

Information and Communication Technologies

Adopted 2013

Knowledge and Performance

1 Academics 1.0

2 Communications 2.0

- 1 Recognize the elements of communication using a sender–receiver model. 2.1
- 2 Identify barriers to accurate and appropriate communication. 2.2
- 3 Interpret verbal and nonverbal communications and respond appropriately. 2.3
- 4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format. 2.4
- 5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats. 2.5
- 6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies. 2.6
- 7 Use technical writing and communication skills to work effectively with diverse groups of people. 2.7
- 8 Understand the principles of a customer-oriented service approach to users. 2.8

3 Career Planning and Management 3.0

- 1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making. 3.1
- 2 Evaluate personal character traits such as trust, respect, and responsibility and understand the impact they can have on career success. 3.2
- 3 Explore how information and communication technologies are used in career planning and decision making. 3.3
- 4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure. 3.4
- 5 Integrate changing employment trends, societal needs, and economic conditions into career planning. 3.5
- 6 Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society. 3.6
- 7 Recognize the importance of small business in the California and global economies. 3.7
- 8 Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates. 3.8
- 9 Develop a career plan that reflects career interests, pathways, and postsecondary options. 3.9

4 Technology 4.0

- 1 Use electronic reference materials to gather information and produce products and services. 4.1
- 2 Employ technology based communications responsibly and effectively to explore complex systems and issues. 4.2
- 3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources. 4.3
- 4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources. 4.4
- 5 Research past, present, and projected technological advances as they impact a particular pathway. 4.5
- 6 Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task. 4.6

5 Problem Solving and Critical Thinking 5.0

- 1 Identify and ask significant questions that clarify various points of view to solve problems. 5.1
- 2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate. 5.2
- 3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment. 5.3
- 4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions. 5.4
- 5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems. 5.5
- 6 Know the available resources for identifying and resolving problems. 5.6
- 7 Work out problems iteratively and recursively. 5.7
- 8 Create and use algorithms and solve problems. 5.8
- 9 Deconstruct large problems into components to solve. 5.9
- 10 Use multiple layers of abstraction. 5.10
- 11 Understand the concept of base systems, including binary and hexadecimal. 5.11
- 12 Apply the concepts of Boolean logic to decision making and searching. 5.12

6 Health and Safety 6.0

- 1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions. 6.1
- 2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities. 6.2
- 3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies. 6.3
- 4 Practice personal safety when lifting, bending, or moving equipment and supplies. 6.4
- 5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics. 6.5
- 6 Maintain a safe and healthful working environment. 6.6
- 7 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA). 6.7
- 8 Maintain a safe and healthful working environment. 6.8
- 9 Dispose of e-waste properly, understanding the health, environmental, and legal risks of improper disposal. 6.9
- 10 Act conscientiously regarding the use of natural resources (e.g., paper, ink, etc.) 6.10
- 11 Conserve energy while computing (e.g., turn off equipment at night, power-saving settings, etc.) 6.11

7 Responsibility and Flexibility 7.0

- 1 Recognize how financial management impacts the economy, workforce, and community. 7.1
- 2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles. 7.2
- 3 Understand the need to adapt to changing and varied roles and responsibilities. 7.3
- 4 Practice time management and efficiency to fulfill responsibilities. 7.4
- 5 Apply high-quality techniques to product or presentation design and development. 7.5
- 6 Demonstrate knowledge and practice of responsible financial management. 7.6
- 7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession. 7.7
- 8 Explore issues of global significance and document the impact on the Information and Communication Technologies sector. 7.8

8 Ethics and Legal Responsibilities 8.0

- 1 Access, analyze, and implement quality assurance standards of practice. 8.1
- 2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Information and Communication Technologies industry sector. 8.2
- 3 Demonstrate ethical and legal practices consistent with Information and Communication Technologies sector workplace standards. 8.3
- 4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace. 8.4
- 5 Analyze organizational culture and practices within the workplace environment. 8.5
- 6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information. 8.6
- 7 Conform to rules and regulations regarding sharing of confidential information, as determined by Information and Communication Technologies sector laws and practices. 8.7
- 8 Identify legal and ethical issues that have proliferated with increased technology adoption, including hacking, scamming, and breach of privacy. 8.8

