

Beijing National Day School  
Department of Mathematics & Computer Science

# AP Computer Science A

## Semester 2 Exam

Location: Library, 6th Floor, Aspiration Building

Date: Wednesday, June 26th, 2019

Start Time: 2:00PM

End Time: 4:00PM

**NO CALCULATORS PERMITTED**

English Name: Answer Key \_\_\_\_\_

Pinyin Name: \_\_\_\_\_

Mr. Alwin Tareen, June 2019

### Exam Record

Multiple Choice \_\_\_\_\_ / 30 pts

Short Answer \_\_\_\_\_ / 30 pts

Java Programs \_\_\_\_\_ / 10 pts

Total: \_\_\_\_\_ / 70 pts

Grade: \_\_\_\_\_

**Section I: Multiple Choice (30 points)**

- Number of questions: 30.
- Decide which is the best of the choices given, and select the correct answer by placing an “X” in the corresponding box.

(1<sup>pt</sup>) 1. Which of the following is NOT a primitive data type?

- int  
 double  
 String  
 boolean

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 2. Which of the following arithmetic expressions produces a result of 3?

- (1 + 17) % 3  
 1 + 17 % 3  
 12 % 3 - 1  
 5 \* 2 % 3

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 3. If the operator AND is used, which of the following will make the whole condition true?

- First operand true, second operand false  
 First operand false, second operand true  
 Both operands true  
 Both operands false

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 4. The Boolean expression !(E && F) is logically equivalent to which of the following?

- E || F  
 !E || !F  
 E && F  
 !E && !F

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 5. What is the output of the following code fragment?

```
for (int i = 3; i <= 12; i++)
{
    System.out.print(i + " ");
}
```

- 5 6 7 8 9  
 4 5 6 7 8 9 10 11 12  
 3 5 7 9 11  
 3 4 5 6 7 8 9 10 11 12

*Solution:* This is the answer.

1 pt

5 pts

- (1<sup>pt</sup>) 6. What is the value of `pos` after the following code executes?

```
String s1 = "ac ded ca";
int pos = s1.indexOf("d");
```

- 3  
 4  
 5  
 -1

*Solution:* This is the answer.

- (1<sup>pt</sup>) 7. How many times does the following code fragment print a `*`?

```
for (int i = 3; i <= 9; i++)
{
    System.out.print("*");
}
```

- 9  
 7  
 6  
 10

*Solution:* This is the answer.

- (1<sup>pt</sup>) 8. Given the following code fragment, what will be the contents of the array `arr` if the method `doubleLast()` is executed?

```
public int[] arr = {-20, -15, 2, 8, 16, 33};
public void doubleLast()
{
    for (int i = arr.length/2; i < arr.length; i++)
    {
        arr[i] = arr[i] * 2;
    }
}
```

- [-40, -30, 4, 16, 32, 66]  
 [-40, -30, 4, 8, 16, 32]  
 [-20, -15, 2, 16, 32, 66]  
 [-20, -15, 2, 8, 16, 33]

*Solution:* This is the answer.

- (1<sup>pt</sup>) 9. Which of the following is a valid reason to use an `ArrayList`, instead of an array?

- An `ArrayList` can grow or shrink as needed, while an array is always the same size.  
 You can use a for-each loop on an `ArrayList`, but not on an array.  
 You can store objects in an `ArrayList`, but not in an array.  
 You can find the length of an `ArrayList`, but you can't find the length of an array.

*Solution:* This is the answer.

1 pt

1 pt

1 pt

1 pt

4 pts

(1<sup>pt</sup>) 10. How many recursive calls does the following method contain?

```
public int fibonacci(int n)
{
    if (n == 0 || n == 1)
        return 1;
    else
        return fibonacci(n-1) + fibonacci(n-2);
}
```

1 pt

- 0  
 1  
 2  
 3

*Solution:* This is the answer.

(1<sup>pt</sup>) 11. Which one of the following statements assigns the letter S to the third row and first column of a two-dimensional array named `strGrid`, assuming row-major order?

- `strGrid[0][2] = "S"`  
 `strGrid[1][3] = "S"`  
 `strGrid[3][1] = "S"`  
 `strGrid[2][0] = "S"`

*Solution:* This is the answer.

(1<sup>pt</sup>) 12. Which of the following statements would correctly retrieve the value 6 out of the array `arr`?

```
int[][] arr = {{2, 4, 6, 8}, {1, 2, 3, 4}};
```

- `arr[0][3]`  
 `arr[1][3]`  
 `arr[0][2]`  
 `arr[2][0]`

*Solution:* This is the answer.

