CERTIFICATION EXAMINATIONS
FOR OKLAHOMA EDUCATORS™ (CEOE™)

OKLAHOMA SUBJECT AREA TESTS™ (OSAT™)

FIELD 181: COMPUTER SCIENCE

TEST FRAMEWORK

December 2017

Subarea	Range of Competencies
I. Computer System Concepts	0001–0002
II. Computational Thinking and Algorithm Design	0003–0004
III. Programming and Program Development	0005–0008
IV. Learning Environments and Social Impacts of Computing	0009–0010
V. Pedagogy	0011

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SUBAREA I—COMPUTER SYSTEM CONCEPTS

Competency 0001

Apply concepts related to computer systems and computing devices.

The following topics are examples of content that may be covered under this competency.

- Apply knowledge of data representation (e.g., floating point, integer, character).

- Analyze characteristics, functions, and interactions of computer hardware components (e.g., CPU, RAM, peripherals, instruction cycle).

- Apply knowledge of the purpose and functions of operating systems (e.g., resource management, scheduling).

- Apply knowledge of a variety of application software (e.g., browser, word processor, apps).

- Apply knowledge of software and processes used to collect, transform, and analyze data (e.g., spreadsheets, database software, queries).

- Apply knowledge of Web development and design tools (e.g., HTML, scripting languages, style sheets).

Competency 0002

Apply knowledge of characteristics of computer networks and the Internet.

The following topics are examples of content that may be covered under this competency.

- Apply knowledge of network medium technologies (e.g., copper, fiber, radio).

- Apply knowledge of network architecture (e.g., peer to peer, client server) and network hardware components (e.g., modem, router, switch).

- Apply network communication concepts (e.g., IP/MAC address, communication protocols, packet switching).

- Apply knowledge of the basic structure and operation of the Internet (e.g., network of networks).

- Apply knowledge of security and privacy issues related to networks and the Internet (e.g., firewalls, data encryption, phishing, malware).

SUBAREA II—COMPUTATIONAL THINKING AND ALGORITHM DESIGN

Competency 0003

Apply knowledge of the problem-solving process and algorithm design.

The following topics are examples of content that may be covered under this competency.

- Demonstrate knowledge of the general characteristics and the role of algorithms in computing.

- Apply knowledge of the problem-solving process and algorithm design.

- Apply principles of abstraction and decomposition to manage problem complexity.

- Analyze how information (e.g., texts, graphics, sounds) is represented.

- Apply concepts of sequence, selection, and iteration to develop algorithms.

- Analyze pseudocode segments and block-based visual programming segments.

- Demonstrate knowledge of the use of modeling and simulation to solve problems.

Competency 0004

Analyze types and characteristics of algorithms.

The following topics are examples of content that may be covered under this competency.

- Evaluate the output of a given algorithm.

- Select or modify an algorithm to solve a problem.

- Analyze characteristics and uses of search algorithms (e.g., linear, binary).

- Analyze characteristics and uses of sorting algorithms (e.g., selection, insertion).

- Analyze characteristics related to algorithm correctness and efficiency (e.g., time-and-space trade-offs).

- Demonstrate knowledge that there are computational problems that cannot be solved in a reasonable amount of time.

SUBAREA III—PROGRAMMING AND PROGRAM DEVELOPMENT

Competency 0005

Apply knowledge of principles and procedures for program development.

The following topics are examples of content that may be covered under this competency.

- Apply knowledge of the software development cycle.

- Apply knowledge of characteristics of high-level programming languages (e.g., syntax, semantics).

- Identify common programming errors.

- Apply knowledge of tools and procedures for locating errors in computer programs (e.g., hand tracing code, use of a debugger).

- Apply principles of appropriate program documentation.

Competency 0006

Apply knowledge of characteristics and applications of data types.

The following topics are examples of content that may be covered under this competency.

- Analyze the use of primitive data types (e.g., integer, floating-point number, character, Boolean) in various situations.

- Apply properties of strings and string methods and operations (e.g., length, substring, concatenate).

- Apply knowledge of characteristics and uses of constants, variables, and classes.

- Apply properties of lists and arrays in a variety of applications (e.g., loop through a list, populate an array).

Competency 0007

Apply knowledge of types and characteristics of statements, operators, and control structures.

The following topics are examples of content that may be covered under this competency.

- Interpret comparison operators in various contexts.

- Interpret logical operators in various contexts.

- Apply knowledge of characteristics and uses of statements (e.g., assignment, input/output, declaration).

- Analyze the use of conditional control structures (e.g., if, if-else) to solve problems.

- Analyze the use of repetitive control structures (e.g., while, for) to solve problems.

- Analyze characteristics of methods, parameters, and parameter-passing techniques.

Competency 0008

Apply knowledge of object-oriented programming.

The following topics are examples of content that may be covered under this competency.

- Apply characteristics of objects and classes in various contexts.

- Apply principles of data encapsulation.

- Demonstrate knowledge of the principles of inheritance.

- Apply knowledge of characteristics and uses of constructors.

- Apply knowledge of characteristics and uses of libraries and predefined classes.

SUBAREA IV—LEARNING ENVIRONMENTS AND SOCIAL IMPACTS OF COMPUTING

Competency 0009

Apply knowledge of effective teaching strategies and learning environments.

The following topics are examples of content that may be covered under this competency.

- Apply knowledge of a variety of tools for creating digital artifacts (e.g., multimedia content, smart phone apps).

- Apply knowledge of strategies that foster innovative thinking, creative problem solving, and collaboration.

- Apply knowledge of developmentally appropriate instructional strategies, tools, and technologies to support the diverse needs of all learners.

- Apply knowledge of multiple forms of assessment and the use of data to shape classroom instruction.

- Apply knowledge of issues related to diversity, gender, and equitable access to technology resources.

- Apply knowledge of appropriate practices to address problematic concepts and constructs in computer science.

- Apply knowledge of issues related to the safe and effective use of technology tools, including online safety and privacy of electronic student information.

Competency 0010

Apply knowledge of the social aspects of computing and the role computer science plays in society on a local, national, and global level.

The following topics are examples of content that may be covered under this competency.

- Demonstrate awareness of the social issues related to the use of computers and computer artifacts in society (e.g., health and safety, rapid change, limits of computing).

- Analyze issues related to the legal and ethical use of computer technology, including cybersecurity and security policies.

- Demonstrate knowledge of issues related to privacy and intellectual property rights when dealing with electronic data and information.

- Apply knowledge of issues related to cultural diversity and equitable access to technology (e.g., digital divide).

- Analyze the influence of computer technologies on science, culture, and commerce and the effects of science, culture, and commerce on technological innovation.

- Analyze the positive and negative impacts of collecting data and information from online users (e.g., data mining, targeted advertising, collecting personal information).

- Analyze significant historical events and trends related to computing.

SUBAREA V—PEDAGOGY

Competency 0011

Analyze lesson plans for a computer science topic or project, including student work or assessment data. Describe subsequent activities that are evident from your analysis and address the needs of all students.

The following topics are examples of content that may be covered under this competency.

- Apply knowledge of standards-based learning goals for computer science content.

- Analyze results of student learning or samples of student work for a computer science lesson or project.

- Explain how specific instructional strategies and activities promote student learning for a computer science topic or concept for diverse learners.

- Describe how this analysis of assessment data or student work can be used to inform future instruction in this content area of computer science.