

# AP Computer Science Summer Assignment

## Part A

Read selected sections of [\*The Cartoon Guide To Computer Science\*](#)

Accessing these will require you to login to the school website and access the following link:

<http://www.veronaschools.org/Page/3140>

Use the book and the web if necessary to find answer the questions. The book was originally written in 1983, so keep in mind that some of the terminology is a little archaic (but useful to know) and some of the numbers describing the capabilities of modern computers are dated to the early 1980's.

### **Part I : Ages of Information**

Part I is a relatively easy read. It reads like a history lesson.

1. Who was Claude Shannon and why was he important? Where did he do his groundbreaking work?
2. What is Shannon's definition of information?
3. Why is "life itself" information?
4. What were the earliest examples of information storage?
5. What Chinese innovation made it easier for humans to do computation?
6. What Indian innovation made it easier for humans to do computation?
7. How long have humans used "calculators?"
8. Who was Al-Khwarismi and what important words/concepts live on as his legacy?

9. What does the Latin word "Calx" mean and what English words did this Latin root spawn?

10. Who was Isaac Newton and which classes at VHS exist to study his innovations?

11. Who was John Napier and what two major innovations did he bring to math/computation?

12. Blaise Pascal invented a computer called the "Pascaline". For what else is he remembered?

13. Who was Gottfried Leibniz and why did he get in a big fight with Newton?

14. What was Jacquard's Loom and why was it an important development?

15. Sketch a diagram of the four major parts of Babbage's Analytical Engine and show the information flow between those parts with arrows

16. Who Ada Lovelace? Define three important programming concepts which she developed.

17. Herman Hollerith built one of the first "electromechanical" computers. What does that mean? Why did he build it and which modern technology company owes its birth to Hollerith?

18. Another of Hollerith's inventions was the "Hollerith String." What is a Hollerith String and why was that an important innovation?
19. What is the function of an electromechanical relay and vacuum tube?
20. What were the advantages and disadvantages of a vacuum tube over an electromechanical relay?
21. The Mark I was an "electromagnetic" computer. What does that mean?
22. ENIAC was the first "electronic" computer. What does that mean?
23. How did the US Army use ENIAC?
24. What key concept did John von Neumann have which streamlined the way computers work today?
25. Name three advantages of the "Von Neumann Architecture".
26. What work did von Neumann do which was instrumental to an Allied victory in World War II?
27. What innovation/development did von Neumann bring to the study of Economics?
28. The Transistor was an electrically-controlled switch, much like the vacuum tube or electromechanical relay. Why was it an improvement over the vacuum tube?

29. Page 83 incorrectly states that the transistor was developed by a team at Stanford. Where was the transistor developed?
30. What is an Integrated Circuit?
31. Mainframes and Minicomputers are somewhat archaic concepts in 2013. What generic term do we use today to refer to computers which provide data or computations to many users?
32. On page 86, the author says “there’s talk of reducing components to molecular size using recombinant DNA Technology”. In March of 2013, a team at Stanford built something called “The Transcriptor”. What is it?

### **Part II : Logical Spaghetti**

Some parts of Part II are a little more densely packed with detail (logic circuits, assembly language) than Part I and might be difficult for you to follow. Just do your best to understand and glean the key concepts from the reading.

33. What important contribution did George Boole make to the development of the computer?
34. What is a “Truth Table?” Write the truth tables for AND, OR, and NOT.
35. What is an “AND-gate” ?
36. Convert the binary number 101011101 to decimal by hand
37. What is a bit and how many possible values can it represent? What is a byte and how many possible values can it represent?

38. What is the difference between an integer and a floating point number?
39. Why was the development of ASCII important? What is the ASCII character for 1010111?  
What is the ASCII code for the number for the @ sign?
40. What is the job of an ALU?
41. What special capability does a “flip-flop” circuit have?
42. What is a register?
43. What is a clock circuit? What does it mean when you say that a computer has a “3 Gigahertz processor?”
44. What are the advantages and disadvantages of electronic and electromechanical memory devices? Which parts of a computer represent electronic memory and which represent electromechanical memory?
45. What is a memory address?
46. What is the decimal equivalent of the hexadecimal number D7 ?

