Fall 2013 **Exam #1 Key** COSC 117

1 Definitions & Short Answer (4 Points Each)

1. 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.

2. What is the difference between a compiler and an interpreter? Also, discuss Java's method.

   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. Java uses a combination of the two. There is a compile stage that translates the Java code into byte-code that the interpreter (known as the JVM or Java Virtual Machine) runs.

3. Java is a "platform-independent language." What is a *platform*, what does *platform-independent* mean, and how does Java attain its platform independence?

   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.

4. 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 runtime errors but the program does not do what it was intended to do.

5. What are reserved words? Give four examples of Java reserved words.

   A reserved word is a word that is used for a particular use in the programming language and cannot be redefined. Hence the programmer cannot use a reserved word as a variable name. There are many reserved words in Java, some we have seen thus far are public, void, class, if, else, while, int, double, long, float, new, import, and static.

2 Program Traces (15 Points Each)

1. For each of the given inputs, write the output of the program.

```
1  import java.util.Scanner;
2
3  public class Exam1Trace1 {
4
5      public static void main(String[] args) {
6          Scanner keyboard = new Scanner(System.in);
7          System.out.print("Input w: ");
8          long w = keyboard.nextLong();
9          System.out.print("Input x: ");
10         double x = keyboard.nextDouble();
11         System.out.print("Input y: ");
12         int y = keyboard.nextInt();
13
14         double z = x / 2 - y / 5;
15         w += z;
16         int m = 2*y;
17         int n = (++y) * (m--);
18
19         System.out.println(x + " " + y + " " + z + " " + w + " " + m + " " + n);
20     }
21 }
```

(a)
```
Input w: 2
Input x: 3
Input y: 4
3.0 5 1.5 3 7 40
```

(b)
```
Input w: 5
Input x: 8
Input y: 12
8.0 13 2.0 7 23 312
```

(c)
```
Input w: 3
Input x: -7
Input y: -7
-7.0 -6 -2.5 0 -15 84
```

2. For each of the given inputs, write the output of the program.

```
1  import java.util.Scanner;
2
3  public class Exam1Trace2 {
4
5      public static void main(String[] args) {
6          Scanner keyboard = new Scanner(System.in);
7          System.out.print("Input str1: ");
8          String str1 = keyboard.nextLine();
9          System.out.print("Input str2: ");
10         String str2 = keyboard.nextLine();
11
12         int pos = str1.indexOf(str2);
13         System.out.println(pos);
14
15         if (pos > 5){
16             str1 = str1.replaceAll(str2, "HERE");
17             str2 = "Replaced All";
18         } else if (pos < 10){
19             str2 = str1.replaceAll(" ", "");
20             str1 = str2.substring(str2.length()/4, str2.length()/2);
21         } else {
22             String tempstr = str1;
23             str1 = str2;
24             str2 = tempstr;
25         }
26
27         System.out.println(str1);
28         System.out.println(str2);
29     }
30 }
```

(a)
```
Input str1: This is a nifty string, if you like string.
Input str2: if
11
This is a nHEREty string, HERE you like string.
Replaced All
```

(b)
```
Input str1: This is a nifty string, if you like string.
Input str2: is
2
iftystrin
Thisisaniftystring,ifyoulikestring.
```

(c)
```
Input str1: This is a nifty string, if you like string.
Input str2: an
-1
iftystrin
Thisisaniftystring,ifyoulikestring.
```

3. For each of the given inputs, write the output of the program.

```
1  import java.util.Scanner;
2
3  public class Exam1Trace3 {
4
5      public static void main(String[] args) {
6          Scanner keyboard = new Scanner(System.in);
7          System.out.print("Input num1: ");
8          int num1 = keyboard.nextInt();
9          System.out.print("Input num2: ");
10         int num2 = keyboard.nextInt();
11         System.out.print("Input num3: ");
12         int num3 = keyboard.nextInt();
13         System.out.print("Input b1: ");
14         boolean b1 = keyboard.nextBoolean();
15         System.out.print("Input b2: ");
16         boolean b2 = keyboard.nextBoolean();
17
18         if (b1 && !b2) {
19             num1++;
20             num2--;
21             num3 += num1 + num2;
22         }
23
24         if ((b1 || b2) && !(num1 > num2)) {
25             num2--;
26             num3 = num2;
27         } else if (num3 > num2) {
28             b1 = b1 ^ b2;
29             b2 = !b2;
30         } else {
31             num1 -= 5;
32             num2 = num3 * 2 / 5;
33         }
34
35         System.out.println(num1 + "  " + num2 + "  " + num3 + "  " + b1 + "  " +
               b2);
36     }
37 }
```

