

Questions	Answers / Descriptions / Examples
What skills does the AP CSA exam tests?	
How many hours long is the AP CSA exam?	
How many sections are on the AP CSA exam?	
How much time is allotted per each part of the exam?	
How many questions is the multiple-choice part?	
How many questions is the free response part?	
How do you complete the free response questions on the AP exam?	<i>Select one:</i> <input type="radio"/> Write Java code on computer <input type="radio"/> Write Java code by hand
How much of the exam is each part worth?	
What will you have access to during the exam?	
How many units will the exam cover?	
What areas will the 4 free response questions cover?	Question 1: Question 2: Question 3: Question 4:

- After completing the notes above, go to 1.1.7 in Runestone and complete their short survey.
(Check box when done)

Questions	Answers / Descriptions / Examples
What do Android phones, Minecraft, and Netflix have in common?	
What must all Java programs start with?	
What syntax is used to start and end class definitions and method definitions?	
What is the difference between the following print commands?	<code>System.out.println(value);</code> vs. <code>System.out.print(value);</code>
What is a string literal? How many characters can it have?	
What must you use to show the end of a Java statement?	
What is the process of removing errors (or bugs) called?	
If you have syntax errors, where will your error messages be displayed by the compiler?	
What are the 4 steps to debugging? (According to the 2 min video)	<p>Step 1:</p> <p>Step 2:</p> <p>Step 3:</p> <p>Step 4:</p>
<p>How does a rubber duck help me debug?</p> 	<p>The rubber duck debugging method is as follows:</p> <ol style="list-style-type: none"> 1. Obtain a rubber duck (from Mrs. Bjorgum after you complete these notes). 2. Place rubber duck on desk and inform it you are just going to go over some code with it. 3. Explain to the duck what your code is supposed to do, and then go into detail and explain your code line by line. 4. At some point you will tell the duck what you are doing next and then realize that is not in fact what you are actually doing. The duck will sit there serenely, happy in the knowledge that it has helped you.
<p>Describe and name the roles of each person in pair programming. How often should the two coders switch roles? (Check box when pairing & input name.) <input type="checkbox"/> Pair?</p>	

1. Add code to the main method below to correspond with the given output when compiled.

```
1 public class APClass
2 {
3     public static void main(String[] args)
4     {
5
6
7
8     }
9 }
```

Output: AP CSA ROCKS!
My teacher's name is Mrs. Bjorgum.

Multiple Choice: Circle the best answer.

2. Consider the following code segment.

```
System.out.print("Hello System.out.println");
System.out.print("!!!");
```

What is printed as a result of executing the code segment?

- (A) Hello!!!
- (B) Hello System.out.println!!!
- (C) Hello
!!!
- (D) Hello System.out.println
!!!
- (E) Nothing is printed because the text "System.out.println" cannot appear inside a print statement.

3. Consider the following code segment.

```
System.out.print(I do not fear computers. ); // Line 1
System.out.println(I fear the lack of them.); // Line 2
System.out.println(--Isaac Asimov); // Line 3
```

The code segment is intended to produce the following output but may not work as intended.

```
I do not fear computers. I fear the lack of them.
--Isaac Asimov
```

Which change, if any, can be made so that the code segment produces the intended output?

- (A) In line 1, print should be changed to println.
- (B) In lines 2 and 3, println should be changed to print.
- (C) The statement System.out.println() should be inserted between lines 2 and 3.
- (D) In lines 1, 2, and 3, the text that appears in parentheses should be enclosed in quotation marks.
- (E) No change is needed; the code segment works correctly as is.

4. Consider the following code segment.

```
System.out.print(*);      // Line 1  
System.out.print(**);    // Line 2  
System.out.println();    // Line 3  
System.out.println(**);  // Line 4
```

The code segment is intended to produce the following output, but may not work as intended.

**
*

Which line of code, if any, causes an error?

- (A) Line 1
- (B) Line 2
- (C) Line 3
- (D) Line 4
- (E) The code segment works as intended.

5. Consider the following code segment.

```
System.out.print(**);  
System.out.println(***);  
System.out.println(****);  
System.out.print(*****);
```

What is printed as a result of executing the code segment?

- (A) *
**

- (B) *
**

- (C) *

- (D) ***

- (E) ***

6. Consider the following code segment.

```
System.out.print("One");   // Line 1  
System.out.print("Two");   // Line 2  
System.out.print("Three"); // Line 3  
System.out.print("Four");  // Line 4
```

The code segment is intended to produce the following output, but does not work as intended.

OneTwo
ThreeFour

Which of the following changes can be made so that the code segment produces the intended output?

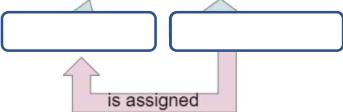
- (A) Changing print to println in line 1 only
- (B) Changing print to println in line 2 only
- (C) Changing print to println in line 3 only
- (D) Changing print to println in lines 2 and 3 only
- (E) Changing print to println in lines 1, 2, 3, and 4

Questions	Answers / Descriptions / Examples
What is a variable?	
What are the two types of variables in Java?	
What are the 3 primitive type variables that are tested on the AP CSA exam?	
What is one of the object type variables on the exam?	
How do you declare (create) a variable in Java? Write a few examples as practice.	
What is = in Java? How is it used in relation to variables and their values?	
Write <i>two lines of code</i> to declare an integer variable called perOfCSA and initialize it for the current period.	
Write <i>one line of code</i> to declare a double variable called height and initialize it for your height in inches.	
What are some rules for naming variables in Java?	
What is camelCase? Make up two examples of variables using camelCase.	
What word is added in front of a declared variable type if its value cannot be changed once it is initialized?	

Answer the following questions based on what you've learned about Variables and Data Types in Java.

1. What are the three PRIMITIVE data types used in APCSA and what are they used to store?
2. What type of variable would you use to store the square root of 2?
3. What type of variable would you use to store your age?
4. Write a single line of code that will create a double variable called bankBalance. Don't initialize it.
5. Write a single line of code that will create an integer variable called i and store 407 in it.
6. Write a line of code that will declare a variable called count to be of type int. Don't initialize.
7. Write a line of code that initializes the double variable bankBalance to 136.05. Assume this variable has already been declared.

<p>8. Circle or highlight the legal Java variable names below.</p> <p>scooter13 139_scooter ;mary public doubled double ab_c</p>	<p>9. Which of the following is a standard way of naming a variable in Java?</p> <p>(A) GroovyDude (B) GROOVYDUDE (C) groovyDude (D) Groovydude (E) groovy_dude (F) groovydude</p>	<p>10. Are the following lines of code correct? Why or why not?</p> <p>a) double dist = 1003; b) int alt = 1493.86;</p>
--	--	--

Questions	Answers / Descriptions / Examples				
What is an assignment statement ?					
What are the names of the various parts of this assignment statement ?	$\text{score} = (10 * \text{points}) + 5;$  <p>= “is assigned” or _____</p>				
Since one variable can be set to copy another variable’s value (without changing the value of the variable that you are copying from), what is the output of the following code?	<pre> 1 public class Test2 2 { 3 public static void main(String[] args) 4 { 5 int x = 3; 6 int y = 2; 7 System.out.println(x); 8 System.out.println(y); 9 x = y; 10 System.out.println(x); 11 System.out.println(y); 12 y = 5; 13 System.out.println(x); 14 System.out.println(y); 15 } 16 }</pre>				
How do you increment (add one to the current value) a variable <code>count</code> by one?					
How do you decrement (subtract one to the current value) a variable <code>count</code> by one?					
What is the output type for the following arithmetic operations?	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">int / int</td> <td style="width: 50%;">double / double</td> </tr> <tr> <td>double + int</td> <td>int * double</td> </tr> </table>	int / int	double / double	double + int	int * double
int / int	double / double				
double + int	int * double				
What is <code>==</code> used for in Java?					
What is <code>!=</code> used for in Java?					
What is an ArithmeticeException error message?					
What are the math operator precedence ? (Don’t forget the parentheses.)					
What is <code>%</code> (the modulo operator) in Java?					

Directions: Evaluate each given expression. Assume that integers have been declared as such and numbers with decimals have been declared as doubles.

/ is the divide math operation.

% is a mod operator, **the remainder of a division problem**.

For example: $79 \% 5 = 4$ (since 5 goes into 79 fifteen times with a **remainder of 4**)

1)	$9 / 4$	
2)	$10 / 4$	
3)	$11 / 4$	
4)	$12 / 4$	
5)	$13 / 4$	
6)	$14 / 4$	
7)	$15 / 4$	
8)	$16 / 4$	
9)	$17 / 4$	

10)	$9.0 / 4.0$	
11)	$10.0 / 4.0$	
12)	$11 / 4.0$	
13)	$12.0 / 4$	
14)	$13 / 4.0$	
15)	$14.0 / 4.0$	
16)	$14.0 / 4$	
17)	$14 / 4.0$	

18)	$9 \% 4$	
19)	$10 \% 4$	
20)	$11 \% 4$	
21)	$12 \% 4$	
22)	$13 \% 4$	
23)	$14 \% 4$	
24)	$15 \% 4$	
25)	$16 \% 4$	
26)	$17 \% 4$	
27)	$4 \% 17$	

```

public class Test {
    public static void main(String args[]) {
        int a = 4;
        int b = 2;
        double c = 5.0;
        int d = 3;
        1 System.out.println("a + b = " + (a + b) );
        2 System.out.println("a - b = " + (a - b) );
        3 System.out.println("a * b = " + (a * b) );
        4 System.out.println("b / a = " + (b / a) );
        5 System.out.println("a / c = " + (a / c) );
        6 System.out.println("b % a = " + (b % a) );
        7 System.out.println("c % a = " + (c % a) );
    }
}

```

FYI: This + is not addition. It's to concatenate a string and a value.

Directions: Given the code above, what will be the output of each line?

Line 1:

Line 5:

Line 2:

Line 6:

Line 3:

Line 7:

Line 4:

Questions	Answers / Descriptions / Examples															
What is the purpose for using a compound assignment operator ?																
Write the shortcut for each math operation using the compound math operator .	<table border="1" data-bbox="559 371 1498 508"> <tr> <td data-bbox="559 371 731 413">+</td> <td data-bbox="731 371 902 413">-</td> <td data-bbox="902 371 1073 413">*</td> <td data-bbox="1073 371 1245 413">/</td> <td data-bbox="1245 371 1498 413">% %</td> </tr> <tr> <td data-bbox="559 413 731 456">$x = x + 1$</td> <td data-bbox="731 413 902 456">$x = x - 1$</td> <td data-bbox="902 413 1073 456">$x = x * 2$</td> <td data-bbox="1073 413 1245 456">$x = x / 2$</td> <td data-bbox="1245 413 1498 456">$x = x \% 2$</td> </tr> <tr> <td data-bbox="559 456 731 508"></td><td data-bbox="731 456 902 508"></td><td data-bbox="902 456 1073 508"></td><td data-bbox="1073 456 1245 508"></td><td data-bbox="1245 456 1498 508"></td> </tr> </table> <p data-bbox="559 508 731 551">(increment)</p> <p data-bbox="731 508 902 551">(decrement)</p>	+	-	*	/	% %	$x = x + 1$	$x = x - 1$	$x = x * 2$	$x = x / 2$	$x = x \% 2$					
+	-	*	/	% %												
$x = x + 1$	$x = x - 1$	$x = x * 2$	$x = x / 2$	$x = x \% 2$												
What is code tracing ?																
Use the tracing tables to trace through the following codes. Then, write the output for each.	<pre data-bbox="559 751 1111 1132"> int x = 0; int y = 5; int z = 1; x++; y -= 3; z = x + z; x = y * z; y %= 2; z--; System.out.println("x = " + x); System.out.println("y = " + y); System.out.println("z = " + z); </pre> <p data-bbox="559 1153 654 1195">Output:</p>															
	<p data-bbox="1139 751 1323 794">Tracing Table:</p> <table border="1" data-bbox="1147 794 1498 984"> <tr> <td data-bbox="1147 794 1245 836">x</td> <td data-bbox="1245 794 1343 836">y</td> <td data-bbox="1343 794 1498 836">z</td> </tr> <tr> <td data-bbox="1147 836 1245 984"></td> <td data-bbox="1245 836 1343 984"></td> <td data-bbox="1343 836 1498 984"></td> </tr> </table> <pre data-bbox="559 1379 1111 1664"> int a = 7; int b = 2; int c = a - b; a = a - 6; b++; c = c--; System.out.println("a = " + a); System.out.println("b = " + b); System.out.println("c = " + c); </pre> <p data-bbox="559 1685 654 1727">Output:</p>	x	y	z												
x	y	z														

Compound Operators Maze (in pairs)

Working in pairs, choose a path through the operator maze below. Begin at the START box and navigate your way to END box. The objective is to obtain the largest possible score by the time you reach END. The rules are:

1. You may choose any path that keeps you within the outer boundaries of the game board.
2. You may traverse as many boxes as you wish with some restrictions.
3. You may travel a maximum of 3 straight boxes at a time, then you must change direction.
4. You may not pass through any box you have previously passed through.
5. You may not cross a path you have previously traversed.
6. Upon completing your path from START to END, total your score for all the boxes you passed through.
7. Is there a different path that ends up with higher x value at the end than the one you obtained?

START $x = 10$	$x *= 10$	$x += 2$	$x -= 1$	$x /= 3$	$x \% = 10$	$x /= 5$
$x /= 3$	$x /= 10$	$x -= 2$	$x \% = 1$	$x \% = 3$	$x \% = 10$	$x \% = 5$
$x \% = 3$	$x \% = 2$	$x /= 2$	$x *= 1$	$x *= 3$	$x *= 10$	$x *= 5$
$x *= 3$	$x++$	$x--$	$x += 1$	$x += 3$	$x += 10$	$x += 5$
$x += 3$	$x /= 10$	$x -= 2$	$x -= 1$	$x -= 3$	$x = 10$	$x = 5$
$x -= 3$	$x *= 10$	$x += 2$	$x -= 1$	$x /= 3$	$x \% = 10$	$x \% = 10$
$x /= 3$	$x /= 10$	$x -= 2$	$x \% = 1$	$x \% = 3$	$x \% = 10$	END $x = _____$

When you have completed your journey, compare your results with other pairs in the class. What's the highest possible x value? _____

Notice that the “END” cell is surrounded by % 10. What does % 10 do to any number?

Compound Operators (Individual Practice)

Fill in each blank in each of the columns. Let int x = 100 be the value of x at the start of each column.

int x = 100; $x += 3$ _____ $x += 25$ _____ $x += -10$ _____ $x *= 2$ _____ $x *= 10$ _____	int x = 100; $x /= 3$ _____ $x /= 25$ _____ $x *= -10$ _____ $x /= 5$ _____ $x /= 2$ _____	int x = 100; $x \% = 3$ _____ $x \% = 25$ _____ $x *= -10$ _____ $x += 5$ _____ $x /= 2$ _____	int x = 100; $x -= 3$ _____ $x -= 25$ _____ $x -= -10$ _____ $x -= 5$ _____ $x -= 2$ _____
--	---	---	---

Questions	Answers / Descriptions / Examples
What is type casting ?	
What is the output of each of the following?	<pre data-bbox="561 346 1290 620">public class OperatorTest2{ public static void main(String[] args) { System.out.print(1/4 + ", "); System.out.println(1.0/4); System.out.println(1/4.0); System.out.println((double)1/4); System.out.println((int)1.0/4); } }</pre> <p data-bbox="1334 346 1428 375">Output:</p>
What does Java assume when doing division with integers?	
List two different ways to get a double result when doing division in Java.	
What code is needed to round a double value to the nearest positive integer ?	
What code is needed to round a double value to the nearest negative integer ?	
Complete the blanks in the code to round the result of dividing 9 by 2 to the correct nearest integer.	<pre data-bbox="561 1182 1428 1453">public class NearestIntPractice{ public static void main(String[] args) { double number = 9.0/2; System.out.println("9.0/2 rounded to nearest int: " _____ } }</pre>
What is the value of Integer.MAX_VALUE ?	
What is the value of Integer.MIN_VALUE ?	
What is integer overflow ?	
What is the output? Can you explain the difference?	<pre data-bbox="561 1769 1269 1930">public static void main(String[] args) { int total = 25; System.out.println((double)(total/3)); System.out.println((double)total/3)); }</pre>

Questions	Answers / Descriptions / Examples
What type of computer language is Java?	
What is a class ?	
What are objects ?	
What are attributes or instance variables ?	
What are behaviors or methods ?	
<p>Complete the following class diagram to show some of the attributes and methods in the class Cat.</p> <p>Cat Objects</p> 	<p>Class: Cat</p> <p>List at least 3 Attributes:</p> <p>List at least 3 Methods:</p>
What is a dot operator used for?	
What does the code <code>yertle.forward()</code> do?	
What are method arguments ? Where will you find them in the code?	
What does the code <code>yertle.forward(50)</code> do?	
<i>Circle</i> all the items on the right that are <i>methods</i> .	<code>turnRight();</code> <code>display2(int a);</code> <code>Math.sqrt(9);</code> <code>turnLeft;</code> <code>object1.display(5);</code> <code>penUp;</code>

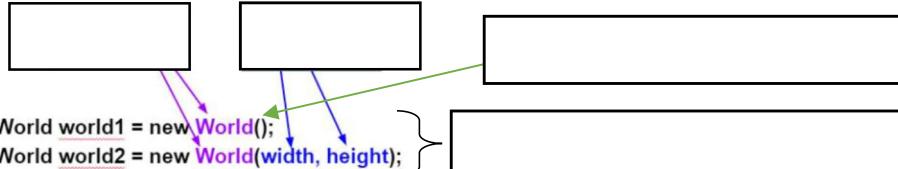
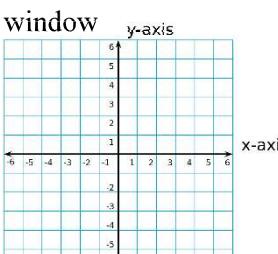
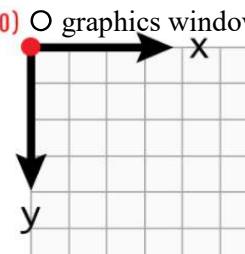
2.1 Answer these questions after Notes 2.1.

1. Which of the following represent the relationship between class - object? Circle all that apply.
 - a. peach - fruit
 - b. fruit - peach
 - c. mammal - squirrel
 - d. pencil - writingUtensil
2. Name 2 methods that may be called on a Turtle object.

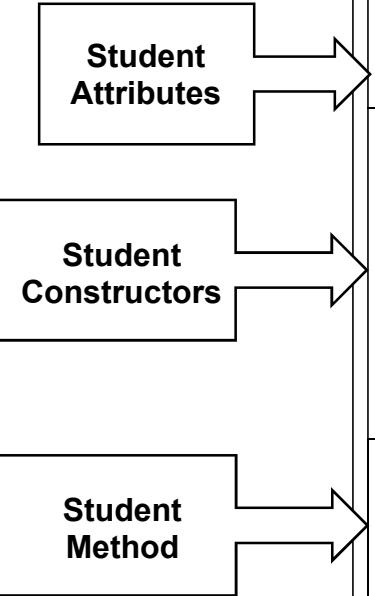
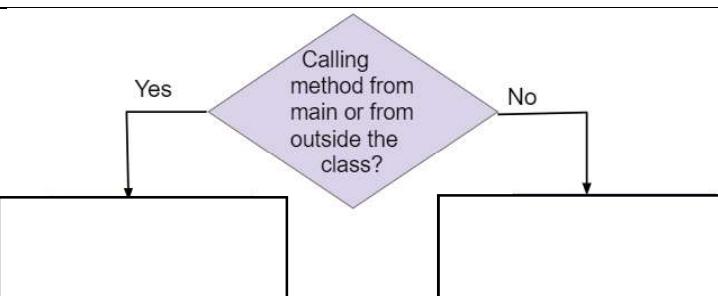
3. If you were to design a class to represent a Fraction, what 2 instance variables would be necessary?