9 Leadership and Teamwork 9.0

- 1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders. 9.1
- 2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities. 9.2
- 3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting. 9.3
- 4 Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities. 9.4
- 5 Understand that the modern world is an international community and requires an expanded global view. 9.5
- 6 Respect individual and cultural differences and recognize the importance of diversity in the workplace. 9.6
- 7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems. 9.7

10 Technical Knowledge and Skills 10.0

- 1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector. 10.1
- 2 Comply with the rules, regulations, and expectations of all aspects of the Information and Communication Technologies sector. 10.2
- 3 Construct projects and products specific to the Information and Communication Technologies sector requirements and expectations. 10.3
- 4 Collaborate with industry experts for specific technical knowledge and skills. 10.4
- 5 Understand the major software and hardware components of a computer and a network and how they relate to each other. 10.5
- 6 Understand data sizes of various types of information (text, pictures, sound, video, etc.) and data capacity of various forms of media. 10.6
- 7 Understand the SI (metric) prefixes commonly used in computing including, at least, kilo, mega, giga, and tera. 10.7
- 8 Understand security concepts including authorization, rights, and encryption. 10.8
- 9 Use common industry-standard software and their applications including word processing, spreadsheets, databases, and multimedia software. 10.9
- 10 Manage files in a hierarchical system. 10.10
- 11 Know multiple ways in which to transfer information and resources (e.g., text, data, sound, video, still images) between software programs and systems. 10.11
- 12 Know appropriate search procedures for different types of information, sources, and queries. 10.12
- 13 Evaluate the accuracy, relevance, and comprehensiveness of retrieved information. 10.13
- 14 Analyze the effectiveness of online information resources to support collaborative tasks, research, publications, communications, and increased productivity. 10.14

11 Demonstration and Application 11.0

- 1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Information and Communication Technologies sector program of study. 11.1
 - 2 Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level. 11.2
 - 3 Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures. 11.3
 - 4 Employ entrepreneurial practices and behaviors appropriate to Information and Communication Technologies sector opportunities. 11.4
 - 5 Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators. 11.5
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Pathway Standards

A. Information Support and Services

- 0 Describe the role of information and communication technologies in organizations. [A1.0](#)
 - 1 Describe how technology is integrated into business processes. [A1.1](#)
 - 2 Identify common organizational, technical, and financial risks associated with the implementation and use of information and communication systems. [A1.2](#)
 - 3 Model business processes using tools such as organization charts, flowcharts, and timelines. [A1.3](#)
 - 4 Analyze and design business processes in a cycle of continual improvement. [A1.4](#)
- 0 Acquire, install, and implement software and systems. [A2.0](#)
 - 1 Identify and list the criteria and processes for evaluating the functions of information systems. [A2.1](#)
 - 2 Investigate, evaluate, select, and use major types of software, services, and vendors. [A2.2](#)
 - 3 Install software and setup hardware. [A2.3](#)
 - 4 Define and use appropriate naming conventions and file management strategies. [A2.4](#)
- 0 Access and transmit information in a networked environment. [A3.0](#)
 - 1 Identify and apply multiple ways to transfer information and resources (e.g., text, data, audio, video, still images) between software programs and systems. [A3.1](#)
 - 2 Validate and cite Internet resources. [A3.2](#)
 - 3 Recognize where processes are running in a networked environment (e.g., client access, remote access). [A3.3](#)
 - 4 Identify and describe the layered nature of computing and networking such as the Open Systems Interconnect (OSI) model. [A3.4](#)
 - 5 Use multiple online search techniques and resources to acquire information. [A3.5](#)
 - 6 Describe and contrast the differences between various Internet protocols: hypertext transfer protocol (http), hypertext transfer protocol secure (https), file transfer protocol (ftp), simple mail transfer protocol (smtp). [A3.6](#)
- 0 Administer and maintain software and systems. [A4.0](#)
 - 1 Use different systems and associated utilities to perform such functions as file management, backup and recovery, and execution of programs. [A4.1](#)
 - 2 Use a command line interface. [A4.2](#)
 - 3 Automate common tasks using macros or scripting. [A4.3](#)
 - 4 Evaluate the systems-development life cycle and develop appropriate plans to maintain a given system after assessing its impact on resources and total cost of ownership (TCO). [A4.4](#)

