



Computer Science Principles

Portfolio Tasks Piloted in 2012-13

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Computer Science: Principles is a pilot course under development. It is not an official Advanced Placement course currently being offered by the College Board.

This document is based upon work supported by the National Science Foundation, grant CNS-0938336. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Portfolio Entry - Data

Task

This portfolio entry includes work on a team (usually 2 members) and as an individual.

1. **Collaborative portion:** Identify and describe a significant area in which you will conduct an investigation to gain insight and knowledge from publicly available data. Develop a set of 3-5 questions that will be the focus of the investigation, find one or more large data sets that will allow you to obtain answers to your questions, and then apply computational tools and techniques to answer your questions, e.g., by finding patterns in the data, by transforming or translating the data, or by finding connections between the data and other sources of knowledge.

Produce an artifact that will allow someone else to understand your investigation, including both the set of questions you pose and the answers you obtain. The artifact should describe the computational tools and techniques you use, explanations of why you chose them, and why they are appropriate for your investigation.

2. **Individual portion:** Create a document in which you make it clear that you can use the computational tools and techniques described in your collaborative artifact to verify the answers that are provided there. Additionally, you must provide enough details about the tools and techniques and their use with the data and other sources of knowledge so that a skilled reader could verify and reproduce your answers using the same data set and other sources of knowledge. You must include a reflection that describes and analyzes the collaborative aspects of the investigation.

Prepare and submit the following

1. A collaboratively developed artifact that communicates a detailed description of your group's investigation, the questions, and your collective findings. You may use any form of digital artifact (e.g., a report, video, presentation, visualization, or combinations of these) that allows you to best communicate your investigation and findings. You and your partner will each submit the same artifact.
2. An individually written document that addresses the investigation. Each group member must write her/his own individual document. In writing the individual document you must adhere to the Task description above and the Requirements description below in supplying details of your investigation.

Requirements

- You must work with a partner on this project. You will collaboratively conduct the investigation: formulating the area to be investigated, developing the questions, finding data set(s) to address those questions, and creating the artifact that allows someone else to understand your investigation. (Groups of three are allowed at the college level and if the number of students in the class is odd.)

- You must use a data set with at least 5000 entries (you may use more than one data set). You must use a data set that supports a meaningful investigation and it must be publicly available online. You are encouraged to identify investigations and data sets that relate to your own interests.
- You **must use** computing tools and techniques to analyze the data and answer your questions and the questions **must require** such tools and techniques.
- Your collaboratively developed artifact must include the following:
 - Overview of your investigation: a description of the intent of the investigation and how it will be used to gain insight and knowledge;
 - The set of 3 to 5 questions that you will answer.
 - Explanation and justification of how the data and other sources used in your investigation (if any) are appropriate for exploring and answering the questions.
 - Information about the data set(s): a description of each data set; the URL of the data set; the date on which you accessed the data; and where possible a reference to the data set from a written work (e.g., an article, book, or blog post).
 - Description of the computational tools and techniques used.
 - Clearly presented answers to your questions and explanations of how the answers help gain insight and knowledge.
- Your individually written document must include the following:
 - Justification of why you chose the specific computing tools and techniques you used to conduct your investigation.
 - An explanation of *why* computing is necessary and *how* computing facilitated analyzing the data to answer the questions.
 - A detailed description of how your team processed the information in the data set to conduct the investigation and how this enabled you to meet your objective of gaining insight and knowledge. This description should be sufficiently detailed to make it clear that you can conduct the investigation and verify the results in answering questions and that a reasonably skilled reader could do so as well.
 - A reflective description, explanation, and analysis of the collaborative aspects of your investigation. This should **not** be a simple enumeration of when and how you worked together.

**Examples of areas of investigations and high quality data sets:
Currently left blank**

Learning Objectives

The Data Portfolio Task addresses the following CS Principles Learning Objectives (LOs):

LO 1: The student can use computing tools and techniques to create artifacts.

LO 2: The student can collaborate in the creation of computational artifacts.