2.2 Answer these questions after Notes 2.2.

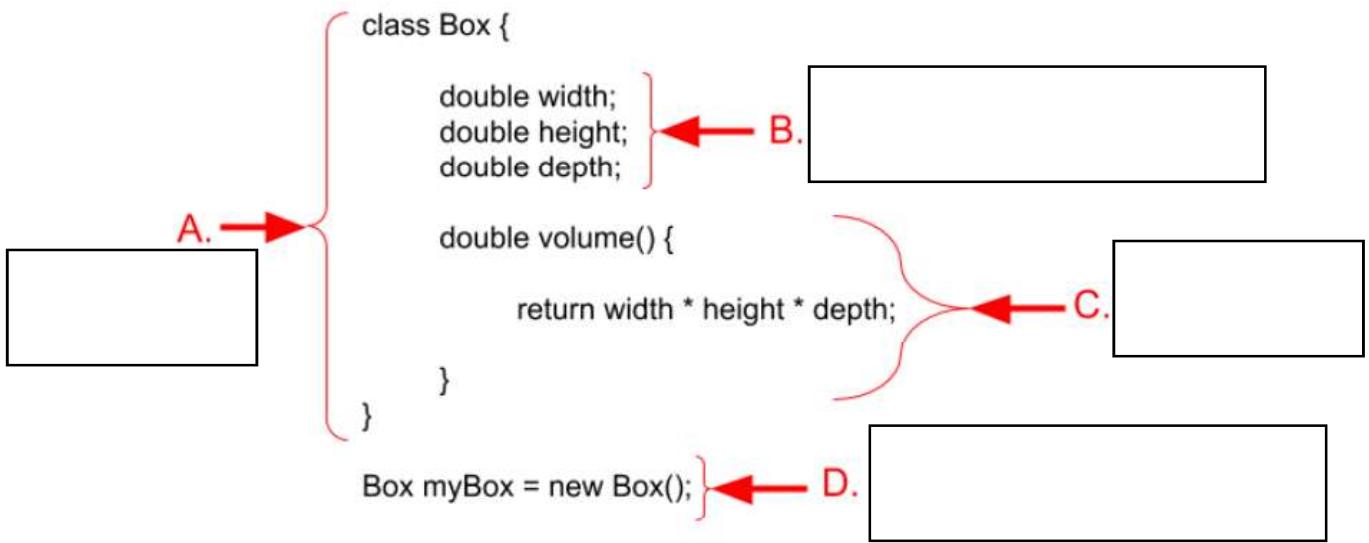
1. What is the purpose of a constructor?
2. If a class has multiple constructors, how does Java know which constructor to use?
3. Write the following code. Create an object called myDuck in a class called Duckies.

Questions	Answers / Descriptions / Examples
What are constructors used for?	
What is the keyword needed to create a new object ?	
What is the generic code needed to create a new object and call a constructor ?	// Code to create a new object and call a constructor
What will each line of code on the right create?	World habitat = new World(); Turtle t = new Turtle(habitat);
What is overloading the constructor?	
What is a no-argument constructor ?	
What is a parameter or actual parameter or argument ?	
Use the example of overloaded constructors to label the parts of the diagram & practice your vocabulary.	 <p>World world1 = new World(); World world2 = new World(width, height);</p>
Which of these images is a cartesian coordinate system versus a graphics window?	<input type="radio"/> cartesian coordinate system <input type="radio"/> graphics window 
	<input type="radio"/> cartesian coordinate system <input checked="" type="radio"/> graphics window 
Do the order of the parameters matter?	
What does it mean to declare an object variable and initialize it to null mean?	
What is a reference ? What holds a reference to an object?	

<p>Write the code to declare and initialize a new variable t1 that refers to a Turtle object in two ways. Using 2 lines of code and again using only one line of code.</p>	<pre>// declare & initialize (2 lines of code) World world1 = new World(); </pre>	<pre>// declare & initialize (1 line of code) World world1 = new World();</pre>
<p>What will constructor headers or signatures tell you?</p>		
<p>Look at the diagram:</p> <p>How many constructor signatures are there?</p> <p>Since the constructors have the same name but different # of parameters, what are they called?</p> <p>How many parameters are there in each of the constructors?</p>	<pre>public class Turtle { /** Constructs a Turtle object in the world w.*/ public Turtle(World w) { /* Implementation not shown */ } /** Constructs a Turtle object at coordinates x and y in the world w.*/ public Turtle(int x, int y, World w) { /* Implementation not shown */ } }</pre>	
<p>Use the diagram in Runestone after 2.2.5 Constructor Signatures to complete the following.</p> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Attributes </div> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Constructors </div>	<pre>public class Date{</pre> <p><i>// instance variables</i></p> <pre>{ /* implementation not shown */}</pre> <p><i>// a no-argument constructor signature to initialize instance variables</i></p> <pre>{ /* implementation not shown */}</pre> <p><i>// a constructor signature to initialize instance variables with given parameters</i></p> <pre>{ /* implementation not shown */}</pre>	
<p>Which are formal parameters versus actual parameters?</p>	<pre>Date birthdate = new Date(2005,9,1);</pre> <pre>public Date(int year, int month, int day) { ... }</pre>	
<p>What does call by value mean?</p>		

Questions	Answers / Descriptions / Examples
What are methods ?	
How do you call an object's method?	
What are object methods or non-static methods ?	
What must follow every method call?	
What is procedural abstraction ?	
Use the diagram in Runestone after 2.3.1 Procedure Abstraction to complete the following for the Student class.	<pre>public class Student{</pre> <p><i>// instance variables for Student attributes</i></p>
	<pre>// a no-argument constructor signature or header to initialize instance variables</pre> <p>{ /* implementation not shown */}</p> <p><i>// a constructor signature to initialize instance variables with given parameters</i></p> <pre>{ /* implementation not shown */}</pre>
	<p><i>// method signature or header to print Student attributes</i></p>
How do you call a method from the main method or from outside the class?	
What must be done BEFORE you call a method from main or from outside of the current class?	
What is NullPointerException ?	

Directions: Identify each part: **class, object, instance variables, method**



Questions	Answers / Descriptions / Examples			
How do you call an object's method and with actual parameters?				
Write a method signature that has one formal parameter.	access specifier return type method name parameter list			
Values provided in the parameter list MUST correspond to what? (Otherwise, you will get an Incompatible Types error)				
What are overloaded methods ?				

Questions	Answers / Descriptions / Examples
What is a void method ?	
What do get methods return?	
When you use a get method , what must you do?	
What is the return type of the following code?	<p>a) int getWidth() will return a(n) _____</p> <p>b) double getMean() will return a(n) _____</p> <p style="text-align: right;"><i>Data type of variable & return type MUST by the SAME</i></p>
What is the toString() method ? How is the method called automatically? (Use in ActiveCode 2.5.1.3)	<ul style="list-style-type: none"> • toString() is a common method that returns a value • called automatically to convert an object to a String by <code>System.out.println(objectName.toString()); OR</code> <p><code>System.out.println(objectName);</code></p>
What is a return statement in a method?	
Practice writing code: Write the method header /signature only! • See Notes 2.4 above for header format	<ol style="list-style-type: none"> 1. Write the header for a method called <code>example1</code> that can be accessed from other classes. This method takes in a boolean "understand" and a String "grade". It returns a double. 2. Write a public method header that accepts as parameters 2 doubles and 1 integer in this order and finds the middle and returns a boolean value.

Refer to the code below. For each question, write a line of code that will accomplish the given task. A list of methods for Simple Turtle is in the Resource tab of your Google Classroom.

```
public static void main(String[] args) {  
    World world = new World(300,300);  
    Turtle yertle = new Turtle(world);  
    // YOUR LINES OF CODE HERE  
}
```

1. Write a line of code that will declare a new turtle named myrtle.

2. Write lines of code that will set yertle's width to 100 and set yertle's height to 200.

3. Write a line of code that will print out myrtle's x coordinate position using `getXPos()`.

4. Write a line of code that will accomplish a left turn for myrtle.

5. Write a line of code that will print out yertle's height.

6. Write a line of code that will print out myrtle's width.

7. Write lines of code that will get and store myrtle's X and Y coordinates in two int variables, `x`, and `y`, respectively.

8. Write lines of code that store yertle's width and height into two int variables, `yWidth` and `yHeight`, respectively.

9. Write a line of code that will give the following output for myrtle's and yertle's coordinates.
Myrtle is at (200,100) and Yertle is at (100,200)

AP CSA: 2.5 Write Headers WS

access outside class / within declared class only

Header Format: **public/private returnType methodName (parameter list)**

Write method header only.

10. Write the header for a method called `problemOne` that can only be accessed within the class it's declared in. This method takes in a `String` called "text" and doesn't return anything.

11. Write the header for a method called `problemTwo` that can be accessed from other classes. This method takes nothing in and returns a `boolean`.

12. Write the header for a method called `problemThree` that can be accessed from other classes. This method takes in a `boolean` "testPassed" and an `integer` "score". It returns a `String`.

13. Write a public method header that accepts as parameters 2 `integers` and a `String` in this order and calculates maximum time of something and returns a `double` value.

14. Write a public method header that would work for this call:

```
double foodBag = object.feedTheDog(2, 10);
```


15. Write a public method header that would work for this call:

```
int given = presents("Christmas", 5, 3);
```


16. Write a public method header that would work for this call:

```
int thingy;
thingy = weightOnShoulders (5, 2.7, "heavy");
```

Questions	Answers / Descriptions / Examples	
What are Strings ?		
What is the easiest way to tell the difference between primitive types and class types ?	<u>Primitive types</u>	<u>Class types</u>
What do object variables refer to ?		
What is a string literal ?		
What class will all classes in Java inherit from at some point in their ancestry? (<i>Circle the answer using the diagram.</i>)	<pre> classDiagram greeting "object variable" --> Hello "String object" Hello --> String "String class" String --> Object "Object class" </pre> <p>The diagram illustrates the class hierarchy in Java. At the top right is the Object class, which contains methods equals and toString. Below it is the String class, which contains methods indexOf, substring, length, and compareTo. A vertical dashed line connects the two classes, labeled reference to parent class. To the left of the hierarchy is a box labeled String object containing the word Hello. A solid line connects the String object to the String class, labeled reference to class. Above the String object is a box labeled object variable containing greeting. A solid line connects the object variable to the String object, labeled reference to object.</p>	
What is concatenation ? What symbols are used to concatenate (or append) a string?		
Are spaces automatically added between strings?		
What happens if you put a variable inside quotes?		
What happens when you add other items to a string using the + operator?		
Write the output of the following.	a) <code>System.out.println("11" + 7 + 5);</code> Output: _____ b) <code>System.out.println("11" + (7 + 5));</code> Output: _____	
Can you explain why the outputs are different?		
What is a backslash escape sequence ?		

	<p>Strings are immutable.</p> <p>This means that String objects cannot be changed or manipulated. The only way to change a variable of type String is to reassign its value.</p> <p>What do you think is the output of the following code segment?</p> <pre>String student = "Jayden"; System.out.println(student); student = "Ian"; System.out.println(student);</pre> <p style="text-align: right;">Output:</p> <hr/>															
<p><u>Practice with concatenation:</u></p> <p>Determine the output for each of the following code segments.</p>	<pre>String firstName = "Keari "; String lastName = "Bjorgum"; String fullName = firstName + lastName; System.out.println(fullName);</pre> <p>Output: _____</p> <hr/> <pre>String greeting = "Hello"; greeting += " students!"; System.out.println(greeting);</pre> <p>Output: _____</p> <hr/> <pre>String senior = "Seniors"; int class = 2026; System.out.println(senior + " are " + "class");</pre> <p>Output: _____</p> <hr/> <pre>String senior = "Seniors"; int class = 2026; System.out.println(senior + " are " + class);</pre> <p>Output: _____</p> <hr/> <pre>String currentAge = "17"; int age = 10; System.out.println("In ten years I will be " + currentAge + age);</pre> <p>Output: _____</p> <hr/> <pre>int currentAge = 17; int age = 10; System.out.println("In ten years I will be " + (currentAge + age));</pre> <p>Output: _____</p> <hr/> <pre>String dialogue = "And then she said, \"Great work!\""; System.out.println(dialogue);</pre> <p>Output: _____</p> <hr/>															
<p>Useful escape sequences used in AP CSA</p>	<table border="1"> <thead> <tr> <th data-bbox="551 1706 763 1748">Escape Sequence</th><th data-bbox="763 1706 1122 1748">Function</th><th data-bbox="1122 1706 1504 1748">Output</th></tr> </thead> <tbody> <tr> <td data-bbox="551 1748 763 1790">\"</td><td data-bbox="763 1748 1122 1790">" \"Allows for quotations\" "</td><td data-bbox="1122 1748 1504 1790">"Allows for quotations"</td></tr> <tr> <td data-bbox="551 1790 763 1833">\\\</td><td data-bbox="763 1790 1122 1833">"Includes a backslash\\\"</td><td data-bbox="1122 1790 1504 1833">Includes a backslash\</td></tr> <tr> <td data-bbox="551 1833 763 1875">\n</td><td data-bbox="763 1833 1122 1875">"This creates \na line break"</td><td data-bbox="1122 1833 1504 1875">This creates a line break</td></tr> <tr> <td data-bbox="551 1875 763 1917">\t</td><td data-bbox="763 1875 1122 1917">"This adds a \ttab space"</td><td data-bbox="1122 1875 1504 1917">"This adds a tab space</td></tr> </tbody> </table>	Escape Sequence	Function	Output	\"	" \"Allows for quotations\" "	"Allows for quotations"	\\\	"Includes a backslash\\\"	Includes a backslash\	\n	"This creates \na line break"	This creates a line break	\t	"This adds a \ttab space"	"This adds a tab space
Escape Sequence	Function	Output														
\"	" \"Allows for quotations\" "	"Allows for quotations"														
\\\	"Includes a backslash\\\"	Includes a backslash\														
\n	"This creates \na line break"	This creates a line break														
\t	"This adds a \ttab space"	"This adds a tab space														

For each of the following, fill in the blanks using words from the word bank:*Word bank: upper case, lower case, strings, string literal, object, package, concatenation, null*

1. _____ in Java are objects that hold sequences of characters.
2. Class names begin with a(n) _____ letter while primitive types begin with a(n) _____ letter.
3. _____ is used to indicate that an object reference doesn't refer to any object yet.
4. A _____ is a set of characters enclosed in double quotes ("").
5. In `java.lang.String`, the `java.lang` part is the _____ name.
6. The parent class of the String class is the _____ class.
7. Strings can be appended to each other with the + or += symbols, also known as _____.

For each of the following, select "V" if the code segment is valid (no errors) or "I" if the code segment is invalid (contains errors).

<input type="radio"/> V <input type="radio"/> I 8. String value = 1234;	<input type="radio"/> V <input type="radio"/> I 9. String letter = A;
<input type="radio"/> V <input type="radio"/> I 10. String letter = "A";	<input type="radio"/> V <input type="radio"/> I 11. String firstName = "Elliott";
<input type="radio"/> V <input type="radio"/> I 12. String name = Ravi;	<input type="radio"/> V <input type="radio"/> I 13. "Keari" = String name;
<input type="radio"/> V <input type="radio"/> I 14. String phoneNumber = "(916) 686-0230";	
<input type="radio"/> V <input type="radio"/> I 15. String book = "I like "Harry Potter"";	

Use the following program segments and fill in the output for each of the following:

String name1 = "Bob"; String name2 = "The Builder"; System.out.println(name2 + name1); 16. _____	String animal = "Pigs"; String descriptor = "Little"; System.out.println("\\" + 3 + " " + descriptor + " " + animal + "!"); 17. _____
String thing1 = "Cat in"; String thing2 = "the"; String phrase = thing1 + " " + thing2 + " Hat"; 18. System.out.println("phrase"); _____	
19. System.out.println("I like \" + phrase + "\"!"); _____	
20. System.out.println("Bring " + thing2 + " " + thing1); _____	

Each of the methods below appear in a `Formula` class. Write each method based on the description given.

Example: Write a method named `computeCost` that is passed an `int` parameter named `numItems` and a `double` parameter named `costPerItem`. The method must return the cost of a customer buying `numItems` at the cost of `costPerItem`. Be sure to specify the method's return type and parameters.

```
public double computeCost(int numItems, double costPerItem)
{
    return numItems*costPerItem;
}
```

1. Complete the method named `computeAreaRectangle` so that it returns the area of a rectangle with length `len` and width `wid`. Assume that positive whole numbers are passed to the parameters `len` and `wid`. Be sure to specify the method's return type and parameters.

```
public _____ computeAreaRectangle(int _____, int _____)
{
    _____
}
```

2. Write a method named `computeCostAfterDiscount` that is passed a `double` parameter named `basePrice` and a `double` parameter named `discountRate`. The method must return the cost of a customer buying an item with a price of `basePrice` AFTER a discount of `discountRate` is applied. Be sure to specify the method's return type and parameters.

```
public _____ computeCostAfterDiscount(_____, _____)
{
    _____
}
```

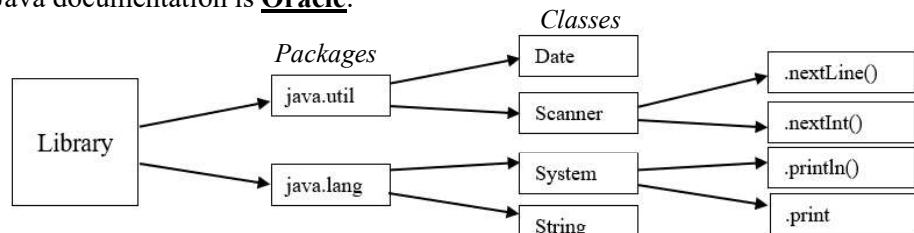
3. Write a method named `computeAreaTrapezoid`. The method must return the area of a trapezoid with measurements specified by the parameters. The formula for the area of a trapezoid is $A = \frac{(b_1 + b_2)h}{2}$. Make sure that your method accepts appropriately named parameters and that it includes the correct return type. You can assume that all parameters are integers.

```
public _____ computeAreaTrapezoid(
{
    _____
}
```

4. Write a method named `fahrenheitToCelsius` that is given the temperature in Fahrenheit, `F`, and returns the temperature in Celsius, `C`, using the formula: $C = \frac{5}{9}(F - 32)$. Make sure that your method accepts appropriately named parameters and that it includes the correct return type.

```
public _____ fahrenheitToCelsius(
{
    _____
}
```