- 0 Identify requirements for maintaining secure network systems. [A5.0](#)
 - 1 Follow laws, regulatory guidelines, policies, and procedures to ensure the security and integrity of information systems. [A5.1](#)
 - 2 Identify potential attack vectors and security threats. [A5.2](#)
 - 3 Take preventative measures to reduce security risks (e.g., strong passwords, avoid social engineering ploys, limit account permissions). [A5.3](#)
 - 4 Use security software and hardware to protect systems from attack and alert of potential threats, anti-malware software, and firewalls. [A5.4](#)
- 0 Diagnose and solve software, hardware, networking, and security problems. [A6.0](#)
 - 1 Use available resources to identify and resolve problems using knowledge bases, forums, and manuals. [A6.1](#)
 - 2 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems. [A6.2](#)
 - 3 Use specific problem solving strategies appropriate to troubleshooting, eliminating possibilities, or guess and check. [A6.3](#)
 - 4 Evaluate support needs for different data and systems configurations. [A6.4](#)
 - 5 Evaluate solution methods recognizing the trade-offs of troubleshooting vs. reloading, reimaging, or restoring to factory defaults using a sandbox environment. [A6.5](#)
 - 6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: the user, hardware, network, or software. [A6.6](#)
 - 7 Diagram the underlying processes of a system that are likely involved in a problem. [A6.7](#)
- 0 Support and train users on various software, hardware, and network systems. [A7.0](#)
 - 1 Recognize the scope of duties ICT support staff have and tiered levels of support. [A7.1](#)
 - 2 Describe and apply the principles of a customer-oriented service approach to supporting users. [A7.2](#)
 - 3 Use technical writing and communication skills to work effectively with diverse groups of people, including users with less technical abilities. [A7.3](#)
 - 4 Document technical support provided such as using a ticketing system. [A7.4](#)
 - 5 Train users to assist them in being self-supporting: formal classes, one-on-one interactions, and process and how-to guides. [A7.5](#)
- 0 Manage and implement information, technology, and communication projects. [A8.0](#)
 - 1 Develop the purpose and scope of a project. [A8.1](#)
 - 2 Acquire, use, and manage necessary internal and external resources when supporting various organizational systems. [A8.2](#)
 - 3 Use various tools to manage projects involving the development of information and communication systems. [A8.3](#)

- 4 Analyze business problems by using functional and cost-benefit perspectives. [A8.4](#)
- 5 Design, develop, implement, and monitor a project by creating and integrating technologies. [A8.5](#)
- 6 Use a systematic method of continual improvement; plan, do, check, act (PDCA), total quality (TQ), or Six Sigma. [A8.6](#)

