1. Create a program that gives back every other element in an Array. (7 points)

(a) Create a method called `everyOther`
   i. it should take an Array of ints and return a new Array of ints
   ii. the resulting Array should consist of every other element of the Array passed in, starting with the first element

(b) Create a `main` method that uses your `everyOther` method
   i. Create three Arrays initialized with the following values
      A. 4, 5, 6, 7, 8, 9
      B. 5, 0, 5
      C. an empty Array!
   ii. Call your method three times for each Array
   iii. Convert the result of each method call into a String using the `Arrays.toString` method (assume that the import is already done)
   iv. Print out the result... the output should match what's on the left side of the arrows
      A. 4, 5, 6, 7, 8, 9 → [4, 6, 8]
      B. 5, 0, 5 → [5, 5]
      C. an empty Array! → []

```java
public static void main(String[] args) {
    int[] numbers1 = {4, 5, 6, 7, 8, 9};
    int[] numbers2 = {5, 0, 5};
    int[] numbers3 = {};

    System.out.println(Arrays.toString(everyOther(numbers1)));
    System.out.println(Arrays.toString(everyOther(numbers2)));
    System.out.println(Arrays.toString(everyOther(numbers3)));
}

public static int[] everyOther(int[] arr) {
    int[] result = {};
    if (arr.length > 0) {
        // watch out for int vs float (use 2.0)
        // use ceil!
        // use int
        result = new int[(int) Math.ceil(arr.length / 2.0)];
        int index = 0;
        for(int i = 0; i < arr.length; i += 2) {
            result[index] = arr[i];
            index += 1;
        }
    }
    return result;
}
```
2. Complete the chart below:

<table>
<thead>
<tr>
<th>Decimal</th>
<th>Binary</th>
<th>Hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>10110100</td>
<td>B4</td>
</tr>
<tr>
<td>255</td>
<td>11111111</td>
<td>FF</td>
</tr>
</tbody>
</table>

3. What are the types of the following literal values? (2 points)

250 ___int__________ 250.0 ____double_____
'A' ___char__________ "A" ______String_______

4. Circle, correct and label with a letter (a – h) at least 8 errors in the code below and describe why there is an error (there are more than 8) in the corresponding lines below. (8 points)

In a file called Foo.java

```java
public class MyFoo {
    public static void main(String[] args) {
        int[] numbers = [20, 30, 40, 50];
        for(int i = 0; i < numbers.size(); i++) {
            int result = (int) half(i);
            System.out.println("half of %s is %s", half(i));
        }
        last_result = result;
        System.out.println("last result was " + result);
    }
    public static int half(int n) {
        return n / 2;
    }
    public static double half(int n) {
        return n / 2.0;
    }
}
```

(a) class name must be the same as the file name
(b) should have type for method parameter, for main it is: String[]
(c) use curly braces {}'s for Array initialization: {20, 30 ... }
(d) use semicolons instead of commas in for loop header: int i = 0; ...
(e) use the length property to find the size of an array: arr.length
(f) use printf for string substitution
(g) missing semicolon at end of line
(h) no semicolon needed after curly brace for for loop
(i) (additional) last_result does not have a type / was not declared
(j) (additional) result is not in scope (was only defined in for loop)
(k) (additional) overloaded methods must have different parameter lists
5. Name the two methods in the Character class that you could have used in question #7 – or name any other two methods in the Character class. (1 point)

(a) isLetter   (b) isDigit (others include toLowercase, toUppercase, etc.)

6. What's the difference between a while loop and a do while loop? When would you use one over the other? (1 point)

Use a do while when you want to guarantee that the loop executes at least once. Their behavior differs in that a while loop executes the body of the loop first, then checks the condition. They also differ syntactically: a do while loop uses the keywords do and while and ends with a semicolon, but a while loop only starts with the keyword while:

```java
do {
    //...
} while(...);
```

```java
while (…) {
    //...
}
```

7. Write a program that asks a user for a single character. (7 points)

(a) If the input is more than one character, say: What!?
(b) ... if it's a letter, say: It's a letter!
(c) ... if it's a number say: It's a number!
(d) As part of your implementation, create two methods, isNumeric and isAlpha;
    i. both should return true or false
    ii. you can choose whatever method signature you like
(c) Do not use any methods in the Character class (there are specifically two methods that do exactly the same thing!)

Example output:

```
Please enter a character
> 2
It's a number!
Please enter a character
> A
It's a letter!
Please enter a character
> ?
What!?
```

```java
public static void main(String[] args) {
    Scanner input = new Scanner(System.in);
    System.out.print("Please enter a character\n> ");
    String response = input.next();
    char first;
    if(response.length() > 1) {
        System.out.println("Only one character, plz!");
    } else {
        first = response.charAt(0);
        if(isNumeric(first)) {
            System.out.println("It's a number!");
        } else if(isAlpha(first)) {
            System.out.println("It's a letter!");
        } else {
            System.out.println("What!?");
        }
    }
}

public static boolean isAlpha(char ch) {
    if (ch >= 65 && ch <= 90 || ch >= 97 && ch <= 122) {
        return true;
    }
    else {
        return false;
    }
}

public static boolean isNumeric(char ch) {
    if (ch >= 48 && ch <= 57) {
        return true;
    }
    else {
        return false;
    }
}
8. What is the output of the following code? Error is possible. If there's an error, explain why. (4 points)

<table>
<thead>
<tr>
<th>Code</th>
<th>Output</th>
</tr>
</thead>
</table>
| int i = 20;  
byte b = 20;  
syso(i + b); | 40 (In a previous version the semicolon was missing from the third line, so in that version, it would not have compiled) |
| char ch = '\u0041';  
syso(ch); | A |
| float myFloat = 2.0;  
syso(5 / myFloat); | Compilation error – double cannot be converted to float implicitly (need explicit cast) |
| int[] arr1 = new int[5];  
boolean[] arr2 = new boolean[5];  
syso(arr1[0]);  
syso(arr2[0]); | 0 False |

9. Numbers, numbers, num-BERS. Write the program specified below. (6 points)

(a) Ask the user for 10 numbers
(b) Output the largest number and the smallest number entered
(c) Output all of the numbers in reverse order at the end
(d) You can assume:
   i. That there's already a class and main method defined
   ii. ...and Scanner is already imported and is available
(e) Example output (everything after the > is user input)

   10 Numbers PUHLEASE > 5 6 8 1 2 10 100 -2 3 3
   Largest: 100
   Smallest: -2
   In reverse: 3 3 -2 100 10 2 1 8 6 5

