R
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Competency 16.2: Demonstrate proficiency in working with basic computer system architecture

Descriptors:
16.2.1 Explain the principles and operation of addresses and interrupts
16.2.2 Discuss the principles and operation of volatile and nonvolatile memory

Correlated English Language Arts Academic Content Benchmarks
• Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

BIL: Essential: ISS, NS
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Competency 16.3: Explain the purpose and importance of hardware standards

Descriptors:
16.3.1 Identify standard-setting bodies, OSI, IEEE, ISO, and ITU-T (formerly CCITT) standards
16.3.2 Explain the purpose and importance of each standard setting body

BIL: Essential: ISS, NS, IM
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Competency 16.4: Identify common computing platforms

Descriptors:
16.4.1 Identify the basic features of standard microprocessors (e.g., Intel family, RISC, AMD) [IM]
16.4.2 Identify standard memory types (e.g., RAM, ROM, DDRAM) [IM]
16.4.3 Identify standard input/output devices (e.g., ISA, EISA, PCI, USB, drive controllers, SCSI, PCMCIA, firewire) [IM]
16.4.4 Identify the basic features of standard operating systems (e.g., Windows Macintosh OS; Solaris, Linux, UNIX) [IM]
16.4.5 Identify the basic features of standard workstations (IM)

BIL: Essential: NS
Recommended: ISS
EDU: 10 12 AD
ISS I R
NS I P
PSD
IM

Competency 16.5: Analyze the computer site environment
Descriptors:
16.5.1 Identify environmental and structural requirements, conditions, and limitations (NS)
16.5.2 Identify power requirements and power supplies (NS)
16.5.3 Identify environmental standards and issues as they pertain to local, state, federal, global, and industry standards (NS)
16.5.4 Identify wiring specifications in compliance with state/local/federal codes (NS)
16.5.5 Identify physical site access and security (NS)

Correlated Mathematics Academic Content Benchmarks
• Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)
• Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
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PSD I
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Competency 16.6: Classify computer architecture and processor types
Descriptors:
16.6.1 Compare/contrast the features of different microcomputer processors, minicomputer architecture and processors, and mainframe architecture and processors enterprise mid-range and personal computing
16.6.2 Identify internal system unit components
16.6.3 Compare/contrast system bus structures
16.6.4 Identify appropriate use of architecture alternatives

BIL: Essential: ISS
Recommended: NS, PSD
Competency 16.7: Classify computer systems

Descriptors:
16.7.1 Interpret terminology and acronyms related to computer systems architecture
16.7.2 Identify the input, process, output and storage hardware required in a system
16.7.3 Identify the basic organization of CPU architecture (e.g., Von Neumann, block diagram, data paths, control path, functional units, instruction cycles)
16.7.4 Compare/contrast multiprocessor architectures (e.g., single multiprocessing and distributed processing, stack, array, vector, multiprocessor, hypercube, client server, supercomputers)
16.7.5 Compare/contrast fundamentals of instruction-set types and architectures, including registers and RISC addressing modes
16.7.6 Compare/contrast of data-structure machine representations, including signed integers, character strings, stacks, records, and linked lists
16.7.7 Describe the principles and operation of volatile and nonvolatile memory
16.7.8 Discuss the principles and operation of advanced memory techniques
16.7.9 Identify standard input/output devices and systems, and IO subsystem
16.7.10 Describe the principles and operation of addresses and interrupt processing, and direct-memory-access data-handling system(s) [e.g., CICS]
16.7.11 Define functions of advanced memory techniques (e.g., virtual, pipeline, cache)
16.7.12 Demonstrate appropriate use of command sets to handle tasks in operating systems
16.7.13 Identify cost and performance issues in designing, building or upgrading a computer system

Correlated English Language Arts Academic Content Benchmarks
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonable of solutions. (Measurement F, 9-10)
• Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation. (Math. Process J, 11-12)

BIL: Essential: ISS
Recommended: NS, PSD
Competency 16.8: Identify and explain CPU and system components

Descriptors:
16.8.1 Explain CPU configuration and structure
16.8.2 Describe the characteristics of system boards
16.8.3 Describe the characteristics and operation of interface cards
16.8.4 Describe the characteristics and operation of the PCMCIA bus (PC Card and CardBus)
16.8.5 Differentiate between ROM, PROM, EPROM, EEPROM, RAM (including cache)
16.8.6 Differentiate between synchronous and asynchronous circuits

Correlated English Language Arts Academic Content Benchmarks
- Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

BIL: Essential: ISS, NS
Recommended: PSD

Competency 16.9: Identify and describe connectivity devices

Descriptors:
16.9.1 Recognize the appropriate use, characteristics, and operations of network interface devices
16.9.2 Discuss the characteristics and operation of analog communication devices (e.g., multiplexers, modems, DSU)
16.9.3 Discuss the characteristics and operation of digital communication devices. (e.g., switches, routers, firewalls, and routers)
16.9.4 Discuss the operation of test equipment (e.g., protocol analyzers)
16.9.5 Discuss wireless technologies (e.g., 802.1x, CDMA, GSM, Microwave, RFID, Bluetooth)

Correlated Mathematics Academic Content Benchmarks
- Compare, order and determine equivalent forms of real numbers. (Number E, 8-10)
- Explain the effects of operations on the magnitude of quantities. (Number F, 8-10)
- Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

BIL: Essential: ISS, NS
Recommended: PSD

Competency 16.10: Identify and describe peripheral equipment
Descriptors:
16.10.1 Describe storage system concepts and technologies
16.10.2 Identify interfaces between computers and other devices (e.g. Firewire, USB, IEEE, Serial ATA, SCSI)
16.10.3 Define printer types and related interface controllers
16.10.4 Define the use and operation of tape equipment and technologies
16.10.5 Compare and contrast RAID concepts

BIL: Essential: ISS, NS
Recommended: PSD

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Competency 16.11 Evaluate cost and performance issues in designing, building or upgrading a computer system

Descriptors:
16.11.1 Identify and document user hardware/software and network requirements
16.11.2 Evaluate and recommend products and services and associated costs
16.11.3 Identify upgrade costs and financial risks and risk management and business continuity

Correlated Mathematics Academic Content Benchmarks
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonable of solutions. (Measurement F, 9-10)
• Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation. (Math. Process J, 11-12)

BIL: Essential: ISS, NS, IM

EDU: 10 12 AD
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Competency 16.12: Troubleshoot computer systems

Descriptors:
16.12.1 Test system using diagnostic tools/software (NS, ISS, IM)
16.12.2 Identify problems in the operating system and related hardware (NS, ISS, IM)
16.12.3 Differentiate between hardware and software failure (NS, ISS, IM)
16.12.4 Update flash memory (BIOS) [(NS]
16.12.5 Optimize hard drive (NS, IM)
16.12.6 Gather information on problem from user (NS, ISS, IM)
16.12.7 Repair/replace malfunctioning hardware (NS, ISS)
16.12.8 Reinstall software as needed (NS, ISS)
16.12.9 Recover data and/or files (NS)
16.12.10 Restore system to normal operating standards (NS, ISS)

**Correlated English Language Arts Academic Content Benchmarks**

- Use a variety of strategies to enhance listening comprehension. (Communication A, 11-12)

**Unit 17: Fundamentals of Electronics Technology**

**BIL: Recommended: NS**

**EDU:** 10 12 AD

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**NS I R**

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**Competency 17.1: Demonstrate an understanding of electrical fundamentals**

**Descriptors:**

17.1.1 Identify electrical components and schematic symbols
17.1.2 Identify electrical components/values using color codes and symbols
17.1.3 Describe of basic atomic structure and its relationship to electricity
17.1.4 Describe the relationship between electrical and magnetic properties
17.1.5 Demonstrate the electrical and magnetic properties of a magnet
17.1.6 Demonstrate the photoelectric effect
17.1.7 Demonstrate the thermocouple and Peltier effects
17.1.8 Discuss electrical static change and the role of friction
17.1.9 Follow electrostatic discharge (ESD) preventive procedures
17.1.10 Identify sources of electricity
17.1.11 Discuss the principles and operation of electrochemical supplies
17.1.12 Calculate voltage, current, resistance, power, and energy
17.1.13 Apply Ohm's law
17.1.14 Apply power formulas
17.1.15 Solve electronic unit problems using metric units

**Correlated Mathematics Academic Content Benchmarks**

- Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)
- Solve and graph linear equations and inequalities. (Algebra F, 8-10)
- Apply algebraic methods to represent and generalize problem situations involving vectors and matrices. (Algebra D, 11-12)
- Use scientific notation to express large numbers and numbers less than one. (Number A, 8-10)
- Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
- Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents. (Number I, 8-10)
• Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates. (Measurement D, 8-10)
• Apply factorials and exponents, including fractional exponents, to solve practical problems. (Number C, 8-10)

**Competency 17.2: Demonstrate knowledge of operating the various types of equipment used to test/measure DC circuits, AC circuits, solid-state devices, digital circuits, analog circuits, and microprocessors**

*Descriptors:*
17.2.1 Demonstrate the function and operation of an analog volt-ohm-meter (AVOM) [e.g., measure voltage, ohms, and amperage]
17.2.2 Demonstrate the function and operation of a digital volt-ohm-meter (DVOM) [e.g., measure voltage, ohms, and amperage]
17.2.3 Demonstrate the function and operation of a clamp-on amp meter
17.2.4 Demonstrate the function and operation of oscilloscopes (i.e., voltage over time)
17.2.5 Demonstrate the function and operation of a logic probe and logic analyzer
17.2.6 Measure properties of circuits using electrical test/measurement equipment
17.2.7 Troubleshoot a multi-component electrical circuit using electrical test/measurement equipment

**Correlated Mathematics Academic Content Benchmarks**
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonable of solutions. (Measurement F, 8-10)
• Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
• Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)
• Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented within a coordinate system. (Geometry G, 8-10)

**Competency 17.3: Demonstrate proficiency in working with DC circuits**

*Descriptors:*
17.3.1 Compute conductance of conductors and insulators
17.3.2 Measure resistance and current of conductors and insulators
17.3.3 Build series, parallel, and combination circuits
17.3.4 Build voltage divider circuits (loaded and unloaded)
17.3.5 Compute voltage divider circuits (loaded and unloaded)
17.3.6 Discuss the electromagnetic properties of circuits and devices
17.3.7 Discuss the physical and electrical characteristics of capacitors and inductors

**Correlated Mathematics Academic Content Benchmarks**

- Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
- Represent and compute with complex numbers. (Number E, 11-12)
- Solve problems situations involving derived measurements; e.g., density, acceleration. (Measurement D, 11-12)
- Solve and graph linear equations and inequalities. (Algebra F, 8-10)
- Solve systems of linear equations involving two variables graphically and symbolically. (Algebra H, 8-10)
- Model and solve problem situations involving direct and inverse variation. (Algebra I, 8-10)
- Describe and interpret rates of change from graphical and numerical data. (Algebra J, 8-10)

**BIL: Essential: NS**
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**Competency 17.4: Demonstrate proficiency in working with AC circuits**

**Descriptors:**
17.4.1 Discuss the principles and operational characteristics of sinusoidal and non-sinusoidal wave forms
17.4.2 List known AC sources (NS)
17.4.3 Explain the principles and operation of various power conditioning systems (e.g., isolation transformers, surge suppressors, uninterruptible power systems) [NS]
17.4.4 Discuss the principles and operation of various safety grounding systems (e.g., lightning arresters, ground electrostatic discharge, fault interrupters) [NS]
17.4.5 Measure voltage, current, time, frequency (f), and phase relationships of AC sine wave signal

**Correlated Mathematics Academic Content Benchmarks**

- Translate information from one representation (words, table, graph, or equation) to another representation of a relation or function. (Algebra C, 8-10)
- Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process, 8-10)
- Use formal mathematical language and notation to represent ideas, to demonstrate relationships within and among representation systems, and to formulate generalizations. (Math. Process, 11-12)
- Use right triangle trigonometric relationships to determine lengths and angle measures.
(Geometry I, 8-10)
• Compare, order and determine equivalent forms of real numbers. (Number E, 8-10)
• Represent transformations within a coordinate system using vectors and matrices.
(Geometry B, 11-12)

Unit 18: Networking
BIL: Essential: ISS, NS
Recommended: PSD

Competency 18.1: Demonstrate knowledge of basic network classifications and topologies
Descriptors:
18.1.1 Interpret basic networking terminology (ISS)
18.1.2 Differentiate between LANs, CANs, WANs, MANs) [ISS]
18.1.3 Describe how to turn LANs into CANs and WANs, MANs) [ISS]
18.1.4 Identify the basic point-to-point network topologies (e.g., star, ring, tree, network, irregular) [ISS]
18.1.5 Explain packet-switching techniques (ISS)
18.1.6 Identify the basic broadcast topologies (e.g., star, ring, bus) [ISS]
18.1.7 Compare the characteristics of connection-oriented and connectionless protocols (ISS)
18.1.8 Identify standard high-speed networks (e.g., broadband, ISDN, SMDS, ATM, FDDI, DS3, SONET, Optical Carrier Systems) [ISS]
18.1.9 Identify emerging networks (e.g., ATM; ISDN; satellite nets; optic nets; integrated voice, data, and video) [ISS]
18.1.10 Explain network storage techniques (e.g., fiber channel, SCSI, IP, ISCSI) [ISS]

BIL: Essential: ISS, NS
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Competency 18.2: Demonstrate knowledge of local-area network trends and issues
Descriptors:
18.2.1 Describe the reasons for installing a network (ISS)
18.2.2 Trace the evolution of networks (ISS)
18.2.3 Analyze current trends and developments in LANs and WANs and wireless networks (ISS)

Correlated English Language Arts Academic Content Benchmarks
• Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

BIL: Essential: ISS, NS
**Competency 18.3: Demonstrate knowledge of network physical layer**

*Descriptors:*
18.3.1 Differentiate between baseband and broadband transmission (ISS)
18.3.2 Identify the criteria used in making cable selection decisions (e.g., physical properties, transmission technologies, transmission span, bandwidth, topology, security, noise immunity, installation considerations, cost)
18.3.3 Differentiate between cable types (e.g., coaxial, twisted-pair, optical fibers) and interfaces (ISS)
18.3.4 Compare/contrast a cable types (e.g., CAT5, CAT5E, CAT6+) [ISS]
18.3.5 Describe types of cable connectors and grounding techniques (ISS)
18.3.6 Describe typical cable applications (ISS)
18.3.7 Identify cable standards (e.g., ANSI, EIA/TIA-568, EIA/TIA-569) [ISS]
18.3.8 Identify the advantages and disadvantages of cabling systems (ISS)
18.3.9 Describe typical problems associated with cable installation (ISS)
18.3.10 Demonstrate cable testing and tolerance levels
18.3.11 Discuss the fundamentals of RF

**Correlated English Language Arts Academic Content Benchmarks**
- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)

**Correlated Mathematics Academic Content Benchmarks**
- *Apply various measurement scales to describe phenomena and solve problems.*
  (Measurement B, 11-12)

**BIL: Essential: ISS, NS**

**Competency 18.4: Demonstrate knowledge of network connectivity basics**

*Descriptors:*
18.4.1 Identify and describe the characteristics and functions of point-to-point channels, switched, and meshed network
18.4.2 Define the characteristics and functions of broadcast channels
18.4.3 Explain types of interoperability
18.4.4 Describe Internet, Intranet, and Extranet usage and connectivity

**Correlated English Language Arts Academic Content Benchmarks**
- *Apply knowledge of roots and affixes to determine the meanings of complex words and subject area vocabulary.* (Vocabulary E, 8-10)
- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)
- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary.* (Vocabulary D, 11-12)
Competency 18.5: Demonstrate knowledge of protocol concepts

Descriptors:
18.5.1 Identify the advantages and disadvantages of standard protocols (ISS)
18.5.2 Explain the purposes of, and procedures for, encapsulation and decapsulation
18.5.3 Explain network protocols (e.g., IP Suite, IPX/SPX, IPSEC) [ISS]

Correlated English Language Arts Academic Content Benchmarks
- **Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary.** (Vocabulary D, 11-12)

Competency 18.6: Demonstrate knowledge of the Open Systems Interconnection (OSI) standard (ISO Standard 7498)

Descriptors:
18.6.1 Identify the benefits of using a layered network model
18.6.2 Identify the seven layers at which decisions must be made according to the OSI standard
18.6.3 Compare OSI stack positions and their relationship to one another
18.6.4 Describe actions to be performed at each of the OSI physical layers

Competency 18.7: Demonstrate knowledge of communication standards for networks

Descriptors:
18.7.1 Explain digital data communication techniques and standards, including asynchronous and synchronous transmission, error detection and correction codes, and physical interfaces
18.7.2 Describe data-transmission basics (e.g., SYN, Syn-ack)

74
Competency 18.8: Demonstrate knowledge of data encoding basics
Descriptors:
18.8.1 Apply and convert amongst the four numbering systems: binary, octal, hexadecimal, and decimal (NS)
18.8.2 Demonstrate ASCII representation of characters (NS)
18.8.3 Demonstrate EBCDIC representation of characters (NS)
18.8.4 Convert ASCII characters to EBCDIC Unicode equivalents and vice versa (NS)
Correlated Mathematics Academic Content Benchmarks
• Compare, order and determine equivalent forms of real numbers. (Number E, 8-10)
BIL: Essential: ISS, NS
Recommended: PSD

Competency 18.9: Demonstrate knowledge of IP addressing schemes
Descriptors:
18.9.1 Explain how names and addresses are determined for LANs (ISS)
18.9.2 Identify components of a network address in dotted decimal form (e.g., Class A, B, C) [ISS]
18.9.3 Identify the class of network to which a given address belongs (ISS)
18.9.4 Differentiate between default subnet masks and custom subnet masks (ISS)
18.9.5 Explain the relationship between an IP address and its associated subnet mask (ISS)
18.9.6 Create custom subnet masks to meet network design requirements (ISS)
18.9.7 Identify difference between classed and classless addressing schemes (ISS)
Correlated Mathematics Academic Content Benchmarks
• Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas. (Math. Process E, 8-10)

Unit 19: Network Architectures
BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS I P
NS P R
PSD I
IM

Competency 19.1: Demonstrate knowledge of the basics of network architecture
Descriptors:
19.1.1 Describe the characteristics and uses of network components (e.g., hub, switches, routers, firewall) [ISS]
19.1.2 Identify LAN transmission methods (e.g., bus, pure ring, star ring topologies) [ISS]
19.1.3 Describe broadband and baseband transmission methods and standards (ISS)
19.1.4 Identify LAN transmission media (e.g., twisted pair, fiber-optic cable, wireless) [ISS]
19.1.5 Evaluate LAN medium-access protocols (e.g., CSMA/CD, token bus, token ring, FDDI)
19.1.6 Identify the components of, and relationships within, the OSI 8802 (IEEE 802) protocol suite
19.1.7 Identify LAN performance factors (signal attenuation, signal propagation delay)
19.1.8 Explain reasoning for OSI modeling (ISS)
19.1.9 Differentiate between a physical and logical topology (e.g., VLAN) [ISS]

Correlated English Language Arts Academic Content Benchmarks
• Distinguish the relationship of word meanings between pairs of words encountered in analogical statements. (Vocabulary B, 11-12)
• Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Solve increasingly complex non-routine measurement problems and check for reasonableness of results. (Measurement A, 8-10)
• Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented within a coordinate system. (Geometry G, 8-10)
• Solve problem situations involving derived measurements; e.g., density, acceleration. (Measurement D, 11-12)