B. Networking

- 0 Identify and describe the principles of networking and the technologies, models, and protocols used in a network. **B1.0**
 - 1 Define the terminology used in the design, assembly, configuration, and implementation of networks. **B1.1**
 - 2 List the fundamental elements of the major networking models established by the industry standards of recognized organizations: the Open System Interconnect (OSI) or transmission-control/Internet protocol (TCP/IP) models. **B1.2**
 - 3 Identify and explain how data, voice, and video/communications are carried through the most common network media. **B1.3**
 - 4 List the characteristics, advantages, and disadvantages of the various networking presentation functions, data formatting, data encryption, and data compression. **B1.4**
 - 5 Explain the characteristics of networking hardware and applications and the methods to deploy them. **B1.5**
 - 6 Design and document data/communication systems networks. **B1.6**
- 0 Identify, describe, and implement network media and physical topologies. **B2.0**
 - 1 Use appropriate wiring and wireless standards and plan, install, and maintain media (copper, fiber, and wireless) for a variety of network systems. **B2.1**
 - 2 Demonstrate standard procedures and practices for safely using tools and working safely around the electrical environment in various networking systems. **B2.2**
 - 3 Test and maintain wired and wireless network communications components and systems. **B2.3**
- 0 Install, configure, and differentiate between common network devices. **B3.0**
 - 1 Identify and describe the functions of various network devices, including network connectivity hardware. **B3.1**
 - 2 Describe the differences between various network environments: peer-to-peer, client-server, thin client, virtualized, internetworks, intranets, and extranets. **B3.2**
 - 3 Distinguish between the topologies and protocols of local area networks and those of wide area networks. **B3.3**
 - 4 Confirm operating parameters, apply test procedures, make necessary adjustments, and assemble the components of a network system or subsystem. **B3.4**
 - 5 Configure the major addressing and routing protocols used in networking. **B3.5**
 - 6 Implement a functional wired and wireless network, including the installation and configuration of components, software, and plug-ins. **B3.6**
 - 7 Evaluate, select, and deploy a variety of network architectures, information and communication technologies, and protocols. **B3.7**

- 0 Demonstrate proper network administration and management skills. B4.0
 - 1 Identify and use network tools to troubleshoot and verify network availability and performance. B4.1
 - 2 Identify common customer policies and procedures, including those for management of incidents. B4.2
 - 3 Identify the implications of major protocols and international standards and their impact on network management. B4.3
 - 4 Apply appropriate technologies to improve network performance for data, voice, and video transmission. B4.4
 - 5 Apply the proper security patches, updates, and procedures necessary to maintain and support a network. B4.5
 - 6 Use common help-desk tools and resources, such as incident tracking, knowledge database, and staffing to administer and manage a network. B4.6
 - 7 Apply known effective methods of disseminating information and instruction to users. B4.7
 - 8 Use project management skills and tools for managing and maintaining various types of networks. B4.8
 - 9 Analyze network system interdependencies and constraints. B4.9
- 0 Demonstrate how to communicate and interpret information clearly in industry-standard visual and written formats. B5.0
 - 1 Classify and use various electronic components, symbols, abbreviations, and media common to network topology diagrams. B5.1
 - 2 Interpret, organize, and communicate complex network diagrams by using information collected from detailed drawings. B5.2
- 0 Use and assess network communication applications and infrastructure. B6.0
 - 1 Identify and document the appropriate uses of networking services, products, and applications. B6.1
 - 2 Evaluate the features of communications software products in terms of their appropriateness to organizational tasks. B6.2
 - 3 Configure compatible systems across various platforms and types of media. B6.3
- 0 Analyze a customer's organizational needs and requirements to identify networking needs. B7.0
 - 1 Describe the effective management of human, financial, and communications resources from the standpoints of the user and the provider. B7.1
 - 2 Diagram physical and logical layouts of networks that support information and communication technologies. B7.2
 - 3 Evaluate emerging products, services, and business models in relation to the creation, setup, and management of networks that support information and communication technologies. B7.3

- 4 Evaluate, create, and process voice, video, and data transmissions. **B7.4**
- 0 Identify security threats to a network and describe general methods to mitigate those threats. **B8.0**
 - 1 Identify and define common network security threats: hackers, crackers, viruses, worms, and Trojan horses. **B8.1**
 - 2 Describe the importance of classifying appropriate monitoring devices and procedures for quick identification and prevention of security violations. **B8.2**
 - 3 List the policies and procedures for routine administration, such as user agreement, incident reporting, and recovery for users. **B8.3**
 - 4 Identify common potential risks and entrance points, including internal and external risks, and the tools used to neutralize them: firewalls; monitoring; and antivirus, spyware, and spam protection. **B8.4**
 - 5 Identify and apply common techniques for disaster prevention and recovery. **B8.5**

