**Beijing National Day School**
**Department of Mathematics**

**AP Computer Science A**

**Test 2: Arrays and Classes**

English Name: _____

Pinyin Name: _____

Mr. Alwin Tareen, Fall 2018

AP Computer Science A
Fall 2018

Test 2: `Arrays` and `Classes`

Mr. Alwin Tareen
BNDS

**Part I: Multiple Choice** (20 points)

- Determine the answer to each of the following questions, using the available space for any necessary scratchwork.

- Decide which is the best of the choices given, and select the correct answer by placing an "**X**" in the corresponding box.

(1$^{pt}$) **1.** Which of the following choices correctly declares and initializes an array of integers named `nums`?

☐ `integer[] nums = new integer[5];`
☐ `new int nums[] = int[5];`
☐ `int[] nums = new int[5];`
☐ `nums = [5];`

| |
|---|
| 1 pt |

(1$^{pt}$) **2.** What would be the output of the following `Java` code?
```
int[] nums = {2, 4, 6, 8};
System.out.println(nums[0] + " " + nums[1]);
```
☐ 2 4
☐ 2 6
☐ 8
☐ 6 8

| |
|---|
| 1 pt |

(1$^{pt}$) **3.** What would be the output of the following `Java` code?
```
int[] nums = {2, 4, 6, 8};
nums[0] = 23;
nums[3] = nums[1];
System.out.println(nums[0] + " " + nums[3]);
```
☐ 31
☐ 23 2
☐ 2 8
☐ 23 4

| |
|---|
| 1 pt |

(1$^{pt}$) **4.** What is the technical name for the following array declaration in `Java`?
```
double[] scores = {93.7, 86.2, 91.5, 98.3};
```
☐ A customizer list.
☐ An initializer list.
☐ An elementary list.
☐ A verifier list.

| |
|---|
| 1 pt |

| |
|---|
| 4 pts |

(1pt) **5.** What would be the output of the following `Java` code?

```
double[] nums = { {1.2, 9.0, 3.2},
                  {9.2, 0.5, 1.5},
                  {7.3, 7.9, 4.8} };
System.out.println(nums[2][1]);
```

☐ 7.3
☐ 7.9
☐ 9.2
☐ 5.1

1 pt

(1pt) **6.** What would be the output of the following `Java` code?

```
int[] nums = {12, 34, 9, 0, -62, 88};
System.out.println(nums.length);
```

☐ 5
☐ 1
☐ 6
☐ 12

1 pt

(1pt) **7.** Consider the following `Java` program. We want to assign numbers into the array `nums`, such that each number is twice the value of its index. Choose one of the following statements to replace `// YOUR CODE HERE` which would generate this result.

```
int[] nums = new int[10];
for (int i = 0; i < nums.length; i++)
{
    // YOUR CODE HERE
}
```

☐ i = 2*i;
☐ nums[2*i] = 2*i;
☐ nums[i] = 2*nums[i];
☐ nums[i] = 2*i;

1 pt

(1pt) **8.** What would be the output of the following `Java` code?

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

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

1 pt

4 pts

(1$^{pt}$)  **9.** What would be the output of the following `Java` code?
```
double[] nums = { {1.2, 9.0},
                  {9.2, 0.5},
                  {7.3, 7.9} };
System.out.println(nums.length);
```
☐ 2

☐ 4

☐ 3

☐ 9

1 pt

(1$^{pt}$)  **10.** Which of the following choices are considered fundamental qualities of good object-oriented design?

☐ catch and release

☐ bait and switch

☐ state and behaviour

☐ divide and conquer

1 pt

(1$^{pt}$)  **11.** 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)`

1 pt

(1$^{pt}$)  **12.** 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.

1 pt

(1$^{pt}$)  **13.** Which of the following choices would be considered an accessor method?

☐ `public Kennel(double price)`

☐ `public String getName()`

☐ `public Ticket()`

☐ `public class Player`

1 pt

(1$^{pt}$)  **14.** Which of the following is a fundamental quality of mutator methods?

☐ Mutator methods always return an integer data type.

☐ The instance variables are declared within mutator methods.

☐ Mutator methods alter the instance variables.

☐ Mutator methods change all the data types of the class.

