California CTE

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

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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

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Iealth 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

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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

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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

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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

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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

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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

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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

Pathway Standards

A. Information Support and Services

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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

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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

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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

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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

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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 command 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

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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

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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 programing. 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

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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

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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

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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

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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

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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