(a)
```
Input num1: 1
Input num2: 2
Input num3: 3
Input b1: true
Input b2: false
2  1  6  true  true
```

(b)
```
Input num1: 5
Input num2: 6
Input num3: 3
Input b1: false
Input b2: true
5  5  5  false  true
```

3 Coding (15 Points Each)

1. Write a program that will ask the user to input three integer values on a single line, separated by spaces. Have these three numbers stored in the variables x, y, and z respectively. Have the program determine which of the three values is the largest (store that value in max), smallest (store that value in min), and the middle value (store that value in mid). Have the program then calculate the average of the three numbers and the average of just the min and max numbers. Finally, have the program print out, on a single line, the min, mid, max, average, and average of min and max values in that order. A sample run is below,

```
Input three numbers separated by a space: 7 15 3
3  7  15  8.33333333333333  9.0
```

```java
import java.util.Scanner;

public class Exam1Code1 {

    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input three numbers separated by a space: ");
        int x = keyboard.nextInt();
        int y = keyboard.nextInt();
        int z = keyboard.nextInt();

        int min = x;
        int max = x;

        if (y < min) min = y;
        if (z < min) min = z;
        if (y > max) max = y;
        if (z > max) max = z;

        int mid = x+y+z-min-max;

        double avg = (x+y+z)/3.0;
        double minmaxavg = (min+max)/2.0;

        System.out.println(min + "  " + mid  + "  " + max  + "  " + avg  + "  "
            + minmaxavg);
    }
}
```

2. Write a program that will simulate the tossing of three coins and one die. We will associate a score with the coin tosses, for each Head we add 3 to the score and for each Tail we subtract one from the score. If the die roll has a higher number than the coin score then the die wins the game and if the coin score is higher than the die roll then the coins win the game. If the scores are equal, it is a draw. Have the program print out the coin tosses (H for a head and T for a tail), the coin score, the die roll and who wins, or that there is a draw. Three sample runs are below,

```
Coins: T T T   Total: -3    Coins: H H T   Total: 5    Coins: H T H   Total: 5
Die: 2                      Die: 4                     Die: 5
Die Wins                    Coins Win                  Draw
```

```java
public class Exam1Code2 {

    public static void main(String[] args) {
        int coin1 = (int) (Math.random() * 2) + 1;
        int coin2 = (int) (Math.random() * 2) + 1;
        int coin3 = (int) (Math.random() * 2) + 1;
        int die1 = (int) (Math.random() * 6) + 1;

        int cointotal = 0;

        String coin1str = "";
        String coin2str = "";
        String coin3str = "";

        if (coin1 == 1) {
            coin1str = "H";
            cointotal += 3;
        } else {
            coin1str = "T";
            cointotal -= 1;
        }

        if (coin2 == 1) {
            coin2str = "H";
            cointotal += 3;
        } else {
            coin2str = "T";
            cointotal -= 1;
        }

        if (coin3 == 1) {
            coin3str = "H";
            cointotal += 3;
        } else {
            coin3str = "T";
            cointotal -= 1;
        }

        System.out.println("Coins: " + coin1str + " " + coin2str + " " + coin3str + "   Total: " + cointotal);
        System.out.println("Die: " + die1);
        if (die1 > cointotal)
            System.out.println("Die Wins");
        else if (die1 < cointotal)
            System.out.println("Coins Win");
        else
            System.out.println("Draw");
    }
}
```

3. Write a program that will ask the user to input their name on a single line in informal style (e.g. John Doe), and their year of birth (in yyyy format, such as 1985). The program should calculate their age and then print out the users formal name (e.g. Doe, John) followed by their age. Then if the user's age is less than or equal to 12 print out "You are just a kid.", if the user's age is greater than 12 but less than 20 then print out "You are a teenager.", if the user's age is greater than or equal to 20 but less than 30 then print out "You are getting up there.", and finally if the user's age is greater than or equal to 30 print out "Man, you are old!". A sample run is below,

```
Input Name (informal format): Don Spickler
Input Year of Birth (yyyy): 1965
Spickler, Don
Age: 48
Man, you are old!
```

```java
import java.util.Scanner;

public class Exam1Code3 {

    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input Name (informal format): ");
        String first = keyboard.next();
        String last = keyboard.next();
        System.out.print("Input Year of Birth (yyyy): ");
        int year = keyboard.nextInt();

        int age = 2013 - year;

        System.out.println(last + ", " + first);
        System.out.println("Age: " + age);

        if (age <= 12){
            System.out.println("You are just a kid.");
        } else if (age < 20) {
            System.out.println("You are a teenager.");
        } else if (age < 30) {
            System.out.println("You are getting up there.");
        } else {
            System.out.println("Man, you are old!");
        }
    }
}
```