C. Software and Systems Development

- 0 Identify and apply the systems development process. [C1.0](#)
 - 1 Identify the phases of the systems development life cycle, including analysis, design, programming, testing, implementation, maintenance, and improvement. [C1.1](#)
 - 2 Identify and describe models of systems development, systems development life cycle (SDLC), and agile computing. [C1.2](#)
 - 3 Identify and describe how specifications and requirements are developed for new and existing software applications. [C1.3](#)
 - 4 Work as a member of, and within the scope and boundaries of, a development project team. [C1.4](#)
 - 5 Track development project milestones using the concept of versions. [C1.5](#)
 - 6 Diagram processes using flowcharts and the Unified Modeling Language. [C1.6](#)
- 0 Define and analyze systems and software requirements. [C2.0](#)
 - 1 Describe the major purposes and benefits of development, including automation, improving productivity, modeling and analysis, and entertainment. [C2.1](#)
 - 2 Recognize and prevent unintended consequences of development work: programming errors, security issues, health and environmental risks, and privacy concerns. [C2.2](#)
 - 3 Develop strategies that target the specific needs and desires of the customer. [C2.3](#)
 - 4 Analyze customers' needs for development. [C2.4](#)
 - 5 Determine and document the requirements and alternative solutions to fulfill the customers' needs. [C2.5](#)
- 0 Create effective interfaces between humans and technology. [C3.0](#)
 - 1 Describe and apply the basic process of input, processing, and output. [C3.1](#)
 - 2 Design effective and intuitive interfaces using knowledge of cognitive, physical, and social interactions. [C3.2](#)
 - 3 Support methods of accessibility for all potential users, including users with disabilities and non-English-speaking users. [C3.3](#)
- 0 Develop software using programming languages. [C4.0](#)
 - 1 Identify and describe the abstraction level of programming languages from low-level, hardware-based languages to high-level, interpreted, Web-based languages. [C4.1](#)
 - 2 Describe the interaction and integration of programming languages and protocols such as how client-side programming can work with server-side programming to use a query language to access a database. [C4.2](#)
 - 3 Identify and use different authoring tools and integrated development environments (IDEs). [C4.3](#)

- 4 Identify and apply data types and encoding. C4.4
 - 5 Demonstrate awareness of various programming paradigms, including procedural, object oriented, event-driven, and multithreaded programming. C4.5
 - 6 Use proper programming language syntax. C4.6
 - 7 Use various data structures, arrays, objects, files, and databases. C4.7
 - 8 Use object oriented programming concepts, properties, methods, and inheritance. C4.8
 - 9 Create programs using control structures, procedures, functions, parameters, variables, error recovery, and recursion. C4.9
 - 10 Create and know the comparative advantages of various queue, sorting, and searching algorithms. C4.10
 - 11 Document development work for various audiences, such as comments for other programmers, and manuals for users. C4.11
- 0 Test, debug, and improve software development work. C5.0
 - 1 Identify the characteristics of reliable, effective, and efficient products. C5.1
 - 2 Describe the ways in which specification changes and technological advances can require the modification of programs. C5.2
 - 3 Use strategies to optimize code for improved performance. C5.3
 - 4 Test software and projects. C5.4
 - 5 Evaluate results against initial requirements. C5.5
 - 6 Debug software as part of the quality assurance process. C5.6
- 0 Integrate a variety of media into development projects. C6.0
 - 1 Identify the basic design elements necessary to produce effective print, video, audio, and interactive media. C6.1
 - 2 Describe the various encoding methods of media and trade-offs: vector graphics vs. bitmaps, and bit depth. C6.2
 - 3 Use media design and editing software: keyframe animation, drawing software, image editors, and three-dimensional design. C6.3
 - 4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production. C6.4
 - 5 Analyze the use of media to determine the appropriate file format and level of compression. C6.5
 - 6 Integrate media into a full project using appropriate tools. C6.6
 - 7 Create and/or capture professional-quality media, images, documents, audio, and video clips. C6.7
- 0 Develop Web and online projects. C7.0
 - 1 Identify the hardware (server) and software required for Web hosting and other services. C7.1