47. What is the difference between RAM and ROM?

48. What is volatile memory? What are some examples of volatile and non-volatile memory in devices you use?

49. What is “Moore’s Law” ?

50. Page 163 talks of 256K memory chips (the year was 1983). In 2013, you can purchase memory chips with 8GB of capacity. To the closest power of 2, how much more information can be stored in an 8GB memory chips than in a 256K memory chip ?

51. What is the job of a “bus” in the computer?

52. Each CPU has an “instruction set”. What is an instruction set?

### **Part III : Software**

In this section, you will read about the history of software

53. Who was Alan Turing and what very important contribution did he make to the Allied efforts in World War II?

54. What is a Turing Machine and why is the concept important? What is a Universal Turing Machine?

55. How are von Neumann’s self-reproducing machines like plant or animal cells? How does a computer virus fall under von Neumann’s definition of a self-reproducing machine?

56. What is an algorithm?

57. How is a high-level language different than assembly language?

58. What source code? What is object code?

59. What is the difference between the way a compiler works and the way an interpreter works?

60. What was the first high-level language?

61. You should think of a variable as a \_\_\_\_\_ in \_\_\_\_\_.

62. What is an operating system and what purposes does it serve?

63. What is UNIX? Where was it developed?

64. Of the four major computer operating systems, Windows 7/8, MacOS, Linux, and ChromeOS, which are ancestors of UNIX ?

65. Much of the world's data, such as your parent's bank account information, your grades, your Amazon.com order history, etc. is stored in a type of database called a "relational database". What is a relational database?

66. For scientists, one of the most useful capabilities of computer is simulation. What are some scientific problems for which simulation is used to model a real-world phenomenon?

67. Before the internet, what was the biggest computer system in the world?

68. What is The Turing Test? Find an iPhone and ask Siri if she passes the Turing test. What does she say?



# AP Computer Science Summer Assignment

## Part B

### I. Establish your Java Development Environment and Write a “Hello World” Program

(1) You should download the *Java SE Development Kit* at

<http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html>

Click “Accept License Agreement”, then download and install the version which matches your computer. Be sure to select the right version (32-bit or 64-bit (x64)) for your computer. You most likely need the 64-bit version. If your computer is old, you might need the 32-bit version.

(2) Create a new folder on your computer called *APCompSci*

(3) Inside your *APCompSci* folder create a new folder called *MyCode*

(4) Download *Eclipse IDE For Java Developers* at <http://www.eclipse.org/downloads/> to your *APCompSci* folder. The download will be a zip (compressed) file. Note that the download is free and you need not make a donation to download Eclipse. After the download has completed right-click on this zip file and select *Extract All* to extract the contents into a folder. This may take a few minutes. After the extract is complete, if the folder has a weird name (like *eclipse=java-luna-SR2-win32-x86\_64*), right-click on the folder and rename it to *eclipse*. After you have extract is complete, delete the zip file you had downloaded.

(5) Navigate to *APCompSci->eclipse->eclipse*. There is an application in this folder called *eclipse* and



the icon for this file should look like this: . Right-click on this file and select *Send to Desktop (create shortcut)*. This will create a shortcut for eclipse on your desktop

(6) Go you’re your Desktop and double-click on your newly created Eclipse icon to start Eclipse

(7) Eclipse might take a little while to start/initialize. After Eclipse has initialized, it will present a *Select A Workspace* dialog box. Click on the *Browse* button and navigate to your *APCompSci->MyCode* folder. Check the checkbox for *Use this as the default and do not ask again*. Then click OK.

(8) A Welcome Window is displayed. If you ever need to return to the Welcome window, select *Help->Welcome*

(9) On the Welcome Window, select *Tutorials*, then select *Create a Hello World Application*.

