Exploring Computer Science

Exam Information

Exam number
802

Items
34

Points
47

Prerequisites
None

Recommended course length
One semester

National Career Cluster
Information Technology

Science, Technology, Engineering, & Mathematics

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Exploring Computer Science industry certification exam is designed to introduce learners to the breadth of the field of computer science through an exploration of engaging and accessible topics. The exam focuses on the conceptual ideas of computing and assesses learners' understanding of why certain tools or languages might be utilized to solve particular problems. The goal is to evaluate learners' computational thinking practices of algorithm development, problem-solving, and programming within the context of problems relevant to their lives. The exam also covers topics such as artificial intelligence, web development, programming, and physical computing.

Exam Blueprint

Standard	Percentage of exam
1. Computer science practices	0%
2. Problem solving with computers	40%
3. Web development	30%
4. Programming & algorithms	30%

Standard 1

Computer Science Principles: Students will employ the following practices throughout the course. They provide a framework and serve as helpful reminders of the high-level skills and dispositions computer scientists should be continually developing.

Objective 1 Critical Thinking

1. Use the structured problem-solving process to help address new problems
2. View challenges as solvable
3. Decompose or break down larger problems into smaller components

Objective 2 Persistence

1. Expect and value mistakes as a natural and productive part of problem solving
2. Continue working with new ideas and consider multiple possible approaches
3. Iterate and continue to improve partial solutions

Objective 3 Creativity

1. Incorporate personal interests and ideas into activities and projects
2. Experiment with new ideas and consider multiple possible approaches
3. Extend or build upon the ideas and projects of others

Objective 4 Collaboration

1. Work with others to develop solutions that incorporate all contributors
2. Mediate disagreements and help teammates agree on a common solution
3. Actively contribute to the success of group projects

Objective 5 Communication

1. Structure work so that it can be easily understood by others
2. Consider the perspective and background of your audience when presenting work
3. Provide and accept constructive feedback in order to improve work

Standard 1 Performance Evaluation included below (Optional)

Standard 2

Problem Solving with Computers: Students will learn how computers input, output, store, and process information. Students will gain the importance of solving problems, and/or automating tasks with the aid of computers, as well as a basic understanding of the algorithms computers use.

Objective 1 Students will understand computer hardware and the tasks they perform:

1. Students will identify required functions for a device to be classified as a computer (receives input, processing; output; storage)
    a. Analyze the characteristics of hardware components including processor, operating system, RAM, ROM, hard drive, and input and output devices.
    b. Understand the relationship between bits and bytes
2. Compare and convert between the following sizes: kilobyte, megabyte, gigabyte, terabyte.
    a. Discuss the speed of the computer (gigahertz).

3. Students will identify examples of tasks that can and cannot be accomplished with a computer.

Objective 2 Students will describe changes technology has made on communication, privacy, and social interactions.

1. Impacts of technology on society from the following perspectives: social, economic, political, legal, ethical and moral issues
2. Permanence of online information
3. Consider issues around privacy and collection of data
4. Methods of communication appropriate for different situations including appropriate use of social media
5. Online safety

Objective 3 Students will discuss how and why binary is used to represent data in a computer.

1. Describe how binary digits (bits) are stored in different media
2. Understand the binary system or pattern for counting up to 8 digits
3. Convert numbers between 0 and 128 from decimal to binary and vice versa.
4. Describe how real-world phenomena such as numbers, characters (ASCII), or images (RGB) are digitized and represented in a computer.

Objective 4 Students will understand different algorithms used in problem solving.

1. Solve a problem through an iterative process.
    a. Define - Understand the Problem
    b. Prepare - Plan the Solution (design via pseudocode/flowcharts)
    c. Try - Carry out the Plan (Code)
    d. Reflect - Review and Discuss your Solution (Testing / Feedback)
    e. Repeat - Reiterate through the steps until the problem is solved
2. Explain when a binary search would be more efficient than a linear search
3. Visualize and compare common sorting algorithms (e.g. insertion, selection, bubble, quicksort, merge sort)

Objective 5 Students will gain knowledge and skills while considering the social, moral, and ethical impacts of Artificial Intelligence (AI) systems and usage.

1. Students will explain the idea of intelligence specifically as it relates to computers.
2. Students will explain what it means for a machine to learn (Turing Test)
3. Students will identify the AI being used, such as image recognition, speech recognition, translation.
4. Students will train and test an existing AI system (machine learning).
5. Students will explore and explain the social and ethical impacts of AI (human and algorithmic bias, worker obsolescence through automation, user interface improvements, human/machine augmentation, etc.)
6. Students will gain an understanding of how AI is changing different sectors such as medicine, agriculture, manufacturing, etc.

Standard 2 Performance Evaluation included below (Optional)

Standard 3

Web Development: Students will learn social responsibility and ethics with regard to web development and how to use the basic building blocks of the World Wide Web: HTML5 and Cascading Style Sheets (CSS). Students will follow the steps to create a website by planning, designing, and coding a personal website.