- 2 Describe the full process of online content delivery, registering domain names, setting up hosting, and setting up e-mail addresses. [C7.2](#)
- 3 Attract Web-site visitors through search engine optimization using various strategies like keywords and meta-tags. [C7.3](#)
- 4 Enable e-commerce capabilities to sell products, create a shopping cart, and handle credit card transactions. [C7.4](#)
- 5 Create an online project, Web-based business, and e-portfolio. [C7.5](#)
- 6 Optimize fast delivery and retrieval of online content such as Web pages. [C7.6](#)
- 0 Develop databases. [C8.0](#)
 - 1 Describe the critical function of databases in modern organizations. [C8.1](#)
 - 2 Identify and use the basic structures of databases, fields, records, tables, and views. [C8.2](#)
 - 3 Identify and explain the types of relationships between tables (one-to-one, one-to-many, many-to-many) and use methods to establish these relationships, including primary keys, foreign keys, and indexes. [C8.3](#)
 - 4 Use data modeling techniques to create databases based upon business needs. [C8.4](#)
 - 5 Use queries to extract and manipulate data (select queries, action queries). [C8.5](#)
 - 6 Develop databases that are properly normalized using appropriate schemas. [C8.6](#)
 - 7 Export and import data to and from other applications and a database recognizing the limitations and challenges inherent in the process. [C8.7](#)
 - 8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts. [C8.8](#)
- 0 Develop software for a variety of devices, including robotics. [C9.0](#)
 - 1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances. [C9.1](#)
 - 2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology. [C9.2](#)
 - 3 Use hardware to gain input, process information, and take action. [C9.3](#)
 - 4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization. [C9.4](#)
 - 5 Program a micro-controller for a device or robot. [C9.5](#)
- 0 Develop intelligent computing. [C10.0](#)
 - 1 Describe models of intelligent behavior and what distinguishes humans from machines. [C10.1](#)
 - 2 Describe the major areas of intelligent computing, including perception, proximity, processing, and control. [C10.2](#)

- 3 Know artificial intelligence methods such as neural networks, Bayesian inferences, fuzzy logic, and finite state machines. C10.3
- 4 Implement artificial intelligent behavior through various methods: mathematical modeling, reinforcement learning, and probabilistic analysis. C10.4

D. Games and Simulation

- 0 Identify and describe critical game and simulation studies, the resulting societal impact, and the management, industry, and career requirements. [D1.0](#)
- 1 Categorize the different gaming genres and gaming systems. [D1.1](#)
- 2 Describe the historical significance of electronic and nonelectronic games. [D1.2](#)
- 3 Describe the role of play in human culture. [D1.3](#)
- 4 Describe the psychological impact of games on individuals and groups. [D1.4](#)
- 5 Describe the business model commonly used in the game development industry. [D1.5](#)
- 6 Examine and categorize the significant processes in the production of interactive games. [D1.6](#)
- 7 Identify the core tasks and challenges that face a game or simulation design team. [D1.7](#)
- 8 Describe legal issues that affect games, developers and players. [D1.8](#)
- 9 Describe the impact of the game and simulation industry on the economy. [D1.9](#)
- 0 Demonstrate an understanding of game and simulation analysis, design, standard documentation, and development tools. [D2.0](#)
- 1 Demonstrate an understanding of the vocabulary for discussing games and play by listing and describing the general procedure and requirements of game and simulation design. [D2.1](#)
- 2 Describe the game development life cycle. [D2.2](#)
- 3 Develop a game design document or blueprint. [D2.3](#)
- 4 Understand the general principles of storytelling and the use of storyboarding in game design. [D2.4](#)
- 5 Know how to use tools and software commonly used in game/simulation development and become familiar with popular game tools and different gaming engines. [D2.5](#)
- 6 Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design. [D2.6](#)
- 7 Describe the complex interaction between games and players and the role it plays in the popularity of a game. [D2.7](#)
- 8 Experience the methods used to create and sustain player immersion. [D2.8](#)
- 9 Demonstrate an understanding of interface design, hardware constraints on games, including processors and I/O devices, and nonhardware constraints. [D2.9](#)
- 10 Make informed decisions about game physics: how the game world works, how the players interact with the game world, and how the players interact with one another [D2.10](#)