(1<sup>pt</sup>) 13. What is a class?

- A class is a data structure similar to an `ArrayList`.  
 A class is a section of main memory which contains no data.  
 A class is like a blueprint, which describes the state and behaviour of an object.  
 A class is an array data structure that can only contain integers.

*Solution:* This is the answer.

(1<sup>pt</sup>) 14. Which of the following invokes the method `length()` of the object referenced by `str` and stores the result in `val`?

- `val = str.length();`  
 `val = length.str();`  
 `val = length().str;`  
 `val = length(str);`

*Solution:* This is the answer.

5 pts

(1<sup>pt</sup>) 15. What is the class of the type wrapper for the primitive type `int`?

- `myInt`  
 `INT`  
 `Integer`  
 `Double`

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 16. How many choices are possible when using a single `if-else` statement?

- 1  
 2  
 3  
 4

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 17. A colony of rabbits doubles its population every 28 days. The population starts out at 2, and increases until it reaches 100000. Say that a section of code simulates this process. Which of the following `while` statements is most likely to be used?

- `while (population = 100000)`  
 `while (population < 100000)`  
 `while (population > 28)`  
 `while (population = 28)`

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 18. When you run a Java application by typing `java SomeClass` what is the first method that starts?

- The `main()` method of `SomeClass`.  
 The `run()` method of `SomeClass`.  
 The `someClass` method.  
 The `applet` method.

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 19. What value is assigned to a reference variable to show that there is no object?

- 0  
 `void`  
 `null`  
 `nada`

*Solution:* This is the answer.

1 pt

(1<sup>pt</sup>) 20. When an object no longer has any reference variables referring to it, what happens to it?

- It sits around in main memory forever.  
 It is swapped out to the hard disk drive.  
 The garbage collector makes the memory it occupies available for new objects.  
 It gets emailed to the Oracle corporation, who then disposes of it.

*Solution:* This is the answer.

1 pt

6 pts

(1<sup>pt</sup>) 21. What is the output of the following code fragment?

```
String str = "Hello World!";
System.out.println(str.length());
```

1 pt

- 0  
 10  
 11  
 12

*Solution:* This is the answer.

(1<sup>pt</sup>) 22. What is the output of the following code fragment?

```
for (int i = 0; i < 5; i++)
{
    System.out.print(i + " ");
}
```

1 pt

- 1 2 3 4 5  
 0 1 2 3 4  
 0 1 2 3 4 5  
 i i i i i

*Solution:* This is the answer.

(1<sup>pt</sup>) 23. What is the output of the following code fragment?

```
int[] arr = {2, 4, 6, 8};
System.out.println(arr[0] + " " + arr[1]);
```

1 pt

- 2 6  
 8  
 2 4  
 6 8

*Solution:* This is the answer.

(1<sup>pt</sup>) 24. What is the output of the following code fragment?

```
int[] arr = {2, 4, 6, 8, 10, 1, 3, 5, 7, 9};
for (int i = 0; i < 5; i++)
{
    System.out.println(arr[i] + " ");
}
```

1 pt

- 2 4 6 8  
 2 4 6 8 10  
 2 4 6 8 10 1  
 2 4 6 8 10 1 3 5 7 9

*Solution:* This is the answer.

4 pts

(1<sup>pt</sup>) **25.** Given the following array declaration, what is values[2][1]?

```
double[] [] values = { {1.2, 9.0, 3.2},
                       {9.2, 0.5, 1.5},
                       {7.3, 7.9, 4.8} };
```

- 7.3  
 7.9  
 9.2  
 There is no such array element.

*Solution:* This is the answer.

(1<sup>pt</sup>) **26.** What is the name of the superclass that every other class in Java inherits from?

- Object  
 Base  
 Root  
 Foundation

*Solution:* This is the answer.

(1<sup>pt</sup>) **27.** Which of the following is the correct way to declare an ArrayList with data type Integer?

- ArrayList<String> list = new ArrayList<String>();  
 ArrayList<int> list = new ArrayList<int>();  
 ArrayList list = new ArrayList();  
 ArrayList<Integer> list = new ArrayList<Integer>();

*Solution:* This is the answer.

(1<sup>pt</sup>) **28.** Which of the following choices is the correct way to set up a constructor?

- public String Rectangle()  
 public static int SportsTeam(int players)  
 public constructor Bicycle(int gears)  
 public Compass(int direction)

*Solution:* This is the answer.

(1<sup>pt</sup>) **29.** Consider a class that has two constructors. Which of the following conditions must be true in order for the program to compile correctly?

