

**Part I.** (44points) Solve each of the following problems. For the multiple choice problems, select the correct answer by placing an “X” in the box beside it.

- (1<sup>pt</sup>) 1. Which of the following is the specific term for the type of variables that are declared at the beginning of a class? 

1 pt
- intrinsic    instance    incognito    inverted
- (1<sup>pt</sup>) 2. What is the name of the class in the following Java statement: 

1 pt
- ```
Rectangle myRect = new Rectangle(44.8, 12);
```
- new    myRect    44.8    Rectangle
- (1<sup>pt</sup>) 3. How would you identify the constructor of a class? 

|      |
|------|
|      |
| 1 pt |
- It must be declared with the keyword `constructor`.
- It always returns an `integer`.
- It has the same name as the class.
- Its functionality is inherited from the `println` method.
- (1<sup>pt</sup>) 4. A method that accesses a class object without altering that object’s instance variables is called: 

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|------|
|      |
| 1 pt |
- An absolute method.
- A retrieval method.
- An adverse method.
- An accessor method.
- (1<sup>pt</sup>) 5. A method that changes the state of an object by modifying at least one of its instance variables is called: 

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|------|
|      |
| 1 pt |
- A mutator method.
- A mixer method.
- A motivator method.
- A masher method.
- (1<sup>pt</sup>) 6. When two or more methods in the same class have the same name but different parameter lists, they are called: 

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|------|
|      |
| 1 pt |
- Extreme methods.
- Overloaded methods.
- Massive methods.
- Major methods.
- (1<sup>pt</sup>) 7. Which of the following statements could be used to create a new object called `b1`, from a class named `BankAccount`? 

|      |
|------|
|      |
| 1 pt |
- `b1 = BankAccount();`
- `BankAccount b1 = new BankAccount();`
- `b1(BankAccount) = new BankAccount();`
- `b1.BankAccount = new BankAccount();`

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|       |
| 7 pts |

(1<sup>pt</sup>) 8. Which of the following is *not* part of a Java class?

- A constructor.
- Instance variables.
- Accessor methods.
- A method to delete the object and release its memory.

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|      |
| 1 pt |

(1<sup>pt</sup>) 9. Which invokes the method `length()` on the object `str` and stores the result in `val`?

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

|      |
|------|
|      |
| 1 pt |

**Questions 10-13 refer to the following Date class declaration:**

```
public class Date
{
    private int myDay;
    private int myMonth;
    private int myYear;

    public Date() // default constructor
    {
        ...
    }

    public Date(int mo, int day, int yr) // constructor
    {
        ...
    }

    public int month() // returns month of Date
    {
        ...
    }

    public int day() // returns day of Date
    {
        ...
    }

    public int year() // returns year of Date
    {
        ...
    }

    // Returns String representation of Date as "m/d/y", e.g. 4/18/1985
    public String toString()
    {
        ...
    }
}
```

|       |
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|       |
| 2 pts |

(3<sup>pts</sup>) 10. Which of the following correctly constructs a `Date` object?

- `Date d = new (2, 13, 1947);`  
 `Date d = Date(2, 13, 1947);`  
 `Date d; d = new (2, 13, 1947);`  
 `Date d; d = Date(2, 13, 1947);`  
 `Date d = new Date(2, 13, 1947);`

3 pts

(3<sup>pts</sup>) 11. Which of the following will cause an error message?

I `Date d1 = new Date(8, 2, 1947);`  
`Date d2 = d1;`

II `Date d1 = null;`  
`Date d2 = d1;`

III `Date d = null;`  
`int x = d.year();`

- I only  
 II only  
 III only  
 II and III only  
 I, II and III

3 pts

(3<sup>pts</sup>) 12. A client program creates a `Date` object as follows: `Date d = new Date(1, 13, 2002);` Which of the following subsequent code segments will cause an error?

- `String s = d.toString();`  
 `int x = d.day();`  
 `Date e = d;`  
 `Date e = new Date(1, 13, 2002);`  
 `int y = d.myYear;`

3 pts

(3<sup>pts</sup>) 13. A method in a client program for the `Date` class has this declaration:

```
Date d1 = new Date(month, day, year);
```

where `month`, `day` and `year` are previously defined integer variables. The same method now creates a second `Date` object `d2` that is an exact copy of the object `d1` refers to. Which of the following code segments will *not* do this correctly?

I `Date d2 = d1;`

II `Date d2 = new Date(month, day, year);`

III `Date d2 = new Date(d1.month(), d1.day(), d1.year());`

- I only  
 II only  
 III only  
 II and III only  
 All will do this correctly.

3 pts

12 pts

- (10<sup>pts</sup>) 14. 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**. 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) (3 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) (3 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:  
 $\text{magnification} = \text{mainLength}/\text{eyeLength}$
  - (d) (3 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:  
 $\text{fNumber} = \text{mainLength}/\text{diameter}$

10 pts

10 pts

- (3pts) 15. For the following Java program, write the output in the box labelled Terminal Output.

```
public class PassByValue
{
    public static int mystery(int x, int y)
    {
        return x + y;
    }

    public static void main(String[] args)
    {
        int a = 7;
        int b = 2;
        int result = 0;
        result = mystery(a, b);
        System.out.println("Result is: " + result);
    }
}
```

3 pts

Terminal Output

- (10pts) 16. 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  $-a/b$ . 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
```

3 pts

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) (3 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) (3 pts) A method `getSlope()` that calculates and returns the slope of the line.
- (d) (3 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.