LO 4: The student can use computing tools and techniques for creative expression.

LO 10: The student can use models and simulations to raise and answer questions.

LO 11: The student can use computers to process information to gain insight and knowledge.

LO 12: The student can collaborate when processing information to gain insight and knowledge.

LO 13: The student can communicate how computer programs are used to process information to gain insight and knowledge.

LO 14: The student can use computing to facilitate exploration and the discovery of connections in information.

LO 15: The student can use large datasets to explore and discover information and knowledge.

Portfolio Entry - Internet

Task

Identify and describe a *significant, contemporary* problem and potential solution that are connected by the Internet to a societal, economic, or cultural context. The problem and/or potential solution must have a strong connection to computing and the Internet. You will create a document describing the problem, the potential solution, the societal, economic, or cultural contexts, cybersecurity concerns, and the relevant characteristics of the Internet. The societal, economic, or cultural context should affect a significant population (more than a few hundred people).

Note: In the task description and the text below the phrase “problem and/or solution” means that either the problem, or the solution, or both should have the characteristics referred to. For example, the task description requires that the problem, or the solution, or both, must have a strong connection to computing and the Internet.

Prepare and submit the following

A single written document that addresses the task and meets all the requirements listed below. The document can include illustrations and non-textual examples. The document does not need to be an essay. For example, it can be a sequence of written paragraphs each of which addresses one of the requirements below, but which does not include words to connect the paragraphs together. You can also write an essay in which the paragraphs are connected.

Requirements

- Maximum length is 1000 words.
- Your document must make references to two external sources that provide context for the problem and solution. The references should be high quality sources. Each reference should include a URL when appropriate, but also a citation for the reference, e.g., the author and title of the reference. You must include a date on which you accessed the source if the source is online. Each reference should be to something written between September 2012 and April 2013. The references should be to sources of information that anyone can use to learn about the problem or its solution.
- Identify at least one cybersecurity concern related to the problem and/or the potential solution (depending on which of these are connected to the Internet). Describe the cybersecurity concern and explain how it relates to the problem or its potential solution or both.
- Provide a brief but clear description of the problem.
 - Identify and describe the problem clearly.
 - What population is affected and how?
 - If the problem is connected the Internet describe how. Be sure to address the specific characteristics of the Internet (see *Description of Internet*

Characteristics) relevant to this problem and how the Internet and the problem are connected.

- Provide a brief but clear description of the potential solution.
 - Describe the potential solution clearly and how it addresses the problem.
 - If the solution is connected to the Internet describe how. Be sure to address the specific characteristics of the Internet (see *Description of Internet Characteristics*) relevant to this solution and how they enable the solution.
- Connect your references to the descriptions of the problem and the solution. That is, your descriptions must make explicit references to your sources.
- Describe one potentially beneficial and one potentially harmful effect the Internet has on society, culture or economics in the context of the problem or the potential solution.
- Identify and describe one field other than computing that contributed to or is impacted by the problem or the proposed solution, citing at least one specific example. Describe how the field contributes to or is impacted by the problem or its solution.

Description of Internet Characteristics

When you describe the characteristics of the Internet relevant to the problem or its solution (or both) you must identify, describe, and explain at least the characteristics below that are relevant and related to the problem or the solution. You only need to identify, describe, and explain those characteristics below that are relevant and related to the problem and/or solution. You may identify characteristics of the Internet in addition to those below.

- Evolving Internet standards and abstractions (e.g., addresses and names)
- Hierarchy and redundancy in the Internet
- Interfaces and protocols of the Internet that enable widespread use
- The trust model of the Internet and its role in cybersecurity
- How cryptography affects cybersecurity

Learning Objectives

The Internet Portfolio Task addresses the following CS Principles Learning Objectives (LOs):

LO 27: The student can explain the abstractions in the Internet and how the Internet functions.

LO 28: The student can explain characteristics of the Internet and the systems built on it.