- The constructors must be declared private and void.  
 The constructors must be placed in separate source code files.  
 The constructors must specify a return type.  
 The constructors must have unique parameter lists.

*Solution:* This is the answer.

(1<sup>pt</sup>) **30.** Which of the following choices would be considered an accessor method?

- public Kennel(double price)  
 public String getName()  
 public Ticket()  
 public class Player

*Solution:* This is the answer.

1 pt

1 pt

1 pt

1 pt

1 pt

1 pt

6 pts

**Part II: Short Answer** (30 points)

- Number of questions: 30.
- Answer each of the following questions in the space provided.

(1Pt) 1. Which of Java's primitive data types would you use to store the square root of 2?

*Solution:* double

1 pt

(1Pt) 2. Which of Java's primitive data types would you use to store your age?

*Solution:* int

1 pt

(1Pt) 3. Write a single line of code that will create an integer variable called `num` and store the number 407 in it.

*Solution:*

```
int num = 407;
```

1 pt

(1Pt) 4. Write a single line of code that will create a `String` variable called `name` and store your name in it.

*Solution:*

```
String name = "Bob";
```

1 pt

(1Pt) 5. If `String buddy = "groovy dude"`; then what is the output of:  
`System.out.println(buddy.toUpperCase());`

*Solution:*

```
GROOVY DUDE
```

1 pt

(1Pt) 6. Which character is at the 5th index in the `String "Herman Munster"`?

*Solution:* n

1 pt

(1Pt) 7. When comparing two `Strings` for equality, the double equals operator(==) should not be used. What is the name of the method that *should* be used?

*Solution:* `.equals()`

1 pt

7 pts



- (1<sup>pt</sup>) 8. Write a single line of code that will increment the integer variable `num` by 1.

*Solution:* `num++;`

1 pt

- (1<sup>pt</sup>) 9. What are the two possible values of a `boolean` variable?

*Solution:*

`true`  
`false`

1 pt

- (1<sup>pt</sup>) 10. What is the Java operator for the boolean **AND** operation?

*Solution:* `&&`

1 pt

- (1<sup>pt</sup>) 11. What is the Java operator for the boolean **OR** operation?

*Solution:* `||`

1 pt

- (1<sup>pt</sup>) 12. What is the output of: `System.out.println(true && true || false);`

*Solution:* `true`

1 pt

- (1<sup>pt</sup>) 13. Write a statement that will store the value `true` in a `boolean` variable `throttle` if the value in the variable `height` is 44 or less.

*Solution:*

```
if (height <= 44)
{
    throttle = true;
}
```

1 pt

- (1<sup>pt</sup>) 14. Write code using a `for`-loop that will print out the numbers 3, 6, 9, 12, 15.

*Solution:*

```
for (int i = 3; i < 16; i += 3)
{
    System.out.print(i + ", ");
}
```

1 pt

- (1<sup>pt</sup>) 15. Given the following line of code, identify the class, and identify the object:

```
Rectangle board = new Rectangle(length, width);
```

*Solution:*

`Rectangle` is the class.  
`board` is the object.

1 pt

8 pts

- (1<sup>pt</sup>) **16.** Instantiate an object called `fido` from the `Puppy` class using a single line of code. Assume that no parameters are sent to the constructor.

*Solution:*

```
Puppy fido = new Puppy();
```

1 pt

- (1<sup>pt</sup>) **17.** Write a single line of code that will create an array of type `double` called `scores` having 800 elements.

*Solution:*

```
double[] scores = new double[800];
```

1 pt

- (1<sup>pt</sup>) **18.** Given the array: `double[] digits = new double[21]`  
What is the output of: `System.out.println(digits.length);`

*Solution:* 21

1 pt

- (1<sup>pt</sup>) **19.** Assume that the integer array `data` contains the five values: 34, 56, -102, 18 and 5. What is the value of `data[1]`?

*Solution:* 56

1 pt

- (1<sup>pt</sup>) **20.** Write a single line of code that will instantiate an `ArrayList` object called `places` and have the restriction that only `String` objects can be stored in it.

*Solution:*

```
ArrayList<String> places = new ArrayList<String>();
```

1 pt

- (1<sup>pt</sup>) **21.** A class from which you cannot create objects is called what kind of class?

*Solution:*

An abstract class.

1 pt

- (1<sup>pt</sup>) **22.** Is it possible to have multiple constructors in the same class?

*Solution:* Yes.

1 pt

- (1<sup>pt</sup>) **23.** Is it true that inheritance models the “is-a” relationship, where objects of the subclass are also objects of the superclass? Answer **yes** or **no**.

*Solution:* Yes.