1 pt

6 pts

(1ᵖᵗ) **15.** Which of the following correctly describes the purpose of the `toString()` method?

☐ It gives client programs the ability to easily display the instance variables of a class.

☐ It constructs an object, and allocates sufficient memory for it.

☐ It alters the instance variables of a class.

☐ It assigns the correct data type to each of the class' variables.

<div style="text-align:right">1 pt</div>

(1ᵖᵗ) **16.** The following is a statement in a `Java` program which compiles and executes correctly.
`submarine.dive(depth);`
Which of the following choices can be inferred from the above statement?

☐ `dive` must be the name of an instance variable.

☐ `dive` must be a method.

☐ `submarine` must be the name of a class.

☐ `submarine` must be a method.

<div style="text-align:right">1 pt</div>

Consider the following implementation of the `Student` class:

```java
public class Student
{
    // instance variables
    private String name;
    private double sum;
    private int numGrades;

    // constructors
    public Student(String n)
    {
        <CODE>
    }

    // accessor methods
    public String getName()
    {
        return name;
    }

    public double getAverage()
    {
        return sum/numGrades;
    }

    // mutator methods
    public void setGrade(int grade)
    {
        sum += grade;
        numGrades++;
    }
}
```

<div style="text-align:right">2 pts</div>

(1$^{\text{pt}}$) **17.** Which of the following should replace <CODE> such that the instance variable `name` is correctly initialized when a new object is created?

☐ `String name = n;`

☐ `name = n;`

☐ `n name;`

☐ Cannot be done because `name` is `private`.

1 pt

(1$^{\text{pt}}$) **18.** Assuming that <CODE> is filled in correctly, how would you create a `Student` object called `pupil` and set `name` to `"Sally"`?

☐ `Student pupil = new Student();`

☐ `pupil.name = "Sally";`

☐ `pupil = new Student("Sally");`

☐ `Student pupil = new Student("Sally");`

1 pt

(1$^{\text{pt}}$) **19.** Which of the following would print the `name` of the student represented by the object called `bart`?

☐ `System.out.println(bart.getName());`

☐ `System.out.println(bart.name());`

☐ `System.out.println(bart(name));`

☐ `System.out.println(name(bart))`

1 pt

(1$^{\text{pt}}$) **20.** Assume a `Student` object called `lisa` has been created and grades have been assigned. How would you correctly retrieve this student's average?

☐ `int average = lisa.getAverage();`

☐ `double average = getAverage(lisa);`

☐ `double average = lisa.getAverage();`

☐ `lisa.setGrade(98);`

1 pt

4 pts

4 pts

**Part II: Short Answer** (13 points)

- Solve each of the following short answer questions. Write your solution in the space provided.

(1$^{\text{pt}}$)  **1.** Write a single line of code that will create an array of type `double` called `nums` having 800 elements.

| |
|---|
| 1 pt |

(1$^{\text{pt}}$)  **2.** Consider the following array: `double[] scores = new double[21]`
What is the output of: `System.out.println(scores.length);`

| |
|---|
| 1 pt |

(1$^{\text{pt}}$)  **3.** Consider the following array: `int[] temps = {34, 56, -102, 18, 5}`
What is the output of: `System.out.println(temps[1])`?

| |
|---|
| 1 pt |

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

| |
|---|
| 1 pt |

(1$^{\text{pt}}$)  **5.** 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.

| |
|---|
| 1 pt |

(1$^{\text{pt}}$)  **6.** 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.

| |
|---|
| 1 pt |

(1$^{\text{pt}}$)  **7.** Consider the following two-dimensional array: `int[][] nums = new int[10][10];`
Write a section of Java code that would place the number `58` into every position in the array. *Hint:* Use two `for` loops.

| |
|---|
| 1 pt |

| |
|---|
| 7 pts |

(4$^{\text{pts}}$) **8.** Consider the following incomplete implementation of the `Rectangle` class:

```
1  public class Rectangle
2  {
3      // instance variables
4      private int length;
5      private int width;
6
7      // constructors
8      public Rectangle(int len, int wid)
9      {
10         length = len;
11         width = wid;
12     }
13 }
```

4 pts

(a) (2 pts) Write an accessor method called `getPerimeter()` which calculates and returns the perimeter of the rectangle.