Questions	Answers / Descriptions / Examples																
What is an index ?																	
What is the index of the first character in a string?																	
What is the length of a string ? What does the length of a string include?																	
What is the index of the last character in a string?																	
Find each String method on the Java Quick Reference Guide for the String Class (can be found in front of the first page of your notes in your workbook and also as a link in 2.7 link of Runestone), read the explanation and then complete the table with what each method returns.	<table border="1"> <thead> <tr> <th data-bbox="559 667 1049 741">String Method</th><th data-bbox="1049 667 1486 741">Returns</th></tr> </thead> <tbody> <tr> <td data-bbox="559 741 1049 804">String(String str)</td><td data-bbox="1049 741 1486 804"></td></tr> <tr> <td data-bbox="559 804 1049 868">int length()</td><td data-bbox="1049 804 1486 868"></td></tr> <tr> <td data-bbox="559 868 1049 931">String substring(int from, int to)</td><td data-bbox="1049 868 1486 931"></td></tr> <tr> <td data-bbox="559 931 1049 994">String substring(int from)</td><td data-bbox="1049 931 1486 994"></td></tr> <tr> <td data-bbox="559 994 1049 1058">int indexOf(String str)</td><td data-bbox="1049 994 1486 1058"></td></tr> <tr> <td data-bbox="559 1058 1049 1121">boolean equals(String other)</td><td data-bbox="1049 1058 1486 1121"></td></tr> <tr> <td data-bbox="559 1121 1049 1184">int compareTo(String other)</td><td data-bbox="1049 1121 1486 1184"></td></tr> </tbody> </table>	String Method	Returns	String(String str)		int length()		String substring(int from, int to)		String substring(int from)		int indexOf(String str)		boolean equals(String other)		int compareTo(String other)	
String Method	Returns																
String(String str)																	
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String substring(int from, int to)																	
String substring(int from)																	
int indexOf(String str)																	
boolean equals(String other)																	
int compareTo(String other)																	
What code is needed to return a single character in String str?																	
How does compareTo () work for String s1 and String s2?	s1.compareTo(s2);																
Is .equals () case sensitive?																	
What is the output of the following examples? <i>(Change the names of the string in ActiveCode Activity 2.7.2.1 to help you with the output)</i>	<pre data-bbox="559 1702 1486 1733">String s1 = "Bjorgum";</pre> <p style="text-align: right;">Output:</p> <pre data-bbox="559 1744 1486 1776">System.out.println(s1.compareTo("Bjorgum"));</pre> <pre data-bbox="559 1786 1486 1818">System.out.println(s1.compareTo("Bandy"));</pre> <pre data-bbox="559 1828 1486 1860">System.out.println(s1.compareTo("Reed"));</pre> <pre data-bbox="559 1871 1486 1902">System.out.println(s1.equals("bjorgum"));</pre> <pre data-bbox="559 1913 1486 1945">System.out.println(s1.equals("Bjorgum"));</pre>																

<p>Packages in Java are groups of related classes along with their methods, fields, and constructors. Packages are part of a programming library.</p> <p>The String class is part of the java.lang package and is available by default.</p>	<p>Use Google to find an API to learn about a class. The definitive source for Java documentation is Oracle.</p>  <p>Each class has an Application Programming Interface (API) that gives us instructions about how to use methods for the class.</p>
<p>What does it mean that strings are immutable?</p>	
<p>When will you get an IndexOutOfBoundsException?</p>	
<p>What is the toString() method?</p>	<p>The toString() method returns a string representing the class and its values. It is a common method found in many class documentations.</p> <p>Documentation for the toString() of the String class.</p> <div data-bbox="563 897 1085 1298" style="border: 1px solid black; padding: 10px;"> <p>toString</p> <pre>public String toString() This object (which is already a string!) is itself returned.</pre> <p>Specified by:</p> <pre>toString in interface CharSequence</pre> <p>Overrides:</p> <pre>toString in class Object</pre> <p>Returns:</p> <pre>the string itself.</pre> </div>
<p>Why do we need the toString() method?</p>	<p>If we try to print an object directly, we get the object's memory location instead of the values associated with the object.</p> <p>Look at the code segment below as an example:</p> <pre>Rectangle rect = new Rectangle(10, 4); System.out.println(rect);</pre> <p>Output: Rectangle@87c0942b</p> <p>If we write a <code>toString()</code> method in the class, this will override the object's existing <code>toString()</code> method so that we return the values we want represented when we print.</p> <pre>public String toString() { return "Rectangle width: " + width + " & height: " + height; }</pre> <p>// now when we print the object, Java recognizes the <code>toString()</code> method and uses it</p>
<p>What is the output after including the toString() method in the class?</p>	<p>Output: _____</p>

For problems 1 – 3, use the following declaration to answer the questions about these String methods.

```
String str = new String("Computer science students rock!");
```

1. Write the Java statement that would print the string “science students” from str using the substring method.

2. What string would be returned by the statement below?

```
String result = str.substring(3,9);
```

3. Write the two Java statements that would print “students rock!” from str using the two substring methods.

For problems 4 & 5, use the preconditions and postconditions to complete the two methods below.

4. // Precondition: str2 is a String variable with one or more chars.

```
// Postcondition: getFirst() returns the first character in str2.
```

```
public static String getFirst(String str2)
{
```

```
}
```

5. // Precondition: str2 is a String variable with one or more characters.

```
// Postcondition: getLast() returns the last character in str2.
```

```
public static String getLast(String str2)
{
```

```
}
```

For problems 6 – 12, use the following declaration to determine the output.

```
String subject = "AP CSA exam is in May.;"
```

- | | | | |
|--|-------|---|-------|
| 6. int length = subject.length();
System.out.println(length); | _____ | 9. System.out.println(subject.substring(17)); | _____ |
| 7. String firstPart = subject.substring(0,2);
System.out.println(firstPart); | _____ | 10. System.out.println(subject.indexOf(".")); | _____ |
| 8. String oneChar = subject.substring(4,5);
System.out.println(oneChar); | _____ | 11. System.out.print(subject.equals(firstPart)); | _____ |
| | | 12. System.out.print(subject.compareTo(oneChar)); | _____ |
| <p>13. Look at the three statements on the right. Which of the following will compile but have a runtime error? Explain why. Also, for the two without errors, what is the output?</p> <p>a. System.out.println("hello".substring(3));
 b. System.out.println("hello".substring(5));
 c. System.out.println("hello".substring(6));</p> | | | |

Questions	Answers / Descriptions / Examples						
What is a wrapper class ?							
What is the wrapper class for the primitive type int called?							
What is the wrapper class for the primitive double called?							
What is an underflow ?							
What is an overflow ?							
When would you use Integer.MIN_VALUE or Integer.MAX_VALUE?							
What is autoboxing ?	<p><u>Example of autoboxing:</u></p> <pre>Integer myInt = 3; Double myDouble = 2.5;</pre> <div style="border: 1px solid black; padding: 5px; margin-left: 20px;"> <i>(Notice that the data type must correspond to the correct wrapper class)</i> </div>						
What is unboxing ?	<p><u>Example of unboxing:</u></p> <pre>int myInt2 = myInt; // converts object back to primitive int type double myDouble2 = myDouble; // converts object back to primitive double</pre>						
Wrapper Class Methods (also in Java Quick Reference Guide)	<table border="1"> <thead> <tr> <th>Method</th><th>Use</th></tr> </thead> <tbody> <tr> <td>Integer.intValue()</td><td>Converts object Integer value into a primitive int value</td></tr> <tr> <td>Double.doubleValue()</td><td>Converts object Double value into a primitive double value</td></tr> </tbody> </table>	Method	Use	Integer.intValue()	Converts object Integer value into a primitive int value	Double.doubleValue()	Converts object Double value into a primitive double value
Method	Use						
Integer.intValue()	Converts object Integer value into a primitive int value						
Double.doubleValue()	Converts object Double value into a primitive double value						
What is the output for each of the examples?	<p><u>Integer Wrapper Class Example:</u></p> <pre>Integer intObject = new Integer(5); int i = intObject.intValue(); System.out.print("The value of i = " + i);</pre> <p>Output:</p> <p><u>Double Wrapper Class Example:</u></p> <pre>Double doubleObject = new Double(5.19); double d = doubleObject.doubleValue(); System.out.print("The value of d = " + d);</pre> <p>Output:</p>						

Questions	Answers / Descriptions / Examples															
What type of methods are in the Math class?																
How do you call static methods ?																
What does the method Math.random() return?																
What is the code needed to return a random integer into a range starting from the minimum number?																
What is the formula for the range ?																
Complete the table for num using type casting and Math.random() .	<table border="1"> <thead> <tr> <th>Code</th> <th>Interval</th> </tr> </thead> <tbody> <tr> <td>int num = (int)(Math.random()*10);</td> <td></td> </tr> <tr> <td>int num = (int)(Math.random()*10) + 1;</td> <td></td> </tr> <tr> <td>int num = (int)(Math.random()*6) + 5;</td> <td></td> </tr> <tr> <td>int num = (int)(Math.random()*20) - 10;</td> <td></td> </tr> <tr> <td></td> <td>$x \in \mathbb{Z}; x \in [0,10]$</td> </tr> <tr> <td></td> <td>$x \in \mathbb{Z}; x \in [12,25]$</td> </tr> </tbody> </table>		Code	Interval	int num = (int)(Math.random()*10);		int num = (int)(Math.random()*10) + 1;		int num = (int)(Math.random()*6) + 5;		int num = (int)(Math.random()*20) - 10;			$x \in \mathbb{Z}; x \in [0,10]$		$x \in \mathbb{Z}; x \in [12,25]$
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Math Methods (listed in the Java Quick Reference)	<table border="1"> <thead> <tr> <th>Static Math Method</th> <th>Returns</th> </tr> </thead> <tbody> <tr> <td>int abs(int x)</td> <td></td> </tr> <tr> <td>double abs(double x)</td> <td></td> </tr> <tr> <td>double pow(double base, double exponent)</td> <td></td> </tr> <tr> <td>double sqrt(double x)</td> <td></td> </tr> <tr> <td>double random()</td> <td></td> </tr> </tbody> </table>		Static Math Method	Returns	int abs(int x)		double abs(double x)		double pow(double base, double exponent)		double sqrt(double x)		double random()			
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Practice for Math Methods: What is the output for each of the following code?	<table border="1"> <thead> <tr> <th>Code</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>int x = Math.abs(-7); System.out.print("Absolute value of -7 is " + x);</td> <td></td> </tr> <tr> <td>double y = Math.abs(-8.5); System.out.print(y);</td> <td></td> </tr> <tr> <td>double z = Math.pow(2,3); System.out.print(z);</td> <td></td> </tr> <tr> <td>double r = Math.sqrt(144); System.out.print(r);</td> <td></td> </tr> <tr> <td>double randNum = Math.random() + 1; System.out.print(randNum);</td> <td></td> </tr> <tr> <td>int rand = (int)(Math.random()*10); System.out.print(rand);</td> <td></td> </tr> </tbody> </table>		Code	Output	int x = Math.abs(-7); System.out.print("Absolute value of -7 is " + x);		double y = Math.abs(-8.5); System.out.print(y);		double z = Math.pow(2,3); System.out.print(z);		double r = Math.sqrt(144); System.out.print(r);		double randNum = Math.random() + 1; System.out.print(randNum);		int rand = (int)(Math.random()*10); System.out.print(rand);	
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double randNum = Math.random() + 1; System.out.print(randNum);																
int rand = (int)(Math.random()*10); System.out.print(rand);																

Complete the table with the appropriate output based upon the Java code statement.

Statement	Output
1. System.out.println(Math.abs(-5));	
2. System.out.println(Math.abs(6));	
3. System.out.println(Math.abs(-5.2));	
4. System.out.println(Math.pow(4, 2));	
5. System.out.println(Math.pow(2, 5));	
6. System.out.println(Math.pow(3, 3));	
7. System.out.println(Math.sqrt(25));	
8. System.out.println(Math.sqrt(64));	
9. System.out.println(Math.random());	
10. System.out.println(Math.random() * 3);	
11. System.out.println((int)(Math.random()*10) + 2);	
12. System.out.println((int)(Math.random()*5) + 3);	
13. System.out.println((int)Math.random()*4 + 5);	
14. System.out.println((int)(Math.random()*50));	
15. System.out.println((int)(Math.random()*8) + 1);	

Complete the table with the appropriate print statement & Math.random() method that will obtain the given output. ($x \in \mathbb{R}$ means that x is a real number. $x \in \mathbb{Z}$ means that x is an integer.)

Statement	Output
16.	$x \in \mathbb{R}; x \in [0.0, 20)$
17.	$x \in \mathbb{R}; x \in [5.0, 25)$
18.	$x \in \mathbb{Z}; x \in [0, 20]$
19.	$x \in \mathbb{Z}; x \in [5, 25]$
20.	$x = 4, 5, 6$

Questions	Answers / Descriptions / Examples																					
What's the difference between = vs ==?	= vs ==																					
What are the relational operators in Java?	<table border="1" data-bbox="559 443 1504 781"> <thead> <tr> <th data-bbox="559 443 845 489">Relational Operator</th><th data-bbox="845 443 1057 489">Sign</th><th data-bbox="1057 443 1504 489">Examples evaluates to _____</th></tr> </thead> <tbody> <tr> <td data-bbox="559 489 845 536">Equal</td><td data-bbox="845 489 1057 536"></td><td data-bbox="1057 489 1504 536">3 == 4 _____</td></tr> <tr> <td data-bbox="559 536 845 582">Not Equal</td><td data-bbox="845 536 1057 582"></td><td data-bbox="1057 536 1504 582">3 != 4 _____</td></tr> <tr> <td data-bbox="559 582 845 629">Less Than</td><td data-bbox="845 582 1057 629"></td><td data-bbox="1057 582 1504 629">3 < 4 _____</td></tr> <tr> <td data-bbox="559 629 845 675">Greater Than</td><td data-bbox="845 629 1057 675"></td><td data-bbox="1057 629 1504 675">3 > 4 _____</td></tr> <tr> <td data-bbox="559 675 845 722">Less Than or Equal</td><td data-bbox="845 675 1057 722"></td><td data-bbox="1057 675 1504 722">3 <= 4 _____</td></tr> <tr> <td data-bbox="559 722 845 768">Greater Than or Equal</td><td data-bbox="845 722 1057 768"></td><td data-bbox="1057 722 1504 768">3 >= 4 _____</td></tr> </tbody> </table>	Relational Operator	Sign	Examples evaluates to _____	Equal		3 == 4 _____	Not Equal		3 != 4 _____	Less Than		3 < 4 _____	Greater Than		3 > 4 _____	Less Than or Equal		3 <= 4 _____	Greater Than or Equal		3 >= 4 _____
Relational Operator	Sign	Examples evaluates to _____																				
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Greater Than or Equal		3 >= 4 _____																				
How are they used?																						
What will they evaluate to?																						
<p>How can you use the % operator to:</p> <ul style="list-style-type: none"> • See if a # is Odd • See if a # is Even • Check divisibility (to see if a number is a multiple of x) • Get last digit from an integer • Get # of minutes left when you convert to hours 																						
<p>How can you check if a:</p> <ul style="list-style-type: none"> • Number is positive • Number is negative 																						

Given the following variable declarations, write what is printed as a result of each line of code in the blank space provided next to the print line statement.

```
int a = 2;
int b = 3;
int c = 4;
int d = 5;
int e = 10;
int number1 = 19;
int number2 = 38;
```

!false
IT'S FUNNY
'CAUSE IT'S
true

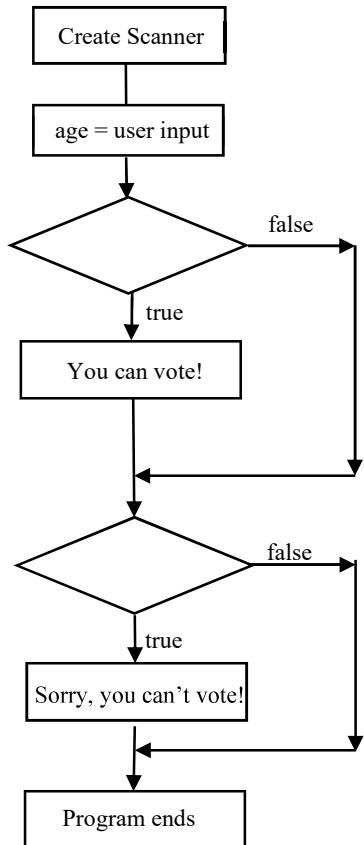
Statement	Output	Statement	Output
1. System.out.println(a == b);	_____	11. System.out.println(a%2);	_____
2. System.out.println(e/a == d);	_____	12. System.out.println(b%2);	_____
3. System.out.println(c != d);	_____	13. System.out.println(number1 %2);	_____
4. System.out.println(e < d);	_____	14. System.out.println(number2 %2);	_____
5. System.out.println(a+b >= d);	_____	15. System.out.println(number1 %10);	_____
6. System.out.println(2*a+1 < c);	_____	16. System.out.println(number2 %10);	_____
7. System.out.println(e - d >= c + 1);	_____	17. System.out.println(a%2 == 0);	_____
8. System.out.println(5*c < number1);	_____	18. System.out.println(b%2 > 0);	_____
9. System.out.println(d == (number1+1)/c);	_____	19. System.out.println(number2%2 > 0);	_____
10. System.out.println(number1 >= c*d);	_____	20. System.out.println(number1%b > 0);	_____
21. System.out.println(number2 % number1 == 0);	_____		

Given: int x = //some int value;
int number = //some int value;

Write the meaning of each of the following Boolean expressions.
22. number%2 == 0
23. number%2 > 0
24. number%x == 0
25. number%x > 0

Questions	Answers / Descriptions / Examples
What is a real-life example of an “if” or conditional statement?	
<p>How does a true or false “if” statement affect the control flow of a program?</p> <p>(Control flow = order of execution of statements in a program)</p>	<pre> graph TD D{ } --> P1[] P1 --> P2[] P2 --> D </pre>
<p>How do you code a conditional (if) statement?</p> <p>What are some important components of “if” statements?</p>	<p>//Code for a single if statement (which of the two options is the AP format?)</p> <p>//Code for a block of (more than one) if statements</p>
What are some common errors with if statements?	<p>Given the following Java main method, find three errors and fix them.</p> <pre> public static void main(String [] args) { int x = 5; int y = 0; // x and y should change only if x is equal to 6 if(x = 6); y = x; x = x + 1; } } </pre>

1. Complete the program control flow (◊) & code to print out whether a user is old enough to vote.



```

import java.util.*;

public class CanVote
{
    public static void main(String[] args)
    {
        Scanner userInput = new Scanner(System.in);
        System.out.println("Enter your age:");
        int age = userInput.nextInt();
        // If user is old enough to vote, print "You can vote!"

        System.out.println
    }
}
  
```

2. Create the method isSquare() for the Rectangle class that returns true if the rectangle is a square and returns false if it is not.

```

public class Rectangle
{
    private int base;
    private int height;

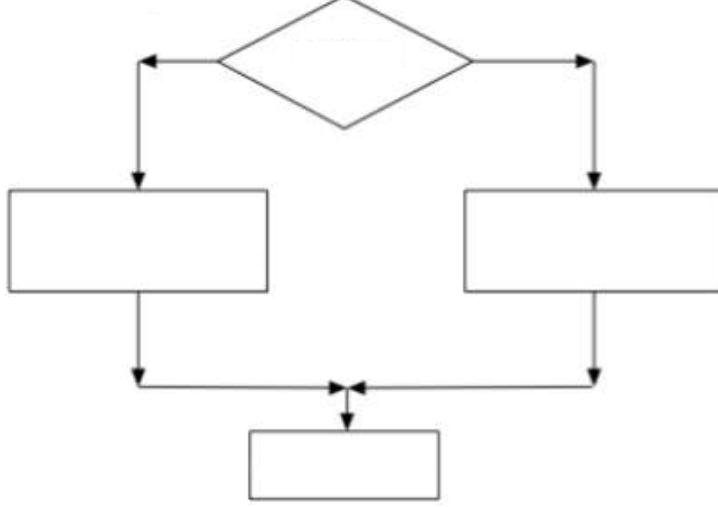
    public Rectangle(int rectBase, int rectHeight)
    {
        base = rectBase;
        height = rectHeight;
    }

    // Write the method signature for isSquare()
  
```

// Check whether base = height

// The rectangle is a square, so return true

// The rectangle is not a square, so return false

Questions	Answers / Descriptions / Examples
<p>What is the program flow chart (the order that statements will execute) in a conditional with TWO options?</p> <p>When will the “else” statement execute?</p>	 <pre> graph TD D{ } --> P1[] D --> P2[] P1 --> F[] P2 --> F </pre>
<p>What is the code format for if-else statements?</p>	<pre>//Code for a single if-else statement</pre> <pre>//Code for a block of if-else statements</pre>
<p>What is the code for a nested if with a dangling else?</p> <p>Which if statement will the dangling else belong to?</p>	
<p>Practice: Complete the main method of class ACT so that it generates a random integer ACT score from [1, 36]. This ACT value then must be used to determine if someone is admitted to college, based on requiring an ACT score of 21 or greater.</p>	<pre>public class ACT { public static _____ main(_____) }</pre>

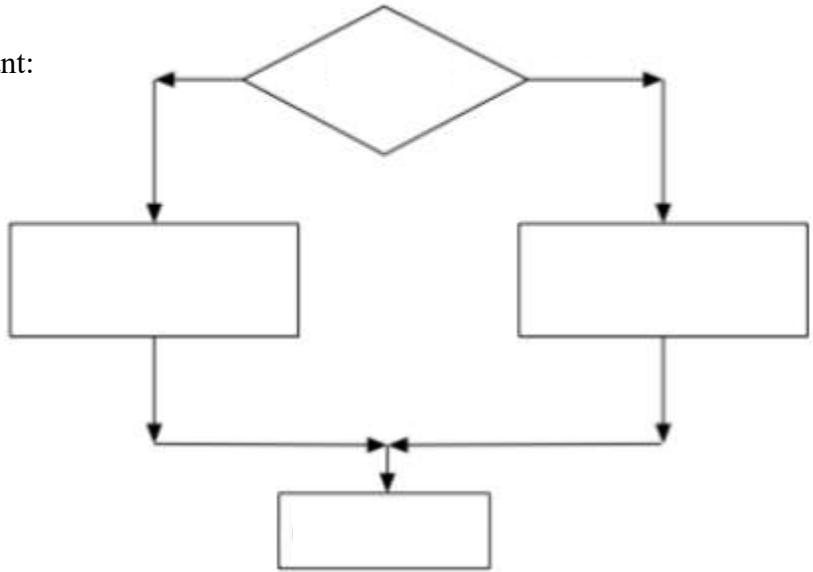
For #1 – 7, evaluate the following expressions and determine what the output would be if the segment were executed. If an error exists in the code segment, indicate with "error" and describe the reason for the error.