Competency 19.2: Demonstrate knowledge of the basics of Ethernet technology
Descriptors:
19.2.1 Describe differences in Ethernet topologies (ISS)
19.2.2 Select appropriate use of basic Ethernet configurations (e.g., simple, hub, hubs and bridges, server, switch) [ISS]
19.2.3 Evaluate the advantages and disadvantages of Ethernet networks as they relate to other networks (ISS)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS 1 P
NS P R
PSD
IM

Certainty 19.3: Demonstrate knowledge of the TCP/IP protocol suite details
Descriptors:
19.3.1 Compare the basics of TCP/IP layers, components, and functions (ISS)
19.3.2 Identify how the TCP layers relate to the OSI model (ISS)
19.3.3 Compare and contrast TCP and IP delivery service (ISS)
19.3.4 Identify TCP/IP applications and services (e.g., rlogin, SMTP, telnet, FTP, DNS, DNS,
19.3.5 Explain TCP/IP protocol details (e.g., Internet addresses, ARP, RARP, IP datagram format, routing IP datagrams, TCP segment format)
19.3.6 Identify how the protocol suite can be used to provide prioritization and differentiation between multiple media types (e.g., QoS)

Unit 20: Network Operating Systems

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS I P
NS P R
PSD
IM

Competency 20.1: Demonstrate knowledge of the network operating systems characteristics

Descriptors:
20.1.1 Identify the purposes of a network operating system (NOS) [ISS]
20.1.2 Identify how the components of a network operating system (i.e., server platform, network services software, network redirection software, communications software) support network operations (ISS)
20.1.3 Define the criteria used to evaluate network operating systems (ISS)
20.1.4 Identify how protocols are supported
20.1.5 Identify licensing requirements
20.1.6 Describe the characteristics of the a tiered model (e.g., peer-to-peer, thin client)
20.1.7 Analyze the advantages and disadvantages of the client/server model (ISS)
20.1.8 Compare and contrast various network operating systems (e.g., Novell NetWare, Windows, Linux, UNIX) [ISS]

Correlated English Language Arts Academic Content Benchmarks
• Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 11-12)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS I P
NS I P
PSD
IM

Competency 20.2: Install and administer network operating system and services

Descriptors:
20.2.1 Create domain trusts (NS)
20.2.2 Maintain domain controllers (NS)
20.2.3 Make policy changes (NS)
20.2.4 Employ policy templates (NS)
20.2.5 Create user accounts, groups, and login scripts (NS)
20.2.6 Control access to files and directories (NS, ISS)
20.2.7 Establish shared network resources (NS, ISS)
20.2.8 Configure network domain accounts and profiles (NS)
20.2.9 Implement system policies (NS)
20.2.10 Create roaming user profiles (NS)
20.2.11 Troubleshoot network performance (NS)

Unit 21: Wide-Area Networks
BIL: Essential: ISS, NS
Recommended: IM
EDU: 10 12 AD
ISS P R
NS P R
PSD
IM I P

Competency 21.1: Demonstrate knowledge of basic telecommunications and the interconnection of networks
Descriptors:
21.1.1 Describe the different types of WAN connections
21.1.2 Describe point-to-point (PPP) interconnection
21.1.3 Identify basic telecommunications services (e.g., satellite, circuit switching, packet switching, wireless)
21.1.4 Identify communications carriers and their services
21.1.5 Identify the role of telecommunications tariffs

BIL: Essential: ISS, NS
Recommended: IM
EDU: 10 12 AD
ISS I P
NS P R
PSD
IM P

Competency 21.2: Assess user needs for a wide-area network (WAN)
Descriptors:
21.2.1 Determine availability from LAN to meet requirements of WAN
21.2.2 Determine the speed needed between sites to access applications
21.2.3 Determine the subnets needed on the WAN including VLSM
21.2.4 Evaluate transmission options

Correlated Mathematics Academic Content Benchmarks
- Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS I P
NS I P
PSD
IM

Competency 21.3: Design WAN systems
Descriptors:
21.3.1 Describe the basics of telephony (analog vs. digital signals) [NS, ISS]
21.3.2 Describe the conversion of analog speech to digital (NS, ISS)
21.3.3 Relate voice, data concepts, and video to wide-area networks (NS)
21.3.4 Select primary and backup data circuits (NS)
21.3.5 Evaluate analog and digital transmission for cost, performance, and reliability (NS)
21.3.6 Integrate firewalls to separate trusted network and WAN (NS)
21.3.7 Establish a Virtual Private Network (VPN) to form the infrastructure of the WAN (NS)
21.3.8 Determine routers needed to connect with LAN (NS)
21.3.9 Interconnect LANs using WAN services (NS)
21.3.10 Demonstrate cost-savings approaches (e.g., voice/video/data compression)
21.3.11 Discuss complexities of routing and multiple services over a WAN (NS)

Correlated English Language Arts Academic Content Benchmarks
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
- Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 11-12)

Unit 22: Network Management

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS I P
PSD I
IM

Competency 22.1: Demonstrate knowledge of network management activities and procedures
Descriptors:
22.1.1 Evaluate the basic principles of network management (NS, ISS)
22.1.2 Identify network system bootstrapping/initial program load (NS)
22.1.3 Identify server configuration and role (e.g., file server, print server or other network services (e.g., DNS, DHCP) [NS]
22.1.4 Determine file organization (e.g., by owners, users, and privileges) [NS]
22.1.5 Establish common standards for setting up and naming for the network, files, accounts, services (NS)
22.1.6 Determine methods for increasing performance (e.g., segmenting and balancing the network load, resolving channel and cable bottlenecks) [NS]
22.1.7 Define the role of the network manager (NS, ISS)
22.1.8 Determine procedures for performance analysis, evaluation, and monitoring (NS)
22.1.9 Determine procedures for network system optimization and tuning (NS)
22.1.10 Determine procedures for managing network assets (e.g., users, groups, printers) [NS]

Correlated English Language Arts Academic Content Benchmarks
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
- Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources. (Research C, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Model and solve problem situations involving direct and inverse variation. (Algebra I, 8-10)

• Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Math. Process A, 8-10)

• Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)

• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

• Apply various measurement scales to describe phenomena and solve problems.

BIL: Essential: ISS, NS
Recommended: PSD

EDU: 10 12 AD
ISS I P
NS I P
PSD I
IM

Competency 22.2: Demonstrate knowledge of network applications

Descriptors:
22.2.1 Describe how disk storage is shared across a network (NS, ISS)
22.2.2 Describe the differences among application-specific servers (e.g., database, print, communications, terminal, fax, security) [NS]
22.2.3 Identify the advantages of sharing backup and management of PCs across a network (NS, ISS)
22.2.4 Identify and manage software licensing requirements and categories (NS, ISS)

BIL: Essential: ISS, NS

EDU: 10 12 AD
ISS P
NS I P
PSD
IM

Competency 22.3: Solve network applications problems

Descriptors:
22.3.1 Identify potential hardware compatibility problems (NS)
22.3.2 Identify precautions included in programs used on networks (e.g., self-metering, security keys, required configuration settings) [NS]
22.3.3 Identify network areas in which application problems could exist (e.g., memory allocation, file lock settings, resource availability) [NS]
22.3.4 Troubleshoot network software problems (NS)
22.3.5 Perform network analysis using monitoring tools

Correlated Mathematics Academic Content Benchmarks

• Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10 )
Competency 22.4: Perform network analysis, selection, and design

Descriptors:
22.4.1 Gather data to identify customer requirements (NS)
22.4.2 Identify system and network requirements (NS)
22.4.3 Analyze requirements (NS)
22.4.4 Define scope of work to meet customer requirements (NS)
22.4.5 Develop functional requirements/specifications for high-level systems (NS)
22.4.6 Identify time, technology, and resource constraints (NS)
22.4.7 Identify physical requirements for system implementation (NS)
22.4.8 Analyze system interdependencies (NS)
22.4.9 Identify alternate solutions
22.4.10 Research product and vendor architecture and equipment specifications/limitations (NS)
22.4.11 Estimate impact of change request (NS)
22.4.12 Prepare cost/benefit/risk analysis
22.4.13 Perform human factors analysis
22.4.14 Participate in design reviews
22.4.15 Design prototype of system
22.4.16 Develop testing strategy
22.4.17 Prepare overall plan for integrating new processes, protocols, and equipment (NS)
22.4.18 Develop deployment strategies appropriate for situation
22.4.19 Analyze facilities' bandwidth requirements and capacity planning (power cable/wire conduit)
22.4.20 Revise processes/structure based on testing and certification (NS)
22.4.21 Identify hardware/software selection criteria (NS)
22.4.22 Select a LAN/WAN technology that meets defined set of requirements (NS)

Correlated English Language Arts Academic Content Benchmarks
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
• Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonable of solutions. (Measurement F, 8-10)
• Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools,
including spreadsheets and graphing calculators. (Data A, 11-12)
• Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation. (Math. Process J, 11-12)

BIL: Essential: NS
Recommended: ISS
EDU: 10 12 AD
ISS I R
NS I P
PSD
IM

**Competency 22.5: Perform network installation procedures**

Descriptors:
22.5.1 Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts) [NS]
22.5.2 Assess user needs to determine which network operating systems to use (NS)
22.5.3 Set up/configure workstation-network connections (NS)
22.5.4 Set up/configure network components (e.g., routers, switches) [NS]
22.5.5 Install LAN (NS)
22.5.6 Configure file server in PC network (NS)
22.5.7 Construct network cables (NS)
22.5.8 Test network connectivity using a network analyzer

**Correlated English Language Arts Academic Content Benchmarks**
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
• Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources. (Research C, 11-12)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS I P
NS I P
PSD
IM

**Competency 22.6: Perform network operation procedures**

Descriptors:
22.6.1 Determine the type of wiring needed for the physical connection of the network (NS, ISS)
22.6.2 Connect PCs to form a network (NS, ISS)
22.6.3 Link mixed vendors (e.g., PC to Mac)
22.6.4 Document LAN configuration (NS, ISS)
22.6.5 Identify how the network protocols work together (NS)
22.6.6 Determine compatibility of various networks (NS)
22.6.7 Set up/configure TCP/IP services on workstations and network servers (NS)
22.6.8 Implement print queue in a network (NS)
22.6.9 Perform file-to-file copy in a network (NS, ISS)
22.6.10 Install/configure file server in a network

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS 1 P
NS 1 P
PSD
IM

Competency 22.7: Perform hardware and desktop support

Descriptors:
22.7.1 Install and use network printers (NS, ISS)
22.7.2 Check physical and virtual connections (NS, ISS)
22.7.3 Map network devices (NS)
22.7.4 Replace basic computer hardware (NS, ISS)
22.7.5 Set up system configuration (NS)
22.7.6 Start up/shut down network system (NS)
22.7.7 Install software packages (NS)
22.7.8 Respond to system messages (NS)
22.7.9 Troubleshoot system (NS)
22.7.10 Perform system analysis (NS)
22.7.11 Perform preventive maintenance (NS)
22.7.12 Perform software license audits
22.7.13 Coordinate security procedures

BIL: Essential: NS
Recommended: ISS
EDU: 10 12 AD
ISS 1 R
NS 1 P
PSD
IM

Competency 22.8: Perform network administration

Descriptors:
22.8.1 Define the role of the LAN administrator (NS)
22.8.2 Implement system security policies
22.8.3 Install network management software (NS)
22.8.4 Perform administration functions using LAN manager software
22.8.5 Perform bandwidth optimization
22.8.6 Respond to system messages (NS)
22.8.7 Troubleshoot system (NS)
22.8.8 Install and monitor server software applications
22.8.9 Perform system analysis (NS)
22.8.10 Perform preventive maintenance (NS)
22.8.11 Perform resource management (e.g., apply standards, address protocols, monitor network activity, perform trend analyses, functional verifications, audits and monitoring
22.8.12 Coordinate security procedures
22.8.13 Document actions taken (e.g., backups, virus prevention, and software distribution) [NS]
22.8.14 Execute network diagnostics program for software and hardware (NS)
22.8.15 Apply standard policies
22.8.16 Establish a preventive maintenance schedule (NS)
22.8.17 Document and diagram network topology (NS)
22.8.18 Describe authentication process to network devices and for users (NS)

**Correlated Mathematics Academic Content Benchmarks**

- Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
- Solve increasingly complex non-routine measurement problems and check for reasonableness of results. (Measurement A, 8-10)

9 6

**BIL: Essential: NS**

**Recommended: ISS**

EDU: 10 12 AD
ISS I R
NS I P
PSD
IM

**Competency 22.9: Perform network maintenance and diagnostics and testing**

**Descriptors:**

22.9.1 Perform preventive maintenance (NS)
22.9.2 Respond to system messages (NS)
22.9.3 Troubleshoot system (NS)
22.9.4 Restore LAN operating systems (NS)
22.9.5 Replace LAN hardware components (NS)
22.9.6 Define the scope and applicability of the test (NS)
22.9.7 Develop a test plan (NS)
22.9.8 Identify needed resources (NS)
22.9.9 Obtain needed resources (NS)
22.9.10 Assess network impact (NS)
22.9.11 Set up test environment (NS)
22.9.12 Set up testing schedule (NS)
22.9.13 Execute testing in accordance with established plans and schedule (NS)
22.9.14 Document errors reported/tracked (NS)
22.9.15 Interpret test results (NS)
22.9.16 Develop central log strategy for network devices

**BIL: Essential: NS**

**Recommended: ISS**

EDU: 10 12 AD
ISS I R
NS I P
PSD
IM

**Competency 22.10: Recommend disaster recovery and business continuity plans**

**Descriptors:**

22.10.1 Differentiate between disaster recovery and business continuity
22.10.2 Identify common backup devices (NS)
22.10.3 Identify the criteria for selecting a backup system (e.g., tape) [NS]
22.10.4 Establish process for archiving files (NS)
22.10.5 Develop and test a disaster recovery plan
22.10.6 Develop a business resumption plan

Correlated English Language Arts Academic Content Benchmarks
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Unit 23: Security Fundamentals
BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM P R

Competency 23.1: Examine the history and components of information assurance
Descriptors:
23.1.1 Identify significant advances in the development of computer security and the trend towards information assurance (NS)
23.1.2 Describe the evolution of major threats to computers including physical security, viruses, worms, spyware, malware, and hacker attempts and the influence this has had on the current state of information assurance (NS, ISS, PSD)
23.1.3 Discuss the role of the government in evolving standards and security initiatives (e.g., encryption, cryptography) [NS]
23.1.4 Describe the role of networking and the increased need for security and information assurance (NS, ISS)
23.1.5 Discuss how legislative and ethical issues and standards have impacted network security (e.g., HIPPA, GLBA, SOX) [NS, ISS]
23.1.6 Discuss the need for confidentiality, integrity, and availability of information (CIA) [NS, ISS, PSD]
23.1.7 Discuss the need for authentication and non-repudiation of information (e.g., PKI) [NS]
23.1.8 Illustrate security risks and associated safeguards (NS)
23.1.9 Examine the role of government-industry-academia partnerships in increasing the information assurance levels domestically and globally (NS)
23.1.10 Discuss careers and certification programs associated with security (NS, ISS, PSD)

Correlated English Language Arts Academic Content Benchmarks
• Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 11-12)

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS I P
Competency 23.2: Describe the components associated with computer and network security systems

Descriptors:
23.2.1 Identify and discuss biometric systems (e.g., fingerprinting, retina scans, voice analysis) [NS]
23.2.2 Describe two-factor authentication techniques (e.g., smart cards) [NS, ISS]
23.2.3 Explain the role of digital signatures in achieving information assurance and integrity (NS)
23.2.4 Explain the role of digital certifications in achieving information assurance (NS)
23.2.5 Explain the role of hashing algorithms (e.g., MD5, SHA1) in achieving information assurance and integrity (NS)
23.2.6 Discuss the need for policy addressing confidentiality (NS, ISS)

Correlated English Language Arts Academic Content Benchmarks
- Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 11-12)

Unit 24: Secure Network Management

BIL: Essential: NS
Recommended: ISS
EDU: 10 12 AD
ISS I R
NS I P
PSD
IM

Competency 24.1: Implement secure network management activities and procedures

Descriptors:
24.1.1 Identify need for data protection (NS)
24.1.2 Identify need for network security (NS)
24.1.3 Analyze network security issues (NS)
24.1.4 Identify security requirements (NS)
24.1.5 Analyze the advantages/disadvantages of firewall architectures
24.1.6 Select the appropriate security appliance (e.g., combined firewall routers, proxy server software solutions, dedicated software solutions, dedicated appliances)
24.1.7 Identify specific access levels that need to be accommodated
24.1.8 Determine how to protect against spoofing
24.1.9 Devise account administration functions to support network security (e.g., managing access control lists [ACL] of network resources)
24.1.10 Develop and establish best practices in security plans
24.1.11 Match security system design to identified security requirements
24.1.12 Analyze and discuss security issues and how they are mitigated with the use of software distribution management systems (e.g., patch management)

Correlated English Language Arts Academic Content Benchmarks
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
Competency 24.2: Describe risk analysis
Descriptors:
24.2.1 Discuss the balance between risk, cost, security, and implementation
24.2.2 Discuss a variety of security architectures and their application as they pertain to business networks
24.2.3 Describe risks based on vulnerability level, likelihood level, and impact level to the organization

Correlated Mathematics Academic Content Benchmarks
• Compute probabilities of compound events, independent events, and simple dependent events. (Data J, 8-10)
• Make predictions based on theoretical probabilities and experimental results. (Data K, 8-10)

Competency 24.3: Explain information technology mechanisms as they apply to a multilayer defense structure
Descriptors:
24.3.1 Discuss currently available intrusion prevention, detection, and mitigation systems
24.3.2 Illustrate auditing and log file management (e.g., archiving, clearing, sizing)
24.3.3 Discuss incident handling procedures, including involvement of CERT and law enforcement
24.3.4 Identify security risks and breeches by reviewing system logs
24.3.5 Discuss concepts and principles in packet inspection and filtering (e.g., firewall and routers)
24.3.6 Discuss concepts as they pertain to black hole lists, spam services, open relay and other types of attacks
24.3.7 Compare and contrast network analysis tools that identify security risks and vulnerabilities
24.3.8 Discuss theory of secure network management with VLANs and out-of-band networks
24.3.9 Discuss information asset identification and classification and disposal
24.3.10 Discuss concepts as they relate to human security (e.g., social engineering)
Competency 24.4 Explain communication in a WAN environment

Descriptors:
24.4.1 Differentiate the use of tunneling protocols both hardware and software in securing communication (e.g., L2TP, PPTP) [NS]
24.4.2 Describe methods for encrypting communication (e.g., IPSEC) [NS]
24.4.3 Describe VPNs using tunneling protocols and encrypting techniques (NS, ISS)
24.4.4 Explain the use of enterprise authentication management in securing communications (NS)
24.4.5 Discuss the role of certificate authorities (NS)

Unit 25: Wireless

BIL: Essential: ISS, NS, IM
Recommended: PSD

Competency 25.1: Explain wireless communications

Descriptors:
25.1.1 Compare and contrast various wireless protocols in common use (IM)
25.1.2 Compare and contrast various characteristics of wireless signals (e.g., reflection, diffraction, scattering and fading) [IM]
25.1.3 Differentiate medium access methods used by wireless (IM)
25.1.4 Describe and define other wireless communication standards in use today as they apply to personal, corporate, and public use (e.g., Bluetooth) [IM]
25.1.5 Describe appropriate applications of wireless technologies to specific communication scenarios (IM)

