

**Part 1: Definitions & Short Answer (3 Points Each)**

1. What does CPU stand for? Central Processing Unit
2. Explain the difference between high-level languages and machine language. A high-level language is human readable code that is either compiled into machine language or interpreted (or a little of both). A machine language is one in which the computer can run directly.
3. What is the difference between a compiler and an interpreter? A compiler will take a program written in a high-level language, translate it into machine language and then save the machine language program to a file that can be run on the computer. An interpreter does essentially the same thing except that it translates the high-level language to machine language one command at a time and does not save the machine language program to a file.
4. Java is a “platform-independent language.” What does this mean? A platform is an operating system, so platform-independent means that the same program can be run on any operating system. Java is compiled into byte code, this byte code is then interpreted by the Java Virtual Machine (JVM). There is a JVM built for every common operating system, so java byte code can be run on any operating system.
5. What is a block statement? A block statement is a segment of code between {}.
6. What are the three types of programming errors? Briefly describe each of them.

Syntax Error: An error in the program code due to misuse of the programming language.

Run-time Error: An error that occurs during a run of the program which usually causes the program to terminate prematurely.

Logic Error: This error occurs when the program is syntactically correct and there are no run-time errors but the program does not do what it was intended to do.

7. What do each of the following do, &&, ||, !, and ^?

&& - Logical and.

|| - Logical or

! - Logical not

^ - Logical xor

## Part 2: Program Traces (15 Points Each)

1. For each of the program inputs below write the output of the program.

```
import java.util.Scanner;

public class Exam1Trace1 {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input w: ");
        double w = keyboard.nextDouble();
        System.out.print("Input x: ");
        double x = keyboard.nextDouble();
        System.out.print("Input y: ");
        int y = keyboard.nextInt();

        double z = x/4-y/2;
        w += z;
        int m = (int)z;
        int n = (y++) * (--m);

        System.out.println(x + " " + y + " " + z + " " + w + " " + m + " " + n);
    }
}
```

(a)

```
Input w: 5
Input x: 7
Input y: 9

7.0 10 -2.25 2.75 -3 -27
```

(b)

```
Input w: 21
Input x: 25
Input y: 15

25.0 16 -0.75 20.25 -1 -15
```

(c)

```
Input w: -3
Input x: -2
Input y: 8

-2.0 9 -4.5 -7.5 -5 -40
```

2. For each of the program inputs below write the output of the program.

```
import java.util.Scanner;

public class Exam1Trace2 {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input x: ");
        int x = keyboard.nextInt();
        System.out.print("Input y: ");
        int y = keyboard.nextInt();

        if (x-y > 0){
            System.out.println("Part 1: (x-y > 0)");
        } else if (x-y < -10){
            System.out.println("Part 2: (x-y < -10)");
        } else if (2*x != 4*y){
            System.out.println("Part 3: (2*x != 4*y)");
        } else if (x*x+y*y <= 16){
            System.out.println("Part 4: (x*x+y*y < 16)");
        } else {
            System.out.println("None of the above. ");
        }
    }
}
```

(a)

Input x: 5  
Input y: 6

Part 3: (2\*x != 4\*y)

(b)

Input x: 0  
Input y: 0

Part 4: (x\*x+y\*y < 16)

(c)

Input x: 10  
Input y: 5

Part 1: (x-y > 0)

(d)

Input x: 5  
Input y: 25

Part 2: (x-y < -10)

3. For each of the program inputs below write the output of the program.

```
import java.util.Scanner;

public class Exam1Trace3 {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input n: ");
        int n = keyboard.nextInt();

        while (n > 0){
            if (n % 5 == 0){
                n = n/5;
            } else if (n % 3 == 0){
                n = n/3;
            } else if (n % 2 == 0){
                n = n/2;
            } else {
                n--;
            }
            System.out.print(n + " ");
        }
    }
}
```

(a)

Input n: 33

11 10 2 1 0

(b)

Input n: 77

76 38 19 18 6 2 1 0

(c)

Input n: 500

100 20 4 2 1 0

### Part 3: Coding (15 Points Each)

1. Write a program that will take in three integers and output them in order from smallest to largest. A sample run of the program will produce the following output.