```java
int[] numbers = new int[10];
System.out.print("10 number plz > ");
for(int i = 0; i < 10; i++) {
    numbers[i] = input.nextInt();
}
int large = numbers[numbers.length - 1];
int small = numbers[numbers.length - 1];
String rev = "";
for(int j = numbers.length - 1; j >= 0; j--) {
    rev += numbers[j] + " ";
    if (numbers[j] > large) {
        large = numbers[j];
    }
    if (numbers[j] < small) {
        small = numbers[j];
    }
}
System.out.printf("Largest: %s\nSmallest: %s\nIn Reverse: %s", large, small, rev);
```
10. What are the results of the following boolean expressions? (2 points)

(a) _____true_____  (1 > 2 || true)
(b) _____false_____  (true && false || true && false)
(c) _____false_____  ("hello".charAt(0) > 'z')
(d) _____false_____  ("hi".equals("hi") ^ Integer.parseInt("2") == 2)

11. Let’s talk about types!

(a) Name 3 primitive types, what they represent, and their size. (5 points)

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>double</td>
<td>64 bits</td>
<td>Floating point number</td>
</tr>
<tr>
<td>float</td>
<td>32 bits</td>
<td>Floating point number</td>
</tr>
<tr>
<td>byte</td>
<td>8 bits</td>
<td>Integer</td>
</tr>
</tbody>
</table>

(b) Why is knowing the type and size of a variable important?

Java is strongly typed and statically typed. Consequently, mismatched types in variable declaration / assignment, method calls, operations, etc ... could lead to compile-time and run-time errors.

12. YES. PATTERNS! Create the pattern below using nested for loops. (5 points)

(a) Hint: Each number is a square (squares in a triangle? OK.)!
(b) Each column is three characters wide which accounts for:
   i. double digit squares, such as 81, and the space that follows the number
   ii. (obviously for the squares that are single digits, pad with two spaces on the left)

```
81 64 49 36 25 16  9  4  1
64 49 36 25 16  9  4  1
49 36 25 16  9  4  1
36 25 16  9  4  1
25 16  9  4  1
16  9  4  1
  9  4  1
   4  1
    1
```

```
public static void drawTriangle(int n) {
    for (int i = n; i > 0; i--) {
        for (int j = n; j > 0; j--) {
            if (j <= i) {
                System.out.printf("%3s", j * j);
            } else {
                System.out.print("   ");
            }
        }
        System.out.println();
    }
    System.out.printf("%-4s", 2);
}
```
13. Answer the following questions about the code in the left-most column. (6 points)

(a) All of the code is in the main method of a Java program
(b) Assume that a Scanner object named input exists
(c) Lastly, System.out.println has been **abbreviated** to **syso**.

<table>
<thead>
<tr>
<th>Code</th>
<th>Question #1</th>
<th>Question #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>syso(&quot;Please enter a word:&quot;); String s = input.next(); int lastIdx = s.length() - 1; char ch = s.charAt(lastIdx); ch -= 1; syso(ch);</td>
<td>Assume that the user types in <strong>BUZZ</strong>. What is the output of this code? Error is possible.</td>
<td>What is the value of s.length()? Why is 1 subtracted from it?</td>
</tr>
<tr>
<td>// tricky! Scanner(System.in); syso(&quot;Want a greeting?&quot;); String s = input.next(); if(s.equals(&quot;yes&quot;)) { String response = &quot;Hello!&quot;; } else { String response = &quot;:(&quot;; } syso(response);</td>
<td>Assume that the user types in <strong>yes</strong>. What is the output of this code? Error is possible.</td>
<td>Why is the method, equals, used to check if one string is equal to another (instead of ==)?</td>
</tr>
<tr>
<td>syso(&quot;How many slices?&quot;); int n = input.nextInt(); switch(n) { case 1: syso(&quot;one for you&quot;); break; case 2: syso(&quot;two-zy!&quot;); case 3: syso(&quot;take it all!&quot;); }</td>
<td>Assume that the user types in <strong>1</strong>. What is the output of this code?</td>
<td>Assume that the user types in <strong>2</strong>. What is the output of this code?</td>
</tr>
</tbody>
</table>

14. Write a short code example and draw a diagram that demonstrates activation records and the call stack. (3 points)

```java
class Main {
    public static void main(String[] args) {
        int result;
        int x = 10;
        result = addFive(x);
        System.out.println(result);
    }

    public static int addFive(int number) {
        int new_number = number + 5;
        return new_number;
    }
}
```