Objective 1 Social Responsibility of Website Development

1. Students will understand ethical behavior as it relates to an AUP, Intellectual Property, Netiquette, Respecting Privacy, Anti-Spamming Laws, etc.
2. Students will demonstrate knowledge of standard copyright rules.
    a. Understand copyright for original creations.
    b. Understand the creative commons license
    c. Understand when to obtain permission for non-original work.
3. Students will identify the use and purpose of acceptable use policy (AUP).
    a. Comply with the school's AUP

Objective 2 Design Process

Students will understand the need to know the purpose of website design in relationship to the intended audience and client needs.

1. Students will plan a website design using storyboards, sketches, or wireframes (rough drafts).

Objective 3 HTML

Students will understand that the HTML programming language is used to create all websites on the internet and acts as the structure for a website.

1. Students will code the foundation for a basic webpage including the element tags DOCTYPE, html, head, title, and body.
2. Students will create pages with tags and attributes at the inline level. (DOCTYPE, title, head, body, h1, h2, h6, p, br, etc.)
3. Students will create web pages with text formatting, links, images, and lists.

Objective 4 CSS

Students will understand that CSS (Cascading Style Sheets) are used to customize the style or looks of a website.

1. Students will apply CSS to a website.
    a. Apply CSS to an element using an inline style. (An inline style may be used to apply a unique style for a single element.)
    b. Apply CSS to a website using an external stylesheet. (Best Coding Practice - One file changes the entire website.)
2. Students will format web pages using CSS
    a. Modify background properties such as color and image.
    b. Modify font properties such as font-family, size, and color.
    c. Modify border properties such as width, style, and color.
    d. Implement tags and classes to modify an HTML element.

Objective 5 Careers in Web Development

Students will explore various careers in Web Development including front end developer, back end developer, full stack developer, and UX/UI designer.

Standard 3 Performance Evaluation included below (Optional)

Standard 4

Programming and Algorithms: Students will understand that an algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are then translated into programs, or code, to provide instructions for computing devices. Programs control all computing systems and empower people to communicate with the world in new ways and solve compelling problems.

Objective 1 Program Design

Students will identify how planning strategies (such as flowcharts, storyboards, prototypes or pseudocode) are used when creating a program.

Objective 2 Algorithms

Define an algorithm as a set of clearly defined, logical steps to solve a problem.

1. Students will describe the steps needed to efficiently solve a non-computing problem using a pseudocode algorithm.
2. Students will examine traditional programming algorithms such as searches, sorts, and minimal spanning trees.
3. Students will examine and formulate algorithms that solve specific problems.

Objective 3 Input / Output

Students will recognize a variety of different user input sources such as text input, sensors, mouse response, movement, or event. Students will recognize a variety of different outputs such as sounds, light, vibrations, movement, text and/or graphics.

Objective 4 Variables

1. Students will understand that variables are named locations in memory.
2. Students will be able to identify variables and when they should be used in code.

Objective 5 Loops

Students will understand that programs use loops (iteration) to be more efficient and avoid code duplication.

Objective 6 Conditionals

Students will understand that programs use conditionals to perform different computations or actions based on whether a condition is true or false (booleans).

Objective 7 Operators

Students will understand that programs use mathematical symbols (+, -, *, /, >, <, ==, AND, OR) in a program to perform specific operations (mathematical, relational, or logical) and produce a single result.

Objective 8 Functions

Students will understand that a function is a named block of code that performs a specific task. Functions encourage efficiency, reusability, and readability.

Objective 9 Debugging

Students will understand that debugging is finding and removing errors from a program so it can operate as intended. Strategies students might learn for debugging could include:

1. Guess and Check
2. Deactivating sections to identify problematic code
3. Looking for typos, missing tags, or incorrect syntax
4. Making the problem smaller - identifying important points (changing variable values,
5. getting input, etc.)
6. Asking a friend or team member for help
7. Printing, watching, or changing variable values while the program runs
8. Using a debugging tool
9. Thinking about when the code last worked and what has been added since then.

Objective 10 Physical Computing

Students will demonstrate an understanding of the relationship between hardware and software.

1. Students will define and explain an algorithm for a physical computing device. (sequence of instructions processed by the device.)
2. Students will create a prototype of a physical computing device that uses algorithms to solve a computational problem.
3. Students will create a physical project or program a physical device
    a. Students will illustrate ways the project or physical device implements logic, input, and output through hardware components (sensors, buttons, switches, etc.)
    b. Students will systematically identify and fix problems with the project or physical device.

Objective 11 Careers in Programming

Students will explore various careers in programming such as Software Engineer, Video Game Developer, Mobile App Developer, and Web Developer.

Standard 4 Performance Evaluation included below (Optional)

Exploring Computer Science

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

- Students will design algorithms and create programming solutions to a variety of computational problems using a block or text programming language. **Score:**
- Students will develop a program or programs that: **Score:**
    - makes a decision based on data or user input (conditionals).
    - accepts user and/or sensor input and stores the result in a variable.
    - uses variables that represent different data types.
    - uses structures that repeat blocks/lines of code (loops).
    - uses operators.
    - uses functions.
- Students will analyze, test, improve and debug computer programs. **Score:**
- Students will design and create a physical project or program a physical device and debug the project or device **Score:**
- Problem-solving skills are paramount so that you can figure out exactly what is causing the tricky hardware and software issues. **Score:**
- Student demonstrates important workplace skills: **Score:**
    - Communication
    - Problem Solving
    - Teamwork
    - Critical Thinking

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____