(b) (2 pts) Write an accessor method called `getArea()` which calculates and returns the area of the rectangle.

4 pts

(2ᵖᵗˢ)   **9.** Consider the following `Java` source code for `PassingParameters.java`:

```java
public class PassingParameters
{
    public static void displayTotal(int total)
    {
        total = 75;
        System.out.println(total);
    }

    public static void main(String[] args)
    {
        int score = 10;
        displayTotal(score);
        System.out.println(score);
    }
}
```

What will be the output when this program is executed? Write your answer in the box below:

**The Terminal Display Output of** `PassingParameters.java`

2 pts

2 pts

2 pts

**Part III: Java Programming** (14 points)

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

### APLine Question(2010 AP CompSci Free Response)

(7$^{\text{pts}}$) **1.** An **APLine** is a line defined by the equation $ax + by + c = 0$, where $a$ is not equal to zero, $b$ is not equal to zero, and $a$, $b$, and $c$ are all integers. The slope of an **APLine** is defined to be the **double** value $-a/b$.

7 pts

A point(represented by integers $x$ and $y$) is on an **APLine** if the equation of the **APLine** is satisfied when those $x$ and $y$ values are substituted into the equation. That is, a point represented by $x$ and $y$ is on the line if $ax + by + c$ is equal to 0. Examples of two **APLine** equations are shown in the following table.

| Equation | Slope($-a/b$) | Is point $(5, 2)$ on the line? |
|---|---|---|
| $5x + 4y - 17 = 0$ | $-5/4 = -1.25$ | Yes, because $5(5) + 4(-2) + (-17) = 0$ |
| $-25x + 40y + 30 = 0$ | $25/40 = 0.625$ | No, because $-25(5) + 40(-2) + 30 \neq 0$ |

Assume that the following code segment appears in a class other than **APLine**. The code segment shows an example of using the **APLine** class to represent the two equations shown in the table.

```
APLine line1 = new APLine(5, 4, -17);
double slope1 = line1.getSlope();      // slope1 is assigned -1.25
boolean onLine1 = line1.isOnLine(5, -2); // true

APLine line2 = new APLine(-25, 40, 30);
double slope2 = line2.getSlope();      // slope2 is assigned 0.625
boolean onLine2 = line2.isOnLine(5, -2); // false
```

Write the **APLine** class. Your class must produce the indicated results when invoked by the code segment given above. You may ignore any issues related to integer overflow. Your implementation must include:

(a) (1 pt) The declaration of the private instance variables **a**, **b** and **c**.

(b) (2 pts) A constructor that has three integer parameters that represent **a**, **b**, and **c**, in that order. You may assume that the values of the parameters representing **a** and **b** are not zero.

(c) (2 pts) A method **getSlope()** that calculates and returns the slope of the line.

(d) (2 pts) A method **isOnLine(int x, int y)** that returns **true** if the point represented by its two parameters (**x** and **y**, in that order) is on the **APLine**, and returns **false** otherwise.

**Write your solution on the next page.**

7 pts

Complete `APLine.java` in the space below.

(7$^{\text{pts}}$) **2.** The three most important numbers describing a telescope are: the `diameter` of the main lens(the one in front), the focal length of the main lens(`mainLength`), and the focal length of the eyepiece(`eyeLength`). Each of these numbers should be considered a `double`.

7 pts

Write the `Telescope` class. Your implementation should include the following:

(a) (1 pt) The declaration of the private instance variables `diameter`, `mainLength` and `eyeLength`.

(b) (2 pts) A constructor that has three variables in its parameter list. These will initialize the values of the private instance variables `diameter`, `mainLength` and `eyeLength`.

(c) (2 pts) An accessor method called `magnification()`, which calculates and returns the magnification of the telescope in the form of a `double`. It is calculated with the formula: magnification = `mainLength/eyeLength`

(d) (2 pts) An accessor method called `fNumber()`, which calculates the focal number of the telescope, and returns it as a `double`. It is calculated with the following formula: fNumber = `mainLength/diameter`

**Write your solution on the next page.**

7 pts

**Complete** `Telescope.java` **in the space below.**

0 pts

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0 pts