Q1: Give the value and type of each of the following Java expressions. If an expression will not compile or will cause an exception at runtime, put an **X** under value and type. If the value is a string, enclose it in double quotes.

Expression	Value	Type
`1 / 0`		
`"800" * 1`		
`"1" + " - " + "1"`		
`3.14159 + (int) Math.PI`		
`1-1-1-1`		
`3 / 2.0 + 2 * 5`		
`(8 <= 2) || (2e8 <= 8e2)`		
`Double.parseDouble("8.5*2")`		
`"1" + 1 + 1 + "1"`		

Q2: Consider the following code:

```java
public class MethodTester {
    private static void methodB(int[] c, int d) {
        c[0]++;
        d += 42;
    }
    private static int methodA(int[] a, int b) {
        methodB(a, b);
        a[0]++;
        return b/2;
    }
    public static void main(String[] args) {
        int[] arr = {8, 9, 10};
        int x = 1;
        x = methodA(arr, x);
        System.out.println(arr[0] + " " + x);
    }
}
```

Which one of the following is the output of this program?

"8 3"

"8 10"

"8 21"

"9 1"

"9 3"

"9 21"

"10 0"

"10 1"

"10 21"

Q3: Consider the following code:

```java
public class Series {
  public static int func(int j) {
  if (j==1) return 1;
    return 2 * func(j - 1) + 5 * func(j - 2);
  }

  public static void main(String[] args) {
    int N = Integer.parseInt(args[0]); // assume N >= 0

    System.out.println(func(N));
  }
}
```

a. Draw the recursion tree for `func(3)`. You only need to draw the tree up to 3 levels.

b. What is the problem with this recursive program, based on the tree you drew above?

Q4: Fill in the blanks in the following table.

hex	decimal	16-bit two's complement	TOY instruction pseudo-code
FFFE	-2	1111111111111110	R[F] = PC; PC = FE
1234	4,660		R[2] = R[3] + R[4]
1101	4,353	0001000100000001	
77FF	30,719	0111011111111111	R[7] = 00FF
FF01			
7A00		0111101000000000	

Hint: $7 \cdot 16^3 = 28{,}672$.

Q5: Consider the following TOY program:

```
20: 81FF  R[1] = stdin
21:     SEE BELOW
22: 1211  R[2] = R[1] + R[1]
23: 0000  halt
```

What is the value of R[1] after executing the code above, where M[21] is replaced by one of the following instructions. Note, the PC starts on line 20 and 1111 is on standard input.

Your answers must be four hex digits.

M[21] **set to**	**Value of** R[1] **after halt**
21: 1111 R[1] = R[1] + R[1]	
21: 0000 halt	
21: 1211 R[2] = R[1] + R[1]	
21: 7100 R[1] = 0000	
21: C023 PC = 23	
21: 8121 R[1] = M[21]	
21: 9122 M[22] = R[1]	