<pre>1. int num1 = 2; int num2 = 8; if (num1 > num2) System.out.println("cat"); else System.out.println("dog");</pre> <p>Output: _____</p>	<pre>2. String city = "HOUSTON"; if (city.equals("Houston")) System.out.println("baseball"); else System.out.println("football");</pre> <p>Output: _____</p>
<pre>3. int n1 = 12; int n2 = 5; int result = (n1 % n2); if (result == 0) System.out.println(n2 + " is a factor of " + n1); else System.out.println(n2 + " is NOT a factor of " + n1);</pre> <p>Output: _____</p>	<pre>4. int a = 3; int b = 5; int c = 7; boolean result = (c == b); if (result) System.out.println(a + b); else System.out.println(b - a);</pre> <p>Output: _____</p>
<pre>5. int a = 10; int b = 5; int remainder = a % b; if (remainder != 0) if (remainder == 1) System.out.print(a); else System.out.print(b);</pre> <p>Output: _____</p>	<pre>6. int val1 = 20; int val2 = 21; if (val1 >= val2) { if (val1 == val2) System.out.println(val2); else System.out.println(val1 - val2); } else System.out.println(val2 - val1);</pre> <p>Output: _____</p>
<pre>7. String word = new String("Awesome"); if (word == "Awesome") System.out.print("Yes"); else System.out.print("No");</pre> <p>Output: _____</p>	<p>What is the output if val1 = 21 and val2 = 20? Output: _____</p> <p>What is the output if val1 = 20 and val2 = 20? Output: _____</p>
<p>8. Consider the following code segment:</p> <pre>if (value > 0) System.out.println("positive"); if (value < 0) System.out.println("negative"); if (value == 0) System.out.println("neither");</pre>	<p>Rewrite the code on the left in the space below so that it uses an if-else structure instead of 3 if statements.</p>

9. Optional: Practice Writing Code by Hand

Write a program for restaurants to use to write bills. Add a method addTip() to the Bill class below that adds a 25% tip for parties with 8 or more people and a 20% tip for parties with fewer than 8 people. addTip() does not return a value.

Flowchart for calculating a bill at the restaurant:



```
public class Bill
{
    public double totalBill;
    public int numPeople;

    public Bill(double mealCost, int numInParty)
    {
        totalBill = mealCost;
        numPeople = numInParty;
    }
}
```

// Create the method signature

// Check if the number of people in the party is 8 or more

// Add 25% to the total owed

// few than 8 people in the dining party

// Add 20% to the total owed

}

Questions	Answers / Descriptions / Examples
<p>What is the flowchart for a conditional with THREE options?</p> <ul style="list-style-type: none"> • if (begins evaluation of a condition), keyword “if” required • else if (optional statement(s), follows an “if” statement, no limit to how many you can have in your code) • else (optional statement(s), follows an “if” statement, must be last to handle lingering cases) 	<pre> graph TD Start(()) --> Cond1{ } Cond1 -- True --> Proc1[] Cond1 -- False --> Cond2{ } Cond2 -- True --> Proc2[] Cond2 -- False --> Proc3[] Proc1 --> End(()) Proc2 --> End Proc3 --> End </pre>
<p>What is the code format for else-if statements?</p> <p>REQUIRED:</p> <ul style="list-style-type: none"> • must start with “if” statement <p>OPTIONAL:</p> <ul style="list-style-type: none"> • may add multiple “else if” statements to handle many different cases that may occur when your “if” statement is false • may add “else” statement to handle all cases not handled by “if” 	<pre>//Code for 3-way choice with else-if statement</pre>
<p>What are the three different selections in this unit and what statements are used to perform them?</p>	<p><u>Single selection</u> <u>Two-way selection</u> <u>Multi-way selection</u></p>

1. Write a program for restaurants to use to write bills. Add a method addTip() to the Bill class below that adds a 25% tip for parties with more than 8 people, a 20% tip for parties of 5 to 8 people, a 15% tip to parties of 2 to 4, and a 10% tip otherwise. addTip() does not return a value.

```
public class Bill
{
    public double totalBill;
    public int numPeople;

    public Bill(double mealCost, int numInParty)
    {
        totalBill = mealCost;
        numPeople = numInParty;
    }

    // Create the method signature

    // Check if the number of people in the party is more than 8

    // Add 25% to the total owed

    // Check if the number of people in the party is 5 to 8

    // Add 20% to the total owed

    // Check if the number of people in the party is 2 to 4

    // Add 15% to the total owed

    // Fewer than 2 in dinning party

}
```

2. Consider the following code segment.

```
boolean weekDay = /* missing code */;
boolean fever = /* missing code */;

if (weekDay)
{
    System.out.print("It's a weekday. ");
    if(fever==false)
        System.out.println("You are not sick! Go to school!");
    else
        System.out.println("You have a fever! Stay home!");
}
else
    System.out.println("It's the weekend! You can sleep in!" );
```

What is the output for the following boolean values for /* missing code */?

a) weekDay is false and fever is false

b) weekDay is false and fever is true

c) weekDay is true and fever is false

d) weekDay is true and fever is true

Multiple Choice: Select the best answer.

3. Consider that the following program segment and assume it is executed many times.

```
double x = Math.random() * 100;
if (x > 75)
    x += x;
else
    x -= x;
System.out.println(x);
```

What is the most frequent output?

- | | | |
|---------------------------------|---|---------|
| (A) A number between 75 and 100 | (C) 75.0 | (E) 0.0 |
| (B) A number less than 0 | (D) Output frequency cannot be determined | |

Questions	Answers / Descriptions / Examples																																																																	
What are the symbols for the boolean logical operators?	and	or	not																																																															
What is the precedent order for the boolean operators?	Order: 1) _____ 2) _____ 3) _____ 4) _____																																																																	
What are the truth tables for each operator?	<table border="1"> <thead> <tr> <th colspan="3">&& (and Operator)</th> </tr> <tr> <th>P</th> <th>Q</th> <th>P && Q</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td></td> </tr> <tr> <td>F</td> <td>T</td> <td></td> </tr> <tr> <td>T</td> <td>F</td> <td></td> </tr> <tr> <td>F</td> <td>F</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="3"> (or Operator)</th> </tr> <tr> <th>P</th> <th>Q</th> <th>P Q</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td></td> </tr> <tr> <td>F</td> <td>T</td> <td></td> </tr> <tr> <td>T</td> <td>F</td> <td></td> </tr> <tr> <td>F</td> <td>F</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">! (not Operator)</th> </tr> <tr> <th>P</th> <th>!P</th> </tr> </thead> <tbody> <tr> <td>T</td> <td></td> </tr> <tr> <td>F</td> <td></td> </tr> </tbody> </table>			&& (and Operator)			P	Q	P && Q	T	T		F	T		T	F		F	F		 (or Operator)			P	Q	P Q	T	T		F	T		T	F		F	F		! (not Operator)		P	!P	T		F																				
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What does short circuit evaluation mean?																																																																		
Complete the truth table for step #2 of the 3.5.4 Programming Challenge before coding in awesome.	<p>"If it's sunny, OR if the temperature is greater than 80 and it's not raining, I will go to the beach."</p> <table border="1"> <thead> <tr> <th>sunny</th> <th>temp > 80</th> <th>rain</th> <th>!rain</th> <th>temp > 80 && !rain</th> <th>Sunny (temp > 80 && !rain)</th> <th>Print: Go to the beach?</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td>T</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td>F</td> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>T</td> <td>F</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>F</td> <td>T</td> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>F</td> <td>T</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>F</td> <td>F</td> <td>T</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>F</td> <td>F</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			sunny	temp > 80	rain	!rain	temp > 80 && !rain	Sunny (temp > 80 && !rain)	Print: Go to the beach?	T	T	T					T	T	F					T	F	T					T	F	F					F	T	T					F	T	F					F	F	T					F	F	F				
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Note: for "and" & "or" operator, 2 simple statements → $2^2 = 4$ rows in the truth table. So, 3 simple statements (sunny, temp > 80, rain) → _____ rows																																																																		

1) Translate each of the following boolean expressions into Java.

English Statement	Java translation
a) The sky is blue or today is not Monday.	a) _____
b) It is not below 50 degrees outside and I am cold.	b) _____
c) A number is between 1 and 100.	c) _____

2) Create the truth table for #1c.

3) Which of the following expressions will short circuit when happy is true and pink is false? Circle all that apply.

- (A) ! happy && pink
 (B) happy || pink
 (C) pink || happy

4) Write the body of the method below given the following requirements.

You have three integers to work with: a, b, and c. If the numbers are all different from each other, print "unique". If all of the numbers are the same, print "boring". If two of the numbers are the same, print "twins!".

```
public void suchFun(int a, int b, int c)
```

Questions	Answers / Descriptions / Examples																																			
What are DeMorgan's Laws in Java?	<p>$!(a \&\& b)$ is equivalent to _____</p> <p>$!(a b)$ is equivalent to _____</p> <p>Ex1) $!(x < 5 \&\& y > 1) \rightarrow$ _____</p> <p>Ex2) $!(x < 5 y > 1) \rightarrow$ _____</p>																																			
How do you simplify negated boolean expressions that have relational operators $<$, $>$ and $=$?	<p>To negate: _____</p> <p>$!(c == d) \rightarrow$ _____ $!(c > d) \rightarrow$ _____</p> <p>$!(c != d) \rightarrow$ _____ $!(c <= d) \rightarrow$ _____</p> <p>$!(c < d) \rightarrow$ _____ $!(c >= d) \rightarrow$ _____</p>																																			
What can be used to prove that two boolean expressions are identical?																																				
<p>Complete the truth tables on the right to help you with #1-3 of the 3.6.4 Programming Challenge before coding in awesome.</p> <p>Are these boolean expressions equivalent?</p> <p>1) $!(x==0 x>=1)$</p> <p>2) $!(x==0) \&\& !(x>=1)$</p> <p>3) $(x!=0) \&\& (x<1)$</p>	<p>1)</p> <table border="1" data-bbox="561 868 1013 1220"> <thead> <tr> <th>$x==0$</th> <th>$x>=1$</th> <th>$x==0 x>=1$</th> <th>$!(x==0 x>=1)$</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td></td> <td></td> </tr> <tr> <td>T</td> <td>F</td> <td></td> <td></td> </tr> <tr> <td>F</td> <td>T</td> <td></td> <td></td> </tr> <tr> <td>F</td> <td>F</td> <td></td> <td></td> </tr> </tbody> </table> <p>3)</p> <table border="1" data-bbox="1037 836 1432 1220"> <thead> <tr> <th>$x!=0$</th> <th>$x<1$</th> <th>$(x!=0) \&\& (x<1)$</th> </tr> </thead> <tbody> <tr> <td>F</td> <td>F</td> <td></td> </tr> <tr> <td>F</td> <td>T</td> <td></td> </tr> <tr> <td>T</td> <td>F</td> <td></td> </tr> <tr> <td>T</td> <td>T</td> <td></td> </tr> </tbody> </table>	$x==0$	$x>=1$	$x==0 x>=1$	$!(x==0 x>=1)$	T	T			T	F			F	T			F	F			$x!=0$	$x<1$	$(x!=0) \&\& (x<1)$	F	F		F	T		T	F		T	T	
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<p>Practice MC: Circle the best answer. (Hint: Create a truth table to help you.)</p> <p>(Note: The boolean variables a and b have been declared and initialized.)</p>	<p>Which of the following best describes the conditions under which the expression will evaluate to true? $(a \&\& (b !a)) == (a \&\& b)$</p> <p>(A) Only when a is true (B) Only when b is true (C) Only when both a and b are true (D) The expression will never evaluate to true. (E) The expression will always evaluate to true.</p>																																			

For each of the compound expressions below, circle whether the expression will be true or false.

1) $18 > 15 \&& 16 > 14$ (A) True (B) False	2) $18 > 15 \&& 14 > 16$ (A) True (B) False	3) $15 > 18 \&& 16 > 14$ (A) True (B) False	4) $15 > 18 \&& 14 > 16$ (A) True (B) False
5) $18 > 15 16 > 14$ (A) True (B) False	6) $18 > 15 14 > 16$ (A) True (B) False	7) $15 > 18 16 > 14$ (A) True (B) False	8) $15 > 18 14 > 16$ (A) True (B) False

Complete the truth table to examine whether the expression is true or false. Compare the column of the first expression with the column containing the second expression (shaded in gray). If the results of the columns are identical, then the expressions are equivalent.

9) Is $!(P \&& Q)$ equivalent to $!P || !Q$?

P	Q	P && Q	$!(P \&& Q)$	$!P$	$!Q$	$!P !Q$
T	T					
T	F					
F	T					
F	F					

Is $!(P \&& Q)$ equivalent to $!P || !Q$? Circle one: Yes No (This is one of De Morgan's Laws)

10) Is $!(a || b)$ equivalent to $!a \&& !b$?

a	b	a b	$!(a b)$	$!a$	$!b$	$!a \&& !b$
T	T					
T	F					
F	T					
F	F					

Is $!(a || b)$ equivalent to $!a \&& !b$? Circle one: Yes No (This is one of De Morgan's Laws)

11) Is $!(P \&& Q)$ equivalent to $!P \&& !Q$?

P	Q	P && Q	$!(P \&& Q)$	$!P$	$!Q$	$!P \&& !Q$
T	T					
T	F					
F	T					
F	F					

Is $!(P \&& Q)$ equivalent to $!P \&& !Q$? Circle one: Yes No

Practice Writing Code:

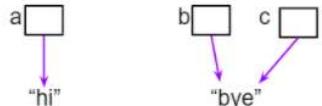
- 12) Suppose we have a website and want to create a program that asks the user to input a password to use when logging into our website. If the user chooses a password with 8 or more characters and starts with #, we will print “Password strength: Good”. If the password does not start with #, we will print “Include a # at the start of your password.” If the password has fewer than 8 characters, we will print “Make password at least 8 characters long.”

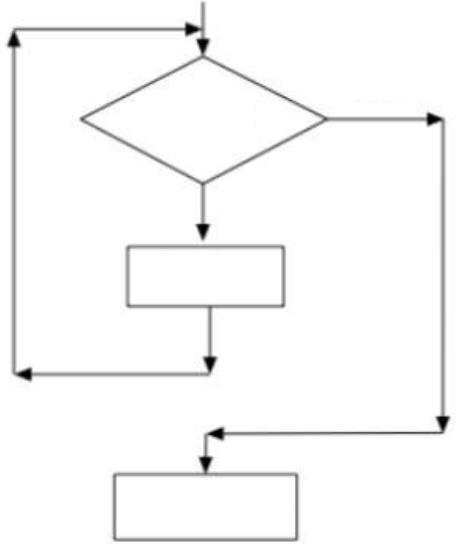
```
public class Password
{
    private String password;
    public Password(String passwordInput)
    {
        password = passwordInput;
    }
    public void passwordStrength()
    {
```

Truth table for passwordStrength() method

.length() >= 8	.startsWith("#")	output
true	false	include #
true	true	Good
false	not executed	make longer

- 13) Create the method isHealthy() that returns true if a user is healthy. isHealthy() receives the parameter temp. A user is healthy if their body temperature is greater than 95.6 and less than 100.3.

Questions	Answers / Descriptions / Examples																				
What are the differences between == and .equals() for checking String equality?	== vs. .equals()																				
What are aliases?	<p>Example of String aliases:</p> <pre>String a = new String("hi"); String b = new String("bye"); String c = b; // c is now an alias for b</pre> 																				
Why do we compare objects to null? What symbols are used to compare objects to null?																					
How do we trace code?	<p>Complete the _____ to help you trace the code in 3.7.4</p> <table border="1" data-bbox="559 1248 1188 1436"> <thead> <tr> <th>String</th><th>Gets value</th><th>Gets value</th><th>Gets value</th></tr> </thead> <tbody> <tr> <td>s1</td><td></td><td></td><td></td></tr> <tr> <td>s2</td><td></td><td></td><td></td></tr> <tr> <td>s3</td><td></td><td></td><td></td></tr> <tr> <td>s4</td><td></td><td></td><td></td></tr> </tbody> </table>	String	Gets value	Gets value	Gets value	s1				s2				s3				s4			
String	Gets value	Gets value	Gets value																		
s1																					
s2																					
s3																					
s4																					
Complete all the blanks on the right to summarize boolean expressions, operators & concepts.	<p>Operator precedence: 1) () 2) 3) != 4) 5) </p> <p>Logical conclusions:</p> <p>A && B is _____ only when both A and B are _____</p> <p>A B is _____ only when both A and B are _____</p> <p>Short circuit: A && B will short circuit when _____ is _____</p> <p>A B will short circuit when _____ is _____</p> <p>DeMorgan's Laws: !(A && B) is equivalent to _____</p> <p>!(A B) is equivalent to _____</p> <p>Other: !A is a legal java expression only when A is a _____</p>																				

Questions	Answers / Descriptions / Examples												
What are other names for a loop in programming?	Loop = _____ or _____ Use the Summary 4.1.6 to define an iteration statement :												
What is the purpose of a loop?													
What is the difference between an if statement verses a while statement?	_____ vs _____ <pre data-bbox="551 692 1506 834">if (condition) { statements; } while (condition) { statements; }</pre>												
What does the control flow look like for a Java while loop?	Control flow in a while loop												
What are the 3 steps to writing a loop?	 <p>Three Steps of Writing a Loop</p> <pre data-bbox="1073 903 1506 1474"> // before the while loop int loopVar = 1; 1. // in the loop header while (loopVar <= 10) 2. System.out.println(loopVar); // in the while loop body at // the end loopVar++; 3. </pre>												
What can you use to keep track of values of variables and how they change during each iteration of a loop?	<p>A _____ showing the values of all of the variables each time through the loop. Iteration 0 means before the loop</p> <table border="1" data-bbox="567 1695 861 1970"> <thead> <tr> <th>iteration</th> <th>var1</th> <th>var2</th> </tr> </thead> <tbody> <tr> <td>0</td> <td></td> <td></td> </tr> <tr> <td>1</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> </tr> </tbody> </table> <p>Studies have shown that students who create _____ like this do much better on code tracing problems on the MC exam.</p> <p>awesome 4-1-5 Trace</p> <p>awesome 4-1-6 Trace</p>	iteration	var1	var2	0			1			2		
iteration	var1	var2											
0													
1													
2													

What is an infinite loop ?	<p>An _____ is one that _____ because the _____ is always _____.</p> <p>Most infinite loops are accidental because you forgot to _____ (do Step 3 of writing a loop).</p>
What is an off-by-one error with loops?	<p>A loop that runs _____ or _____ times.</p> <p>Most off-by-one errors are usually caused by the _____ (miscoding Step 2 of writing a loop) and using the incorrect relational operator _____ or _____.</p>
What are ways to stop a loop prematurely?	<p>1)</p> <p>2)</p> <p>3)</p>
What is an example of a sentinel (a value that is not part of the data) or a flag (a boolean variable set to true when end of input is reached) used in input-controlled loops ?	<p>Input by user like: _____ or _____</p> <p>In the Magpie Chatbot Lab, what line of code determined if the program should stop (this is an example of an input controlled loop)? (You may need to refer to the Magpie replit code under the Main.java file.)</p>
<p>Practice Writing Code:</p> <p><i>Write the while loops to satisfy the stated requirements.</i></p>	<p>1. Write a while loop that will print the integers from 1 to 100 (inclusive), one number per line.</p> <pre>int num =</pre> <p>2. Write a while loop that will print the integers from 50 to -50 (inclusive), one number per line.</p> <pre>int num =</pre> <p>3. Given some positive integer n, write a while loop that will print the odd integers from $-n$ to n (inclusive), one number per line. The given number n may be even or odd.</p> <pre>int num =</pre>

Circle the best answer to each problem.