LO 29: The student can analyze how characteristics of the Internet and systems built on it influence their use.

LO 30: The student can connect the concern of cybersecurity with the Internet and systems built on it.

LO 31: The student can analyze how computing affects communication, interaction, and cognition.

LO 33: The student can connect computing with innovations in other fields.

LO 34: The student can analyze the beneficial and harmful effects of computing.

LO 35: The student can connect computing within economic, social, and cultural contexts.

Portfolio Entry - Programming

Task

This portfolio entry includes work on a team (usually 2 members) and as an individual.

1. **Collaborative portion:** Collaborate with a partner to identify an area of focus or subject of your choosing in which you can write and reflect on several different programs that solve problems or do something that is personally relevant to you. The discussion below uses the term *area* to refer to the subject or focus you have chosen as this first part of this portfolio task. The area you choose should be one that allows you and your partner to write programs that go beyond simple explorations. Work together to write a program to solve a problem in the area you chose or to illustrate features and characteristics of the area.
2. **Individual portion:** Working alone, write another program to solve a different problem or to illustrate some other feature or characteristic of the area you chose. Working alone, produce a single piece of writing that reflects on each of the following: the collaborative experience, the program that resulted from the collaboration, and the program you created individually. This reflection piece should include an explanation of how you see the programs as part of the area you chose.

Prepare and submit the following

1. The program you developed collaboratively with your partner within your area. You and your partner will each submit this same program.
2. The program you developed independently within your area.
3. An individually written description and reflection document as described below in the *Requirements* section. Each group member must write her/his own reflection.

Requirements

- You must work with a partner on this project. You will collaboratively identify an area and will collaboratively develop a program within that area. (Groups of three are allowed at the college level and if the number of students in the class is odd.)
- You and your partner will work with your instructor to identify a suitable area that lends itself to creating programs that are reasonably complex: each program must include each of the following: sequencing, selection, abstraction, and either iteration or recursion.
- You are free to determine the purpose of your programs, but your programs should leverage the richness of the area you have chosen. For example, your programs might solve a problem or create something creative or artistic (though you are not limited to these two examples). Furthermore, your programs should demonstrate the complexity of the programming environment/language you are working in.
- The programs you and your partner produce individually must be different, both in content and purpose, from one another and from the one you write collaboratively. All the programs must be relevant to the area you chose.
- Your individually written description and reflection document has a maximum length of 400 words.
- Your individually written reflection document should include the following:
 - A brief description that identifies the area in which you and your partner chose to work, as well as the problem you attempted to solve or the features and/or characteristics you attempted to illustrate.

- A brief description that describes the additional problem that, working alone, you attempted to solve or the features and/or characteristics you attempted to illustrate.
- A description of why the programs are relevant to the area you chose.
- An evaluation of the correctness of both your own individual program and the program you produce with your partner. This evaluation should include
 - a description of the algorithms these programs implement,
 - an explanation of how these programs function at a detailed level, and
 - a justification of why these programs perform correctly.
- A description of the collaboration process you used to create your shared program. Describe in what ways this process was or was not appropriate for the creation of your shared program.

Commentary

This portfolio task achieves several objectives. It has students working collaboratively in groups. Students gain experience using programming as a creative tool. Writing and reflection are important components of this portfolio task.

Learning Objectives

The Programming Portfolio Task addresses the following CS Principles Learning Objectives (LOs):

LO 1: The student can use computing tools and techniques to create artifacts.

LO 2: The student can collaborate in the creation of computational artifacts.

LO 3: The student can analyze computational artifacts.

LO 4: The student can use computing tools and techniques for creative expression.

LO 5: The student can use programming as a creative tool.

LO 8: The student can develop an abstraction.

LO 17: The student can develop an algorithm.

LO 21: The student can explain how programs implement algorithms.

LO 22: The student can use abstraction to manage complexity in programs.

LO 23: The student can evaluate a program for correctness.

LO 24: The student can develop a correct program.

LO 25: The student can collaborate to solve a problem using programming.