Correlated English Language Arts Academic Content Benchmarks

• Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Communication E, 8-10; Communication E, 11-12)

BIL: Essential: NS
Recommended: ISS, IM

Competency 25.2: Design and implement a wireless network solution

Descriptors:
25.2.1 Compare and contrast wireless solutions operating in ad hoc mode and infrastructure mode (NS)
25.2.2 Describe the various frequency ranges and associated rules in the wireless spectrum as managed by the Federal Communication Commission (FCC) [NS]
25.2.3 Define the Service Set Identifier (SSID) as used in wireless communications (NS)
25.2.4 Select and install access points, wireless NICs, antennas and other hardware and software components to provide a wireless networking solution as determined by a site and customer survey (NS)
25.2.5 Troubleshoot Wireless LANs using system logs, vendor provided utilities and diagnostic tools (NS)

**BIL: Essential: NS**
**Recommended: ISS, IM**
**EDU: 10 12 AD**
ISS I
NS I P
PSD
IM I P

**Competency 25.3: Evaluate security concerns specific to wireless networks and devices, and techniques for minimizing those risks**

**Descriptors:**
25.3.1 Define and describe the practice of “war driving” and how to mitigate this risk (NS)
25.3.2 Explain various methods of increasing the security of a wireless network, e.g., MAC address filtering, Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA), 802.1x and RADIUS) [NS]
25.3.3 Compare and contrast various methods, with their strengths and weaknesses, of encrypting wireless communications (NS)
25.3.4 Identify security enhancements provided by IEEE 802.11(x) [NS]
25.3.5 Define practices and policies to prevent and detect installation of unauthorized Wireless Access Points (WAPs) [NS]

**Correlated English Language Arts Academic Content Benchmarks**
- Compile, organize and evaluate information, take notes and summarize findings.
  (Research B, 11-12)

**Unit 26: Telecommunications**

**BIL: Essential: NS**
**Recommended: ISS**
**EDU: 10 12 AD**
ISS I R
NS I P
PSD
IM

**Competency 26.1: Demonstrate knowledge of transmission line applications**

**Descriptors:**
26.1.1 Define power conversion (NS)
26.1.2 Discuss the principles and operation of two-wire and four-wire transmission lines (NS)
26.1.3 Discuss the principles and operation of coaxial cable (NS)
26.1.4 Discuss the principles and operation of a microwave, satellite, and laser transmissions and receptions (NS)
26.1.5 Discuss the principles and operation of optical, analog, and digital transmissions (NS)
26.1.6 Compare transmission speeds of various media (NS)

**Correlated English Language Arts Academic Content Benchmarks**

- *Distinguish the relationship of word meanings between pairs of words encountered in analogical statements.* (Vocabulary B, 11-12)

**BIL: Essential: NS**
**Recommended: ISS**

**EDU:** 10 12 AD

**ISS I R**
**NS I P**
**PSD**
**IM**

**Competency 26.2: Demonstrate knowledge of concepts and techniques used in working with communications systems**

**Descriptors:**
- 26.2.1 Discuss techniques for communication media splicing and termination (NS)
- 26.2.2 Differentiate between various communications systems (NS)
- 26.2.3 Identify the characteristics and components of cabling systems (NS)
- 26.2.4 Identify bandwidth and attenuation limitations for communications systems (e.g., fiber, copper, wireless) [NS]
- 26.2.5 Identify the characteristics of various types of light sources and light detectors used in fiber optic systems (NS)
- 26.2.6 Identify the components of fiber optic transmission systems and the function of each (e.g., CWDM, DWDM) [NS]
- 26.2.7 Discuss how data signals are transformed into light pulses (NS)
- 26.2.8 Operate a simple fiber optic data transmission system
- 26.2.9 Discuss the characteristics of multi-mode and single-mode systems (NS)

**BIL: Essential: NS**
**Recommended: ISS**

**EDU:** 10 12 AD

**ISS I R**
**NS I P**
**PSD**
**IM**

**Competency 26.3 Demonstrate knowledge of telecommunications networks**

**Descriptors:**
- 26.3.1 Discuss the role telecommunication networks play in the contemporary business environment (NS)
- 26.3.2 Discuss how voice, data, and video inputs are converted to electromagnetic signals (NS)
- 26.3.3 Discuss advanced telecommunication broadband technologies (e.g., including frame relay and ATM, broadband, T1, T2, T3, Ethernet, IP) [NS]
- 26.3.4 Discuss the characteristics and function of ISDN and BRI, PRI signaling (NS)
- 26.3.5 Discuss mobile communications technologies, including cellular and personal communication networks (NS)
- 26.3.6 Discuss the characteristics, function and types of data compression and generational losses (NS)
26.3.7 Discuss the function and characteristics of DSL technologies (NS)

Correlated English Language Arts Academic Content Benchmarks
- Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)
- Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 11-12)

Unit 27: Information Systems (IS) Theory

BIL: Essential: ISS, NS, PSD
EDU: 10 12 AD
ISS I P
NS I P
PSD I R P
IM

Competency 27.1: Explain systems theory
Descriptors:
27.1.1 Explain the underlying concepts of the information systems discipline (ISS, NS)
27.1.2 Compare/contrast data, information, and knowledge (ISS, NS)
27.1.3 Compare methods for achieving productivity in knowledge work (NS)
27.1.4 Apply general systems theory to the analysis and development of an information system (NS)
27.1.5 Identify the properties of open and proprietary systems (PSD, NS)
27.1.6 Define the relationship between system components (NS)
27.1.7 Characterize the role of data representation, both non-numeric and numeric (e.g., integers, reals, errors) [ISS, PSD, NS]
27.1.8 Identify procedures for formal problem solving (PSD, NS)
27.1.9 Differentiate between the role of information systems within a company and their role in a global environment (ISS, NS)

Correlated Mathematics Academic Content Benchmarks
- Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers. (Number D, 8-10)
- Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros. (Algebra E, 8-10)
- Use formal mathematical language and notation to represent ideas, to demonstrate relationships within and among representation systems, and to formulate generalizations. (Math. Process H, 11-12)

BIL: Essential: ISS, NS, PSD
EDU: 10 12 AD
ISS P
NS P
PSD I P
IM

Competency 27.2: Define the information system infrastructure
Descriptors:
27.2.1 Identify systems architecture (PSD)
27.2.2 Identify the components of the information system infrastructure (e.g., hardware, communications, systems, site) [PSD]
27.2.3 Identify the relationship of users and suppliers to the information system
27.2.4 Identify the objectives of information system
27.2.5 Identify the process for selecting software products and processes
27.2.6 Outline the system controls (i.e., change management, service level agreement SLA)

**BIL:** Essential: NS  
**Recommended:** ISS, PSD  
**EDU:** 10 12 AD

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**Competency 27.3: Select systems development approach**

Descriptors:

- 27.3.1 Summarize application planning, development, and risk management for information system
- 27.3.2 Identify potential problems in system implementation
- 27.3.3 Determine whether prototyping system is feasible
- 27.3.4 Evaluate third-party products to include in the project implementation
- 27.3.5 Develop a plan using data-oriented techniques
- 27.3.6 Apply object-oriented development techniques
- 27.3.7 Apply process-oriented development techniques
- 27.3.8 Evaluate systems engineering considerations
- 27.3.9 Determine system design process, from specification to implementation
- 27.3.10 Appraise system process and product life-cycle models
- 27.3.11 Assess system design methods and tools

**Correlated English Language Arts Academic Content Benchmarks**

- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
- Construct convincing arguments based on analysis of data and interpretations of graphs. (Data F, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)
Descriptors:
27.4.1 Identify stakeholders in a given IS context (i.e., key individuals)
27.4.2 Identify desired group and team behavior in an IS context
27.4.3 Describe how to apply team methods to empower coworkers
27.4.4 Define empowerment and effectiveness measurement
27.4.5 Identify knowledge-building and knowledge-maintaining tasks
27.4.6 Differentiate between individual and group technology
27.4.7 Describe the characteristics and attributes of knowledge work for both individual and group technology
27.4.8 Describe group support technology for common knowledge requirements
27.4.9 Identify work modifications necessitated by working in groups (e.g., additional processing)
27.4.10 Describe the information analysis process
27.4.11 Describe information technology solutions

Correlated English Language Arts Academic Content Benchmarks
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
- Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 11-12)

BIL: Essential: ISS
Recommended: NS, PSD
EDU: 10 12 AD

ISS I P
NS P
PSD I
IM

Competency 27.5: Evaluate strategies for implementing systems
Descriptors:
27.5.1 Identify requirements through interviewing of individuals and groups (ISS)
27.5.2 Determine information requirements through analysis of individual and group tasks
27.5.3 Identify information technology requirements for given worksite (ISS)
27.5.4 Select overall implementation strategy (e.g., top-down, bottom up; teams vs. individual)
27.5.5 Analyze the interaction of the operating system and hardware architecture
27.5.6 Establish ownership of data and system
27.5.7 Determine methods for providing computing support and training for the end user (ISS)
27.5.8 Plan measures to ensure system integrity

Correlated Mathematics Academic Content Benchmarks
- Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)
- Solve problem situations involving derived measurements; e.g., density, acceleration. (Measurement D, 11-12)

BIL: Essential: ISS
Recommended: NS, PSD
EDU: 10 12 AD
Competency 27.6: Measure achievement

Descriptors:
27.6.1 Evaluate potential systems solutions against criteria for success
27.6.2 Apply continuous improvement methodologies
27.6.3 Identify quality standards to be documented (e.g., ISO, Baldridge)
27.6.4 Identify the competitive advantage achieved through IS
27.6.5 Specify measurements to be taken
27.6.6 Assign responsibility for documentation

Correlated Mathematics Academic Content Benchmarks
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)

Unit 28: Information Systems

BIL: Recommended: ISS, PSD
EDU: 10 12 AD
ISS I
NS
PSD I
IM

Competency 28.1: Develop and implement organizational planning for information systems

Descriptors:
28.1.1 Analyze the strategic role of information systems in organizations
28.1.2 Identify information technology needed to support given sets of tasks and activities for individuals, workgroups, and the organization
28.1.3 Align IS planning with enterprise planning
28.1.4 Define the strategic relationship of IS activities to enhancing competitive position
28.1.5 Differentiate between strategic, tactical and operational level applications
28.1.6 Define the IS role in process re-engineering
28.1.7 Develop short-range IS plan
28.1.8 Develop continuous improvement plan
28.1.9 Specify functional structures (internal vs. outsourcing)
28.1.10 Establish goals and objectives for IS
28.1.11 Define mission and critical success factors

Correlated Mathematics Academic Content Benchmarks
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)

BIL: Essential: ISS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS
PSD I
**IM**

**Competency 28.2: Establish how information systems will be developed and managed within the organization**

*Descriptors:*

28.2.1 Identify hierarchical and flow models of the organization (ISS)
28.2.2 Identify organizational work groups
28.2.3 Define the roles of professional IS personnel within the organization (ISS)
28.2.4 Define the function of IS management (ISS)
28.2.5 Identify drivers and inhibitors of information technology change in the organization
28.2.6 Define the role of the cognitive process in information systems design and implementation
28.2.7 Identify IS support for decision making (ISS)

**BIL: Essential: ISS**

**Recommended: PSD**

**EDU:** 10 12 AD

**ISS P**

**NS**

**PSD I**

**IM**

**Competency 28.3: Perform IS functions**

*Descriptors:*

28.3.1 Conduct EDP audits
28.3.2 Compare/contrast the advantages and disadvantages of various options for outsourcing IS functions
28.3.3 Conduct internal and external performance evaluations for IS function
28.3.4 Define how information and information systems will be used in documentation, decision making, and control of organizational activity
28.3.5 Define the relationship between systems goals and quality concepts

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD

**ISS I**

**NS**

**PSD I**

**IM**

**Competency 28.4: Assess and manage IS functions**

*Descriptors:*

28.4.1 Create technical and end-user telecommunication system documentation
28.4.2 Identify security and privacy considerations
28.4.3 Analyze configuration controls
28.4.4 Develop DBMS projects, including systems development and user documentation
28.4.5 Manage computer facilities
28.4.6 Manage group decision support systems
28.4.7 Justify the project management approach to be implemented
28.4.8 Devise techniques to enhance creative problem solving

**BIL: Recommended: PSD**

**EDU:** 10 12 AD
Competency 28.5: Apply management principles to IS functions
Descriptors:
28.5.1 Identify the characteristics of principle-centered leadership
28.5.2 Implement a proactive approach to IS management
28.5.3 Devise techniques to enhance the creative design process

Unit 29: Information System Analysis and Design

Competency 29.1: Evaluate the role of systems analysts
Descriptors:
29.1.1 Identify the functions of systems analysts (ISS)
29.1.2 Identify the skills required for systems analysts (ISS)

Competency 29.2: Initiate a system project
Descriptors:
29.2.1 Identify the phases in a system project (ISS)
29.2.2 Select basic fact-gathering techniques to be used
29.2.3 Define the scope of the systems project
29.2.4 Conduct a preliminary investigation

Competency 29.3: Conduct a detailed system investigation and analysis
Descriptors:
29.3.1 Identify time, technology and resource constraints
29.3.2 Determine investigation techniques to be used
29.3.3 Record facts gathered through system investigation
29.3.4 Perform appropriate diagnostic tests
29.3.5 Investigate system alerts
29.3.6 Evaluate technical alternatives

**Correlated English Language Arts Academic Content Benchmarks**

- Compile, organize and evaluate information, take notes and summarize findings.
  (Research B, 11-12)

**BIL: Essential : ISS**

**Recommended: PSD**

**EDU:** 10 12 AD

- ISS P
- NS
- PSD I
- IM

**Competency 29.4: Design an information system**

**Descriptors:**

29.4.1 Execute the steps in system design
29.4.2 Design system output, system input, files, and processing
29.4.3 Analyze the interaction of the operating system and hardware architecture
29.4.4 Justify the communications selections for the system (e.g., single PCs, LANs and/or WANs)
29.4.5 Present system design to management

**Correlated English Language Arts Academic Content Benchmarks**

- Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.
  (Research E, 8-10)

**BIL: Essential : ISS**

**Recommended: PSD**

**EDU:** 10 12 AD

- ISS P
- NS
- PSD I
- IM

**Competency 29.5: Develop the information system**

**Descriptors:**

29.5.1 Execute tasks involved in system development
29.5.2 Identify the system components and their relationships
29.5.3 Specify the workflow system
29.5.4 Develop programming specifications
29.5.5 Program the system

**BIL: Essential: ISS**

**Recommended: PSD**

**EDU:** 10 12 AD

- ISS P
- NS
- PSD I
- IM

**Competency 29.6: Evaluate applications within the information system**

**Descriptors:**

29.6.1 Design a framework for evaluating information system functions
29.6.2 Compare the capabilities of an application with the requirements it is intended to meet
29.6.3 Identify alternative outcomes of the application verification process
29.6.4 Evaluate the results and the probabilities of errors in application software
29.6.5 Modify inputs, outputs, and processing to refine an application
29.6.6 Recommend new features or enhancements to existing tools

**Correlated English Language Arts Academic Content Benchmarks**
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
- Communicate findings, reporting on the substance and processes orally, visually and in writing, or through multimedia. (Research E, 8-10; Research E, 11-12)

**Correlated Mathematics Academic Content Benchmarks**
- Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)
- Understand the difference between a statement that is verified by mathematical proof, such as a theorem, and one that is verified empirically using examples or data. (Math. Process G, 11-12)

11 7

**BIL: Essential: ISS**
**Recommended: NS, PSD**

**EDU:** 10 12 AD
ISS P
NS P
PSD I
IM

**Competency 29.7: Develop IS implementation plan**

Descriptors:
29.7.1 Analyze the effect of IS on the organizational structure (ISS)
29.7.2 Depict the interaction between IS and continuous improvement (ISS)
29.7.3 Specify the teamwork, leadership, and empowerment strategies to be used (ISS)
29.7.4 Specify consensus-building process to be used (ISS)
29.7.5 Specify the system conversion method to be used (ISS)
29.7.6 Document system implementation plans (ISS)

**Correlated English Language Arts Academic Content Benchmarks**
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

**BIL: Essential: ISS, NS**
**Recommended: PSD**

**EDU:** 10 12 AD
ISS P
NS P
PSD I
IM

**Competency 29.8: Perform management functions related to the planned change**

Descriptors:
29.8.1 Schedule system change according to risk
29.8.2 Secure needed approvals for change
29.8.3 Document contingency plans
29.8.4 Complete a time line for the implementation of change
29.8.5 Perform regression tests
29.8.6 Document testing results
29.8.7 Initiate problem correction

Correlated English Language Arts Academic Content Benchmarks
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Construct convincing arguments based upon analysis of data and interpretation of graphs. (Data F, 8-10)
• Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (Data B, 11-12)
• Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulations, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

Unit 30: System Installation and Maintenance
BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS P
PSD I
IM

Competency 30.1: Explain the life cycle of an information system
Descriptors:
30.1.1 Research the concept of information system life cycles (ISS)
30.1.2 Identify criteria for deciding between acquisition of software packages and custom development of software

Correlated English Language Arts Academic Content Benchmarks
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS P
PSD I
IM

Competency 30.2: Implement a system
Descriptors:
30.2.1 Develop a detailed training, conversion, and installation plan for an information system application
30.2.2 Design networked solutions
30.2.3 Install DBMS on the server
30.2.4 Install appropriate operating system and telecommunications hardware and software (ISS)
30.2.5 Install information system application program in accordance with requirements
30.2.6 Evaluate processes and outcomes
30.2.7 Operate server applications
30.2.8 Operate coupled application systems
30.2.9 Evaluate emerging technologies and their potential effect on information system software (ISS)

Correlated English Language Arts Academic Content Benchmarks
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS P
NS P
PSD I
IM

Competency 30.3: Perform software configuration and installation
Descriptors:
30.3.1 Develop program and system specifications according to client needs
30.3.2 Install software with minimum disruption of process flow
30.3.3 Configure software appropriately for system and user application

BIL: Essential: ISS, NS
Recommended: PSD
EDU: 10 12 AD
ISS I P
NS P
PSD I
IM

Competency 30.4: Monitor the information system
Descriptors:
30.4.1 Conduct post-implementation evaluation
30.4.2 Identify abnormal system performance (ISS)
30.4.3 Recognize security problems (ISS)
30.4.4 Recognize environmental problems (ISS)
30.4.5 Perform remote monitoring

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS P R
NS P
Competency 30.5: Perform system maintenance

Descriptors:
30.5.1 Demonstrate the basic elements of computer maintenance (e.g., SLAs outside vendor management)
30.5.2 Identify available diagnostic tools used for system maintenance
30.5.3 Identify maintenance procedures and processes
30.5.4 Assemble and disassemble computer
30.5.5 Establish a preventive maintenance plan
30.5.6 Perform maintenance and change control

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS P
NS I P
PSD
IM

Competency 30.6: Explain backup and recovery, both on and offsite

Descriptors:
30.6.1 Compile backup and recovery plan to be used by technical support group and users (NS)
30.6.2 Discuss backup procedures in accordance with a regular schedule (NS)
30.6.3 Discuss recovery procedures as needed (NS)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS P R
NS I P
PSD
IM

Competency 30.7: Troubleshoot problems

Descriptors:
30.7.1 Demonstrate basic troubleshooting procedures (NS)
30.7.2 Diagnose computer problems (NS)
30.7.3 Develop resolution plan (NS)
30.7.4 Test identified solutions (NS)
30.7.5 Implement selected solution (NS)