1. Consider the following method.

```
public int mystery(int num)
{
    int x = num;
    while (x > 0)
    {
        if (x/10 % 2 == 0)
            return x;
        x = x/10;
    }
    return x;
}
```

What value is returned as a result of the call

`mystery(1034)?`

- (A) 4
- (B) 10
- (C) 34
- (D) 103
- (E) 1034

2. Consider the following code segment.

```
int val = 48;
int div = 6;
while ((val % 2 == 0) && div > 0)
{
    if (val % div == 0)
    {
        System.out.print(val + " ");
    }
    val /= 2;
    div--;
}
```

What is printed when the code segment is executed?

- (A) 48 12 6
- (B) 48 12 6 3
- (C) 48 12 6 3 1
- (D) 48 24 12 6
- (E) 48 24 12 6 3

Write the while loops to satisfy the stated requirements.

3. Write a sentinel controlled while loop that will allow you to calculate the average low temperature for any month. The average temperature should be displayed as a properly calculated double value and print out the message “The average temperature is: ____”. Explain why you chose the sentinel value using the proper comment notation within your code. The code for the input of the initial temperature value is provided.

```
Scanner scan = new Scanner(System.in);
int temp = scan.nextInt();
```

4. Write a flag controlled while loop that will convert an input word to pig Latin and print out the original word & the word in pig Latin. The flag should be set to false when the word “end” is entered and no pig Latin word displayed. You may assume that the statement **pigLatin = pl.translate(word)** ; will convert the input word to pig Latin correctly. The code for the input of the initial word is provided. You may assume that at least one word will be translated.

```
Scanner scan = new Scanner(System.in);
String word = scan.nextLine();
String pigLatin;
```

5. Write a while loop that will count and print out the quantity of even numbers entered. The loop should stop when 0 is entered and 0 should not be counted. You may use any form of while loop you desire. The code for the input of the initial number is provided.

```
Scanner scan = new Scanner(System.in);
int number = scan.nextInt();
```

Questions	Answers / Descriptions / Examples																					
<p>What are the three parts of a for loop declaration?</p> <p>Bounds error ~ when a loop executes too many or too few times</p>	<p style="text-align: center;"><i>for loop declaration</i></p> <pre>for (_____; _____; _____) { loop body; }</pre> <p>Example: <code>for (int num = 5; num < 9; num++)</code></p> <p>{ } Needed when? { System.out.println(num); }</p> <p>Each of the three parts of a for loop must be separated by _____. In the example above, the loop control variable is _____.</p>																					
<p>Given a for loop and a while loop, identify the 3 parts</p> <ul style="list-style-type: none"> * initialization * condition * change <p>of each type of loop using a corresponding notation (i.e. underline, circle, & box) or 3 different highlight colors.</p>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding-bottom: 5px;">For loop</th> <th style="text-align: center; padding-bottom: 5px;">maps to</th> <th style="text-align: center; padding-bottom: 5px;">While loop</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding-top: 5px;"><code>for (int x = 3; x > 0; x--)</code></td> <td></td> <td style="text-align: center; padding-top: 5px;"><code>int x = 3;</code></td> </tr> <tr> <td style="text-align: center; padding-top: 5px;">{</td> <td></td> <td style="text-align: center; padding-top: 5px;">while (<code>x > 0</code>)</td> </tr> <tr> <td style="text-align: center; padding-top: 5px;"> System.out.println(x);</td> <td></td> <td style="text-align: center; padding-top: 5px;">{</td> </tr> <tr> <td style="text-align: center; padding-top: 5px;">}</td> <td></td> <td style="text-align: center; padding-top: 5px;"> System.out.println(x);</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center; padding-top: 5px;"> x = x - 1;</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center; padding-top: 5px;">}</td> </tr> </tbody> </table>	For loop	maps to	While loop	<code>for (int x = 3; x > 0; x--)</code>		<code>int x = 3;</code>	{		while (<code>x > 0</code>)	System.out.println(x);		{	}		System.out.println(x);			x = x - 1;			}
For loop	maps to	While loop																				
<code>for (int x = 3; x > 0; x--)</code>		<code>int x = 3;</code>																				
{		while (<code>x > 0</code>)																				
System.out.println(x);		{																				
}		System.out.println(x);																				
		x = x - 1;																				
		}																				
<p>What is the flow control for a for loop?</p>	<pre> graph TD Init[Initialization] --> Cond{Condition} Cond -- True --> Body[Body] Body --> Change[Change] Change --> Cond Cond -- False --> Next[Next] </pre>																					

What are two common patterns in for loops?	1) Count from _____ 2) Count from _____	
What variable is often used as a counter in for loops?		
What does each of the following code print? How many times will each loop run?	<pre>for (int i = 0; i < 5; i++) { System.out.print(i + " "); }</pre> <p>Output: _____ # of times loop runs: _____</p>	<pre>for (int i = 1; i <= 5; i++) { System.out.print(i + " "); }</pre> <p>Output: _____ # of times loop runs: _____</p>
How do you change the loop declaration in order to get a loop to count backwards? (Decrement down to 0 or 1)	Write a <i>for loop declaration</i> that will count from 10 down to 0.	
This code is supposed to print out numbers divisible by three from 0 to 102, inclusive, using a for loop and if statement. However, there are errors in the code.	<p><i>Fix the errors in the code.</i></p> <pre>public static void main(String [] args) { for(int i = 0; i < 102, i++); { if(i % 3 = 0) System.out.println(i); } }</pre>	
<u>Practice writing code:</u> Complete method getMean so that it will compute the mean of a set of consecutive integers from 1 to parameter n and then return the mean. You are expected to use a for loop structure to compute the sum of the integers.	<pre>// Postcondition: getMean returns the mean of [1,2,...n]. public static double getMean(int n) {</pre>	

AP CSA: 4.2 For Loops WS

Practice Writing Code

Name _____

Date _____ Period _____

For problems 1-4, circle the best answer to each problem.

1. Consider the following code segments. Code segment 2 is a revision of code segment 1 in which the loop increment has been changed.

Code segment 1

```
int sum = 0;
for (int k = 1; k <= 30; k++)
{
    sum+= k;
}
System.out.println("The sum is: " + sum);
```

Code Segment 2

```
int sum = 0;
for (int k = 1; k <= 30; k = k + 2)
{
    sum += k;
}
System.out.println("The sum is: " + sum);
```

Code segment 1 prints the sum of the integers from 1 through 30, inclusive. Which of the following best explains how the output changes from code segment 1 to code segment 2?

- (A) Code segment 1 and code segment 2 will produce the same output.
- (B) Code segment 2 will print the sum of only the even integers from 1 through 30, inclusive because it starts sum at zero, increments k by twos, and terminates when k exceeds 30.
- (C) Code segment 2 will print the sum of only the odd integers from 1 through 30, inclusive because it starts k at one, increments k by twos, and terminates when k exceeds 30.
- (D) Code segment 2 will print the sum of only the even integers from 1 through 60, inclusive because it starts sum at zero, increments k by twos, and iterates 30 times.
- (E) Code segment 2 will print the sum of only the odd integers from 1 through 60, inclusive because it starts k at one, increments k by twos, and iterates 30 times.

3. Consider the following code segment.

```
for (int k = 1; k <= 7; k += 2)
{
    System.out.print(k);
}
```

Which of the following code segments will produce the same output as the code segment above?

- (A) `for (int k = 0; k < 7; k += 2)`
`{`
 `System.out.print(k);`
`}`
- (B) `for (int k = 0; k <= 7; k += 2)`
`{`
 `System.out.print(k);`
`}`
- (C) `for (int k = 0; k <= 8; k += 2)`
`{`
 `System.out.print(k + 1);`
`}`
- (D) `for (int k = 1; k < 7; k += 2)`
`{`
 `System.out.print(k + 1);`
`}`
- (E) `for (int k = 1; k <= 8; k += 2)`
`{`
 `System.out.print(k);`
`}`

2. Consider the following two segments. Code segment II is a revision of code segment I in which the loop header has been changed.

Code segment I

```
for (int k = 1; k <= 5; k++)
{
    System.out.print(k);
}
```

Code segment II

```
for (int k = 5; k >= 1; k--)
{
    System.out.print(k);
}
```

Which of the following best explains how the output changes from code segment I to code segment II?

- (A) Both code segments produce the same output, because they both iterate four times.
- (B) Both code segments produce the same output, because they both iterate five times.
- (C) Code segment I prints more values than code segment II does, because it iterates for one additional value of k.
- (D) Code segment II prints more values than code segment I does, because it iterates for one additional value of k.
- (E) The code segments print the same values but in a different order, because code segment I iterates from 1 to 5 and code segment II iterates from 5 to 1.

4. Consider the following code segment.

```
for (int j = 1; j < 10; j += 2)
{
    System.out.print(j);
}
```

Which of the following code segments will produce the same output as the code segment above?

- (A) `int j = 1;`
`while (j < 10){`
 `j += 2;`
 `System.out.print(j);}`
- (B) `int j = 1;`
`while (j < 10){`
 `System.out.print(j);`
 `j += 2;}`
- (C) `int j = 1;`
`while (j <= 10){`
 `j += 2;`
 `System.out.print(j);}`
- (D) `int j = 1;`
`while (j >= 10){`
 `j += 2;`
 `System.out.print(j);}`
- (E) `int j = 1;`
`while (j >= 10){`
 `System.out.print(j);`
 `j += 2;}`

The following is two different codes of a while loop that will print out all the even numbers between 0 and 100 inclusive. Each number will be printed on its own line.

```
// Solution #1 using remainder operator  
int num = 0;  
while (num <= 100)  
{  
    if (num % 2 == 0)  
        System.out.println(num);  
    num++;  
}
```

```
// Solution #2 using increment by 2  
int num = 0;  
while (num <= 100)  
{  
    System.out.println(num);  
    num += 2;  
}
```

5. Rewrite the code for solution #1 above using a **for loop**.

6. Rewrite the code for solution #2 above using a **for loop** (notice that it does not have an if statement.)

7. Write a **for loop** so that the even numbers are printed from 100 to 0, inclusive.

Questions	Answers / Descriptions / Examples
What value should loops that process Strings start at?	Since the first character in a Java String is at index _____, and the last character is at _____, loops that process Strings should start at _____.
What are some String methods (see awesome 2.7) that are often used to process Strings?	<ul style="list-style-type: none"> • _____: returns the _____ of characters in a String object • _____: returns the _____ of the _____ occurrence of the String; returns _____ if not found • _____: returns the substring beginning at index from and ending at index (_____. Note that <code>s.substring(i, i + 1)</code> returns the character at index _____. • _____: returns substring (from, _____)
How do we code a method to remove a certain letter of a String using the String indexOf method to find certain characters in a string and a substring method to remove them using a while loop ? (It is HIGHLY recommended that you click on the Java visualizer after 4.3.1 to see the code step by step in order to trace the loop.)	<p>While “Remove” Loop (Remove all a’s in “awesome csa”)</p> <pre data-bbox="551 783 1506 1564"> public static void main(_____) { String s = "awesome csa"; int index = 0; System.out.println("Original string: " + _____); // while there is an a in s _____ { // Find and save the next index for an a _____ // Process the string at that index by removing the a at the index by // concatenating substring up to index and then rest of the string. _____ } // end loop System.out.println("String without a's: " + _____); } // end method </pre>
What type of loop should be used when you are looking for a certain character or substring in a string and do not know how many times the loop needs to run?	
What type of loop should be used when you want to visit every character in a String?	

How do we code a method to process every character in the String so that we can count the number of occurrences of a particular letter using a **for loop**?

For “Count occurrence of a letter” Loop (Count e’s in a given string)

```
public static _____  
{  
    String message = “e is the most frequent letter.”;  
    int count = _____  
    // loop through the entire string from 0 to length  
  
    _____  
    {  
        if (message.substring(i,i+1).equalsIgnoreCase(“e”))  
            count++;  
    } // end loop  
    System.out.println(_____);  
} // end method
```

How do we code a method that creates a new String that will reverse the letters of a given string using a **for loop**? (Use the exercise 4.3.22 ActiveCode to help you)

For “Reverse String” Loop (Reverse the letters in a given string)

```
public _____  
{  
    String orig = “Howdy”;  
    String origRev = “ ”;  
    String ithLetter;  
  
    _____  
    {  
        ithLetter = _____  
        // add the letter at index i to what’s already reversed  
        origRev = _____ + origRev;  
    } // end loop  
    System.out.println(orig + “ reversed is “ _____);  
} // end method
```

The next 3 questions below refer to the code on the right.

What would happen if you started the Reverse loop above at **1** instead of **0**?

What would happen if you used **<=** instead of **<** in your for loop header in the Reverse loop?

What would happen if you **changed the order** in which you added the ithLetter in origRev line of code?

Circle the best answer to each problem.

1. Consider the following code segment.

```
String str = "a black cat sat on a table";
int counter = 0;
for (int i = 0; i < str.length() - 1; i++)
{
    if (str.substring(i, i + 1).equals("a") &&
        str.substring(i + 1, i + 2).equals("b"))
    {
        counter++;
    }
}
System.out.println(counter);
```

What is printed as a result of executing this code segment?

- (A) 1 (B) 2 (C) 3 (D) 5 (E) 6

2. Consider the following method.

```
public static boolean mystery(String str)
{
    String temp = "";
    for (int k = str.length(); k > 0; k--)
    {
        temp = temp + str.substring(k - 1, k);
    }
    return temp.equals(str);
}
```

Which of the following calls to mystery will return true?

- | | |
|---------------------|---------------------|
| (A) mystery("no") | (D) mystery("nono") |
| (B) mystery("on") | (E) mystery("noon") |
| (C) mystery("nnoo") | |

3. Consider the following method.

```
public String wordPlay(String word)
{
    String str = "";
    for (int k = 0; k < word.length(); k++)
    {
        if (k % 3 == 0)
        {
            str = word.substring(k, k + 1) + str;
        }
    }
    return str;
}
```

The following code segment appears in another method in the same class as wordPlay.

```
System.out.println(wordplay("Computer Science"));
```

What is printed as a result of executing this code segment?

- | |
|------------|
| (A) C |
| (B) ci tm |
| (C) eeStm |
| (D) ncepC |
| (E) eeSepC |

Evaluate the following code segments and determine what the output would be when the segment is executed. If an error exists in the code segment, indicate with “error” and describe the reason for the error.

4. Code

```
String s = "It seems impossible until it's not.";

String target = "o";
int index = s.indexOf(target);

while(index >= 0)
{
    System.out.println("Location: " + index);
    s = s.substring(0, index) +
        s.substring(index+1);
    index = s.indexOf(target);
}
System.out.println(s);
```

Output**5. Code**

```
String word = "Wingardium Leviosa";
for(int x = 0; x < word.length(); x += 2)
{
    System.out.print(word.substring(x,x+1));
```

Output

6. Code	Output
<pre>String word = "Expelliarmus"; for(int x = 0; x<= word.length(); x--) { System.out.print(word.substring(x,x +1)); }</pre>	

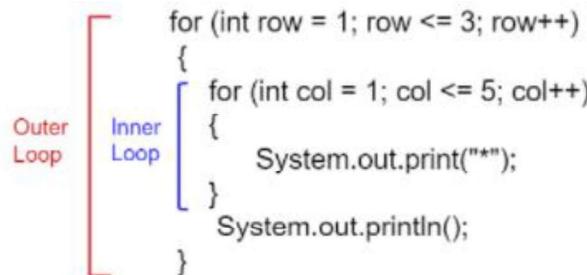
7. Code	Output
<pre>String word = "Alohomora"; for(int x = word.length()- 1; x >= 0; x--) { System.out.print(word.substring(x,x+1)); }</pre>	

8. Code	Output
<pre>String word = "Expecto Patronum"; String build = ""; for(int x = 0; x < word.length(); x++) { String lett = word.substring(x,x+1); if (x % 2 == 1) build = build + lett; } System.out.println(build);</pre>	

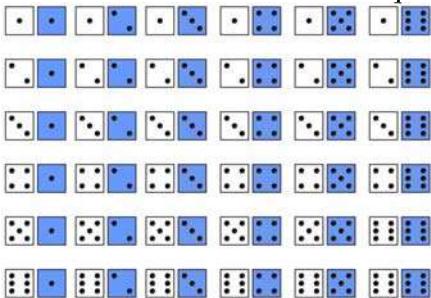
9. Code	Output
<pre>int x = 0; String phrase = "Harry Potter"; String build = ""; while(x<phrase.length()/2) { build += phrase.substring(0,x); x++; } System.out.println(build);</pre>	

10. Fill in the blanks to complete the code to display the number of occurrences of the letter 'e' in a String that is input by the user. Assume the String variable is called **name**.

```
int count=0;
for( int x = _____; x < _____ ; _____ )
{
    String lett = name._____ (_____, _____);
    if( _____
    _____
}
System.out.println_____
```

Questions	Answers / Descriptions / Examples
What is a nested loop ?	<p>A nested loop has _____.</p>  <p>In each iteration of the _____ loop, the _____ loop will be re-started. The _____ loop MUST finish all of its iterations BEFORE the _____ loop can continue to its next iteration.</p>
Where do nested iteration statements appear?	<p>Nested iteration statements appear in the _____ of another _____.</p>
Complete the code so that a rectangle with 3 rows and 7 columns of * will print.	<pre>public class NestedLoops { public _____ { for (int row = 1; row <= _____) { for (int col = 1; col <= _____) { System.out.print_____ } System.out.println(); } } }</pre>
How many times will each loop repeat?	<p>5 public class Nested03 6 { 7 public static void main(String[] args) 8 { 9 int count = 0; 10 for (int x = 1; x <= 3; x++) 11 { 12 for (int y = 1; y <= 4; y++) 13 { 14 for (int z = 1; z <= 5; z++) 15 { 16 count++; 17 } 18 } 19 } 20 System.out.println("count: " + count); </p> <p>Output: _____</p> <ul style="list-style-type: none"> The outer loop with int x, repeats _____ times. The middle-nested loop with int y, repeats _____ times. The third inner loop with int z, repeats _____ times. The inner loop number of executions equals the product of the nested loops. Hence, the value of count: _____.

