



## Unit 1

### Creative Development

**Computing Innovation:** an innovation that uses a program as a key part of their function.

**Computing Innovation Examples:**

- **Physical:** Robots, Tablets, smart tech
- **Non-physical:** Social Media, Video Games

**Collaboration**

- allows for diverse ideas and thoughts that cater to different people
- **Pair Programming:** when two people share one computer and take turns coding

**Program Function and Purpose**

- **Purpose:** What a program is designed to do (ex: solving problems, creative expression)
- **Code Segments:** a smaller collection of statements that are part of a program
- **Code Statements:** individual instructions.
- **Program Inputs:** pieces of data (visual, auditory, touch, etc) that a computer takes in and processes
- **Program Outputs:** the data (same types as inputs) that the computer returns
- **Program Events:** an action that gives a program data to respond to.
- **Program Behavior:** how a program will respond to a user interacting with it.

**Development Processes:**

- **iterative development process:** develop working prototypes of a program and go back through the cycle to redevelop the program
- **incremental development process:** break a problem into small parts and then reassemble the solution when each part is fixed
- **Program Documentation:** a description of how something in your program works
- **Comments:** program doc. written directly into the program itself

**Common Errors:**

- **Logic Errors:** unexpected behavior in program's output
- **Syntax Errors:** the code does not work properly because it is typed or written incorrectly
- **Run-Time Errors:** error occurs while code runs
- **Overflow Errors:** the numbers are too big for the computer

**Methods of Fixing:**

- **Hand tracing:** manually tracking your variables' values as your program goes along
- **Print statements:** printing out values to make sure they're correct



## Unit 2

### Data

**Data** is a collection of facts.

- Computing devices store data in **bits** (binary digits)
- Computers read machine code which is usually in the **binary system**.
- **Abstraction:** reduces complexity by only focusing on the most important parts & hiding the irrelevant parts from the user — **important** for AP CSP!!

**Binary Numbers**

- **8 bits = 1 byte**
- **Hexadecimal** is used for RGB color codes & it uses **Base 16**

**Conversion Charts: Binary and Hexadecimal**

Power of 2	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
Value Represented (Base 10)	8	4	2	1
Amount of Value	(either 0 or 1)	(either 0 or 1)	(either 0 or 1)	(either 0 or 1)

Power of 16	16 <sup>3</sup>	16 <sup>2</sup>	16 <sup>1</sup>	16 <sup>0</sup>
Value Represented (Base 10)	4096	256	16	1
Amount of Value	(0-9 or A - F for 10 - 16)	(0-9 or A - F for 10 - 16)	(0-9 or A - F for 10 - 16)	(0-9 or A - F for 10 - 16)

**Data Representation**

- **ASCII code** converts text to binary format
- **Analog data** is measured continuously & changes smoothly
- **Digital data** is measured digitally and leaves out extra data by simplifying the data collected (form of abstraction)

**Data Compression**

- Data compression is dependent on 1) the method used and 2) the amount of repeated info in the data
- **Lossless compression:** less compression & better file quality
- **Lossy compression:** more compression & worse file quality

**Extracting Information from Data**

- **Metadata:** data about data
- **Data mining:** examining very large data sets to find information
- **Transforming data:** editing or modifying data (ex: doubling every number/graphing data points)
- **Cleaning data:** making data uniform w/o changing meaning (ex: correcting misspelled words)



## Unit 3

### Algorithms & Programming

- **Pseudocode** will be used a lot on the MCQ section of the AP Exam, make sure to review the AP CSP exam sheet and fully understand all of the pseudocode.

- **Important:** AP Pseudocode **has an index that starts at 1!**

**Data Types**

- Ex: Numbers, strings, lists and booleans
- **Strings** are an ordered list of characters ("hello world")
  - **Substrings** are part of a string ("ello")
  - **String concatenation** occurs when two strings or more are connected w/ a "+"
- **List** (array) an ordered sequence of elements
  - An **element** is an individual value in a list
  - All elements have an **index:** number that represents their position in the list (ex: in the list [5,6,7], 5 is at index number 1 because it's in the first position)

- **Booleans:** either True or False; go with the logical operators: NOT, AND and OR

- **Loops** traverse through lists/arrays/strings

**Mathematical Operators:**

- **Look at the exam reference sheet** for the meaning of operators such as / and %
  - MOD (%) gives you the *remainder* of 2 #'s

**Algorithms**

- An **algorithm** has instructions that accomplish a task or solve a problem; created using sequencing, selection, and iteration

**Sequencing, Selection and Iteration**

- **Sequencing** means that all of the code is executed in the order they are written in.
- **Selection: if statements:** have conditions that need to be met for the selection to run
  - **Else statements** are attached to if statements which specify what happens if a condition is not met
  - **Nested conditional statements** have conditional statements inside of conditional statements
- **Iteration:** "repeat n times"/"repeat until"; you can use NOT, AND and OR to write loops
  - **Binary Search:** type of algorithm used to search; works by splitting the data set and eliminates ½ the data with each round of splitting