BIL: Essential: ISS, NS
EDU: 10 12 AD
ISS P R
NS I P
PSD
IM

Competency 30.8: Evaluate problem-solving processes and results

Descriptors:
30.8.1 Evaluate problem-solving outcomes to determine whether the problem was solved as intended (NS)
30.8.2 Evaluate whether the process was applied in an efficient and responsible manner (NS)
30.8.3 Determine needed follow-up actions (NS)
BIL: Essential: ISS, NS  
EDU: 10 12 AD  
ISS P R  
NS I P  
PSD  
IM  

**Competency 30.9: Integrate software upgrades and fixes**  
*Descriptors:*  
30.9.1 Identify principles governing software acquisition and upgrades (NS)  
30.9.2 Analyze operational problems (NS)  
30.9.3 Install software upgrades or patches as needed (NS)  

**Unit 31: System Administration and Control**  
BIL: Essential: ISS, NS  
Recommended: PSD  
EDU: 10 12 AD  
ISS I P  
NS P  
PSD I  
IM  

**Competency 31.1: Analyze and perform general system administration tasks**  
*Descriptors:*  
31.1.1 Facilitate the delivery of technical services (ISS)  
31.1.2 Set up/maintain user accounts on multiple systems  
31.1.3 Prepare cost justifications  
31.1.4 Participate in evaluation of total system  
31.1.5 Demonstrate basic scripting skills as they relate to systems administration and control  

**Correlated Mathematics Academic Content Benchmarks**  
• *Connect statistical techniques to applications in workplace and consumer situations.*  
  (Data D, 11-12)  
• *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation.*  
  (Math. Process J, 11-12)  

**BIL: Recommended: ISS**  
EDU: 10 12 AD  
ISS I  
NS  
PSD  
IM  

**Competency 31.2: Analyze and perform advanced system administration tasks**  
*Descriptors:*  
31.2.1 Manage inventory and assets  
31.2.2 Analyze historical data to identify trends  
31.2.3 Prepare documentation manuals and required reports  
31.2.4 Analyze future technology  

**Correlated English Language Arts Academic Content Benchmarks**  
• *Demonstrate comprehension of print and electronic text by responding to questions*
(e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

- Produce functional documents that report, organize and convey information and ideas accurately foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

- Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)
- Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation. (Math. Process J, 11-12)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD
ISS P
NS
PSD I
IM

**Competency 31.3: Develop control language programs to access system functions and database files**

**Descriptors:**
31.3.1 Explain the role of control language in relation to other languages
31.3.2 Create, compile and test control language programs
31.3.3 Build forms using a layout editor
31.3.4 Integrate forms, reports and graphics

**BIL: Recommended: ISS, NS, PSD**

**EDU:** 10 12 AD
ISS P
NS I
PSD I
IM

**Competency 31.4: Integrate cross platform data exchange**

12 5

**Descriptors:**
31.4.1 Transfer files from a mid-range computer to a microcomputer
31.4.2 Transfer files from a microcomputer to a mid-range
31.4.3 Create Web applications to perform file transfer
31.4.4 Run forms and reports on the Web

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD
ISS P
NS
PSD I
IM

**Competency 31.5: Store media**

**Descriptors:**
31.5.1 Determine file and retrieval methods for stored media
31.5.2 Employ visual tool sets, languages, and libraries
31.5.3 Initialize/catalog media
31.5.4 Comply with company and/or government standards for media security
31.5.5 Maintain archives of company records as required by policy or law

**Unit 32: Database Management System Basics**

**BIL:** Essential: ISS, PSD
**Recommended:** NS

**EDU:** 10 12 AD
ISS I P
NS I
PSD I P
IM

**Competency 32.1: Demonstrate knowledge of Database Management System (DBMS) basics**

**Descriptors:**
32.1.1 Define terminology associated with relational databases (ISS, PSD)
32.1.2 Identify the uses of a DBMS in business organizations (ISS, PSD)
32.1.3 Utilize the features, functions, and architecture of a DBMS (PSD)
32.1.4 Analyze the organization of data in a DBMS
32.1.5 Use the transaction control techniques to ensure data integrity

**Correlated English Language Arts Academic Content Benchmarks**

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* [Reading Process B, 11-12]

**BIL:** Essential: ISS
**Recommended:** PSD

**EDU:** 10 12 AD
ISS I P
NS
PSD I P
IM

**Competency 32.2: Apply data structure concepts to store and retrieve data**

**Descriptors:**
32.2.1 Map data model to a relational model (ISS)
32.2.2 Enter records into physical files (ISS)
32.2.3 Create and implement logical files (ISS)

**BIL:** Recommended: ISS, PSD

**EDU:** 10 12 AD
ISS I
NS
PSD I
IM

**Competency 32.3: Design and implement stored procedures**

**Descriptors:**
32.3.1 Explain procedural SQL extensions (e.g., SQL Server, Oracle)
32.3.2 Develop stored procedures within the DBMS
32.3.3 Execute and test stored procedures within the DBMS
Competency 32.4: Create database query
Descriptors:
32.4.1 Create a query to extract information from single and multiple files (ISS, PSD)
32.4.2 Create nested queries (ISS)
32.4.3 Create reports and/or files from queries (ISS, PSD)

Competency 32.5: Employ a DBMS
Descriptors:
32.5.1 Distribute data across a distributed DBMS
32.5.2 Analyze/model organizations using Entity-Relationship and Object technologies
32.5.3 Identify the impact of networks on DBMS
32.5.4 Remove data anomalies through the process of normalization
32.5.5 Create/update a relational database using Structured Query Language
32.5.6 Query a relational database using Structured Query Language
32.5.7 Query data from an organizational repository using a database access facility
32.5.8 Perform database administration tasks

Competency 32.6: Manage implementation of a DBMS
Descriptors:
32.6.1 Execute implementation plan according to project timeline
32.6.2 Implement transition plan with minimal impact on productivity
32.6.3 Conduct user training
32.6.4 Define needed external informational resources (e.g., source, content, cost, and timeliness)
32.6.5 Access external information resources using Internet tools
32.6.6 Create/maintain a directory of external information resources
32.6.7 Develop editors to facilitate data entry
32.6.8 Design simple reports for validating the performance of application systems
32.6.9 Apply software development principles, methods, and tools in implementing IS applications
32.6.10 Apply database design techniques to the implementation of a solution with calls from
a program to the DBMS
32.6.11 Apply networking considerations in implementing distributed models
32.6.12 Develop server applications for installation and operation in a multi-user environment

Correlated English Language Arts Academic Content Benchmarks
• Give presentations using a variety of delivery methods, visual displays and technology. (Communication G, 8-10; Communication F, 11-12)
• Give informational presentations that contain a clear perspective; present ideas from multiple sources in logical sequence; and include a consistent organizational structure. (Communication E, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)

BIL: Recommended: ISS, NS, PSD
EDU: AD
ISS I
NS I
PSD I
IM

Competency 32.7: Monitor a DBMS
Descriptors:
32.7.1 Coordinate security requirements, including documentation functions
32.7.2 Identify desired levels of access and security
32.7.3 Communicate decisions concerning levels of access and security
32.7.4 Select monitoring tools and procedures
32.7.5 Identify monitoring methodologies
32.7.6 Identify problems in a timely fashion
32.7.7 Document problems
32.7.8 Propose solutions that are congruent with application requirements
32.7.9 Implement solutions to problems
32.7.10 Calibrate DBMS configuration parameters for optimum performance

Unit 33: Application Database Administration
BIL: Essential: PSD
Recommended: ISS
EDU: AD
ISS IP
NS
PSD IP R
IM

Competency 33.1: Apply databases to actual situations and business problems
Descriptors:
33.1.1 Evaluate database design from a workflow drawing or other requirement documents (PSD)
33.1.2 Design a database to solve a business problem or other real-life problem situation
33.1.3 Identify the relationship between database components
33.1.4 Sort data on multiple fields
33.1.5 Add/remove filters
33.1.6 Create queries with multiple criteria
33.1.7 Create/apply different types of queries
33.1.8 Join tables in a query
33.1.9 Enhance the design of a form
33.1.10 Create needed subforms
33.1.11 Group data in reports
33.1.12 Make a calculation on a report
33.1.13 Imbed data and graphics
33.1.14 Import data and graphics
33.1.15 Link data and graphics

**Correlated Mathematics Academic Content Benchmarks**

- Make predictions based on theoretical probabilities and experimental results. (Data K, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)
- Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation. (Math. Process J, 11-12)

**Correlated English Language Arts Academic Content Benchmarks**

- Apply editing strategies to eliminate slang and improve conventions. (Writing Process D, 11-12)

**BIL: Essential: PSD**
**Recommended: ISS**

**EDU:** 10 12 AD
ISS I
NS
PSD I P
IM

**Competency 33.2: Apply data modeling techniques**

*Descriptors:*
- 33.2.1 Interpret terminology associated with data models (PSD)
- 33.2.2 Compare/contrast various data models
- 33.2.3 Analyze data models
- 33.2.4 Develop a data model to describe an application’s data

**Correlated English Language Arts Academic Content Benchmarks**

- Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD
ISS I
Competency 33.3: Create conceptual data models

Descriptors:
33.3.1 Analyze model requirements
33.3.2 Identify business entities and the relationships between them
33.3.3 Define data in an integrated data dictionary
33.3.4 Ensure that conceptual model includes tools to facilitate user access

BIL: Recommended: ISS, PSD
EDU: 10 12 AD
ISS I
NS
PSD I
IM

Competency 33.4: Validate conceptual data models

Descriptors:
33.4.1 Present conceptual data model to client
33.4.2 Resolve issues with client
33.4.3 Secure client approval for model
33.4.4 Feed recommendations back into the modeling process
33.4.5 Document validation process

Correlated English Language Arts Academic Content Benchmarks
• Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure. (Communication E, 8-10; Communication E, 11-12)
• Give presentations using a variety of delivery methods, visual displays and technology. (Communication F, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Use counting techniques, such as permutations and combinations, to determine the total number of options and possible outcomes. (Data H, 8-10)

BIL: Recommended: ISS, PSD
EDU: 10 12 AD
ISS I
NS
PSD I
IM

Competency 33.5: Integrate conceptual data models with enterprise models

Descriptors:
33.5.1 Ensure that conceptual data model is consistent with enterprise model (e.g., entity names, relationships, and definitions)
33.5.2 Develop conceptual schema
33.5.3 Secure client approval for modifications in enterprise models

BIL: Recommended: ISS, PSD
Competency 33.6: Reconcile conceptual models with appropriate-level process models

Descriptors:
33.6.1 Verify consistencies between models
33.6.2 Identify areas of overlap
33.6.3 Verify that data entities in process model have a corresponding entity data model
33.6.4 Document changes or modifications in either model

Correlated Mathematics Academic Content Benchmarks
• Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Algebra C, 8-10)

BIL: Recommended: ISS, PSD

Competency 33.7: Create logical data models

Descriptors:
33.7.1 Map data model to a relational model
33.7.2 Identify attributes of model entities and relationships between them
33.7.3 Verify that logical model is consistent with conceptual model
33.7.4 Specify integrity constraints

Correlated Mathematics Academic Content Benchmarks
• Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Algebra C, 8-10)

BIL: Essential: PSD
Recommended: ISS

Competency 33.8: Identify unique identifiers (e.g., keys)

Descriptors:
33.8.1 Document identifiers (PSD)
33.8.2 Identify rationale for selection of identifiers (PSD)
33.8.3 Validate identifiers with client (PSD)

BIL: Essential: PSD
Recommended: ISS
**Competency 33.9: Normalize data models**
*Descriptors:*
33.9.1 Normalize logical data model in accordance with established company policy (PSD)
33.9.2 Verify that data model matches specifications (PSD)
33.9.3 Validate logical data model with client (PSD)
**BIL: Recommended: ISS, PSD**
**EDU:** 10 12 AD
ISS I
NS
PSD I
IM

**Competency 33.10: Reconcile conceptual models with lower process models**
*Descriptors:*
33.10.1 Verify consistencies between models
33.10.2 Identify areas of overlap
33.10.3 Verify that data entities in process model have a corresponding entity data model
33.10.4 Document changes or modifications in either model
33.10.5 Integrate logical data model with enterprise model

**Unit 34: Database Administration**
*Descriptors:*
34.1.1 Research potential computer environments/platforms
34.1.2 Identify platform capabilities and limitations
34.1.3 Select environment/platform based on technical, business, and skill information gathered
34.1.4 Secure approval of target environment/platform

**Correlated English Language Arts Academic Content Benchmarks**
*Compile, organize and evaluate information, take notes and summarize findings.*
(Restruch B, 11-12)
**BIL: Essential: ISS, NS**
**Recommended: PSD**
**EDU:** 10 12 AD
ISS P
NS P
PSD I
IM

**Competency 34.2: Identify backup and recovery requirements for physical database**
*Descriptors:*
34.2.1 Establish backup requirements consistent with corporate policy and business needs
34.2.2 Document established backup procedures
34.2.3 Control access to database to maintain security
34.2.4 Identify means to control access to backup

**BIL: Recommended: ISS, NS, PSD**

**EDU:** 10 12 AD
ISS I
NS I
PSD I R R
IM

**Competency 34.3: Identify and integrate database access requirements**

*Descriptors:*

- 34.3.1 Identify inputs, output, and volume of every user view
- 34.3.2 Categorize user views by type of transaction
- 34.3.3 Document access to data by type of access
- 34.3.4 Integrate access requirements with backup and recovery plan

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD
ISS I
NS
PSD I R
IM

**Competency 34.4: Specify physical database characteristics**

*Descriptors:*

- 34.4.1 Identify name, type, and length of attributes
- 34.4.2 Employ table and file names that conform to naming conventions
- 34.4.3 Group/assign tables to disk files
- 34.4.4 Index files for performance and integrity
- 34.4.5 Verify that data types are consistent between attributes
- 34.4.6 Employ normalization and modeling as cross-checking techniques

**BIL: Recommended: ISS, PSD**

**EDU:** 10 12 AD
ISS I
NS
PSD I
IM

**Competency 34.5: Reconcile physical design with processing requirements**

*Descriptors:*

- 34.5.1 Resolve conflicts between physical model and process model
- 34.5.2 Verify that data entities in process model have a corresponding entity data model
- 34.5.3 Document changes made to either model

**Unit 35: Data Warehousing**

**BIL: Recommended: ISS, NS, PSD**

**EDU:** 10 12 AD
ISS I
NS I
PSD I
IM

**Competency 35.1: Demonstrate knowledge of basic data warehousing concepts**
Descriptors:
35.1.1 Differentiate between traditional databases and data warehouses
35.1.2 Recognize importance of data warehouses and integration
35.1.3 Recognize that information is a competitive resource
35.1.4 Identify components of data warehouses (e.g., subject-oriented, integrated, time variant, nonvolatile)
35.1.5 Identify the characteristics and uses of metadata
35.1.6 Define types of information (e.g., associations, sequences, classifications, clusters, and forecasting)
35.1.7 Discuss data conversion techniques and functions
35.1.8 Identify types of programs and applications for data warehousing
35.1.9 Identify types of data mining tools (i.e., neural networks, decision trees, rule induction, and data visualization)
35.1.10 Define public summary data
35.1.11 Discuss ethical issues of data warehousing

Correlated English Language Arts Academic Content Benchmark
• *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10; Vocabulary E, 11-12)

**BIL: Recommended: NS, PSD**

EDU: 10 12 AD
ISS
NS I
PSD I
IM

**Competency 35.2: Apply ethical behaviors to data warehousing**

Descriptors:
35.2.1 Define appropriate security measures
35.2.2 Describe the limitations of external data
35.2.3 Identify ethical uses of data
35.2.4 Define use of permanent detail data for legal or ethical purposes

**BIL: Recommended: PSD**

EDU: 10 12 AD
ISS
NS
PSD I
IM

**Competency 35.3: Perform data entry and updating**

Descriptors:
35.3.1 Develop an entity-relationship diagram
35.3.2 Employ appropriate index or indices
35.3.3 Define data repositories
35.3.4 Design metamodel
35.3.5 Apply appropriate security measures
35.3.6 Differentiate between permanent detail data and regular data
35.3.7 Apply skill in working with data programs
35.3.8 Maintain metadata
35.3.9 Size data warehouse
35.3.10 Load/transfer data (map data)
35.3.11 Scrub/filter data
BIL: Recommended: PSD
EDU: 10 12 AD
ISS
NS
PSD I
IM

**Competency 35.4: Perform data retrieval**

*Descriptors:*
- 35.4.1 Locate appropriate data warehouses
- 35.4.2 Perform strategic analyses using a multidimensional database
- 35.4.3 Secure necessary indices
- 35.4.4 Design reasonable query
- 35.4.5 Define nature of application
- 35.4.6 Apply appropriate security measures
- 35.4.7 Obtain necessary responses from data query
- 35.4.8 Calculate derived and aggregate data
- 35.4.9 Validate the processing of data

**Correlated Mathematics Academic Content Benchmark**

*Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data B, 11-12)

**BIL: Recommended: PSD**

**Competency 35.5: Apply data**

*Descriptors:*
- 35.5.1 Optimize query procedures
- 35.5.2 Evaluate information gathered in query
- 35.5.3 Utilize public summary data
- 35.5.4 Design reporting medium
- 35.5.5 Perform online analytical processing
- 35.5.6 Construct report from data gathered

**Correlated English Language Arts Academic Content Benchmark**

*Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

**Correlated Mathematics Academic Content Benchmark**

*Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data B, 11-12)

**Unit 36: Interactive Multimedia Production**

BIL: Essential: IM
Recommended: ISS, PSD
Competency 36.1: Demonstrate knowledge of interactive media

Descriptors:
36.1.1 Define interactive media components
36.1.2 Identify the major characteristics of interactive media presentations
36.1.3 Identify the important historical developments leading to contemporary interactive media
36.1.4 Identify various interactive media industry genres
36.1.5 Perform critical review of various interactive media end products
36.1.6 Identify rights, responsibilities, and controls related to various interactive media
36.1.7 Interpret intellectual property laws relative to interactive media
36.1.8 Analyze the social and cultural implications of interactive media
36.1.9 Identify key criticisms of interactive media
36.1.10 Identify possible applications for interactive media (e.g., sales and marketing, interactive advertising, K-12 education, corporate training, corporate communications, distance learning, news, entertainment)
36.1.11 Identify specific uses of interactive media in each potential market
36.1.12 Identify future trends in interactive media

Correlated English Language Arts Academic Content Benchmark
• Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 11-12)
• Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 11-12)

BIL: Essential: IM
Recommended: ISS, PSD

Competency 36.2: Produce interactive media as a member of a development team

Descriptors:
36.2.1 Define the role of individual team members
36.2.2 Develop a conceptual model for the interactive media project
36.2.3 Select appropriate hardware tools
36.2.4 Select appropriate software tools
36.2.5 Select the media elements (e.g., sound, video, graphics, text, animation) to be used
36.2.6 Integrate media elements
36.2.7 Select the publication process to be used
36.2.8 Select the distribution method to be used
36.2.9 Explain decisions made (e.g., inputs and outputs)

BIL: Essential: IM
Recommended: ISS, PSD
Competency 36.3: Develop project concept proposal