1. Write the code of a nested for loop that will print all combinations of 2 dice. The image lists all the combinations.



Partial Output:

(1, 1) (1, 2) (1, 3), ...
(2, 1) (2, 2) ...
(3, 1) ...

2. Complete program **FR0402** so that it will compute and display all the combinations of quarters, dimes and nickels that add up to 50 cents. The output shown below must be computed with nested loop structures and cannot be “hard-coded” with multiple **println** statements.

Output:

```
0 Quarters + 0 dimes + 10 nickles == 50 cents
0 Quarters + 1 dimes + 8 nickles == 50 cents
0 Quarters + 2 dimes + 6 nickles == 50 cents
0 Quarters + 3 dimes + 4 nickles == 50 cents
0 Quarters + 4 dimes + 2 nickles == 50 cents
0 Quarters + 5 dimes + 0 nickles == 50 cents
1 Quarters + 0 dimes + 5 nickles == 50 cents
1 Quarters + 1 dimes + 3 nickles == 50 cents
1 Quarters + 2 dimes + 1 nickles == 50 cents
2 Quarters + 0 dimes + 0 nickles == 50 cents
```

```
public class FR0402
{
    public static void main(String[] args)
    {
```

Questions	Answers / Descriptions / Examples																																						
<p>Complete the tracing table for the coding exercise in awesome 4.5.1 to keep track of the variables and their values throughout each iteration of the loop.</p>	<p>Code 4.5.1</p> <table border="1" data-bbox="559 266 850 534"> <thead> <tr> <th>iteration</th><th>var1</th><th>var2</th></tr> </thead> <tbody> <tr><td>0</td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> </tbody> </table>	iteration	var1	var2	0			1			2			<p>MC Problem 4.5.2</p> <table border="1" data-bbox="858 266 1176 534"> <thead> <tr> <th>iteration</th><th>var1</th><th>var2</th></tr> </thead> <tbody> <tr><td>0</td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> </tbody> </table>	iteration	var1	var2	0			1			2			<p>MC Problem 4.5.3</p> <table border="1" data-bbox="1184 266 1516 534"> <thead> <tr> <th>iteration</th><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>0</td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> </tbody> </table>	iteration	x	y	0			1			2		
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What is it called when we analyze a loop to determine how many times they run?																																							
What is the formula to calculate how many times a loop executes ?																																							
If the loop uses counter \leq limit, what is the largest value?																																							
If the loop uses counter $<$ limit, what is the largest value?																																							
How do we find the TOTAL number of times nested loops run?																																							
<p>How many iterations are made in the following loops?</p>	<pre>for (int i=1; i<10; i++) { System.out.print("*"); }</pre>	<p>a) # of iterations: _____</p>	<pre>for (int i=1; i<=10; i+=2) { System.out.print("*"); }</pre> <p>b) # of iterations: _____</p>																																				
	<pre>for(int i=0; i<7; i++) { for(int j=1; j<=5; j++) { System.out.print("*"); } System.out.println(); }</pre>	<p>c) # of iterations: _____</p>	<pre>for(int i=1; i<=10; i++) { for(int j=0; j<10; j++) { System.out.print("*"); } System.out.println(); }</pre> <p>d) # of iterations: _____</p>																																				

Circle the best answer to each problem.

1. Consider the following code segment.

```
int counter = 0;
for (int x = 10; x > 0; x--)
{
    for (int y = x; y <= x; y++)
    {
        counter++; // line 6
    }
}
```

How many times will the statement in line 6 be executed as a result of running the code segment?

- (A) 0 (B) 1 (C) 10 (D) 11 (E) 20

2. Consider the following code segment.

```
int outerMax = 10;
int innerMax = 5;
for (int outer = 0; outer < outerMax; outer++)
{
    for (int inner = 0; inner <= innerMax; inner++)
    {
        System.out.println(outer + inner);
    }
}
```

How many values will be printed when the code segment is executed?

- (A) 45 (B) 50 (C) 55 (D) 60 (E) 66

3. The question refer to the following code segment.

```
int k = a random number such that 1 ≤ k ≤ n ;
for (int p = 2; p <= k; p++)
    for (int r = 1; r < k; r++)
        System.out.println("Hello");
```

What is the minimum number of times that Hello will be printed?

- (A) 0 (B) 1 (C) 2 (D) n - 1 (E) n - 2

4. The question refer to the following code segment.

```
int k = a random number such that 1 ≤ k ≤ n ;
for (int p = 2; p <= k; p++)
    for (int r = 1; r < k; r++)
        System.out.println("Hello");
```

What is the maximum number of times that Hello will be printed?

- (A) 2 (B) n - 1 (C) n - 2
(D) $(n-1)^2$ (E) n^2

Complete the tracing table and determine the output for each code segment

5. Code	Tracing Table	Output								
<pre>int i = 1, j = 1; while(i<=6 j<5) { i *= 2; j += 2; } System.out.println(i + " " + j);</pre>	<table border="1"> <thead> <tr> <th>Iteration #</th><th>i</th><th>j</th><th></th></tr> </thead> <tbody> <tr> <td></td><td></td><td></td><td></td></tr> </tbody> </table>	Iteration #	i	j						
Iteration #	i	j								

6. Code	Tracing Table	Output								
<pre>int i = 4, j = 8; while(i<=j && j!=0) { i = i+1; j = j-1; } System.out.println(i + " " + j);</pre>	<table border="1"> <thead> <tr> <th>Iteration #</th><th>i</th><th>j</th><th></th></tr> </thead> <tbody> <tr> <td></td><td></td><td></td><td></td></tr> </tbody> </table>	Iteration #	i	j						
Iteration #	i	j								

7. Code	Tracing Table				Output
	Iteration #	i	count		
<pre>int count = 0; for(int i=1; i<=6; i++) { System.out.print("\$"); count++; }</pre>					

8. Code	Tracing Table					Output
	Iteration #	i	j	count	count_i	
<pre>int count_i = 0, count=0; for(int i=0; i<6; i++) { for(int j=0; j<4; j++) { System.out.print("\$"); count++; } System.out.println(); count_i = count_i+1; }</pre>						

9. In problem #8, what does the variable **count** keep track of?

10. In problem #8, what does the variable **count_i** keep track of?

Questions	Answers / Descriptions / Examples
What vocabulary from Unit 2 will be needed to help understand Unit 5?	<p>Class – _____</p> <p>Objects – _____</p> <p>Things about the objects are called _____ or _____.</p> <p>Different String variables are also called _____.</p>
How do you write a class?	<pre>_____ _____ _____ ← class declaration ↑ name of class { // Body of a class goes in between the curly braces; }</pre>
What is the main method of a class used for?	
What are the names of the parts of the Person class?	<pre>public class Person { /* instance variables for Person attributes */ private String name; private String email; private String phoneNumber; /** a constructor to initialize the attributes * for a Person object with the given parameters*/ public Person(String initName, String initEmail, String initphoneNumber) { /* Implementation not shown */ } /* method to print Person attributes */ public void print() { /* Implementation not shown */ } }</pre>
Where does the execution of a code always start?	
What do instance variables do and what are they also called?	<p>Instance variables _____.</p> <p>Instance variables are also called _____, _____ or _____.</p>
How and when are instance variables declared?	<p>Instance variables should be declared _____.</p> <p>Private means that _____.</p> <p>Instance variables are usually declared _____. For example:</p> <pre>private _____ _____;</pre> <p style="text-align: center;">↑ type of variable ↑ name of variable</p>

What does it mean for OOP (Object Oriented Programming) to stress data encapsulation ?	<p>Data encapsulations is where _____.</p> <p>The data is _____ from harm by being kept _____.</p> <p>From the summary: Instance variables are encapsulated by using the _____.</p>						
What are methods ? How are they declared?	<p>Methods _____.</p> <p>Methods defined for an object can _____.</p>						
How do the keywords public vs private affect access to classes, data, constructors and methods?	<p style="text-align: center;">public vs private</p> <p>Methods can be _____ or _____, but they are usually public.</p> <p>Attributes should be _____ and only accessed by public members of the same class. Constructors are _____ so they can be accessed outside the class file.</p>						
How many public classes can be placed in one Java file?							
What does a return type void indicate?							
How do you call a method to do its job?							
What are the steps of Object Oriented Programming ?	<p>1) Decide _____</p> <p>2) Figure out _____</p>						
What are the names of the parts of a class diagram?	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px; vertical-align: top;"> Turtle - name: String - bodycolor: Color - width: int = 15 </td> <td style="width: 10%; padding: 5px; vertical-align: top;"> </td> <td style="width: 10%; padding: 5px; vertical-align: top;"> </td> </tr> <tr> <td style="padding: 5px; vertical-align: top;"> + forward() + turnLeft() + setwidth() </td> <td style="width: 10%; padding: 5px; vertical-align: top;"> </td> <td style="width: 10%; padding: 5px; vertical-align: top;"> </td> </tr> </table>	Turtle - name: String - bodycolor: Color - width: int = 15			+ forward() + turnLeft() + setwidth()		
Turtle - name: String - bodycolor: Color - width: int = 15							
+ forward() + turnLeft() + setwidth()							
5.1.4 What are your Class and Attributes for Monopoly?	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; height: 40px;"></td> <td style="width: 50%; height: 40px;"></td> </tr> <tr> <td style="width: 50%; height: 40px;"></td> <td style="width: 50%; height: 40px;"></td> </tr> </table>						

access outside class / within declared class only

Header Format: **public/private returnType methodName (parameter list)**

Write method header only.

1. Write the header for a method called `avgTemp` that can only be accessed within the class it's declared in. This method returns a `String` and accepts as parameters one `double` and one `String` and calculates the average temperature of a city for the current month.
 2. Write the header for a method called `cheerful` that can be accessed from other classes. This method does not return anything but accepts as parameters 3 `Strings` and prints out a cheerful sentence with the input in it.
 3. Write the header for a method called `maxScore` that can be accessed from other classes. This method returns an `integer` and accepts as parameters 2 `integers`.
 4. Write a public method header that returns a `double` and accepts as parameters 1 `String` and 2 `doubles` and calculates the speed of a student running to the lunch line.
 5. Write a public method header that would work for this call:
`int petra = score.golfGame(60, 2);`
 6. Write a public method header that would work for this call:
`double trapezoid = area(4.2, 3.0, 9.6);`
 7. Write a public method header that would work for this call:
`int workDay;
workDay = hourOfWork (7.5, 5, "easy");`

Questions	Answers / Descriptions / Examples
What do constructors do?	Constructors _____ _____
Where are constructors written in a new class?	Constructors are usually written _____ _____
What are some important things about constructors?	<p>Constructors MUST have the SAME NAME as the _____.</p> <p>Constructors have _____ return _____.</p> <p>Classes usually have _____ constructor. (Usually ≥ 2)</p> <p>1) A constructor that takes _____ 2) A constructor that takes _____</p>
Practice writing constructors for the Person class.	<pre>// default constructor: initialize instance vars to default empty strings public _____ { _____ } // constructor: initialize all 3 instance variables to parameters public _____ { _____ }</pre>
What happens in Java when there are no constructors written for a class?	
What happens when you pass object references as parameters to constructors or methods?	
What are constructor parameters and what do they provide?	

1. The Toy class is started below. Write three constructors for this class as explained in the comments below.

```
public class Toy
{
    private String toyName;
    private String toyMaker;
    private double toyCost;

    //default constructor

    //constructor which has two String parameters

    // constructor with three parameters

}
```

2. The Song class is provided below, but the constructors contain errors. Read the comments to determine the number of errors, then find, circle and fix. Each line of code can have zero, one, or more than one errors. If a line of code contains errors, rewrite it correctly to the right.

```
public class Song
{
    private String title;
    private String artist;
    private int trackMinutes;
    private int trackSeconds;

// default constructor contains 2 errors
public void Song
{
    title = artist = "";
    trackMinutes = trackSeconds = 0.0;
}

// 1-arg constructor contains 5 errors
public song(title)
{
    title = title;
    artist = 0;
    trackMinutes = "";
    trackSecond = 0;
}

// 2-arg constructor contains 3 errors
public Song(String t, a)
{
    t = title;
    a = artist;
    trackMinutes = trackSeconds = 0;
}

//4-arg constructor contains 4 errors
private Song(String t, String a, int min, int sec);
{
    title = t;
    artist = art;
    trackMin = min;
    trackSec = sec;
}
```

Questions	Answers / Descriptions / Examples
What are the three types of comments in Java (give symbols and description)?	
Since the compiler will skip over comments, what are the purpose of comments ?	
What are some examples of good commenting ?	
What is a precondition ?	Write an example of substring method precondition:
What is a postcondition ?	
5.3.5 List 4 steps that you must do to purchase <i>pay for an AP CSA exam online</i> . Be sure to <i>list the preconditions and postconditions</i> for each step.	
<u>Practice writing comments:</u> Above each method, describe what you think each method does using comments . Try to be as specific as possible about what is returned by each method.	The following class is from APCalendar question (2019 AP CS A exam): <pre data-bbox="445 1459 1465 2008"> public class APCalendar { private static boolean isLeapYear(int year){} public static int numberofLeapYears(int year1, int year2){} private static int firstDayOfYear(int year){} private static int dayOfYear(int month, int day, int year){} public static int dayOfWeek(int month, int day, int year){} }</pre>

Questions	Answers / Descriptions / Examples
What are other names for accessor methods ? What do accessor methods allow?	Also called: return methods , _____ or _____ Accessor methods _____
What two Java syntax features are required for return or get methods ?	
Complete the code for the accessor method called getName() for the Student class.	<pre>class Student { // instance variable name // getName() method example @return name } public static void main(String[] args) { // to call a get method, use objectName.getVarName() }</pre>
What are three common errors with return methods?	1) 2) 3)
What is the meaning of return by value ?	
What is returned when the expression is a reference to an object?	
What does the toString() method return?	
Use the Student class. <pre>public class Student { private int age; public Student (int a) { age = a; } }</pre>	// method getAge() @return age // method clone() @return copy of Student object

Decide whether the given information is for methods or constructors.

1) sets the initial values for the object's instance variables	<input type="radio"/> Method <input type="radio"/> Constructor
2) block of code that performs specific actions	<input type="radio"/> Method <input type="radio"/> Constructor
3) public void setGrade(int newGrade)	<input type="radio"/> Method <input type="radio"/> Constructor
4) public APClass(String student, int gradeLevel)	<input type="radio"/> Method <input type="radio"/> Constructor
5) has no return type	<input type="radio"/> Method <input type="radio"/> Constructor
6) public double getGPA()	<input type="radio"/> Method <input type="radio"/> Constructor
7) has same name as the class	<input type="radio"/> Method <input type="radio"/> Constructor
8) public int max(int num1, int num2)	<input type="radio"/> Method <input type="radio"/> Constructor

9) In the following code, **circle the method headers** and **underline the constructor headers**.

```
public class Dog
{
    private String name;
    private int age;
    private double weight;

    public Dog()
    {
        name = "Loki";
        age = 3;
        weight = 58.6;
    }

    public Dog(String n, int a, double w)
    {
        name = n;
        age = a;
        weight = w;
    }

    public void speak()
    {
        System.out.println("ruf");
    }

    public int getTreat(int num)
    {
        for (int i=1; i<num; i++)
            treat++;
        return treat;
    }
}
```

Questions	Answers / Descriptions / Examples		
What are other names for mutator methods ? What are mutator methods?	Also called: Set methods _____		
Complete the code for the mutator method called <code>setName()</code> for the <code>Student</code> class.	<pre> class Student { // instance variable name // setName() sets name to newName @parameter newName { } public static void main(String[] args) { // to call a set method, use objectName.setVarName(newValue) } </pre>		
What is the difference between set (mutator) and get (accessor) methods?	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"><u>set method</u></td> <td style="width: 50%; padding: 5px; vertical-align: top;"><u>get method</u></td> </tr> </table>	<u>set method</u>	<u>get method</u>
<u>set method</u>	<u>get method</u>		
Given the partial class <code>Student</code> , write the mutator methods for the five instance variables. <pre> public class Student{ private String lastName private String firstName private int age; private int grade; private double GPA; // Constructor public Student(String last, String first, int ag, int gr, double gpa) { lastName = last; firstName = first; age = ag; grade = gr; GPA = gpa; } } </pre>	// Write your mutator method below		

AP CSA: 5.1-5.5 MC Practice

1. Consider the following class definition.

```
public class ItemInventory{
    private int numItems;
    public ItemInventory(int num) {
        numItems = num;
    }
    public updateItems(int newNum) {
        numItems = newNum;
    }
}
```

Name	
Date	
Period	

A B C D E

1

2

3

4

5

6

7

Which of the following best identifies the reason the class does not compile?

- (A) The constructor header is missing a return type.
- (B) The updateItems method is missing a return type.
- (C) The constructor should not have a parameter.
- (D) The updateItems method should not have a parameter.
- (E) The instance variable numItems should be public instead of private.

2. The Car class will contain two string attributes for a car's make and model. The class will also contain a constructor.

```
public class Car
{ /* missing code */ }
```

Which of the following replacements for /* missing code */ is the most appropriate implementation of the class?

- (A)

```
public String make;
public String model;public Car(String myMake, String myModel)
{ /* implementation not shown */ }
```
- (B)

```
public String make;
public String model;
private Car(String myMake, String myModel)
{ /* implementation not shown */ }
```
- (C)

```
private String make;
private String model;
public Car(String myMake, String myModel)
{ /* implementation not shown */ }
```
- (D)

```
public String make;
private String model;
private Car(String myMake, String myModel)
{ /* implementation not shown */ }
```
- (E)

```
private String make;
private String model;
private Car(String myMake, String myModel)
{ /* implementation not shown */ }
```

3. The following method is intended to return a string containing the character at position n in the string str. For example, getChar("ABCDE", 2) should return "C".

```
/* missing precondition */
public String getChar(String str, int n)
{ return str.substring(n, n + 1); }
```

Which of the following is the most appropriate precondition for the method so that it does not throw an exception?

- (A) /* **Precondition:** 0 < n < str.length() - 1 */
- (B) /* **Precondition:** 0 <= n <= str.length() - 1 */
- (C) /* **Precondition:** 0 <= n < str.length() */
- (D) /* **Precondition:** n > str.length() */
- (E) /* **Precondition:** n >= str.length() */

4. Consider the following class definition. The class does not compile.

```
public class Player{  
    private double score;  
    public getScore(){  
        return score;}  
    // Constructor not shown  
}
```

The accessor method `getScore` is intended to return the score of a `Player` object. Which of the following best explains why the class does not compile?

- (A) The `getScore` method should be declared as `private`.
- (B) The `getScore` method requires a parameter.
- (C) The return type of the `getScore` method needs to be defined as `void`.
- (D) The return type of the `getScore` method needs to be defined as `String`.
- (E) The return type of the `getScore` method needs to be defined as `double`.

5. Consider the following class declaration.

```
public class Student {  
    private String firstName;  
    private String lastName;  
    private int age;  
  
    public Student(String firstName, String lastName, int age){  
        firstName = firstName;  
        lastName = lastName;  
        age = age;  
    }  
  
    public String toString(){  
        return firstName + " " + lastName;  
    }  
}
```

The following code segment appears in a method in a class other than `Student`. It is intended to create a `Student` object and then to print the first name and last name associated with that object.

```
Student s = new Student("Rohan", "Khatri", -1);  
System.out.println(s);
```

Which of the following best explains why the code segment does not work as expected?

- (A) The code segment will not compile because an object cannot be passed as a parameter in a call to `println`.
- (B) The code segment will not compile because `firstName`, `lastName`, and `age` are names of instance variables and cannot be used as parameter names in the constructor.
- (C) The code segment will not compile because the constructor needs to ensure that `age` is not negative.
- (D) The code segment will compile but the instance variables will not be initialized correctly because the variable names `firstName`, `lastName`, and `age` refer to the instance variables inside the constructor.
- (E) The code segment will compile but the instance variables will not be initialized correctly because the variable names `firstName`, `lastName`, and `age` refer to the local variables inside the constructor.