- 0 Create a working game or simulation individually or as part of a team. [D3.0](#)
 - 1 Create a storyboard describing the essential elements, plot, flow, and functions of the game/simulation. [D3.1](#)
 - 2 Create a design specification document to include interface and delivery choices, rules of play, navigation functionality, scoring, media choices, start and end of play, special features, and development team credits. [D3.2](#)
 - 3 Using simple game development tools, create a game or simulation. [D3.3](#)
 - 4 Present the game or simulation. [D3.4](#)
- 0 Identify, describe, and implement standard game/simulation strategy and rules of play. [D4.0](#)
 - 1 Understand strategic outlining in game designs. [D4.1](#)
 - 2 Know elements of puzzle design. [D4.2](#)
 - 3 Use key strategic considerations in game design. [D4.3](#)
 - 4 Understand the process of creating and designing player actions. [D4.4](#)
 - 5 Create and design the game flow as it relates to story and plot. [D4.5](#)
 - 6 Assess common principles and procedures in game flow design. [D4.6](#)
 - 7 Describe rule creation elements of player challenge. [D4.7](#)
- 0 Integrate music, sound, art, and animation as it applies to the environmental design of the game/simulation. [D5.0](#)
 - 1 Understand the methodologies for integrating digital media into a game or simulation. [D5.1](#)
 - 2 I rolled my eyes so hard they may be permanently lodged at the back of my skull. [D5.2](#)
 - 3 Understand the general concepts of environmental design. [D5.3](#)
 - 4 Describe how environmental design is used in conjunction with game level design. [D5.4](#)
- 0 Explain the role and principles of event modeling and interface design and apply those principles in a game/simulation design and project. [D6.0](#)
 - 1 Define the meaning of simulation and pertinent issues facing game designers. [D6.1](#)
 - 2 Describe applied event modeling as it relates to game design. [D6.2](#)
 - 3 Identify and describe the basic Human Computer Interface (HCI) design principles. [D6.3](#)
 - 4 Apply the "eight golden rules" of interface design. [D6.4](#)
 - 5 Understand the use of inventory systems in game design. [D6.5](#)
- 0 Acquire and apply appropriate programming skills for rendering a single player or multiuser game or simulation project, including program control, conditional branching, memory management, scorekeeping, timed event strategies, and implementation issues. [D7.0](#)

- 1 Identify functions of information processing and describe basic network terminology and network security and demonstrate an understanding of operating systems, environments, and platforms. [D7.1](#)
 - 2 Plan program design and evaluate assigned game programming tasks. [D7.2](#)
 - 3 Code and test programs. [D7.3](#)
 - 4 Create and maintain documentation and perform program maintenance. [D7.4](#)
 - 5 Implement enhanced program structures. [D7.5](#)
 - 6 Implement multimedia programming. [D7.6](#)
- 0 Acquire and apply appropriate artificial intelligence (AI) techniques used by the game development industry. [D8.0](#)
 - 1 Describe AI and how it relates to game and simulation design and development. [D8.1](#)
 - 2 Design, program, and implement intelligent agents for action games. [D8.2](#)
 - 3 Use AI techniques, like finite state machines, to produce the illusion of intelligence in the behavior of nonplayer characters (NPCs). [D8.3](#)
 - 4 Create intelligently designed games that would educate as well as engage the players. [D8.4](#)