Descriptors:
36.3.1 Determine purpose of the interactive media project
36.3.2 Determine client needs and expected outcomes
36.3.3 Determine the target audience
36.3.4 Determine objectives
36.3.5 Research the content
36.3.6 Develop a design brief
36.3.7 Select appropriate message design (e.g., instructional, informational, entertainment)
36.3.8 Determine the setting where the message will be used
36.3.9 Determine the interactive media elements to be used
36.3.10 Determine degree of interactivity desired
36.3.11 Identify available media and content sources
36.3.12 Decide whether to produce or acquire content (graphics, animation, audio, video, simulations, virtual environments, copyrights)
36.3.13 Develop time line, task breakdown, and responsibilities for completion
36.3.14 Develop project budget
36.3.15 Write proposal
36.3.16 Obtain client approval throughout project

Correlated English Language Arts Academic Content Benchmarks
• Formulate writing ideas, and identify a topic appropriate to the purpose and audience. (Writing Process A, 8-10; Writing Process A, 11-12)
• Determine the usefulness of organizers and apply appropriate pre-writing tasks. (Writing Process B, 8-10)
• Select and use an appropriate organizational structure to refine and develop ideas for writing. (Writing Process B, 11-12)
• Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics. (Writing Process F, 8-10)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonable of solutions. (Measurement F, 8-10)
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem
formulation, identification of a mathematical model, interpretations of solution within the model, and validations to original problem situation. (Math. Process J, 11-12)

BIL: Essential: IM
Recommended: ISS, PSD
EDU: 10 12 AD
ISS I
NS
PSD I P
IM I P

Competency 36.4: Develop navigational structures
Descriptors:
36.4.1 Identify types of navigational menu structures (e.g., rollovers, drop-downs, disjointed) [IM]
36.4.2 Determine placement of navigational units (IM)
36.4.3 Construct and place navigational units (IM)
36.4.4 Developing logic/site maps (IM)

BIL: Essential: IM
Recommended: ISS, PSD
EDU: 10 12 AD
ISS I R
NS
PSD I R
IM I P

Competency 36.5: Develop scripts, storyboards and flowcharts used in interactive media
Descriptors:
36.5.1 Determine uses and need for scripts, storyboards and flow charts
36.5.2 Make preliminary sketches showing placement of images and text on screen
36.5.3 Show placement of buttons/navigational graphics
36.5.4 Provide information on color schemes
36.5.5 Describe music to be used
36.5.6 Describe video (still and motion)
36.5.7 Describe special effects (video and audio)
36.5.8 Provide a sample layout

Correlated English Language Arts Academic Content Benchmark
• Compose narratives that establish a specific setting, plot and a consistent point of view, and develop characters by using sensory details and concrete language. (Writing Applications A, 8-10)

BIL: Essential: IM
Recommended: ISS, PSD
EDU: 10 12 AD
ISS I
NS
PSD I
IM I P

Competency 36.6: Combine media elements to produce an interactive multimedia project
Descriptors:
36.6.1 Apply visual design skills (IM)
36.6.2 Generate text for multi-image presentations (e.g., title graphics, charts, graphs) [IM]
36.6.3 Create 2-D computer graphics (IM)
36.6.4 Create 3-D computer graphics (IM)
36.6.5 Create computer animation (IM)
36.6.6 Prepare photographic images for interactive media
36.6.7 Alter images using an image manipulation program
36.6.8 Integrate photographically derived images with hand-drawn graphic images
36.6.9 Integrate the use of photographic special effects into interactive media presentations
36.6.10 Acquire talent, if necessary
36.6.11 Coordinate work with the acquired talent
36.6.12 Create/acquire video footage
36.6.13 Digitize/edit video footage using computer video-editing software
36.6.14 Record/acquire sound track, including narration, voice-overs, sound effects, and music
36.6.15 Integrate sound with visuals
36.6.16 Build in hotspots and interactive links
36.6.17 Synthesize available interactive media technologies into a unified presentation/product using software and hardware tools
36.6.18 Test product
36.6.19 Debug product
36.6.20 Maintain/update product

**Correlated English Language Arts Academic Content Benchmarks**

- Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure. (Communication E, 8-10)
- Give presentations using a variety of delivery methods, visual displays and technology. (Communication G, 8-10; Communication F, 11-12)
- Give informational presentations that contain a clear perspective; present ideas from multiple sources in logical sequence; and include a consistent organizational structure. (Communication E, 11-12)

**BIL:** Essential: IM

**Recommended:** ISS, PSD

**EDU:** 10 12 AD

**ISS I**

**NS**

**PSD I R**

**IM P R**

**Competency 36.7: Explain the types and uses of interactive media applications**

**Descriptors:**

36.7.1 Describe an interactive media presentation (e.g., Web-based, local)
36.7.2 Define *kiosks* and their uses
36.7.3 Define video conferences and their uses
36.7.4 Identify the characteristics of gaming and simulations
36.7.5 Analyze interactive communities (e.g., gaming, interpersonal, auctions, support
groups) and their functions in society
36.7.6 Define mobile applications and their uses
36.7.7 Identify emerging applications and their uses

Correlated English Language Arts Academic Content Benchmark
• Use multiple sources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

BIL: Essential: ISS, IM
EDU: 10 12 AD
ISS I P
NS
PSD
IM P R

Competency 36.8: Demonstrate knowledge of developing a training product
Descriptors:
36.8.1 Differentiate between training needs and development needs (ISS)
36.8.2 Identify the major characteristics of learner audiences (adults, adolescents, etc.) [ISS]
36.8.3 Identify methods of product delivery (e.g., Internet, CD-ROM, Audio/Video) [ISS]

BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
ISS I
NS
PSD
IM I P

Competency 36.9: Develop a training product
Descriptors:
36.9.1 Analyze the audience (IM)
36.9.2 Identify learner needs (IM)
36.9.3 Develop training objectives (IM)
36.9.4 Employ sound instructional design principles (IM)
36.9.5 Employ a variety of media in presenting training (IM)
36.9.6 Evaluate training effectiveness (IM)

Correlated English Language Arts Academic Content Benchmarks
• Formulate writing ideas, and identify a topic appropriate to the purpose and audience. (Writing Process A, 8-10; Writing Process A, 11-12)
• Evaluate the content and purpose of a presentation by analyzing the language and delivery choices made by a speaker. (Communication C, 8-10)
• Evaluate the clarity, quality, effectiveness and overall coherence of a speaker’s key points, arguments, evidence, organization of ideas, delivery, diction and syntax. (Communication B, 11-12)
• Give presentations using a variety of delivery methods, visual displays and technology. (Communication G, 8-10; Communication G, 11-12)
• Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational
Competency 36.10: Maintain interactive media equipment
Descriptors:
36.10.1 Demonstrate proper care and handling procedures for interactive media equipment
36.10.2 Perform pre-and post-production routines for presentations
36.10.3 Analyze equipment performance against industry standards
36.10.4 Troubleshoot simple equipment problems

Competency 36.11: Assess interactive media career opportunities
Descriptors:
36.11.1 Identify potential career areas in interactive media
36.11.2 Identify education/training needs (e.g., degree, non-degree, certificates, and certification)
36.11.3 Initiate portfolio

Correlated English Language Arts Academic Content Benchmarks
• Apply tools to judge the quality of writing. (Writing Process E, 8-10)
• Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics. (Writing Process F, 8-10)
• Give presentations using a variety of delivery methods, visual displays and technology. (Communications G, 8-10; Communication F, 11-12)

Unit 37: Appreciation of the Arts

Competency 37.1: Demonstrate knowledge of and an appreciation for music
Descriptors:
37.1.1 Compare/contrast the role of music in different historical periods (IM)
37.1.2 Assess the role of music in contemporary living (IM)
37.1.3 Compare/contrast the function of music in different cultures (IM)
37.1.4 Distinguish the basic physical properties of sound (e.g., pitch, intensity, duration, and
timbre) [IM]
37.1.5 Distinguish the various elements of music (e.g., rhythm, melody, harmony, tone, color, and form) [IM]
37.1.6 Identify how musical elements relate to the meaning or content of a composition (IM)
37.1.7 Identify the feelings conveyed by various musical elements (e.g., thematic construction, tonal color, instruments, texture, volume, and tempo) [IM]
37.1.8 Discuss how music visualization is used to evoke a specific emotional response (IM)

Correlated English Language Arts Academic Content Benchmarks

- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
- Produce informational essays or reports that establish a clear and distinctive perspective on the subject, include relevant perspectives, take into account the validity and reliability of sources and provide a clear sense of closure. (Writing Applications D, 11-12)

**BIL:** Essential: IM
**Recommended:** ISS
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**Competency 37.2: Demonstrate knowledge of and an appreciation for the visual arts**

**Descriptors:**
37.2.1 Compare/contrast the visual art styles of various historical periods (IM)
37.2.2 Define various forms of visual art (IM)
37.2.3 Define the various elements of visual arts (e.g., lines, colors, light and dark, texture, volume, perspective) [IM]
37.2.4 Identify the feelings conveyed by various elements of visual arts (IM)
37.2.5 Discuss how music and visuals can evoke a specific emotional response (IM)

Correlated English Language Arts Academic Content Benchmarks

- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly (Writing Applications C, 11-12)
- Produce informational essays or reports that establish a clear and distinctive perspective on the subject, include relevant perspectives, take into account the validity and reliability of sources and provide a clear sense of closure. (Writing Applications D, 11-12)

**BIL:** Essential: IM
**Recommended:** ISS
EDU: 10 12 AD
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Competency 37.3: Demonstrate knowledge of and an appreciation for literature

Descriptors:
37.3.1 Compare/contrast the role of literature in different historical periods
37.3.2 Assess the role of literature in contemporary living
37.3.3 Compare/contrast the function of literature in different cultures
37.3.4 Discuss the impact of literature on the business environment
37.3.5 Discuss the basic themes used in literature
37.3.6 Discuss the basic styles/genres of literature
37.3.7 Identify the basic elements of a story (e.g., plot, characters, and setting)
37.3.8 Analyze the themes and styles used in interactive stories

Correlated English Language Arts Academic Content Benchmarks
• Identify similar recurring themes across different works. (Reading: Literary Text D, 8-10)
• Analyze the use of a genre to express a theme or topic. (Reading: Literary Text E, 8-10)
• Explain techniques used by authors to develop style. (Reading: Literary Text G, 8-10)
• Explain ways characters confront similar situations and conflict. (Reading: Literary Text B, 11-12)
• Recognize and analyze characteristics of subgenres and literary periods. (Reading: Literary Text C, 11-12)
• Analyze and evaluate the five elements (e.g., plot, character, setting, point of view and theme) in literary text. (Reading: Literary Text A, 11-12)
• Critique an author’s style. (Reading: Literary Text E, 11-12)

Unit 38: Graphic Design Fundamentals

BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
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Competency 38.1: Demonstrate basic knowledge of technical art skills (traditional and electronic)

Descriptors:
38.1.1 Demonstrate the ability to center, space, and scale drawings
38.1.2 Identify various types of drawing media and a variety of surfaces
38.1.3 Identify various examples of mechanical drawing equipment
38.1.4 Interpret information from drawings, prints, and sketches
38.1.5 Draw freehand sketches
38.1.6 Alter drawings
38.1.7 Create charts, graphs, and diagrams
38.1.8 Evaluate drawings

Correlated English Language Arts Academic Content Benchmarks
• Analyze whether graphics supplement textual information and promote the author’s
Correlated Mathematics Academic Content Benchmarks

- Describe and apply properties of similar and congruent figures, and justify conjectures involving similarity and congruence. (Geometry B, 8-10)
- Represent transformations within a coordinate system using vectors and matrices. (Geometry B, 11-12)
- Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability. (Data A, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Formally define geometric figures. (Geometry A, 8-10)

BIL: Essential: PSD, IM
Recommended: ISS
EDU: 10 12 AD
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Competency 38.2: Demonstrate knowledge of design principles

Descriptors:
38.2.1 Apply the principles of basic composition picture plan (PSD)
38.2.2 Apply the principles and elements of design and their relationship to each other
38.2.3 Identify the nature of color and color harmonies
38.2.4 Assess the impact of various color harmonies on basic composition
38.2.5 Assess how color affects the principles of line, value, shape and form

Correlated English Language Arts Academic Content Benchmarks

- Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

BIL: Essential: IM
Recommended: ISS, PSD
EDU: 10 12 AD
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Competency 38.3: Demonstrate design skills

Descriptors:
38.3.1 Apply elements of design (e.g., line, shape, color)
38.3.2 Apply principles of design (e.g., proportion, balance, harmony, rhythm, unity)
38.3.3 Apply color theory
38.3.4 Develop thumbnail concepts
38.3.5 Develop rough and comprehensive layouts
38.3.6 Create symmetric and asymmetric designs
38.3.7 Make collages
38.3.8 Describe digital color concepts

**Correlated Mathematics Academic Content Benchmarks**
- Identify subsets of the real number system. (Number B, 8-10)
- Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers. (Number D, 8-10)

**BIL: Essential : IM**
**Recommended: ISS, PSD**

**Competency 38.4: Demonstrate knowledge of available graphics software applications**

*Descriptors:*
- 38.4.1 Apply tones, hues, and values
- 38.4.2 Apply color for emotional impact
- 38.4.3 Contrast/compare vector and raster images
- 38.4.4 Identify industry accepted graphic file types (e.g., .jpg, .gif, .tif, .eps,.pdf)
- 38.4.5 Compare/contrast different types of graphics applications (e.g., vector, raster, image)
- 38.4.6 Identify graphic tools, menus, and functions, such as grouping, transformations and blending
- 38.4.7 Identify simple and advanced development tools, styles, templates, and automated tasks
- 38.4.8 Identify simple and advanced techniques for manipulating object attributes and types
- 38.4.9 Select the most effective graphics applications for the intended uses

**BIL: Essential : IM**
**Recommended: ISS, PSD**

**Competency 38.5: Construct digital graphics**

*Descriptors:*
- 38.5.1 Identify audience and purpose of graphics
- 38.5.2 Select the appropriate style of graphics based on the intended purpose
- 38.5.3 Create graphics that integrate principles of communication and elements of visual design

**Correlated English Language Arts Academic Content Benchmarks**
- Analyze whether graphics supplement textual information and promote the author’s purpose. (Reading: Informational Text C, 8-10)

**BIL: Essential : IM**
**Recommended: ISS, PSD**

**EDU: 10 12 AD**
Competency 38.6: Manipulate digital graphics

Descriptors:
38.6.1 Manipulate color, shape, size, and textures of graphics
38.6.2 Import objects from other applications
38.6.3 Export objects to other applications
38.6.4 Rotate graphics
38.6.5 Rotate text
38.6.6 Paint/touch up images
38.6.7 Add/subtract image parts
38.6.8 Apply 2-D and 3-D graphics principles
38.6.9 Manipulate multiple image layers
38.6.10 Employ masking techniques
38.6.11 Crop images
38.6.12 Determine appropriate uses of halftone, duotone, and multi-color processes
38.6.13 Scale images
38.6.14 Employ various filtration methods
38.6.15 Convert raster to vector images
38.6.16 Store images in appropriate formats and resolutions for specific applications
38.6.17 Save/retrieve graphics
38.6.18 Print graphics to various output devices (e.g., file, monitor, pdf)

Correlated Mathematics Academic Content Benchmarks

• Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangle, to solve problems involving measurements and rates. (Measurement D, 8-10)
• Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
• Use coordinate geometry to represent and examine the properties of geometric figures. (Geometry D, 8-10)
• Draw and construct representations of two-and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology. (Geometry E, 8-10)
• Represent and model transformations in a coordinate plane and describe the results. (Geometry F, 8-10)

BIL: Essential: IM
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Competency 38.7: Integrate knowledge of typography

Descriptors:
38.7.1 Interpret typographic terms (e.g., serif, sans-serif, picas, points)
38.7.2 Identify typographic styles
38.7.3 Define basic letter structures
38.7.4 Mix families of type within a project
38.7.5 Select proper letter and line spacing
38.7.6 Select appropriate typefaces
38.7.7 Prepare type formats (e.g., style guides)

**Correlated English Language Arts Academic Content Benchmarks**

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)

**Correlated Mathematics Academic Content Benchmarks**

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number G, 8-10)

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**Unit 39: Photography**

**BIL:** Essential: IM

**Recommended:** ISS

**EDU:** 10 12 AD

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**IM I P**

**Competency 39.1: Develop competency in the use of photographic equipment**

**Descriptors:**

- 39.1.1 Differentiate between various formats (i.e., traditional vs. digital) [IM]
- 39.1.2 Select appropriate camera format for given situation (IM)
- 39.1.3 Demonstrate knowledge of apertures (IM)
- 39.1.4 Identify appropriate depth of field (IM)
- 39.1.5 Employ appropriate shutter speeds (IM)
- 39.1.6 Employ appropriate shutter speed for desired exposure effects (IM)
- 39.1.7 Use shutter speed to stop and show motion (IM)
- 39.1.8 Calculate equivalent exposures (IM)
- 39.1.9 Identify desired exposure using a light meter (IM)
- 39.1.10 Provide needed lighting conditions using electronic flash units (IM)
- 39.1.11 Create photographs using varied lighting and formats (IM)
- 39.1.12 Create photographs using different lenses (e.g., wide-angle, telephoto, zoom) [IM]
- 39.1.13 Identify appropriate light sources (IM)
- 39.1.14 Create photographs using various lens filters (e.g., color-compensating, polarizing, special effects, black-and-white contrast control) [IM]

**Correlated Mathematics Academic Content Benchmarks**

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number G, 8-10)
- *Find the square root of perfect squares, and approximate the square root of non-perfect squares.* (Number H, 8-10)

**BIL:** Essential: IM
Competency 39.2: Demonstrate knowledge of photographic terminology
Descriptors:
39.2.1 Discuss the role played by the following photographic elements: composition, formal qualities, scale, use of space, use of light (IM)
39.2.2 Discuss how the meaning of a photograph is affected by composition, formal qualities, scale, use of space, and use of light (IM)
39.2.3 Identify the use and meaning of symbolism in given photographs (IM)
39.2.4 Identify the use and meaning of metaphor in given photographs (IM)

Correlated English Language Arts Academic Content Benchmarks
• *Use context clues and text structures to determine the meaning of new vocabulary.* (Vocabulary A, 8-10)
• *Recognize the importance and function of figurative language.* (Vocabulary C, 8-10)
• *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary E, 11-12)

Unit 40: Visual Media Design
BIL: Essential: IM
Recommended: ISS, PSD
EDU: 10 12 AD
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IM I P

Competency 40.1: Create visual design guidelines
Descriptors:
40.1.1 Integrate paint, illustration, and imaging manipulation techniques with digital images (IM)
40.1.2 Consider the visual characteristics of various media (e.g., video, print, Web) [IM]
40.1.3 Assess how the technical limitations of the medium affect content and style (IM)
40.1.4 Consider the relationship between form and content (IM)
40.1.5 Plan a visual design utilizing the form follows function principle (IM)
40.1.6 Create a multi-layered image (IM)
40.1.7 Select appropriate colors for the design (IM)
40.1.8 Define color editing capabilities (IM)
40.1.9 Identify appropriateness of 3-D elements
40.1.10 Integrate human factors and user interface in visual design (IM)
40.1.11 Evaluate visual appeal of design (IM)
40.1.12 Construct model (i.e., physical or computer-based) [IM]
40.1.13 Evaluate model against guidelines (IM)