6. This question refers to the following declarations.

```
public class Point

{
    private double myX;
    private double myyY;

    // postcondition: this Point has coordinates (0,0)
    public Point()
    { /* implementation not shown */ }

    // postcondition: this Point has coordinates (x,y)
    public Point(double x, double y)
    { /* implementation not shown */ }

    // other methods not shown
}
```



```
public class Circle

{
    private Point myCenter;
    private double myRadius;

    // postcondition: this Circle has center at (0, 0) and radius 0.0
    public Circle()
    { /* implementation not shown */ }

    // postcondition: this Circle has the given center and radius
    public Circle(Point center, double radius)
    { /* implementation not shown */ }

    // other methods not shown
}
```

In a client program which of the following correctly declares and initializes `Circle circ` with center at (29.5, 33.0) and radius 10.0?

- (A) `Circle circ = new Circle(29.5, 33.0, 10.0);`
- (B) `Circle circ = new Circle((29.5, 33.0), 10.0);`
- (C) `Circle circ = new Circle(new Point (29.5, 33.0), 10.0);`
- (D)

```
Circle circ = new Circle();
circ.myCenter = new Point(29.5, 33.0);
circ.myRadius = 10.0;
```
- (E)

```
Circle circ = new Circle();
circ.myCenter = new Point();
circ.myCenter.myX = 29.5;
circ.myCenter.myY = 33.0;
circ.myRadius = 10.0;
```

7. Consider the definition of the `Person` class below. The class uses the instance variable `adult` to indicate whether a person is an adult or not.

```
public class Person
{
    private String name;
    private int age;
    private boolean adult;
    public Person (String n, int a)
    {
        name = n;
        age = a;
        if (age >= 18)
        {
            adult = true;
        }
        else
        {
            adult = false;
        }
    }
}
```

Which of the following statements will create a `Person` object that represents an adult person?

- (A) `Person p = new Person ("Homer", "adult");`
- (B) `Person p = new Person ("Homer", "23");`
- (C) `Person p = new Person ("Homer", 17);`
- (D) `Person p = new Person ("Homer", 23);`
- (E) `Person p = new Person ("Homer", true);`

Questions	Answers / Descriptions / Examples
What does procedural abstraction allow us to do?	
List the main reasons to use multiple methods (procedural abstraction) in your programs.	
What are the three steps to creating and calling a method ? (Write the example “template” as well for each step.)	
<p>Identify the formal parameters (parameters in the method header) vs the actual parameters (arguments in the local variables).</p> <p>Method signature/header</p> <p>In Summary: Values provided in the arguments in a method call need to correspond to the _____ and _____ of the parameters in the method signature</p>	<pre> mySong.verse("one", "thumb"); public void verse(String number, String rhyme) { System.out.println("This old man, he played " + number); System.out.println("He played knick knock on my " + rhyme); } mySong.verse("two", "shoe"); public void verse(String number, String rhyme) { System.out.println("This old man, he played " + number); System.out.println("He played knick knock on my " + rhyme); } </pre>

What does Java's call by value mean?	
What is aliasing ? (or what are aliases)	<i>** Problem with aliasing is that the intended change in one object can result in an unintended change in another object. **</i>
What is good programming practice in regards to mutable objects? (in Summary)	Recall: Strings are _____ objects (meaning that they cannot be changed by the method. Only a new changed copy of them can be made.
<p><i>Write the lines of code described by each comment.</i></p> <pre>public static void main(String arg[]) { int num1 = 2; int num2 = 4; System.out.println("num1: " + num1); System.out.println("num2: " + num2); add(num1, num2); subtract(num1, num2); multiply(num1, num2); // method call for intDivide(int n1, int n2) // method call for remainderDivide(int n1, int n2) } public static void add(int n1, int n2) { System.out.println("Add: "+(n1+n2)); }</pre>	<pre>public static void subtract(int n1, int n2) { // finish subtract method } public static void multiply(int n1, int n2) { // finish multiply method } public static void intDivide(int n1, int n2) { // finish integer divide method } public static void remainderDivide(int n1, int n2) { // finish remainder divide method }</pre>

Identify the code segments indicated in **bold** as: method header, method call, arguments (actual parameters), formal parameters, object name, method name, or error.

1. _____ 1. Math.pow(**2**, **8**);
2. _____ 2. **solution**.output("Hello", 5);
3. _____ 3. public void welcome(**String back**)
4. _____ 4. solution.**output**("Hello", 5);
5. _____ 5. **public void doStuff(String num)**
6. _____ 6. **solution.doStuff(27.5)**;
7. _____ 7. Helper help = new Helper();
int n1 = 12;
int n2 = 5;
help.doStuff(int n1, int n2);

8. Fill in the method header below with two formal parameters called **n1** and **n2**. The data passed in will be used as whole numbers.

public void addNums(_____, _____)

9. Fill in the method header with two parameters that will be used for a person's name and a dollar amount (in that order). You may create your own variable names.

public void mystery(_____, _____)

10. Fill in the method header that corresponds to the following method call. Variable names will vary.
example.doStuff("Bob", 45, 12.99);

public void _____(_____, _____, _____)

11. Consider the following method header in a class called Farm:

public void chicken(String name, double weight)

/* The chicken's name is "Charlie" and weighs 6.7 pounds. Below is the program segment in the main method. Write the method call to activate the chicken method. */

Farm animal = new Farm();

_____ (_____, _____);

Write the line(s) of code described in the comments. Use the calcAreaOfRect as examples.

```
public static void main(String args[])
{
    int length = 2;
    int width = 4;
    int triangleBase = 4;
    int triangleHeight = 4;
    int radius = 1;

    // method call for parameter method to calculate and print the area of a rectangle
    calcAreaOfRect(length, width);
```

12. // Write method call for parameter method to calculate and print the area of a triangle

13. / Write method call for parameter method to calculate and print the area of a circle

14. / Write method call for parameter method to calculate and print the circumference of a circle

}

```
// Complete parameter method to calculate and print the area of a rectangle
public static void calcAreaOfRect(int l, int w)
{
    System.out.println("Area of Rectangle: "+(l*w));
}
```

15. /* Write the complete parameter method to calculate and print the area of a triangle given that the area of a triangle is $0.5 * \text{base} * \text{height}$ */

16. /* Write the complete parameter method to calculate and print the area of a circle given that the area of a circle is $3.14159 * \text{radius}^2$ */

17. /* Write the complete parameter method to calculate and print the circumference of a circle given that the circumference of a circle is $2 * 3.14159 * \text{radius}$ */

Questions	Answers / Descriptions / Examples
<p>What are static variables?</p> <p>Where do you include the keyword static in the variable declaration?</p> <p>How many copies of a static variable allowed?</p> <p>What are some common uses for static variables?</p> <p>How are static variables called?</p>	
<p>What are static methods?</p> <p>Where do you include the keyword static in the variable declaration?</p> <p>What can static methods access or not access?</p> <p>How are static methods called?</p> <p>List any other information you found in 5.7 or the summary.</p>	
<p>Complete the template for how to code a static variable and static method.</p>	<pre>class ClassName { // static variable public _____ // static method public _____ { // implementation not shown } } // to call a static method or variable, use the ClassName System.out.println _____</pre>

Multiple Choice: Select the best answer.

1. Consider the following class definition.

```
public class Something
{
    private static int count = 0;
    public Something(){
        count += 5;
    }
    public static void increment(){
        count++;
    }
}
```

The following code segment appears in a method in a class other than Something.

```
Something s = new Something();
Something.increment();
```

2. Consider the following class definition.

```
public class WordClass
{
    private final String word;
    private static String max_word = "";
    public WordClass (String s)
    {
        word = s;
        if (word.length() > max_word.length())
        {
            max_word = word;
        }
    }
}
```

3. Consider the following class definition.

```
public class SomeClass
{
    private int x = 0;
    private static int y = 0;
    public SomeClass(int pX)
    {
        x = pX;
        y++;
    }
    public void incrementY()
    { y++; }
    public void incrementY(int inc)
    { y += inc; }
    public int getY()
    { return y; }
}
```

The following code segment appears in a class other than SomeClass.

```
SomeClass first = new SomeClass(10);
SomeClass second = new SomeClass(20);
SomeClass third = new SomeClass(30);
first.incrementY();
second.incrementY(10);
System.out.println(third.getY());
```

Which of the following best describes the behavior of the code segment?

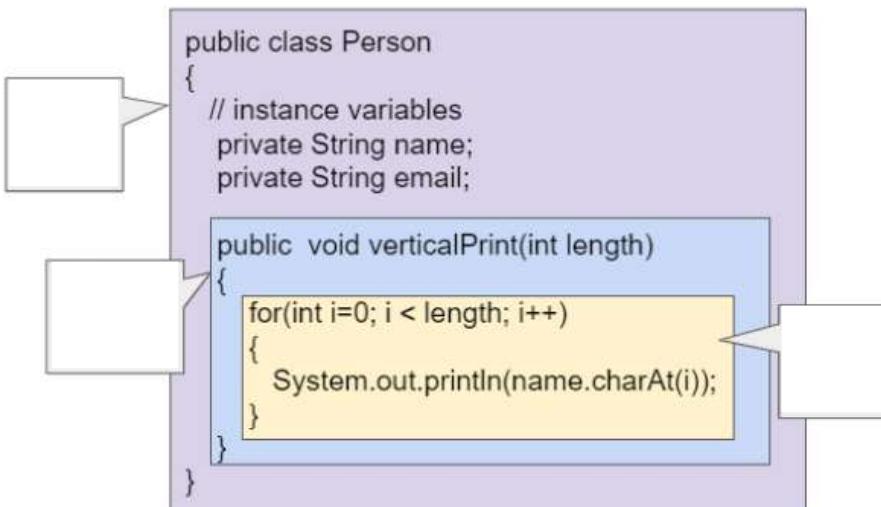
- (A) The code segment does not compile because the increment method should be called on an object of the class Something, not on the class itself.
- (B) The code segment creates a Something object s. The class Something's static variable count is initially 0, then increased by 1.
- (C) The code segment creates a Something object s. The class Something's static variable count is initially 0, then increased by 5, then increased by 1.
- (D) The code segment creates a Something object s. After executing the code segment, the object s has a count value of 1.
- (E) The code segment creates a Something object s. After executing the code segment, the object s has a count value of 5.

Which of the following is a true statement about the behavior of WordClass objects?

- (A) A WordClass object can change the value of the variable word more than once.
- (B) Every time a WordClass object is created, the max_word variable is referenced.
- (C) Every time a WordClass object is created, the value of the max_word variable changes.
- (D) No two WordClass objects can have their word length equal to the length of max_word.
- (E) The value of the max_word variable cannot be changed once it has been initialized

What is printed as a result of executing the code segment if the code segment is the first use of a SomeClass object?

- (A) 0
- (B) 1
- (C) 11
- (D) 14
- (E) 30

Questions	Answers / Descriptions / Examples
What is the scope of a variable?	
How is the scope determined?	
What are the 3 levels of scope in Java and what type of variables do they correspond to?	<p>_____ Level Scope for _____ inside a _____.</p> <p>_____ Level Scope for _____ inside a _____.</p> <p>_____ Level Scope for _____ and other local variables defined inside of _____ of code with _____.</p> <p><i>Complete the image with the names of the 3 levels of scope.</i></p>  <pre data-bbox="750 675 1224 1161"> public class Person { // instance variables private String name; private String email; public void verticalPrint(int length) { for(int i=0; i < length; i++) { System.out.println(name.charAt(i)); } } } </pre>
What are local variables ? How are they used? Where is the scope of a local variable?	
What happens when a local variable with the same name as an instance variable is used?	
What do you think will happen when two variables with the same name are in the same scope?	
Name the type of scope for the variables custodianHasKeys , teacherHasKeys , and index in the code at the right.	<pre data-bbox="554 1700 1485 1985"> public class WhoHasKeysInSchool { private boolean custodianHasKeys=true; public boolean classRoom(String[] studentNames) { boolean teacherHasKeys = true; for (int index = 0; index < studentNames.length; index++) { System.out.println(studentNames[index] + " does not have keys."); } } } </pre>

Questions	Answers / Descriptions / Examples
What and where is the keyword this used for? (this is also called the implicit parameter)	
What does this.variable indicate?	
Can this keyword be used inside a static method or to call a static method?	
How do programmers use the keyword this to distinguish between variables to avoid a naming conflict (when using the same name)?	<p>// variable name is an _____</p> <pre>private String name; // constructor public Person(String name) { // set this object's instance variable name to the parameter variable name _____ }</pre>
Where can this variable be used?	
Example of how to pass the implicit parameter this to a different method in a class (using this as a parameter).	<pre>public static void main (String[] args) { MyClass m1 = new MyClass("Batman"); m1.doSomething(); }</pre>
What is the output for the code at the right?	<pre>public class MyClass { private String name; public MyClass (String n){ name = n; } public String getName(){ return name; } public void doSomething(){ nowDoSomethingWith(this); // pass "this" to another method } public void nowDoSomethingWith(MyClass myObject) { System.out.println("I am " + myObject.getName()); } }</pre>

Questions	Answers / Descriptions / Examples										
What is an array ? [In this unit, it's also called a static 1D (dimensional) array]	An array is _____ that _____ of data items (called _____) of the _____ type.										
What is the code for declaring a single int variable vs. an array of integers ?	/* Declaration for a single int vs // Declaration for an array of int variable */										
How do you create an array ?	// Declare an integer array variable called highScores // Create the array with 5 elements										
Can you change the size of an array after it is initially set at the time of creation?											
What are the default array elements ?	<table border="1"> <thead> <tr> <th>Type</th><th>Default elements</th></tr> </thead> <tbody> <tr> <td>int</td><td></td></tr> <tr> <td>double</td><td></td></tr> <tr> <td>boolean</td><td></td></tr> <tr> <td>String</td><td></td></tr> </tbody> </table>	Type	Default elements	int		double		boolean		String	
Type	Default elements										
int											
double											
boolean											
String											
What can an array store? (Also in summary)											
Write the code for creating an array using an initializer list .											
What type of variable is the array length ? How do we access it?											
Write the line of code that will print out the length of an array called gpa.											

<p>What is the index of the first element of an array?</p> <p>What is the index of the last element of an array?</p>	<p>Index of first element:</p> <p>Index of last element:</p>	<p>Using an index outside of the range [0, length – 1] will result in the message</p>
<p>How do you use an indexed array variable to access or modify array items?</p>	<p>An indexed variable like _____ can be used anywhere a regular variable can be used.</p> <pre>// Change the third element in the highScores array to 99</pre> <pre>// Print the second element of the highScores array</pre>	
<p>Help with 6.1.5.5 ActiveCode</p>	<p>(int)(Math.random()*max) will return a number from _____ up to _____</p> <p>Complete the code that will allow you to pick out a random image for the ActiveCode public class ImageEx in awesome exercise 6.1.5.5.</p> <pre>int index = _____</pre>	
<p><u>Multiple Choice #1: Circle the best answer.</u></p> <p>Assume that an array of integer values has been declared as follows and has been initialized.</p> <pre>int[] arr = new int[10];</pre> <p>Which of the following code segments correctly interchanges the value of <code>arr[0]</code> and <code>arr[5]</code>?</p> <p>(A) <code>arr[0] = 5;</code> <code>arr[5] = 0;</code></p> <p>(B) <code>arr[0] = arr[5];</code> <code>arr[5] = arr[0];</code></p> <p>(C) <code>int k = arr[5];</code> <code>arr[0] = arr[5];</code> <code>arr[5] = k;</code></p> <p>(D) <code>int k = arr[0];</code> <code>arr[0] = arr[5];</code> <code>arr[5] = k;</code></p> <p>(E) <code>int k = arr[5];</code> <code>arr[5] = arr[0];</code> <code>arr[0] = arr[5];</code></p>	<p><u>Multiple Choice #2: Circle the best answer.</u></p> <p>Consider the following method.</p> <pre>public static int getValue(int[] data, int j, int k)</pre> <pre>{</pre> <pre> return data[j] + data[k];</pre> <pre>}</pre> <p>Which of the following code segments, when appearing in another method in the same class as <code>getValue</code>, will print the value 70?</p> <p>(A) <code>int arr = {40, 30, 20, 10, 0};</code> <code>System.out.println(getValue(arr, 1, 2));</code></p> <p>(B) <code>int[] arr = {40, 30, 20, 10, 0};</code> <code>System.out.println(getValue(arr, 1, 2));</code></p> <p>(C) <code>int[] arr = {50, 40, 30, 20, 10};</code> <code>System.out.println(getValue(arr, 1, 2));</code></p> <p>(D) <code>int arr = {40, 30, 20, 10, 0};</code> <code>System.out.println(getValue(arr, 2, 1));</code></p> <p>(E) <code>int arr = {50, 40, 30, 20, 10};</code> <code>System.out.println(getValue(arr, 2, 1));</code></p>	

1. Write a two-line declaration for a static array, called list, that stores 100 int values.

2. Write a one-line declaration for a static array, called list, that stores 100 int values.

3. Write a declaration for a static array with an initializer list of 5 double values.

4. What is the output of the following program segment?

```
String[] names= {"Ann","Bob","Sue","Tom"};
System.out.println(names[0]);
int n = names.length;
System.out.println(names[n]);
```

5. What is the output of the following program segment?

```
String[] names= {11,22,33,44,55};
System.out.println(names);
```

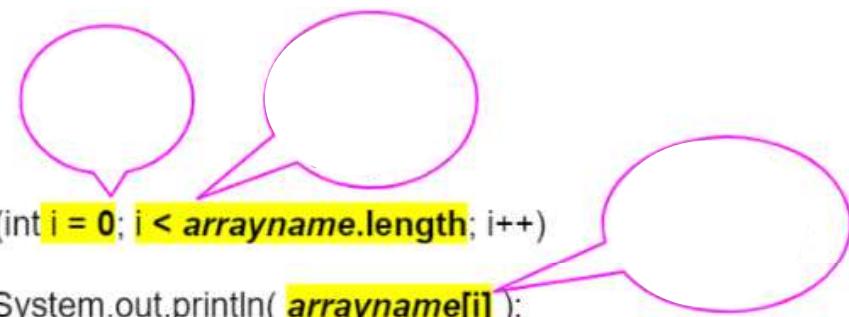
Answer the following questions after completing the programming challenge. Use the code in the 6.1.6 Programming Challenge in awesome as a reference. What will be the result of the following statements?