Input three integers: 2 3 1  
Sorted: 1 2 3

Solution 1:

```
import java.util.Scanner;

public class Exam1Code1 {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input three integers: ");
        int num1 = keyboard.nextInt();
        int num2 = keyboard.nextInt();
        int num3 = keyboard.nextInt();

        System.out.print("Sorted: ");

        if (num1 < num2) {
            if (num1 < num3) {
                System.out.print(num1 + " ");
                if (num2 < num3) {
                    System.out.print(num2 + " ");
                    System.out.print(num3 + " ");
                } else {
                    System.out.print(num3 + " ");
                    System.out.print(num2 + " ");
                }
            } else {
                System.out.print(num3 + " ");
                System.out.print(num1 + " ");
                System.out.print(num2 + " ");
            }
        } else {
            if (num2 < num3) {
                System.out.print(num2 + " ");
                if (num1 < num3) {
                    System.out.print(num1 + " ");
                    System.out.print(num3 + " ");
                } else {
                    System.out.print(num3 + " ");
                    System.out.print(num1 + " ");
                }
            } else {
                System.out.print(num3 + " ");
                System.out.print(num2 + " ");
                System.out.print(num1 + " ");
            }
        }
    }
}
```

Solution 2:

```
import java.util.Scanner;

public class Exam1Code1 {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input three integers: ");
        int num1 = keyboard.nextInt();
        int num2 = keyboard.nextInt();
        int num3 = keyboard.nextInt();

        if (num2 < num1) {
            int temp = num1;
            num1 = num2;
            num2 = temp;
        }

        if (num3 < num2) {
            int temp = num2;
            num2 = num3;
            num3 = temp;
        }

        if (num2 < num1) {
            int temp = num1;
            num1 = num2;
            num2 = temp;
        }

        System.out.println("Sorted: " + num1 + " " + num2 + " " + num3);
    }
}
```

2. Write a program that will simulate rolling two die and count the number rolls it takes to get two consecutive rolls of snake-eyes. A sample run is below.

Number of rolls = 862

```
public class Exam1Code2 {
    public static void main(String[] args) {

        boolean lastrollsnaakeeyes = false;
        boolean thisrollsnaakeeyes = false;
        int count = 0;

        while (!lastrollsnaakeeyes || !thisrollsnaakeeyes) {
            lastrollsnaakeeyes = thisrollsnaakeeyes;
            int die1 = (int) (Math.random() * 6) + 1;
            int die2 = (int) (Math.random() * 6) + 1;
            if ((die1 == 1) && (die2 == 1))
                thisrollsnaakeeyes = true;
            else
                thisrollsnaakeeyes = false;

            count++;
        }
        System.out.println("Number of rolls = " + count);
    }
}
```

3. Write a program that will take an input a String and count the number of uppercase characters, lowercase characters and output these counts along with a count of the number of other characters. A sample run is below.

Input the String: This Is A TeSt of the CHARacter COunts

Uppercase = 11

Lowercase = 20

Other = 7

```
import java.util.Scanner;

public class Exam1Code3 {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input the String: ");
        String str = keyboard.nextLine();

        int ucount = 0;
        int lcount = 0;

        for (int i = 0; i < str.length(); i++) {
            char testchar = str.charAt(i);
            if ((testchar >= 'A') && (testchar <= 'Z'))
                ucount++;
            if ((testchar >= 'a') && (testchar <= 'z'))
                lcount++;
        }

        System.out.println("Uppercase = " + ucount);
        System.out.println("Lowercase = " + lcount);
        System.out.println("Other = " + (str.length() - ucount - lcount));
    }
}
```