BIL: Essential: IM
Recommended: ISS, PSD
Competency 40.2: Demonstrate proficiency in the use of digital imaging techniques and equipment
Descriptors:
40.2.1 Identify standard hardware platform components and configurations (e.g., UNIX, Windows, Macintosh) [IM]
40.2.2 Identify memory and storage requirements (IM)
40.2.3 Identify computer architecture requirements for digital imaging (IM)
40.2.4 Explain how a digital image is generated (IM)
40.2.5 Identify types of digital imaging software (IM)
40.2.6 Compare performance of different types of image acquisition hardware (IM)
40.2.7 Operate digital imaging equipment (e.g., scanner, digital camera, video input devices, graphics tablet, graphics expansion board, printer, film recorder, and output devices) [IM]
40.2.8 Compare/contrast area and linear arrays (IM)
40.2.9 Compare/contrast exposure and multieposure systems (IM)
40.2.10 Compare/contrast layering techniques (IM)
40.2.11 Select appropriate resolution (IM)
40.2.12 Perform resolution calculations (e.g., number of pixels, number of colors) [IM]
40.2.13 Compare/contrast addressable and displayable resolution (IM)
40.2.14 Archive and manage images (IM)

Correlated Mathematics Academic Content Benchmarks
• Draw and construct representations of two- and three-dimensional geometric object using a variety of tools, such as straightedge, compass and technology. (Geometry E, 8-10)
• Represent transformations within a coordinate system using vectors and matrices. (Geometry B, 11-12)
• Compare, order and determine equivalent forms of real numbers. (Number E, 8-10)

BIL: Essential: IM
Recommended: ISS

Competency 40.3: Demonstrate knowledge of the basic principles of 3-D modeling
Descriptors:
40.3.1 Explain how to convert objects from two-dimensional to three-dimensional
40.3.2 Explain how a computer deals with geometry (e.g., algorithms, vectors)
40.3.3 Identify the software available for 3-D modeling
40.3.4 Explain the steps for building a 3-D model
40.3.5 Define the components of a wireframe model

Correlated Mathematics Academic Content Benchmarks
• Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented with a coordinate system. (Geometry G, 8-10)

• Represent transformations within a coordinate system using vectors and matrices. (Geometry B, 11-12)

BIL: Recommended: ISS, IM
EDU: 10 12 AD
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Competency 40.4: Create 3-D models
Descriptors:
40.4.1 Create a model using 3-D modeling software
40.4.2 Determine desired camera angle
40.4.3 Adjust lighting angle, focus, and color to achieve desired effect
40.4.4 Adjust surface color, texture, transparency, and reflectivity to achieve desired effect
40.4.5 Compare/contrast flat shading, curved shading, ray tracing, and radiosity methods
40.4.6 Render the object using flat shading
40.4.7 Render the object using curved shading
40.4.8 Render the object using ray tracing
40.4.9 Combine models to create a scene
40.4.10 Render the completed scene

Correlated Mathematics Academic Content Benchmarks
• Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines. (Geometry C, 8-10)

• Represent and model transformations in a coordinate plane and describe the results. (Geometry F, 8-10)

BIL: Essential: IM
Recommended: ISS
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Competency 40.5: Perform advanced 3-D image generation techniques
Descriptors:
40.5.1 Follow basic animation principles
40.5.2 Perform basic texture-mapping algorithms
40.5.3 Perform basic antialiasing
40.5.4 Perform basic volume-rendering algorithms
40.5.5 Develop basic curves and surfaces
40.5.6 Perform surface detail modeling

BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
ISS I
Competency 40.6: Utilize the basic principles of 2-D animation

Descriptors:
40.7.1 Explain the principles of continuity, key frames, motion paths, and motion (e.g., shape tweening, path tweening, motion tweening)
40.7.2 Create special effects and virtual navigation
40.7.3 Identify available animation software programs/tools
40.7.4 Create 2-D sprite animation
40.7.5 Discuss the principles of cell animation
40.7.6 Explain timelines, key frames, and objects in animation

Correlated English Language Arts Academic Content Benchmarks
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
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Competency 40.7: Utilize the basic principles of 3-D animation

Descriptors:
40.7.1 Create pre-rendered 3-D animation (IM)
40.7.2 Create real-time Virtual Reality Mark-up Language (VRML) 3-D animation

BIL: Recommended: ISS, IM
EDU: 10 12 AD
ISS I
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IM I P

Competency 40.8: Develop animated characters

Descriptors:
40.8.1 Design a character based on a narrative context
40.8.2 Develop characters in accordance with designs
40.8.3 Animate a character so as to express its nature
40.8.4 Capture motion
40.8.5 Design 2-D characters
40.8.6 Design 3-D models of characters

Correlated Mathematics Academic Content Benchmarks
• Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology. (Geometry E, 8-10)
• Represent transformations with a coordinate system using vectors and matrices.
  (Geometry B, 11-12)

BIL: Recommended: ISS, IM
EDU: 10 12 AD
Competency 40.9: Create 3-D environments

Descriptors:
40.9.1 Create buildings and rooms
40.9.2 Import buildings and rooms
40.9.3 Create land forms
40.9.4 Import land forms
40.9.5 Create bodies of water (e.g., lakes, rivers, oceans, waterfalls)
40.9.6 Create basic water textures, reflections, refractions, and splashing
40.9.7 Incorporate fog and background images
40.9.8 Manipulate particle systems such as rain and snow
40.9.9 Apply lighting effects
40.9.10 Add special effects
40.9.11 Code object intelligence into a 3-D environment

BIL: Recommended: ISS, IM

EDU: 10 12 AD

Competency 40.10: Demonstrate knowledge of virtual environment

Descriptors:
40.10.1 Explain the basic principles of virtual environment
40.10.2 Explain the principles of geometry relative to virtual environment
40.10.3 Differentiate virtual environment file formats (e.g., QTVR, IPIX)
40.10.4 Manage polygon resources
40.10.5 Create a basic virtual environment

Unit 41: Video Production

BIL: Essential: IM
Recommended: ISS

EDU: 10 12 AD

Competency 41.1: Identify technical support tasks of video production

Descriptors:
41.1.1 Identify steps needed to acquire talent
41.1.2 Identify needed equipment and props
41.1.3 Identify potential locations for shooting
41.1.4 Identify scheduling needs
41.1.5 Identify editing needs
41.1.6 Describe music to be used
41.1.7 Describe video (still and motion)
41.1.8 Describe special effects (video and audio)
41.1.9 Describe scenes
41.1.10 Identify tasks required to price production needs

**BIL: Essential: IM**
**Recommended: ISS**
EDU: 10 12 AD
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**Competency 41.2: Interpret the relationship between the creative and craft skills required for video production**

**Descriptors:**
41.2.1 Identify the working relationships that exist between the various participants involved in the video production process
41.2.2 Discuss the relationship of the specific technical processes used by the camera, grip, lighting, sound, art, costume, special effects, make up, and editing departments
41.2.3 Analyze a script to identify technical requirements
41.2.4 Compare/contrast the techniques used in film and video production in studio and field

**BIL: Essential: IM**
**Recommended: ISS**
EDU: 10 12 AD
ISS I
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IM P R

**Competency 41.3: Perform camera-related tasks for a video production**

**Descriptors:**
41.3.1 Analyze the aesthetic needs of a shot and accomplish them (IM)
41.3.2 Organize the proper care and handling of camera and camera assist equipment (IM)
41.3.3 Analyze the script for camera lens and shot requirements (IM)
41.3.4 Organize pre and post-production routines for camera operation (IM)
41.3.5 Analyze production requirements to determine camera equipment needs (IM)

**BIL: Essential: IM**
**Recommended: ISS**
EDU: 10 12 AD
ISS I
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IM P R

**Competency 41.4: Perform lighting activities for a video production**

**Descriptors:**
41.4.1 Identify different types of lighting fixtures (IM)
41.4.2 Identify parts of lighting fixtures and the function of each (IM)
41.4.3 Identify various applications of stage lighting equipment (IM)
41.4.4 Describe functions of master lighting panel and dimmer board (IM)
41.4.5 Analyze/document lighting requirements for production (IM)
41.4.6 Design a standard lighting plot (IM)
41.4.7 Set up appropriate lighting for a production (IM)
41.4.8 Operate master lighting panel and dimmer board in accordance with specifications
41.4.9 Appraise maintenance needs for lighting equipment (IM)
41.4.10 Design special effects lighting (IM)

**BIL: Essential: IM**

**Recommended: ISS**

**EDU:** 10 12 AD

**ISS I**

**NS**

**PSD**

**IM I P**

**Competency 41.5: Design scenery for a video production**

**Descriptors:**

41.5.1 Design scenic plans to scale (IM)
41.5.2 Interpret scenic plans to determine the materials and hardware needed for scenic construction (IM)
41.5.3 Formulate design strategies for the construction of scenery (IM)
41.5.4 Create special effects scenery (IM)
41.5.5 Select stage props (IM)
41.5.6 Organize transportation of scenery to remote locations
41.5.7 Inspect/repair scenery as needed

**BIL: Essential: IM**

**Recommended: ISS**

**EDU:** 10 12 AD

**ISS I**

**NS**

**PSD**

**IM I P**

**Competency 41.6: Operate video cameras/camcorders**

**Descriptors:**

41.6.1 Set white balance for different lighting conditions (e.g., tungsten, daylight, backlight)
41.6.2 Practice camera movements (e.g., panning, zooming, tilting) using a tripod and handheld camera
41.6.3 Practice manual iris and focus
41.6.4 Playback recording on monitor
41.6.5 Identify the effect on a video camera of changing the setting in low light levels
41.6.6 Describe how a camera converts light to an electronic signal (e.g., CCD, CMOS, single vs. multi-chip, optics, A-D converter)

**BIL: Essential: IM**

**Recommended: ISS**

**EDU:** 10 12 AD

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**IM I P**

132
Competency 41.7: Perform technical support tasks for a video production
Descriptors:
41.7.1 Formulate strategies to properly utilize grip equipment during video production (IM)
41.7.2 Create solutions to unique shooting problems (IM)
41.7.3 Organize pre- and post-production routines (IM)
41.7.4 Analyze production requirements to determine grip equipment needs
41.7.5 Create required effects for lighting set-ups (IM)
41.7.6 Demonstrate safe work habits (IM)
41.7.7 Work as a member of a video production team (IM)
BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
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Competency 41.8: Identify video formats
Descriptors:
41.8.1 Compare/contrast consumer, industrial, and broadcast-grade video cameras
41.8.2 Identify the characteristics of various camera formats (e.g., Betacam, VHS, 8mm, super VHS, and DV-Cam)
41.8.3 Identify image characteristics affected by camera choice
41.8.4 Compare/contrast technical aspects of NTSC, PAL, SECAM, HDTV video signals (scanning, frame rate, frame size, etc.)
41.8.5 Describe frame synchronization and time-based correction
Correlated English Language Arts Academic Content Benchmarks
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros. (Algebra E, 8-10)

BIL: Essential: IM
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Competency 41.9: Perform editing operations
Descriptors:
41.9.1 Identify operational components of video editing systems
41.9.2 Compare/contrast linear and nonlinear editing systems
41.9.3 Edit digital video, including transitions (e.g., dissolves, wipes, cuts), special effects, and computerized backgrounds
41.9.4 Employ the batch capture process
41.9.5 Add sound track
41.9.6 Add narration and/or voiceover
41.9.7 Interpret edit decision lists
41.9.8 Employ edit decision lists
41.9.9 Perform edits using timelines

Correlated Mathematics Academic Content Benchmarks
• Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
• Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. (Measurement F, 8-10)

BIL: Essential: IM
Recommended: ISS
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Competency 41.10: Import and export digital video
Descriptors:
41.10.1 Describe the characteristics and uses of digitized video
41.10.2 Identify digital video bandwidths and their implications
41.10.3 Digitize analog video
41.10.4 Compress video files using various codes

Correlated Mathematics Academic Content Benchmarks
• Explain the effects of operations on the magnitude of quantities. (Number F, 8-10)
• Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)

Unit 42: Audio Production
BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
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IM P R

Competency 42.1: Demonstrate knowledge of audio recording and sound reinforcement
Descriptors:
42.1.1 Describe basic acoustic principles and formulae
42.1.2 Differentiate the functions between microphones design
42.1.3 Diagram signal flow throughout the recording chain
42.1.4 Operate a mixing console/applications, including its input and output functions
42.1.5 Edit audio recordings
42.1.6 Compare and contrast the properties of analog and digital recording
42.1.7 Explain sound reinforcement techniques used for live programs
42.1.8 Describe the characteristics and applications of analog signal processing
42.1.9 Describe the characteristics and applications of digital signal processing
42.1.10 Critique recordings

Correlated English Language Arts Academic Content Benchmarks
- Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
ISS I
NS
PSD
IM PR

Competency 42.2: Demonstrate knowledge of audio production

Descriptors:
42.2.1 Analyze current trends in electronic music
42.2.2 Describe MIDI
42.2.3 Describe how analog signals are digitized
42.2.4 Select music appropriate for a given application
42.2.5 Demonstrate digital sampling for compressing sound files
42.2.6 Describe methods of analog and digital editing
42.2.7 Explain digital audio bandwidths and their implications
42.2.8 Describe the various computer hardware and software used in studio recording
42.2.9 Describe methods for mastering audio recordings (e.g., in the form of an audiotape, compact disc, DVD)
42.2.10 Identify future technologies predicted for audio recording

Correlated English Language Arts Academic Content Benchmarks
- Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

BIL: Essential: IM
Recommended: ISS
EDU: 10 12 AD
ISS I
NS
PSD
IM PR

Competency 42.3: Create a sound track

Descriptors:
42.3.1 Evaluate performance needs (IM)
42.3.2 Evaluate technical resources (IM)
42.3.3 Analyze script information to identify sound requirements (IM)
42.3.4 Design sound score appropriate to production and post-production needs (IM)
42.3.5 Select sound material (IM)
42.3.6 Hire talent, if necessary (IM)
42.3.7 Coordinate the work of the hired talent (IM)
42.3.8 Determine microphone and speaker placement (IM)
42.3.9 Incorporate mechanical and electrical sound effects (IM)
42.3.10 Discuss audio-for-video recording devices (analog, digital) [IM]
42.3.11 Set up audio-for-video recording devices (IM)
42.3.12 Operate audio-for-video recording devices (IM)
42.3.13 Explain the time-code system for audio-video synchronization (IM)
42.3.14 Set up time-code system for audio-video synchronization (IM)
42.3.15 Operate time-code system for audio-video synchronization (IM)
42.3.16 Identify the parts of an audio mixing console/applications (IM)
42.3.17 Operate audio mixing console/applications (IM)
42.3.18 Create a MIDI sound score (IM)

**Correlated Mathematics Academic Content Benchmarks**

- Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. (Measurement F, 8-10)

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**Unit 43: Web Page Design**

**BIL:** Essential: PSD, IM
**Recommended:** ISS

**EDU:** 10 12 AD
ISS I
NS
PSD I P
IM P R

**Competency 43.1: Demonstrate knowledge of usability and interface design**

**Descriptors:**
- 43.1.1 Discuss ADA section 508 compliancy requirements
- 43.1.2 Discuss assistance devices and their interface with Web pages (PSD)
- 43.1.3 Identify the fundamentals of interface design (e.g., usability, navigation, use of color, functionality) [PSD]
- 43.1.4 Examine psychological and cultural implications

**BIL:** Essential: PSD, IM
**Recommended:** ISS, NS

**EDU:** 10 12 AD
ISS I
NS I R
PSD I P
IM P R

**Competency 43.2: Demonstrate knowledge of Web programming basics**

**Descriptors:**
- 43.2.1 Recognize the importance of Web programming standards (e.g., World Wide Web Consortium) [PSD]
- 43.2.2 Compare and contrast standard Web programming languages (e.g., Perl, JavaScript, Action Scripting, ASP, PHP, XHTML)
- 43.2.3 Compare and contrast standard Web markup languages (e.g., HTML, XML) [PSD]
- 43.2.4 Demonstrate use of organizational design guidelines
- 43.2.5 Differentiate between various versions of Web programming
- 43.2.6 Identify authoring programs specifically designed for Internet programming production (e.g., Microsoft FrontPage, Macromedia Dreamweaver) [PSD]
- 43.2.7 Identify cross-platform issues (i.e., PC, MAC, UNIX, Linux)
- 43.2.8 Identify new and emerging trends related to Web programming
- 43.2.9 Identify security issues related to client-side processing
43.2.10 Create and maintain a basic Web site (PSD)

BIL: Essential: PSD, IM
Recommended: ISS, NS
EDU: 10 12 AD
ISS I
NS I R
PSD I P
IM I P

Competency 43.3: Explain basic Web programming

Descriptors:
43.3.1 Identify the purpose of Web content delivery enablers (e.g., CGI, API, SSI) [IM, PSD]
43.3.2 Discuss client-side processing and its advantages/disadvantages (IM)
43.3.3 Identify standard scripting languages (e.g., JavaScript, Visual Basic Script, Action Scripting) [IM]
43.3.4 Discuss the uses and advantages/disadvantages of various scripting languages (IM, PSD)
43.3.5 Explain how to use a scripting language to program a site (IM)
43.3.6 Identify Internet protocol governing bodies (IM, PSD)
43.3.7 Explain how to use Internet communication protocols (IM)

BIL: Essential: PSD, IM
Recommended: ISS, NS
EDU: 10 12 AD
ISS I
NS P
PSD I P
IM I P

Competency 43.4: Apply knowledge of Web hosting

Descriptors:
43.4.1 Compare the advantages and disadvantages of running one’s own server vs. using a server provider (IM, PSD)
43.4.2 Identify hardware requirements for a server (IM, PSD)
43.4.3 Identify server software options (IM)
43.4.4 Demonstrate the process of ordering a domain name (IM)
43.4.5 Evaluate hosting providers (e.g., size, legitimacy, security, bandwidth allocation) [IM]
43.4.6 Explain how to assign a domain name to a DNS server (IM)
43.4.7 Comply with TCP/IP (Transfer Control Protocol/Internet Protocol) [IM]
43.4.8 Upload files to the server (IM, PSD)
43.4.9 Publicize the site (e.g., optimize search engine placement) (IM)
43.4.10 Collect/analyze usage statistics

Correlated Mathematics Academic Content Benchmarks
• Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)
Competency 43.5: Create/maintain a static Web site
Descriptors:
43.5.1 Open up a workspace to create a new Internet programming document
43.5.2 Create the basic Internet programming structure for a Web page using a text editor or Web development software
43.5.3 Explain the advantages of creating short multiple Web pages rather than a single, long Web page
43.5.4 Determine logical points to split information into multiple Web pages
43.5.5 Build basic navigation based on hyperlinks
43.5.6 Create a template file using a text editor
43.5.7 Make appropriate changes to template file to create individual pages
43.5.8 Insert non-displayed comments into Internet programming files
43.5.9 Display document within a Web browser
43.5.10 Make text modifications using a text editor
43.5.11 Place different level headings within document using appropriate Internet programming tags
43.5.12 Insert paragraph breaks into the text of document using appropriate Internet programming tag
43.5.13 Manipulate text cut and paste functions
43.5.14 Insert a stylized footer at the bottom of a page
43.5.15 Format text
43.5.16 Create lists
43.5.17 Add graphics/images
43.5.18 Add animation

Correlated English Language Arts Academic Content Benchmarks
• Use revision strategies to improve the style, variety of sentence structure, clarity of controlling idea, logic, effectiveness of word choice and transitions between paragraphs, passages or ideas. (Writing Process C, 8-10)