**Procedures/Functions**

- **Procedures** are programming instructions that are also called **methods or functions**
- **Parameters:** input variables of a procedure
- **Arguments:** a procedure call with defined values
- You can call a procedure without knowing how it works: this is an example of **abstraction**

**Unit 4**

## Computer Systems &amp; Networks

**The Internet**

- **Internet** = **inter**connection and **net**works
- **computer network**: when multiple computing devices (ex: computer, tablet) communicate with each other
- Data on the internet is split into **data packets** with **metadata** (data about the data packets) attached to each packet to tell the routers information
- **routing**: the process of finding the best path to deliver information.
- **path**: sequences of connected computing devices (**routers**) that begin at the sender and end at the receiver.
- **bandwidth**: the rate of data transfer from one device to another; megabits per second
- **protocol**: set of rules; the internet uses the **TCP/IP and UDP** protocols to communicate
- **World Wide Web**: a system of web-pages, programs, and files; runs on the Internet but is *not the internet*
- **scalability**: the capacity to change in size and scale to meet new demands.

**Fault Tolerance**

- **fault tolerant**: something can still function even w/ a partial malfunction
- **redundancy**: duplication of things; helps make the internet fault tolerant

**Parallel and Distributed Computing**

- **sequential computing**: traditional programming where each program is processed at a time
- **Parallel computing**: when program is broken into smaller operations and processed at the same time using multiple processors
- **Distributed computing**: multiple devices communicate together to run a program
- **sequential solution**: takes as long as the # of all steps in a program; With 3 steps of a, b, and c length, the sequential solution equals  $a + b + c$
- **parallel computing solution**: faster w less # of cores; if all steps are independent, find the solution that results in the minimum possible time
- **speedup** of a parallel solution: sequential solution time/parallel solution time

**Unit 5**

## Impact of Computing

**Key Concepts**

- **digital divide**: gaps between those who have access to the internet and those who do not
  - The things that affect this are demographics, socioeconomic status, and geographic location
- **computing bias**: computing innovations can reflect existing racial/gender/etc biases. Ex: recruiting algorithms that prefer one race or gender over another
  - This is often because computers run on historical data, which reflects historical biases
- **Intellectual property**: the work that people consider “theirs”
- **copyright**: the person who created something determines who uses their creation
- **Creative Commons**: copyright license for creators to give others the ability to use their work
- **Open-sourcing**: work is freely shared, distributed, and modified
- **Open access**: research available to public w/ out restrictions
- **Crowdsourcing**: getting a large amount of input or information from people on the Internet.
- **Citizen Science**: scientific research that the general population helps to conduct.

**Digital Security**

- **personally identifiable information (PII)**: information that can be used to identify you
- **virus vs worm**: Viruses are attached to infected files and must be activated by the user; worms can operate independently.
- **malware**: malicious software that takes control of a system
- **phishing**: tricks people into giving their personal information away by pretending to be a trustworthy group
- **multi-factor authentication**: requiring multiple methods of verification.

**Encryption**

- **encryption**: encoding data to prevent others from accessing it
- **key**: a secret piece of information used to encrypt data
- **symmetric key encryption**: **one key** for both encrypting & decrypting
- **public key encryption**: public key to encrypt & private key to decrypt

**Exam Tips****MCQs**

**120 minutes (2 hrs) | 70 multiple choice questions | 70% of AP Exam Score**

- Pace yourself! You have around 1.7 minutes for each question so make sure to keep track of the time.
- If you are confused on a question, skip and come back later. If you cannot understand
- a question within 5-10 seconds of reading it, try to answer other questions first.
- If necessary, guess. College Board does not have a guessing penalty (points are only
- rewarded if earned, not taken away if answered incorrectly.
- Read the AP CSP reference sheet ahead of time for easy use on the AP Exam.
- Find and use practice questions! Practice makes perfect!

**Create Task**

**12+ hours in class work time | 30% of AP Exam Score | DUE: May 1st, 2023 @ 11:59 PM EDT**

- Work ahead of time! Try to avoid submitting your Create Task late to avoid technical errors.
- Before submitting, review the scoring guidelines on the College Board website to make sure you have fulfilled the requirements for each row on the rubric.
- To make sure your Create Task is completed properly, view the sample responses on the College Board
- Website and cross reference and compare your work to the samples.
- Any examples or samples you see, write down to make sure you do not accidentally plagiarize. A Create Task that is flagged for plagiarism will receive a score of 0.
- Be confident in your work! You have gone through this class for an entire year & are prepared!