(10) Follow the tutorial instructions and complete all parts of the tutorial.

If you have any questions, email me at [rwertz@veronaschools.org](mailto:rwertz@veronaschools.org)

# AP Computer Science Summer Assignment

## Part C

### I. Download the Standard Library Code

(1) In your *APCompSci* folder, create a new folder called *Jars*

Visit the following link to download and save the file *stdlib.jar* in your *Jars* folder.

<http://introcs.cs.princeton.edu/java/stdlib/stdlib.jar>

“Jar” stands for “Java archive” and a jar file is essentially a zip file of useful code. The code in *stdlib.jar* will help us draw graphics, make sound and manipulate images. Be sure to just download and save this file in your *Jars* folder and do not try to open it.

### II. Configure Eclipse to make “smart” suggestions

(1) In Eclipse, select *Window->Preferences*, then in the tree on the left, expand the tree to select *Java->Editor->Content Assist->Advanced*. On the *Advanced* window, left-click on the *Restore Defaults* button, then left-click on the OK button.

(2) In Eclipse, select *Window->Preferences*, then in the tree on the left, expand the tree to select *Code Recommenders->Completions*. On the *Intelligent Code Completion* window, left-click on the *Enable intelligent code completion checkbox*, then left-click on the OK button.

### III. Download and run the “Right Triangle” code

(1) In Eclipse, create a new Java Project (*File->New->Java Project*) and name the project *RightTriangle*

(2) In the Package Explorer window of Eclipse, right-click on the Folder for the *RightTriangle* project and select *Build Path->Add External Archives*. Then navigate to the *stdlib.jar* you downloaded in your *Jars* folder and select it. This step effectively imports some important code that will help us draw on the screen

(3) In the Package Explorer window of Eclipse, right-click on the Folder for the *RightTriangle* project and select *New->Class*. Then name the new class *RightTriangle*. An empty class will appear in the editor window of Eclipse. The Editor window is the window we use to write code.

(4) Visit the following website

<http://introcs.cs.princeton.edu/java/15inout/RightTriangle.java>

and copy the code in the browser window (click on the browser window and type Control-a, then Control-c)

Then return to the Editor window of Eclipse and paste the copied code (type Control-a, then Control-v)

(5) Right-click on the Editor window and select *Run As->Java Application*. If a “Save and Launch” dialog box appears, check the “Always save resources before launching” and then click OK. You should see a right triangle inscribed in a circle.

(6) Experiment with this code and see if you can change it and then rerun it to see your change. Some examples might be

- a. Create different shapes
- b. Create shapes that are colored in

- c. Draw your name using different shapes

#### IV. Download and run the “Bouncing Ball” code

- (1) In Eclipse, create a new Java Project (*File->New->Java Project*) and name the project *BouncingBall*
- (2) In the Package Explorer window of Eclipse, right-click on the Folder for the BouncingBall project and select *Build Path->Add External Archives* . Then navigate to the *stdlib.jar* you downloaded in your *Jars* folder and select it. This step effectively imports some important code that will help us draw on the screen
- (3) In the Package Explorer window of Eclipse, right-click on the Folder for the BouncingBall project and select *New->Class*. Then name the new class *BouncingBall*. An empty class will appear in the editor window of Eclipse.
- (4) Visit the following website  
<http://intros.cs.princeton.edu/java/15inout/BouncingBall.java>  
and copy the code in the browser window (click on the browser window and type Control-a, then Control-c)  
Then return to the Editor window of Eclipse and paste the copied code (type Control-a, then Control-v)
- (5) Right-click on the Editor window and select *Run As->Java Application* . If a “Save and Launch” dialog box appears, check the “Always save resources before launching” and then click OK. You should see a black ball bouncing on a gray background.
- (6) Experiment with this code and see if you can change it and then rerun it to see your change. Some examples might be
  - a. Change the color of the ball or the background
  - b. Change the velocity of the ball
  - c. Make the ball larger or smaller
  - d. Replace the ball with a picture of your pet