Competency 43.6: Demonstrate how to format page layout
Descriptors:
43.6.1 Determine targeted devices to be served (e.g., desktop, PDA, tablets, cell phone)
43.6.2 Explain Internet programming codes for formatting page layout (e.g., table, CSS)
43.6.3 Create a solid color background
43.6.4 Calculate the hexadecimal code for a color value
43.6.5 Change the color of text and hypertext link items
43.6.6 Create a textured background using a graphic file
43.6.7 Create various types of hard rule lines for page dividers (e.g., different thicknesses and widths, with and without 3-D shading)
43.6.8 Create a table with rows and columns of text in a gridded display
43.6.9 Create a layout scheme integrating text and pictures
43.6.10 Create an invisible table with side-by-side columns
43.6.11 Create a table that has different colored cells
43.6.12 Explain interface design
43.6.13 Display interlaced images
43.6.14 Organize information using frames

**Correlated English Language Arts Academic Content Benchmarks**

- *Evaluate how features and characteristics make information accessible and usable and how structures help authors achieve their purposes.* (Reading: Informational Text A, 8-10)
- *Analyze whether graphics supplement textual information and promote the author’s purpose.* (Reading: Informational Text C, 8-10)

**Correlated Mathematics Academic Content Benchmarks**

- *Identify subsets of the real number system.* (Number B, 8-10)
- *Explain the effects of operations on the magnitude of quantities.* (Number F, 8-10)
- *Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence.*

- *Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.* (Geometry E, 8-10)
- *Represent and model transformations in a coordinate plane and describe the results.* (Geometry F, 8-10)

**BIL: Essential: IM**

**Recommended: ISS, NS, PSD**

**EDU:** 10 12 AD

ISS I
NS I
PSD I R
IM I P

**Competency 43.7: Demonstrate how to add audio and video to a Web page**

**Descriptors:**

43.7.1 Define the process of delivering audio and video signals in real time (streaming) [IM]
43.7.2 Assess audio sweetening techniques for the Web (IM)
43.7.3 Define appropriate CODECS used for Web design (IM)
43.7.4 Embed audio and video to a Web page (IM)
43.7.5 Establish network administration procedures for audio and video (IM)

**BIL: Essential: PSD, IM**

**Recommended:** ISS, NS

**EDU:** 10 12 AD

ISS I
Competency 43.8: Demonstrate how to link documents
Descriptors:
43.8.1 Identify the function and structure of URLs (Uniform Resource Locators)
43.8.2 Identify the significance of a file called index.html on a Web server
43.8.3 Copy URLs from a Web browser to an Internet programming text document
43.8.4 Demonstrate the use of anchors in Web pages
43.8.5 Attach a hyperlink to graphics
43.8.6 Create a hypertext link that will send an e-mail message
43.8.7 Differentiate between client-side image mapping and server-side image mapping
43.8.8 Create images with linkable hot spots

Unit 44: Business Processes for IT Professionals
This unit details the methodology for the development, implementation, and monitoring of an IT-related work product or system. It is strongly recommended that the process oriented competencies in this unit be taught in conjunction with (not separate from) the technical, workplace, and academic skills outlined in other units.

Initiation/Planning Phase - Project Planning
BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P R
NS P R
PSD I P R
IM P R

Competency 44.1: Demonstrate knowledge of project planning methodology
Descriptors:
44.1.1 Define terms associated with project planning
44.1.2 Identify steps associated with project planning
44.1.3 Identify methodologies associated with project planning
44.1.4 Define the project’s contribution to business needs
44.1.5 Identify stakeholders and decision makers
44.1.6 Define the scope of the project
44.1.7 Evaluate project requirements
44.1.8 Develop task list (e.g., work breakdown structures)
44.1.9 Prioritize tasks according to business needs
44.1.10 Identify required resources and budget
44.1.11 Develop initial project management flowchart
44.1.12 Identify critical milestones
44.1.13 Evaluate risks
44.1.14 Prepare contingency plan
44.1.15 Develop a method of evaluation
44.1.16 Explain alternative development methodologies

Correlated English Language Arts Academic Content Benchmark
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
Correlated Mathematics Academic Content Benchmarks

- Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)
- Generalize and explain patterns and sequences in order to find the next term and the nth term. (Algebra A, 8-10)

Requirements Analysis Phase

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS 1 P
NS 1 P
PSD 1 P
IM 1 P

Competency 44.2: Conduct requirements analysis
Descriptors:
44.2.1 Identify business needs/expectations (PSD, NS, IM, ISS)
44.2.2 Analyze use of product or system (PSD, NS, IM, ISS)
44.2.3 Specify functional requirements (NS, IM, ISS)
44.2.4 Specify data requirements (NS, IM, ISS)
44.2.5 Describe how processes and data support business expectations (PSD, NS, IM, ISS)
44.2.6 Develop test criteria and plans (NS, IM, ISS)
44.2.7 Revise documentation prepared in initiation/planning phase as needed (NS, IM, ISS)
44.2.8 Generate task status report (NS, IM, ISS)
44.2.9 Track critical milestones (NS, IM, ISS)
44.2.10 Participate in project phase review (NS, IM, ISS)
44.2.11 Report project status (NS, IM, ISS)

Correlated English Language Arts Academic Content Benchmarks

- Use revision strategies to improve the style, variety of sentence structure, clarity of controlling idea, logic, effectiveness of word choice and transitions between paragraphs, passages or ideas. (Writing Process C, 8-10)
- Use a variety of strategies to revise content, organization and style, and to improve word choice, sentence variety, clarity and consistency of writing. (Writing Process C, 8-10; Writing Process C, 11-12)
- Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)
Correlated Mathematics Academic Content Benchmarks
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
• Construct convincing arguments based on analysis of data and interpretation of graphs. (Data F, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (Data B, 11-12)
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)
• Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 44.3: Demonstrate knowledge of the requirements analysis phase
Descriptors:
44.3.1 Identify business expectations (PSD, ISS, NS, IM)
44.3.2 Explain how implementation will impact the environment (NS, IM)
44.3.3 Explain budget and time restraints (ISS, NS, IM)
44.3.4 Explain how the business environment impacts requirements (e.g., risks and rewards)
[NS, IM]
44.3.5 Explain how internal and external forces impact project requirements (ISS, NS, IM)
44.3.6 Explain how legal and regulatory issues impact project requirements (NS, IM)

Correlated English Language Arts Academic Content Benchmarks
• Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). [Reading Process B, 11-12]

Design/Development Phase
BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 44.4: Identify current technical environment
Descriptors:
44.4.1 Identify current internal and external technical resources (NS, ISS, IM)
44.4.2 Identify current internal and external technology (PSD, NS, ISS, IM)
44.4.3 Identify internal and external processes (NS, ISS, IM)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD
- ISS I P
- NS I P
- PSD I R P
- IM I P

**Competency 44.5: Demonstrate knowledge of design alternatives and options**

**Descriptors:**
44.5.1 Determine return on investment (ROI) [e.g., cost-benefit analysis] [NS, ISS, IM]
44.5.2 Explain Total Cost of Ownership (TCO) [PSD, NS, ISS, IM]
44.5.3 Define risks and rewards for each option (NS, ISS, IM)
44.5.4 Explain the components of “build versus buy” (PSD, NS, ISS, IM)
44.5.5 Explain processes to compare design versus requirements (NS, ISS, IM)

**Correlated Mathematics Academic Content Benchmarks**
- *Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis.* (Data E, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data A, 11-12)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Math. Process B, 8-10)
- *Connect statistical techniques to applications in workplace and consumer situations.* (Data D, 11-12)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD
- ISS I P
- NS I P
- PSD I R P
- IM I P

**Competency 44.6: Demonstrate knowledge of how systems and products are developed**

**Descriptors:**
44.6.1 Define components that go into the development plan (e.g., hardware, software, communications) [PSD, ISS, NS, IM]
44.6.2 Explain what makes a good development plan (e.g., end-user involvement, programming code reviews) [PSD, ISS, NS, IM]
44.6.3 Identify documentation requirements in initiation/planning phase as needed (ISS, NS, IM)
44.6.4 Explain project status report (ISS, NS, IM)
44.6.5 Define purpose of critical milestones and paths (ISS, NS, IM)
44.6.6 Discuss need for project phase review (ISS, NS, IM)
44.6.7 Report project status (ISS, NS, IM)

**Correlated English Language Arts Academic Content Benchmarks**
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)
Correlated Mathematics Academic Content Benchmarks
• Use precise mathematical language and notations to represent problem situations and mathematical ideas. (Math. Process F, 8-10)
• Write clearly and coherently about mathematical thinking and ideas. (Math. Process G, 8-10)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS P R
PSD I P
IM I P

Competency 44.7: Discuss solutions versus requirements
Descriptors:
44.7.1 Explain how unit testing is used to validate requirements (PSD, ISS, IM)
44.7.2 Explain the purpose of technical review (ISS, IM)
44.7.3 Explain the purpose of end-user solution review (ISS, IM)

Correlated Mathematics Academic Content Benchmarks
• Describe sampling methods and analyze the effects of method chosen regarding how well the resulting sample represents the population. (Data G, 8-10)

Quality Assurance and Testing
BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 44.8: Explain quality assurance processes
Descriptors:
44.8.1 Discuss the historical evolution of quality assurance initiatives (ISS, NS, IM)
44.8.2 Interpret quality management terminology (NS)
44.8.3 Identify the role of quality within the organization (ISS, NS, IM)
44.8.4 Identify the features and benefits of quality planning (PSD, NS)
44.8.5 Discuss the relationship among organizational structures, policies, procedures and quality assurance (NS, IM)
44.8.6 Identify successful efforts by industry to improve quality and/or reduce costs (NS)
44.8.7 Differentiate between prevention and detection (ISS, NS)
44.8.8 Differentiate between variable and attribute data
44.8.9 Identify types of control charts
44.8.10 Explain how statistical techniques are used to control quality

Correlated Mathematics Academic Content Benchmarks
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
• Construct convincing arguments based on analysis of data and interpretation of graphs. (Data F, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlations and variability. (Data B, 11-12)
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM P R

Competency 44.9: Demonstrate knowledge of the testing environment

Descriptors:
44.9.1 Identify the purpose of integration testing (ISS, NS)
44.9.2 Identify the purpose of system testing (ISS, NS)
44.9.3 Identify the purpose of security testing (ISS, NS)
44.9.4 Identify the purpose of acceptance testing (PSD, ISS, NS)

Implementation Phase

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 44.10: Describe key components of an implementation plan (e.g., communication, business continuity plan)

Descriptors:
44.10.1 Identify turn-back points (e.g., go or no-go) [NS, IM, ISS]
44.10.2 Identify new work processes and procedures (PSD, NS, IM, ISS)
44.10.3 Identify steps all business units must take to implement (NS, IM, ISS)
44.10.4 Identify decision criteria for retiring old solution (i.e., displaced technology) [NS, IM, ISS]

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS P R
NS P R
PSD P R
IM P R

Competency 44.11: Explain the value a communication plan can provide to implementation

Descriptors:
44.11.1 Identify communication vehicles
44.11.2 Identify components of a communication plan
44.11.3 Explain the importance of audience when developing a communication plan
44.11.4 Describe types of communication channels (e.g., formal vs. informal)
44.11.5 Define stakeholder relationships (e.g., customer, employers, shareholders, suppliers)

Correlated English Language Arts Academic Content Benchmarks
• Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 44.12: Explain the value a training plan can provide to implementation
Descriptors:
44.12.1 Identify components of training plan (ISS, IM, NS)
44.12.2 Identify common training methodologies (e.g., computer-based, hands on) [ISS, IM, NS]
44.12.3 Identify strengths and weaknesses of each methodology (ISS, IM, NS)
44.12.4 Identify functions of a training plan (PSD, ISS, IM, NS)

Correlated English Language Arts Academic Content Benchmarks
• Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS P R
NS I P
PSD I P
IM I P

Competency 44.13: Explain how business continuity plans (e.g., disaster recovery, rollback) interrelate with implementation plans
Descriptors:
44.13.1 Describe purpose and components of a roll-back plan (e.g., go-no-go) [IM, NS]
44.13.2 Describe purpose and components of a fall-back plan (e.g., disaster recovery plan)
[PSD, IM, NS]
44.13.3 Describe purpose and components of a business continuity plan (IM, NS)

Maintenance/Operations Phase
BIL: Essential: ISS NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 44.14: Demonstrate knowledge of information technology operations and maintenance
Key Indicators
Descriptors:
44.14.1 Describe maintenance and operations phase (ISS, NS, IM)
44.14.2 Identify systems operations (ISS, IM)
44.14.3 Define problem and modification process (PSD, ISS, IM)
44.14.4 Define steps to maintain system (ISS, IM)
44.14.5 Revise previous documentation as needed (ISS, IM)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS I P
PSD I P
IM I P

**Competency 44.15: Explain the role of maintenance as part of the IT function**

Descriptors:
44.15.1 Define components of maintenance contracts (PSD, ISS, IM, NS)
44.15.2 Define upgrade process (ISS, IM, NS)
44.15.3 Define Service Level Agreements (SLAs) [ISS, IM, NS]

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS I P
PSD I P
IM I P

**Competency 44.16: Define components of incidence and problem management**

Descriptors:
44.16.1 Define escalation process (NS, IM)
44.16.2 Explain different methodologies for event notification (e.g., paging, e-mail) [ISS, PSD, NS, IM]
44.16.3 Explain support contract (ISS, NS, IM)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS I P
PSD I P
IM I P

**Competency 44.17: Identify components of change management process**

Descriptors:
44.17.1 Define the change and value of change (ISS, IM, NS)
44.17.2 Define when to do change (ISS, IM, NS)
44.17.3 Explain what change entails (ISS, IM, NS)
44.17.4 Explain the impact of change (ISS, PSD, NS)
44.17.5 Contact all affected parties (ISS, IM, NS)
44.17.6 Identify back-up plan (IM, ISS, NS)

**Unit 45: Business Law and Legal Issues**

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I R P
NS P R
PSD I P R
IM P R

**Competency 45.1: Define intellectual property rights covered by intellectual law**
Descriptors:
45.1.1 Distinguish among the various forms of intellectual property rights (e.g., copyright, patent, trademark, trade secrets) [ISS]
45.1.2 Define plagiarism (ISS)
45.1.3 Define authorship (ISS)
45.1.4 Define work made for hire (ISS)
45.1.5 Define fair use (ISS)
45.1.6 Differentiate the rights granted under copyright, patent, and trademark (ISS)
45.1.7 Identify the rights related to electronic imagery (ISS)
45.1.8 Discuss consequences of violation of copyright trademark and patent law (ISS)
45.1.9 Identify the liability for invasion of privacy (ISS)
45.1.10 Identify the liability for slander and libel (ISS)
45.1.11 Identify legal terms related to IT (ISS)
45.1.12 Discuss licensing issues (ISS)
45.1.13 Discuss confidentiality issues and their liability implications

Correlated English Language Arts Academic Content Benchmarks
• Use style guides to produce oral and written reports that give proper credit for sources (e.g., words, ideas, images, information) and include an acceptable format for source acknowledgment. (Research D, 8-10; Research D, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS 1 P
NS 1 P
PSD 1 P
IM 1 P

Competency 45.2: Describe the components of contracts
Descriptors:
45.2.1 Define statement of work (NS, IM, ISS)
45.2.2 Define duration (NS, ISS, IM)
45.2.3 Define liabilities (NS, ISS, IM)
45.2.4 Define termination clause (NS, ISS, IM)
45.2.5 Define service level agreements (PSD, NS, ISS, IM)
45.2.6 Define exclusions (NS, ISS, IM)
45.2.7 Define warranties (NS, ISS, IM)
45.2.8 Explain dispute resolution (NS, ISS, IM)
45.2.9 Define terms and conditions (NS, ISS, IM)

BIL: Essential: ISS NS, PSD, IM
EDU: 10 12 AD
ISS 1 P
NS 1 P
PSD 1 P
IM 1 P

Competency 45.3: Identify current regulatory issues (e.g., HIPAA, Gramm-Leach-Bliley, Sarbanes-Oxley, NSA–National Security Act, Homeland Security)
Descriptors:
45.3.1 Explain the impact of regulatory compliance issues on the design and development process (PSD, NS, ISS, IM)
45.3.2 Define/explain the impact of non-compliance to the company/organization (PSD, NS, IM, ISS)
45.3.3 Explain risk of non-compliance to the company/organization (PSD, NS, ISS, IM)

Unit 46: Technical Writing and Documentation

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS P R
PSD I P
IM I P

Competency 46.1: Evaluate technical writing requirements

Descriptors:
46.1.1 Define/prioritize communication needs (PSD, ISS, IM)
46.1.2 Resolve conflicting requirements (ISS)
46.1.3 Specify project objectives (PSD, ISS)
46.1.4 Determine the size and specifics of the work to be completed (PSD, ISS)
46.1.5 Estimate time, materials, and capabilities needed to complete assignment (ISS)
46.1.6 Identify criteria for successful completion of project (ISS)
46.1.7 Evaluate strengths and weaknesses of completed project (ISS)

Correlated English Language Arts Academic Content Benchmarks

- Select and use an appropriate organizational structure to refine and develop ideas for writing. (Writing Process B, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS P R
PSD I P
IM I P

Competency 46.2: Write technical reports

Descriptors:
46.2.1 Determine audience (PSD, ISS, IM)
46.2.2 Access needed information using standard references and sources (ISS, IM)
46.2.3 Identify type of report needed (ISS, IM)
46.2.4 Compile relevant data (ISS, IM)
46.2.5 Organize data into charts and graphs (ISS, IM)
46.2.6 Analyze data (ISS, IM)
46.2.7 Draw conclusions from data analysis (ISS, IM)
46.2.8 Outline report (ISS, IM)
46.2.9 Draft report (ISS, IM)
46.2.10 Edit report (e.g., check spelling, grammar, punctuation, sentence structure, accuracy of content) [ISS, IM]
46.2.11 Review report with peers (ISS, IM)
46.2.12 Revise report as needed based on peer feedback (ISS, IM)
46.2.13 Proofread revised report (ISS, IM)
46.2.14 Present reports (ISS, IM)

Correlated English Language Arts Academic Content Benchmarks
• Formulate writing ideas, and identify a topic appropriate to the purpose and audience. (Writing Process A, 8-10; Writing Process A, 11-12)
• Determine the usefulness of organizers and apply appropriate pre-writing tasks. (Writing Process B, 8-10)
• Select and use an appropriate organizational structure to refine and develop ideas for writing. (Writing Process B, 11-12)
• Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and include formatting techniques that are user friendly. (Writing Applications C, 11-12)
• Produce informational essays or reports that establish a clear and distinctive perspective on the subject, include relevant perspectives, take into account the validity and reliability of sources and provide a clear sense of closure. (Writing Applications D, 11-12)
• Use revision strategies to improve the style, variety of sentence structure, clarity of controlling idea, logic, effectiveness of word choice and transitions between paragraphs, passages or ideas. (Writing Process C, 8-10; Writing Process C, 11-12)
• Edit to improve sentence fluency, grammar and usage. (Writing Process D, 8-10)
• Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics. (Writing Process F, 8-10)

**Correlated Mathematics Academic Content Benchmarks**
• Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data. (Data D, 8-10)
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
• Construct convincing arguments based on analysis of data and interpretation of graphs. (Data F, 8-10)
• Describe sampling methods and analyze the effects of method chosen regarding how well the resulting sample represents the population. (Data G, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (Data B, 11-12)
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)
• Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)