1 pt

8 pts

- (1<sup>pt</sup>) **24.** What must be required of an array of numbers before a binary search can be done?

*Solution:*

It must be initially sorted.

1 pt

- (1<sup>pt</sup>) **25.** Which is generally more efficient, a linear search or a binary search, if the array is already sorted?

*Solution:* Binary search.

1 pt

- (1<sup>pt</sup>) **26.** If we were given a sufficiently large amount of memory space, which of the following sorting algorithms would be more efficient: selection sort, insertion sort, or merge sort?

*Solution:* Merge sort.

1 pt

- (1<sup>pt</sup>) **27.** Consider the following array: `int[] temps = {34, 56, -102, 18, 5}`  
What is the output of: `System.out.println(temps[3] + temps[4])`?

*Solution:* 23

1 pt

- (1<sup>pt</sup>) **28.** Consider the following array: `String[] names = {"Bob", "Jim", "Sally"}`  
Write a single line of Java code that will display the element "Sally" from this array.

*Solution:*

```
System.out.println(names[2]);
```

1 pt

- (1<sup>pt</sup>) **29.** Consider the following array: `int[] nums = new int[7];`  
Write a section of Java code that would place the number 23 into every position in the array. *Hint:* Use a for loop.

*Solution:*

```
for (int i = 0; i < nums.length; i++)  
{  
    nums[i] = 23;  
}
```

1 pt

- (1<sup>pt</sup>) **30.** Merge sort uses the “divide-and-conquer” approach in its algorithm. In this context, explain what “divide-and-conquer” means.

*Solution:*

Dividing a problem into smaller pieces, each of which can be easily solved. Then, combining those pieces together to arrive at the final answer.

1 pt

7 pts

**Section III: Java Programs** (10 points)

- Number of questions: 3.
- Show all of your work. Remember that program segments are to be written in the Java programming language.

- (4<sup>pts</sup>) 1. Assume that `word` is a `String` of lower case text characters. Write a Java function that counts the number of a's and b's that are contained in the `String` `word`. Your function should be called:

4 pts

```
public static int countAlphaBeta(String word)
```

The function should return an integer which is the total quantity of a's and b's in the `String`.

- If the following statements are executed:

```
int result = countAlphaBeta("azcbobobegghakl");  
System.out.println(result);
```

Then the output of your program should be: 5

```
public static int countAlphaBeta(String word)  
{  
    // YOUR CODE HERE
```

*Solution:*

```
public static int countAlphaBeta(String word)  
{  
    int count = 0;  
    for (int i = 0; i < word.length(); i++)  
    {  
        String letter = word.substring(i, i+1);  
        if (letter.equals("a") || letter.equals("b"))  
        {  
            count++;  
        }  
    }  
    return count;  
}
```

4 pts

- (3<sup>pts</sup>) 2. Write a Java function that takes in a single `int` parameter called `num`, and returns an `int []` array containing the values `0, 1, 2, ..., num - 1`. Your function should be called:

3 pts

```
public static int[] fizzArray(int num)
```

The function should return an `int []` array.

- If the following statement is executed:

```
int[] result = fizzArray(5);
```

Then `result` should contain: `[0, 1, 2, 3, 4]`

```
public static int[] fizzArray(int num)
{
    // YOUR CODE HERE
}
```

*Solution:*

```
public static int[] fizzArray(int num)
{
    int[] sequence = new int[num];
    for (int i = 0; i < num; i++)
    {
        sequence[i] = i;
    }
    return sequence;
}
```

3 pts

- (3pts) 3. Consider the following Java program that contains a student's daily schedule of school courses, represented as **Strings** in an **ArrayList** called **courseSchedule**. This **ArrayList** stores each course in consecutive order, by period. For instance, **Computer Science** takes place in the first period, **Spanish** takes place in the second period, etc.

3 pts

After one week of school, the student decides that she would like to change her schedule in the following manner:

- Change the **Calculus** course to **Geometry**.
- Drop the **Physics** course.

Write the necessary Java code statements that would update the **ArrayList** to reflect the student's new course schedule.

```
import java.util.*;

public class SelectedCourses
{
    public static void main(String[] args)
    {
        ArrayList<String> courseSchedule = new ArrayList<String>();
        courseSchedule.add("Computer Science");
        courseSchedule.add("Spanish");
        courseSchedule.add("Calculus");
        courseSchedule.add("English");
        courseSchedule.add("History");
        courseSchedule.add("Physics");

        // YOUR CODE HERE

    }
}
```

*Solution:*

```
courseSchedule.set(2, "Geometry");
courseSchedule.remove(5);
```

3 pts