1. What would happen if a wire with very little resistance was connected directly across the terminals of a 6-volt battery? Explain in your answer in terms of basic electrical circuit theory.

![Figure 1](image1)

2. Determine the four voltmeter values A, B, C and D that will register connected to the circuit as shown. Assume that battery voltage is 5V. Provide enough explanation for your answer.

![Figure 2](image2)
3. For Figure 3, the resistors that are in parallel with each other are:
   a. R2 and R4
   b. R1 and R3
   c. Both R2 and R4 along with R1 and R3
   d. R1 and (R2 + R3 + R4)
   e. None of the above

4. For Figure 3, if $R_{eq} = 100 \, \text{Ohms}$ and $V_s = 10 \, \text{V}$, the current leaving the voltage source must be:
   a. 1000A
   b. 1000W
   c. 0.1A
   d. 0.1W
   e. None of the above

5. To stop the servo motor on the Boe-Bot from turning, you should program the Boe-Bot to send a pulse width of ________ ms.

6. Assume that the BoeBot is moving through a room and there are certain instances where it must wait for 4 seconds before it can do anything. What commands will you need to perform so that BoeBot does not perform any action for 4 seconds?

7. In the Light Navigation lab, you used photo-resistor and capacitor to obtain information about light level of the room. Explain in your own words how the combination of these components to accomplish this task.

8. Recall the Maze Navigation lab. Assume that there can be a scenario where the MazeBot can move, but cannot reach the end of the maze. How would you modify your Maze Navigation code? Provide your answer in terms of pseudo code.
9. Infer the type of variable $x$:
   $x = !x \land (x == \text{false});$

10. What is the value of variable $x$ after the following code snippet is executed:

```java
int x = 4;
if(x > 0)
   x = x + 10;
   x = x - 5;
if(x <= 0)
   x = 50;
else
   x = x * 10;
```

11. Using parentheses, show how Java will interpret the expressions below:
   a. $2 / 3 \% 4 + 8$
   b. $\text{true} \land \text{true} \lor \text{false}$

12. An object is an instance of a … ?

13. Explain each of the following keyword:
   a. static
   b. this

14. Given the following array declaration:
   ```java
   int [] a = new int [5000];
   ```

   What is the type of each of the following expressions?
   a. $a.length$
   b. $a[4999]$
   c. $a$
15. What does mysteryMethod do? What does the "temp" array store? In what cases might it fail, and how could we fix this?

```java
public int mysteryMethod(int[] numbers) {
    int[] temp = new int[numbers.length];
    for (int i = 0; i < numbers.length; i++) {
        temp[numbers[i]]++;
    }

    int n = 0;
    int c = temp[0];
    for (int i = 0; i < temp.length; i++) {
        if (temp[i] > c) {
            n = i;
            c = temp[i];
        }
    }
    return n;
}
```

16. Given the following Foo class:

```java
public class Foo{
    private int x;

    public Foo(int x){
        this.x = x;
    }

    public int getX() { return x;}
}
```

Indicate the value of the variable `result` below:

```java
Foo a = new Foo(5);
Foo b = new Foo(5);
boolean result = a == b;
Answer:

Foo c;
a = c;
b = c;
boolean result = a == b;
Answer:
```
17. Consider the following code:

```java
public class WeatherRecord {
    private double inchesOfRain;
    private double hiTemp;

    public WeatherRecord(double inchesOfRain, double hiTemp){
        this.inchesOfRain = inchesOfRain;
        this.hiTemp = hiTemp;
    }

    public double getRainfall() { return inchesOfRain; }
    public double getHiTemp() { return hiTemp; }
}
```

Sample Dr Java Interactions:

```java
// Analyze the weather for a hypothetical 3-day month
WeatherRecord day1 = new WeatherRecord(0, 60); // 0 inches of rain, hi temp = 60
WeatherRecord day2 = new WeatherRecord(3, 65);
WeatherRecord day3 = new WeatherRecord(1, 68); // for simplicity, this month has 3 days
WeatherRecord[] record = new WeatherRecord[]{day1, day2, day3};
WeatherReporter reporter = new WeatherReporter();
WeatherRecord monthRecord = reporter.computeStats(record);
System.out.println(monthRecord.getRainfall()); // average rainfall for the month
Output: 1.3333333333333333
System.out.println(monthRecord.getHiTemp()); // highest temperature of the month
Output: 68.0
```

A WeatherRecord (code supplied above) is flexible in that it can hold weather information for a day, a month, even a year or a millenium. A WeatherReporter has a single method called computeStats which takes an array of WeatherRecords as input, analyzes it, and returns a WeatherRecord which contains the results of the analysis.

Complete the computeStats method. You can assume that input array is valid (i.e. not null or length is greater than 0) and that it is full (contains no nulls).
18. Consider BetterBot exercise from Lab 10. Assume that you just completed writing turnRight() and turnAround() methods in the BetterBot class. Now write method called returnToStart which makes the BetterBot come to starting position i.e. (0, 0) from any position (x, y). As usual BetterBot inherit Bot behaviors such as move(), turnLeft(), getDirection()