**BIL: Essential: ISS, NS, PSD, IM**
EDU: 10 12 AD
ISS 1 P
NS P R

150
Competency 46.3: Conduct technical research

Descriptors:
46.3.1 Identify target audience (PSD, ISS, IM)
46.3.2 Define research questions (ISS, IM)
46.3.3 Determine priorities for the information that should be gathered (ISS, IM)
46.3.4 Identify potential sources of information (ISS, IM)
46.3.5 Target audience/user group as a key information source (ISS, IM)
46.3.6 Identify subject matter experts (ISS, IM)
46.3.7 Evaluate potential sources of information based on established criteria (e.g., affordability, relevance) [ISS, IM]
46.3.8 Conduct interviews with selected human information sources (ISS)
46.3.9 Gather information from selected print and electronic sources (ISS)
46.3.10 Determine the accuracy and completeness of the information gathered (ISS)

Correlated English Language Arts Academic Content Benchmarks

• Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted. (Research A, 8-10; Research A, 11-12)
• Evaluate the usefulness and credibility of data and sources. (Research B, 8-10)
• Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources. (Research C, 11-12)
• Organize information from various resources and select appropriate sources to support central ideas, concepts and themes. (Research C, 8-10)
• Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD

Competency 46.4: Design technical documentation

Descriptors:
46.4.1 Define purpose of documentation (PSD, ISS)
46.4.2 Specify standards for documentation, including critical success criteria (ISS)
46.4.3 Identify delivery options (ISS)
46.4.4 Evaluate cost-effectiveness of each delivery option (ISS)
46.4.5 Select tools appropriate for task purpose (ISS)
46.4.6 Plan information flow (ISS)
46.4.7 Select writing style and tone appropriate for given documentation (ISS)
46.4.8 Determine level of detail needed (ISS)
46.4.9 Identify visuals appropriate for given documentation (ISS)
46.4.10 Provide feedback on design to development team/individual (ISS)

Correlated English Language Arts Academic Content Benchmarks

• Formulate writing ideas, and identify a topic appropriate to the purpose and audience.
• Determine the usefulness of organizers and apply appropriate pre-writing tasks. (Writing Process B, 8-10)

• Select and use an appropriate organizational structure to refine and develop ideas for writing. (Writing Process B, 11-12)

**Correlated Mathematics Academic Content Benchmarks**
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)

**Correlated English Language Arts Academic Content Benchmarks**
• Formulate writing ideas, and identify a topic appropriate to the purpose and audience. (Writing Process A, 8-10; Writing Process A, 11-12)

• Evaluate the usefulness and credibility of data and sources. (Research B, 8-10)
• Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources. (Research C, 11-12)
• Organize information from various resources and select appropriate sources to support central ideas, concepts and themes. (Research C, 8-10)
• Compile, organize and evaluate information, take notes and summarize findings. (Research
• Give presentations using a variety of delivery methods, visual displays and technology. (Communication G, 8-10; Communication F, 11-12)
• Edit to improve sentence fluency, grammar and usage. (Writing Process D, 8-10)
• Apply tools to judge the quality of their writing. (Writing Process E, 8-10)
• Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product. (Writing Process F, 11-12)

**Correlated Mathematics Academic Content Benchmarks**
• Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. (Data E, 8-10)
• Construct convincing arguments based on analysis of data and interpretation of graphs. (Data F, 8-10)
• Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
• Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions. (Data C, 11-12)
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)
• Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretations of solution within the model, and validation to original problem situation. (Math. Process J, 11-12)

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**Unit 47: Professional Practices**

**BIL:** Essential: ISS, NS, PSD, IM

**EDU:** 10 12 AD  
ISS I P  
NS P R  
PSD I P R  
IM I P  

**Competency 47.1: Identify legal and ethical behavior**

**Descriptors:**  
47.1.1 Differentiate between legal and ethical behavior (ISS, IM)  
47.1.2 Explain terms, principles, and characteristics of legal and ethical behavior (e.g., loyalty, discretion, solicitation, competitor, supplier) [ISS, IM]  
47.1.3 Explain legal ramifications of breaching rules and regulations (ISS, IM)  
47.1.4 Explain the effects and consequences of unethical and/or unlawful behavior (ISS, IM)

**Correlated English Language Arts Academic Content Benchmarks**
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

**BIL:** Essential: ISS, NS, PSD, IM

**EDU:** 10 12 AD
Competency 47.2 Explain professional responsibilities

Descriptors:
47.2.1 Explain the need for professional and ethical standards
47.2.2 Explain responsibility of the individual to apply ethical standards
47.2.3 Identify responsibility to clients(s) and employer(s)
47.2.4 Explain importance of conflict resolution in the workplace

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS P R
PSD I P
IM I P

Competency 47.3: Explain the role of the IT professional in maintaining customer satisfaction

Descriptors:
47.3.1 Explain the nature of positive customer/client relations (ISS, IM)
47.3.2 Describe the importance of all customers to the business (PSD, ISS, IM)
47.3.3 Explain the importance of interaction with customers in a professional manner (ISS, IM)
47.3.4 Explain the importance of maintaining customer base (ISS, IM)
47.3.5 Determine appropriate communication vehicles (phone, e-mail, face-to-face) [PSD, ISS, IM]
47.3.6 Differentiate internal vs. external customer service (cost of existing versus new) [ISS, IM]
47.3.7 Discuss the role of company image (ISS, IM)
47.3.8 Discuss the role of customer feedback in customer satisfaction (ISS, IM)
47.3.9 Define function of call center (PSD, ISS, IM)
47.3.10 Identify customer expectations (ISS, IM)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS P R
PSD I P
IM I P

Competency 47.4: Explain the importance of teams in achieving IT project goals

Descriptors:
47.4.1 Identify desired group and team behavior in an IT context (PSD, ISS, IM)
47.4.2 Explain the importance of cross-functional teams in the IT environment (ISS, IM)
47.4.3 Define roles/responsibilities within the group decision making process (PSD, ISS, IM)
47.4.4 Identify ways to assess team productivity and results (ISS, IM)

Correlated Mathematics Academic Content Benchmarks
• Connect statistical techniques to applications in workplace and consumer situations. (Data D, 11-12)

194

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS 1 P
NS P R
PSD 1 P
IM 1 P R

**Competency 47.5: Explain the importance of professional behavior in the IT environment**

*Descriptors:*

47.5.1 Identify appropriate resources for company policies affecting professional behavior (e.g., organizational policies, personnel handbooks, and manuals) [PSD, ISS]

47.5.2 Discuss how specific organizational policies and rules influence a specific work situation (ISS)

47.5.3 Explain the importance of self-discipline, positive attitude and integrity in a work situation (e.g., attendance, personal appearance) [PSD, ISS]

47.5.4 Explain the importance of flexibility and willingness to learn new skills and knowledge (PSD, ISS)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS 1 R P
NS P R
PSD 1 P
IM 1 P R

**Competency 47.6: Explain the importance of health and safety standards and concepts in the IT workplace**

*Descriptors:*

47.6.1 Explain the relationship between health, safety and productivity (ISS)

47.6.2 Identify sources of safety information (e.g., company procedural manuals, documentation, standards, flowcharts) [ISS]

47.6.3 Explain the importance of maintaining a safe work area (ISS)

47.6.4 Explain how ergonomics and repetitive strain injury impact IT professionals (PSD, ISS)

**Correlated English Language Arts Academic Content Benchmarks**

• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary E, 11-12)

195

**Unit 48: Basic Business Concepts**

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS 1 P
NS P R
PSD 1 R P
IM 1 P

**Competency 48.1: Explain business ownership**
Descriptors:
48.1.1 Define types of business ownership (e.g., sole proprietorship, partnership) [PSD, ISS, IM]
48.1.2 Explain the advantages and disadvantages of the different forms of business ownership (ISS, IM)
48.1.3 Identify variations in ownership forms (ISS, IM)
48.1.4 Explain how business organization ownership can evolve over time (ISS, IM)

Correlated English Language Arts Academic Content Benchmark
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS P R
PSD I P
IM I P

Competency 48.2: Explain basic business organization and structure
Descriptors:
48.2.1 Differentiate between divisional and departmental structures (e.g., customer, geographic and product) [PSD, ISS, IM]
48.2.2 Identify types of organizational structures (e.g., organic, matrix, mechanistic) [PSD, ISS, IM]
48.2.3 Explain how internal and external forces impact the requirements for tech or service implementation (e.g., size, complexity, profitability) [PSD, ISS, IM]

Correlated Mathematics Academic Content Benchmarks
• Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Math. Process H, 8-10)
• Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of mathematical model, interpretation of solution with the model, and validation to original problem situation. (Math. Process J, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 48.3: Discuss the role of IT in meeting business strategic objectives
Descriptors:
48.3.1 Identify common sources outlining strategic business objectives (NS, ISS, IM)
48.3.2 Define typical business objectives (PSD, ISS, IM)
48.3.3 Identify ways in which business objectives are measured (e.g., key performance indicators) [NS, ISS, IM]
48.3.4 Identify business stakeholders (e.g., shareholders, customers, suppliers) (NS, ISS, IM)
48.3.5 Discuss how IT functions impact business objectives (NS, ISS, IM)
48.3.6 Discuss obstacles in measuring the impact of IT functions on business objectives (NS, ISS, IM)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS P R
PSD I P
IM I P

**Competency 48.4: Explain how IT functions interface with other business functions**

*Descriptors:*
48.4.1 Explain the role of IT in the business organization (PSD, ISS, IM)
48.4.2 Explain how IT interfaces with the human resource function (ISS, IM)
48.4.3 Explain how IT interfaces with the finance and accounting functions (ISS, IM)
48.4.4 Explain how IT interfaces with the production/manufacturing functions (ISS, IM)
48.4.5 Explain how IT interfaces with the sales, marketing, and distribution functions (ISS, IM)

**BIL: Essential: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS I P
PSD I P
IM I P

**Competency 48.5: Determine factors affecting business risk**

*Descriptors:*
48.5.1 Define business risk (PSD, NS, ISS, IM)
48.5.2 Identify types of business risks (NS, ISS, IM)
48.5.3 Describe ways to minimize business risks (NS, ISS, IM)
48.5.4 Identify factors affecting a business’ profit (NS, ISS, IM)

**Correlated Mathematics Academic Content Benchmarks**

- Explain difference among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations. (Measurement A, 11-12)
- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collections and analysis. (Data E. 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data A, 11-12)
- Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Math. Process B, 8-10)

**BIL: Recommended: ISS, NS, PSD, IM**

**EDU:** 10 12 AD

ISS I P
NS I R
PSD I
IM I P
Competency 48.6: Explain basic accounting concepts
Descriptors:
48.6.1 Define accounting and explain the purpose of the accounting system
48.6.2 Explain basic accounting principles and applications
48.6.3 Identify appropriate accounting concepts and techniques for acquisition, depreciation, and disposal of property, plant, and equipment

Correlated English Language Arts Academic Content Benchmark
• Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

Correlated Mathematics Academic Content Benchmarks
• Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases. (Number D, 11-12)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 48.7: Demonstrate knowledge of cost-benefit analysis
Descriptors:
48.7.1 Define cost and benefit analyses (NS, PSD, IM, ISS)
48.7.2 Differentiate between nonrecurring costs and recurring costs (IM, ISS)
48.7.3 Identify major cost categories (e.g., hardware, software, communication services, training, interface conversion) [IM, ISS]
48.7.4 Differentiate between tangible benefits and intangible benefits (IM, ISS)
48.7.5 Explain why intangible benefits are included in analyses (IM, ISS)
48.7.6 Identify tools used to rank and compare alternative costs and benefits (e.g., Net Present Value, Return on Investment, Discounted Payback Period) [ISS]
48.7.7 Execute full cost-benefit analysis (ISS)

BIL: Essential: ISS, NS, PSD, IM
EDU: 10 12 AD
ISS I P
NS I P
PSD I P
IM I P

Competency 48.8: Explain the vendor management process
Descriptors:
48.8.1 Define components of a RFP (Request for Proposals) [e.g., transmittal letter, instructions and procedures, and requirements and specifications] (NS, ISS, IM)
48.8.2 Identify basic criteria for vendor selection (NS, PSD, ISS, IM)
48.8.3 Identify common forms of vendor-buyer agreements (NS, ISS, IM)
48.8.4 Identify common problems in the vendor management process in the IT environment (e.g., compliance, confidentiality and non-disclosure) [NS, ISS, IM]
Pupil Evaluation Methods

Formative
- Observation
- Homework
- Quizzes
- Skill checks
- Class work-individual or group
- Clinical

Summative
- Chapter tests
- Projects
- Unit tests
- Research papers
- Non-linguistic representations
- Abstracts
- Case studies

Diagnostic
- Pre-assessment
- Post-assessment
The described competencies will be connected to the literacy and math Common Core Standards listed below: Appendix A - Common Core Literacy Standards for Broadcasting.

**Literacy**

**Key Ideas and Details:**

**CCSS.ELA-Literacy.RST.11-12.1**
Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

**CCSS.ELA-Literacy.RST.11-12.2**
Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

**CCSS.ELA-Literacy.RST.11-12.3**
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

**Craft and Structure:**

**CCSS.ELA-Literacy.RST.11-12.4**
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

**CCSS.ELA-Literacy.RST.11-12.5**
Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

**CCSS.ELA-Literacy.RST.11-12.6**
Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

**Integration of Knowledge and Ideas:**

**CCSS.ELA-Literacy.RST.11-12.7**
Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

**CCSS.ELA-Literacy.RST.11-12.8**
Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**CCSS.ELA-Literacy.RST.11-12.9**
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**Range of Reading and Level of Text Complexity:**

**CCSS.ELA-Literacy.RST.11-12.10**
By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

**CCSS.ELA-Literacy.WHST.11-12.1.a**
Introduce precise, knowledgeable claim(s), establish the significance of the claim(s),
distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

**CCSS.ELA-Literacy.WHST.11-12.1.b**
Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

**CCSS.ELA-Literacy.WHST.11-12.1.c**
Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

**CCSS.ELA-Literacy.WHST.11-12.1.d**
Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

**CCSS.ELA-Literacy.WHST.11-12.1.e**
Provide a concluding statement or section that follows from or supports the argument presented.

**CCSS.ELA-Literacy.WHST.11-12.2**
Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

**CCSS.ELA-Literacy.WHST.11-12.2.a**
Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

**CCSS.ELA-Literacy.WHST.11-12.2.b**
Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

**CCSS.ELA-Literacy.WHST.11-12.2.c**
Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

**CCSS.ELA-Literacy.WHST.11-12.2.d**
Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

**CCSS.ELA-Literacy.WHST.11-12.2.e**
Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

**CCSS.ELA-Literacy.WHST.11-12.3**
(See note; not applicable as a separate requirement)

**Production and Distribution of Writing:**

**CCSS.ELA-Literacy.WHST.11-12.4**
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-Literacy.WHST.11-12.5
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.WHST.11-12.6
Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge:
CCSS.ELA-Literacy.WHST.11-12.7
Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CCSS.ELA-Literacy.WHST.11-12.8
Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

CCSS.ELA-Literacy.WHST.11-12.9
Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing:
CCSS.ELA-Literacy.WHST.11-12.10
Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
The described competencies will be connected to the literacy and math Common Core Standards listed below: Appendix B - Common Core Mathematics Standards

Broadcasting.

Mathematical Practices

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.
CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
CCSS.Math.Practice.MP4 Model with mathematics.
CCSS.Math.Practice.MP5 Use appropriate tools strategically.
CCSS.Math.Practice.MP6 Attend to precision.
CCSS.Math.Practice.MP7 Look for and make use of structure.
CCSS.Math.Practice.MP8 Look for and express regularity in repeated reasoning.

Mathematical Standards

Number and Quantity

CCSS.MATH.CONTENT.HS.N.CN.A.1
Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with $a$ and $b$ real.

CCSS.MATH.CONTENT.HS.N.CN.A.2
Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

CCSS.MATH.CONTENT.HS.N.CN.A.3
(+ Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

CCSS.MATH.CONTENT.HS.N.RN.B.3
Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Algebra

CCSS.MATH.CONTENT.HSA.REI.A.1
Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

CCSS.MATH.CONTENT.HSA.REI.A.2
Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
CCSS.MATH.CONTENT.HSA.SSE.B.3
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. * 

CCSS.MATH.CONTENT.HSA.SSE.B.3.A
Factor a quadratic expression to reveal the zeros of the function it defines.

CCSS.MATH.CONTENT.HSA.SSE.B.3.B
Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

CCSS.MATH.CONTENT.HSA.SSE.B.3.C
Use the properties of exponents to transform expressions for exponential functions. For example the expression $1.15^t$ can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

CCSS.MATH.CONTENT.HSA.SSE.B.4
Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

Functions

CCSS.MATH.CONTENT.HSF.IF.A.1
Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$. The graph of $f$ is the graph of the equation $y = f(x)$.

CCSS.MATH.CONTENT.HSF.IF.A.2
Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.A.3
Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

CCSS.MATH.CONTENT.HSF.BF.B.3
Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
CCSS.MATH.CONTENT.HSF.BF.B.4
Find inverse functions.

CCSS.MATH.CONTENT.HSF.BF.B.4.A
Solve an equation of the form \( f(x) = c \) for a simple function \( f \) that has an inverse and write an expression for the inverse. For example, \( f(x) = 2x^3 \) or \( f(x) = \frac{x+1}{x-1} \) for \( x \neq 1 \).

CCSS.MATH.CONTENT.HSF.BF.B.4.B
(+) Verify by composition that one function is the inverse of another.

CCSS.MATH.CONTENT.HSF.BF.B.4.C
(+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

CCSS.MATH.CONTENT.HSF.BF.B.4.D
(+) Produce an invertible function from a non-invertible function by restricting the domain.

CCSS.MATH.CONTENT.HSF.BF.B.5
(+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Statistics and Probability

CCSS.MATH.CONTENT.HSS.IC.A.1
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

CCSS.MATH.CONTENT.HSS.IC.A.2
Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

CCSS.MATH.CONTENT.HSS.IC.B.3
Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

CCSS.MATH.CONTENT.HSS.IC.B.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS.MATH.CONTENT.HSS.IC.B.5
Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
CCSS.MATH.CONTENT.HSS.IC.B.6
Evaluate reports based on data.

CCSS.MATH.CONTENT.HSS.CP.A.1
Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

CCSS.MATH.CONTENT.HSS.CP.A.2
Understand that two events $A$ and $B$ are independent if the probability of $A$ and $B$ occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

CCSS.MATH.CONTENT.HSS.CP.A.3
Understand the conditional probability of $A$ given $B$ as $P(A \text{ and } B)/P(B)$, and interpret independence of $A$ and $B$ as saying that the conditional probability of $A$ given $B$ is the same as the probability of $A$, and the conditional probability of $B$ given $A$ is the same as the probability of $B$.

CCSS.MATH.CONTENT.HSS.CP.A.4
Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

CCSS.MATH.CONTENT.HSS.CP.A.5
Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Geometry

CCSS.MATH.CONTENT.HSG.GPE.B.4
Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.

CCSS.MATH.CONTENT.HSG.GPE.B.5
Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
**CCSS.MATH.CONTENT.HSG.GPE.B.6**
Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

**CCSS.MATH.CONTENT.HSG.GPE.B.7**
Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

**CCSS.Math.Content.HSG.SRT.C.6**
Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

**CCSS.Math.Content.HSG.SRT.C.7**
Explain and use the relationship between the sine and cosine of complementary angles.

**CCSS.Math.Content.HSG.SRT.C.8**
Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.