6. System.out.println(capital[2] + ", " + country[2]);

7. System.out.println(capital[3] + ", " + country[9]);

8. System.out.println(language[8] + " is spoken in the " + country[9]);

9. System.out.println("A picture of " + capital[4] + ", " + country[4] +
" is under the name " + filename[4]);

Questions	Answers / Descriptions / Examples
Notice that in the code at the right, a variable for the index of the array is used. Additionally, math can be done inside the [] as in the last line of the code. What does the code print out?	<pre>// highScores array declaration int[] highScores = { 10, 9, 8, 8}; // use a variable for the index int index = 3; // modify array value at index highScores[index] = 11; // print array value at index System.out.println(highScores[index]); System.out.println(highScores[index - 1]);</pre> <p>Code output:</p>
What does <u>traversing the array</u> entail?	<p>Traversing means to use _____</p>  <pre>for (int i = 0; i < arrayname.length; i++) { System.out.println(arrayname[i]); }</pre>
Why is using a variable as the index a powerful data abstraction (hiding unnecessary details from the user) feature?	<p>(An example of this is in awesome Activity 6.2.2.1 ActiveCode. You added your name to the array but did not need to change the for loop to see it since a variable index was used.)</p>
What does it mean that arrays are objects in Java ?	<p>Arrays in Java are objects. When arrays are _____ _____ _____ _____</p>
Circle and fix the “off by one” error and change the code so that the code will not get an ArrayIndexOutOfBoundsException message AND traverse EVERY element in the array.	<pre>public class OffByOne { public static void main(String[] args) { int[] scores = { 10, 9, 8, 7}; // Make this loop print out all the scores! for (int i = 1; i <= scores.length; i++) { System.out.println(scores[i]); } } }</pre>

For problems 1 – 5, what is the output for each code?

```
1. int[] nums = new int[10];
for(int i = 0; i < nums.length; i++)
{
    nums[i] = i*2;
}
System.out.println(nums[8]);
```

Output: _____

```
2. int[] ray = {3,22,25,9,27,-3,0,15,33};
int count = 0;
for(int i = 0; i <= ray.length-1; i++)
{
    if (ray[i]%3 == 0)
        count++;
}
System.out.println(count);
```

Output: _____

```
3. int[] array = {1,2,3,4,5,6};
int sum = 0;
for(int i = 0; i < array.length; i++)
{
    sum = sum + array[i];
}
System.out.println(sum);
```

Output: _____

```
4. int[] scores = {8,5,7};
int sum = 0;
for(int i = 0; i < scores.length; i++)
{
    sum += scores[i];
}
System.out.println(sum/scores.length);
```

Output: _____

```
5. int[] someNums = {1,2,2,3,1,2,2,1,3,3,2,2,2};
for(int i = 0; i <= someNums.length - 2; i++)
{
    if (someNums[i] == 2 && someNums[i + 1] == 2)
        System.out.print(i + " ");
}
System.out.println();
```

Output: _____

6. Answer the questions using the code below.

```
int[] numbers = {6,1,2,3,5};
int smallest = 0;
for(int x = 0;x<numbers.length;x++ )
{
    if(numbers[x]< smallest)
        smallest = numbers[x];
}
System.out.println(smallest);
```

- a) What algorithm is this code attempting to perform?
- b) Traverse the array and trace the code. What is the output?
- c) Fix the code on the left so that it will work as intended.

7. Complete method getMax below. If you need help, see our Google classroom (under resource) for a YouTube video Using a Loop to Access an Array. Begin the video at the 7 min mark to see how to code the for loop.

```
/* precondition: list is a non-empty array of doubles.
postcondition: getMax returns the largest double in an array called list. */
```

```
public static
```

Multiple Choice: Select the best answer.

8. Consider the following code segment, which is intended to print the sum of all elements of an array.

```
int[] arr = {10, 5, 1, 20, 6, 25};  
int sum = 0;  
for (int k = 0; k <= arr.length; k++)  
{  
    sum += arr[k];  
}  
System.out.println("The sum is " + sum);
```

A runtime error occurs when the code segment is executed. Which of the following changes should be made so that the code segment works as intended?

- (A) The `for` loop header should be replaced with `for (int k = 0; k < arr.length; k++)`.
- (B) The `for` loop header should be replaced with `for (int k = 0; k <= arr.length; k--)`.
- (C) The `for` loop header should be replaced with `for (int k = 1; k <= arr.length - 1; k++)`.
- (D) The statement in the body of the `for` loop should be replaced with `sum += arr[0]`.
- (E) The statement in the body of the `for` loop should be replaced with `sum += arr[k - 1]`.

9. Consider the following method that is intended to return the sum of the elements in the array `key`.

```
public static int sumArray(int[] key){  
    int sum = 0;  
    for(int i = 1; i <= key.length; i++)  
    {  
        /* missing code */  
    }  
    return sum;
```

Which of the following statements should be used to replace `/* missing code */` so that `sumArray` will work as intended?

- (A) `sum = key[i];`
- (B) `sum += key[i - 1];`
- (C) `sum += key[i];`
- (D) `sum += sum + key[i - 1];`
- (E) `sum += sum + key[i];`

10. Consider the following code segment.

```
int[] arr = {1, 2, 3, 4, 5, 6, 7};  
for (int i = 1; i < arr.length; i += 2)  
{  
    arr[i] = arr[i - 1];  
}
```

Which of the following represents the contents of the array `arr` after the code segment is executed?

- (A) `{0, 1, 2, 3, 4, 5, 6}`
- (B) `{1, 1, 1, 1, 1, 1, 1}`
- (C) `{1, 1, 3, 3, 5, 5, 7}`
- (D) `{1, 2, 3, 4, 5, 6, 7}`
- (E) `{2, 2, 4, 4, 6, 6, 7}`

11. Consider the following code segment, which traverses two integer arrays of equal length. If any element of arr1 is smaller than the corresponding (i.e., at the same index) element of minArray, the code segment should replace the element of minArray with the corresponding element of arr1. After the code segment executes, minArray should hold the smaller of the two elements originally found at the same indices in arr1 and minArray and arr1 should remain unchanged.

```
for (int c = 0; c < arr1.length; c++)
{
    if (arr1[c] < minArray[c])
    {
        arr1[c] = minArray[c];
    }
    else
    {
        minArray[c] = arr1[c];
    }
}
```

Which of the following changes will ensure that the code segment always works as intended?

- (A) Changing the Boolean expression in line 1 to `c <= arr1.length`
- (B) Changing the relational operator in line 3 to `>`
- (C) Removing lines 5–8
- (D) Swapping the positions of line 5 and line 9
- (E) Removing lines 7–10

12. Consider the following code segment.

```
boolean[] oldVals = {true, false, true, true};
boolean[] newVals = new boolean[4];
for (int j = oldVals.length - 1; j >= 0; j--)
{
    newVals[j] = !(oldVals[j]);
}
```

What, if anything, will be the contents of `newVals` as a result of executing the code segment?

- (A) {true, true, false, true}
- (B) {true, false, true, true}
- (C) {false, true, false, false}
- (D) {false, false, true, false}
- (E) The array `newVals` will not contain any values because the code segment does not compile.

13. Consider the following code segment.

```
int[] arr = {3, 1, 0, 4, 2};
for(int j = 0; j < arr.length; j++)
{
    System.out.print(arr[j] + j + " ");
}
```

What, if anything, is printed as a result of executing the code segment?

- (A) 3 1 0 4 2
- (B) 3 2 2 7 6
- (C) 6 2 0 8 4
- (D) 7 2 3 6 2
- (E) Nothing is printed, because an `ArrayIndexOutOfBoundsException` is thrown.

Questions	Answers / Descriptions / Examples	
Why is an <u>enhanced for each loop</u> easier to write than an indexed loop?		
What is the <u>code</u> to set-up a <u>for each loop</u> ?		
Complete the examples of the for each loop.	<pre> int[] highScores = { 10, 9, 8, 8}; String[] names = {"Jamal", "Emily", "Destiny", "Mateo"}; // for each Loop: for each value in highScores // for (type variable : arrayname) for (int _____) { // Notice no _____ or _____, just the variable called value System.out.println(value); } // for each Loop with a String array to print each name // the type for variable name is String! for (String _____) { System.out.println(name); } </pre>	
Why should we use the enhanced for each loop with arrays when possible?		
Rewrite the indexed for loop using a for each loop	<pre> int[] array = {10, 20, 30}; //indexed for loop for(int i = 0; i < 3; i++) System.out.println(array[i]); </pre>	<pre> int[] array = {10, 20, 30}; // enhanced for each loop </pre>
When should we use the enhanced for each loop with arrays? When should we NOT use for each loop with arrays?	Use for-each loops:	Do NOT use for-each loops:
Complete the getLargest() method to return the largest value in an integer array called vals. (Use the drop box code in 6.3.2 For each Loop Algorithm if you need help)	<pre> public int getLargest() { } </pre>	

DIRECTIONS: For each code segment below, complete the table. (Rewrite using either an enhanced for loop or an indexed for loop. Then, describe what the code does.)

- 1) `int[] ray = new int[size];`
`//assume ray is filled with values for all indexes from 0 to size-1`

indexed loop	for each loop	What does the code do?
<pre>int stuff = 0; for(int i = 0; i < size; i++) if(ray[i]%2 > 0) stuff++; return stuff;</pre>		
	<pre>int stuff = 0; for(int item : ray) if(item > 0) stuff += item; return stuff;</pre>	

- 2) Given the following code segment:

```
String[] animals = {"ant", "bird", "cat", "dog", "emu", "frog", "giraffe"};

for(int index = 1; index <= animals.length; i++)
    System.out.print(animals[index-1].substring(0,1));
```

- a) Rewrite using an enhanced for each loop

```
String[] animals =
```

```
for
```

- b) What is the output?

Questions	Answers / Descriptions / Examples	
What is an <u>algorithm</u> ?	An _____ is an unambiguous step-by-step sequence of instructions that solves a problem.	
What are two common array transversal loops that can be used for algorithms?	//enhanced for each loop for(int _____ { } }	//index for loop for(int _____ { } }
What are some common algorithms that you should be familiar with for the AP CSA exam?	<ul style="list-style-type: none"> Determine the _____ or _____ value in an array Compute a _____, _____ or _____ of array elements Search for a _____ in the array Determine if _____ element has a particular property Determine if _____ elements has a particular property Access all consecutive _____ of elements Determine the presence or absence of _____ elements Determine the _____ of elements meeting specific criteria Shift or _____ elements _____ or _____ the order of the elements _____ 	

Given the description of the algorithm, complete the following **METHODS** for an array called *list*.

Returns the <u>smallest number</u>	Returns the <u>largest number</u>	Returns the <u>sum of the numbers</u>
<pre>public static int getMin(int[] list) { int nbr = 9999; for (int item : list) if (item < _____) nbr = _____; return _____; }</pre>	<pre>public static int getMax(int[] list) { int nbr = 0; for (int item : list) if (item _____ nbr) nbr = item; return nbr; }</pre>	<pre>public static int getSum(int[] list) { int nbr = 0; for (_____ item : _____) nbr += item; return nbr; }</pre>
Returns the <u>mean of the numbers</u>		Reverses order of the numbers
<pre>public static int getSum(int[] list) { int nbr1 = 0; for (int item : list) nbr1 _____; // find sum return nbr1; } public static double getMean(int[] list) { int nbr1 = getSum(list); double nbr2 = (double) nbr1 / _____; return nbr2; }</pre>		<pre>public static void doReverse(int[] list) { int p = 0; int q = list.length-1; while (p <= q) { swap(list,list[p],list[q]); p++; q--; } } public static void swap(int[] list, int p, int q) { int temp = list[p]; list[p] = _____; list[q] = _____; }</pre>

Consider a software system that models a horse barn.

```
public class Horse
{
    /** @return the horse's name */
    String getName();
    /** @return the horse's weight */
    int getWeight();
    // There may be methods that are not shown.
}
```

A horse barn consists of N numbered spaces. Each space can hold at most one horse. The spaces are indexed starting from 0; the index of the last space is $N - 1$. No two horses in the barn have the same name.

The declaration of the HorseBarn class is shown below. You will write two unrelated methods of the HorseBarn class.

```
public class HorseBarn
{
    /** The spaces in the barn. Each array element holds a reference to the horse
     * that is currently occupying the space. A null value indicates an empty space.
     */
    private Horse[] spaces;

    /**
     * Returns the index of the space that contains the horse with the specified name.
     * Precondition: No two horses in the barn have the same name.
     * @param name the name of the horse to find
     * @return the index of the space containing the horse with the specified name;
     *         -1 if no horse with the specified name is in the barn.
     */
    public int findHorseSpace(String name)
    { /* to be implemented in part (a) */ }

    /**
     * Consolidates the barn by moving horses so that the horses are in adjacent spaces,
     * starting at index 0, with no empty space between any two horses.
     * Postcondition: The order of the horses is the same as before the consolidation.
     */
    public void consolidate()
    { /* to be implemented in part (b) */ }

    // There may be instance variables, constructors, and methods that are not shown.
}
```

- (a) Write the HorseBarn method `findHorseSpace`. This method returns the index of the space in which the horse with the specified name is located. If there is no horse with the specified name in the barn, the method returns -1.

For example, assume a HorseBarn object called `sweetHome` has horses in the following spaces.

0	1	2	3	4	5	6
"Trigger" 1340	null	"Silver" 1210	"Lady" 1575	null	"Patches" 1350	"Duke" 1410

The following table shows the results of several calls to the `findHorseSpace` method.

Method Call	Value Returned	Reason
<code>sweetHome.findHorseSpace("Trigger")</code>	0	A horse named Trigger is in space 0.
<code>sweetHome.findHorseSpace("Silver")</code>	2	A horse named Silver is in space 2.
<code>sweetHome.findHorseSpace("Coco")</code>	-1	A horse named Coco is not in the barn.

Complete method `findHorseSpace` in CSAwesome 6.4.1.2.

```

/** Returns the index of the space that contains the horse with the specified name.
 * Precondition: No two horses in the barn have the same name.
 * @param name the name of the horse to find
 * @return the index of the space containing the horse with the specified name;
 *         -1 if no horse with the specified name is in the barn.
 */
public int findHorseSpace(String name)

```

- (b) Write the `HorseBarn` method `consolidate`. This method consolidates the barn by moving horses so that the horses are in adjacent spaces, starting at index 0, with no empty spaces between any two horses. After the barn is consolidated, the horses are in the same order as they were before the consolidation.

For example, assume a barn has horses in the following spaces.

0	1	2	3	4	5	6
"Trigger" 1340	null	"Silver" 1210	null	null	"Patches" 1350	"Duke" 1410

The following table shows the arrangement of the horses after `consolidate` is called.

0	1	2	3	4	5	6
"Trigger" 1340	"Silver" 1210	"Patches" 1350	"Duke" 1410	null	null	null

Complete method `consolidate` in CSAwesome 6.4.2.1

```

/** Consolidates the barn by moving horses so that the horses are in adjacent spaces,
 * starting at index 0, with no empty space between any two horses.
 * Postcondition: The order of the horses is the same as before the consolidation.
 */
public void consolidate()

```

A positive number is called a “self-divisor” if every decimal digit of the number is a divisor of the number, that is, the number is evenly divisible by each and every one of its digits. For example, the number 128 is a self-divisor because it is evenly divisible by its digits, 1, 2 and 8. However, 26 is not a self-divisor because it is not evenly divisible by its digit 6. Note that 0 is not considered to be a divisor of any number, so any number containing a 0 digit is NOT a self-divisor. There are infinitely many self-divisors.

```
public class SelfDivisor
{
    /** @param number the number to be tested
     *      Precondition: number > 0
     *      @return true if every decimal digit of number is a divisor of number;
     *              false otherwise */

    public static boolean isSelfDivisor(int number)
    {
        int currNumber = number;
        int digit = 0;
        while (currNumber > 0)
        {
            digit = currNumber % 10;
            if (digit == 0)
            { return false; }
            if (number % digit != 0)
            { return false; }
            currNumber = currNumber / 10;
        }
        return true;
    }

    /** @param start starting point for values to be checked
     *      Precondition: start > 0
     *      @param num the size of the array to be returned
     *      Precondition: num > 0
     *      @return an array containing the first num integers  $\geq$  start that are self-divisors
     */
    public static int[] firstNumSelfDivisors(int start, int num)
    { /* to be implemented in part (b) */ }

    // There may be fields, constructors, and methods that are not shown.
}
```

Since you are only doing part B of this FRQ, look at the code for the method `isSelfDivisor()` since you MUST call the method in part B.

- 1) What are the parameters for `isSelfDivisor()`?
 - 2) What is the return type of `isSelfDivisor()`?
 - 3) What type of parameters does `firstNumSelfDivisors()` receive?
 - 4) What is the return type of `firstNumSelfDivisors()`?
- (b) Write method `firstNumSelfDivisors`, which takes two positive integers as parameters, representing a start value and a number of values. Method `firstNumSelfDivisors` returns an array of size `num` that contains the first `num` self-divisors that are greater than or equal to `start`.

For example, the call `firstNumSelfDivisors(10, 3)` should return an array containing the values 11, 12, and 15, because the first three self-divisors that are greater than or equal to 10 are 11, 12, and 15.

In writing `firstNumSelfDivisors`, assume that `isSelfDivisor` works as specified, regardless of what you wrote in part (a).

Complete method `firstNumSelfDivisors` in CSAwesome 6.4.3.1

```
/** @param start starting point for values to be checked
 *      Precondition: start > 0
 *      @param num the size of the array to be returned
 *      Precondition: num > 0
 *      @return an array containing the first num integers  $\geq$  start that are self-divisors
 */
```

```
public static int[] firstNumSelfDivisors(int start, int num)
```

Digital sounds can be represented as an array of integer values. For this question, you will write two unrelated methods of the Sound class.

A partial declaration of the Sound class is shown below.

```
public class Sound
{
    /** the array of values in this sound; guaranteed not to be null */
    private int[] samples;

    /** Changes those values in this sound that have an amplitude greater than limit.
     * Values greater than limit are changed to limit.
     * Values less than -limit are changed to -limit.
     * @param limit the amplitude limit
     *      Precondition: limit ≥ 0
     *      @return the number of values in this sound that this method changed
     */
    public int limitAmplitude(int limit)
    { /* to be implemented in part (a) */ }

    /** Removes all silence from the beginning of this sound.
     * Silence is represented by a value of 0.
     * Precondition: samples contains at least one nonzero value
     * Postcondition: the length of samples reflects the removal of starting silence
     */
    public void trimSilenceFromBeginning()
    { /* to be implemented in part (b) */ }

    // There may be instance variables, constructors, and methods that are not shown.
}
```

- (a) The volume of a sound depends on the amplitude of each value in the sound. The amplitude of a value is its absolute value. For example, the amplitude of -2300 is 2300 and the amplitude of 4000 is 4000.

Write the method `limitAmplitude` that will change any value that has an amplitude greater than the given limit. Values that are greater than `limit` are replaced with `limit`, and values that are less than `-limit` are replaced with `-limit`. The method returns the total number of values that were changed in the array. For example, assume that the array `samples` has been initialized with the following values.

40	2532	17	-2300	-17	-4000	2000	1048	-420	33	15	-32	2030	3223
----	------	----	-------	-----	-------	------	------	------	----	----	-----	------	------

When the statement

```
int numChanges = limitAmplitude(2000);
```

is executed, the value of `numChanges` will be 5, and the array `samples` will contain the following values.

40	2000	17	-2000	-17	-2000	2000	1048	-420	33	15	-32	2000	2000
----	------	----	-------	-----	-------	------	------	------	----	----	-----	------	------

Complete method `limitAmplitude` in CSAwesome 6.4.4.3.

```
/** Changes those values in this sound that have an amplitude greater than limit.  
 * Values greater than limit are changed to limit.  
 * Values less than -limit are changed to -limit.  
 * @param limit the amplitude limit  
 * Precondition: limit ≥ 0  
 * @return the number of values in this sound that this method changed  
 */  
public int limitAmplitude(int limit)
```

- (b) Recorded sound often begins with silence. Silence in a sound is represented by a value of 0.

Write the method `trimSilenceFromBeginning` that removes the silence from the beginning of a sound. To remove starting silence, a new array of values is created that contains the same values as the original `samples` array in the same order but without the leading zeros. The instance variable `samples` is updated to refer to the new array. For example, suppose the instance variable `samples` refers to the following array.

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value	0	0	0	0	-14	0	-35	-39	0	-7	16	32	37	29	0	0

After `trimSilenceFromBeginning` has been called, the instance variable `samples` will refer to the following array.

Index	0	1	2	3	4	5	6	7	8	9	10	11
Value	-14	0	-35	-39	0	-7	16	32	37	29	0	0

Complete method `trimSilenceFromBeginning` in CSAwesome 6.4.5.3.

```
/** Removes all silence from the beginning of this sound.  
 * Silence is represented by a value of 0.  
 * Precondition: samples contains at least one nonzero value  
 * Postcondition: the length of samples reflects the removal of starting silence  
 */  
public void trimSilenceFromBeginning()
```