#### V. Download and run the “GrayScale” code

- (1) In Eclipse, create a new Java Project (*File->New->Java Project*) and name the project *GrayScale*
- (2) Save the following JPEG file on your computer by right-clicking on it in your browser and selecting “Save Picture As...”  
<http://www.veronaschools.org/cms/lib02/NJ01001379/Centricity/Domain/181/1968.jpg>
- (3) Drag the saved file into the *GrayScale* folder in the Package Explorer window of Eclipse. If you are prompted with a “File Operation’ dialog box, select “Copy Files” and click OK.
- (4) In the Package Explorer window of Eclipse, right-click on the Folder for the GrayScale project and select *Build Path->Add External Archives* . Then navigate to the *stdlib.jar* you downloaded in your *Jars* folder and select it. This step effectively imports some important code that will help us manipulate digital images
- (5) In the Package Explorer window of Eclipse, right-click on the Folder for the GrayScale project and select *New->Class*. Then name the new class *GrayScale*. An empty class will appear in the editor window of Eclipse.
- (6) Visit the following website  
<http://www.veronaschools.org/cms/lib02/NJ01001379/Centricity/Domain/181/GrayScale.txt>

and copy the code in the browser window (click on the browser window and type Control-a, then Control-c)

Then return to the Editor window of Eclipse and paste the copied code (type Control-a, then Control-v)

- (7) Right-click on the Editor window and select *Run As->Java Application* . If a “Save and Launch” dialog box appears, check the “Always save resources before launching” and then click OK. You should see two versions of the jpeg file, one version on top of the other. You can use the mouse to move the two versions side by side to see the differences.
- (8) Experiment with this code and see if you can change it and then rerun it to see your change. Some examples might be
  - a. Convert a picture of your pet to grayscale
  - b. Change the program to remove all red and blue from the picture
  - c. Only change part of the picture to grayscale

## VI. Download and run the “PlayThatTune” code

- (1) In Eclipse, create a new Java Project (*File->New->Java Project*) and name the project *PlayThatTune*
- (2) Save the following Text file on your computer by selecting *File->Save As* from your browser menu <http://www.veronaschools.org/cms/lib02/NJ01001379/Centricity/Domain/181/STH.txt>
- (3) Drag the saved file into the *PlayThatTune* folder in the Package Explorer window of Eclipse. If you are prompted with a “File Operation’ dialog box, select “Copy Files” and click OK.
- (4) In the Package Explorer window of Eclipse, right-click on the Folder for the PlayThatTune project and select *Build Path->Add External Archives* . Then navigate to the *stdlib.jar* you downloaded in your *Jars* folder and select it. This step effectively imports some important code that will help us use the audio capabilities of the computer.
- (5) In the Package Explorer window of Eclipse, right-click on the Folder for the PlayThatTune project and select *New->Class*. Then name the new class *PlayThatTune*. An empty class will appear in the editor window of Eclipse.
- (6) Visit the following website <http://www.veronaschools.org/cms/lib02/NJ01001379/Centricity/Domain/181/PlayThatTune.txt> and copy the code in the browser window (click on the browser window and type Control-a, then Control-c)  
Then return to the Editor window of Eclipse and paste the copied code (type Control-a, then Control-v)
- (7) Right-click on the Editor window and select *Run As->Java Application* . If a “Save and Launch” dialog box appears, check the “Always save resources before launching” and then click OK. You should hear a song playing on the speakers or headphone jack of your computer.
- (8) Experiment with this code and see if you can change it and then rerun it to see your change. Some examples might be
  - a. Change the tempo (fast/slow) of the song
  - b. Create another file to have the computer play a tune of your choice
  - c. Shift the key of the song to a higher or lower key

## VII. Backup Up Your Work

- (1) Copy your *MyCode* folder to a USB Flash Drive so that you can bring it to school