1 Short Answer (5 Points Each)

1. Which of the following are valid variable names. If the variable name is invalid state why.

   (a) `Scanner`
   Solution: Valid but not recommended.

   (b) `while`
   Solution: Invalid, else is a reserve word.

   (c) `Intel Inside`
   Solution: Invalid, cannot have a space.

   (d) `Book001`
   Solution: Valid

   (e) `Trap_Door`
   Solution: Valid

2. What are the three types of programming errors? Briefly describe each of them.

   Solution:

   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.

3. Answer the following questions about numeric data types in Java.

   (a) What happens when you overload an int?
   Solution: The value cycles around to the minimum value of an int.

   (b) What happens when you overload a double?
   Solution: The value turns into Infinity.

   (c) What happens when you underload an int?
   Solution: The value cycles around to the maximum value of an int.

   (d) What happens when you underload a double?
   Solution: The value turns into 0.

   (e) What happens when you do an assignment statement where you are assigning a float data type to a long data type?
   Solution: The program will have a syntax error and not allow you to compile or run the program.

4. Write a single line of code that will extract the integer portion of a double variable x and store it into a long variable t.

   Solution:

   ```
   long t = (long) x;
   ```

5. Write a single line of code that will find the position of the first space in a string and store it in the variable pos.

   Solution:

   ```
   int pos = str.indexOf(" ");
   ```

6. Write a single line of code that will calculate,

$$h = \sqrt{r^2 - \left(\frac{s}{2}\right)^2}$$

Assume that r and s are already defined as doubles and have values, you will need to declare h and assign it to the formula's value.

Solution:

```
double  h = Math.sqrt(r * r - (s / 2) * (s / 2));
```

7. Write a couple lines of code that will take a string named `str`, find the position of the first "." and then split the string into two strings, the first going up to and including the "." and the second being everything after the ".".

Solution:

```
int pos = str.indexOf(".") + 1;
String part1 = str.substring(0, pos);
String part2 = str.substring(pos);
```

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 Exam01Trace01 {
4
5      public static void main(String[] args) {
6          Scanner keyboard = new Scanner(System.in);
7
8          System.out.print("Input x: ");
9          int x = keyboard.nextInt();
10         System.out.print("Input y: ");
11         int y = keyboard.nextInt();
12         System.out.print("Input z: ");
13         double z = keyboard.nextDouble();
14
15         int u = 1;
16         long t = 2;
17         double r = 3;
18         double w = 4;
19
20         if (x <= z && y < x) {
21             System.out.println("Block 1");
22             t = x % y;
23             u = ++y + x;
24             z += 5;
25         } else if (y > z) {
26             System.out.println("Block 2");
27             w = y / z;
28             r = Math.pow(x, 3);
29             y--;
30         } else {
31             System.out.println("Block 3");
32             t = Math.round(z / x);
33             r = (int) Math.PI;
34             x++;
35         }
36
37         System.out.println(x + "  " + y + "  " + z);
38         System.out.println(w + "  " + t + "  " + u + "  " + r);
39     }
40 }
```

(a)
```
Input x: 7
Input y: 14
Input z: 21
```
Solution:
```
Block 3
8  14  21.0
4.0  3  1  3.0
```

(b)
```
Input x: 7
Input y: 3
Input z: 10
```
Solution:
```
Block 1
7  4  15.0
4.0  1  11  3.0
```

2. For the given input, write the output of the program. For any spaces, including leading or trailing, use an under bracket to represent the space. For example, `Hi  There` should be written as `Hi␣␣There␣`.

```
1  import java.util.Scanner;
2
3  public class Exam01Trace02 {
4
5      public static void main(String[] args) {
6          Scanner keyboard = new Scanner(System.in);
7
8          System.out.print("Input a string: ");
9          String str1 = keyboard.next();
10         String str2 = keyboard.nextLine();
11         System.out.println(str1);
12         System.out.println(str2);
13
14         String str3 = str2.substring(0, 8);
15         String str4 = str2.substring(10);
16
17         System.out.println(str3);
18         System.out.println(str4);
19         System.out.println(str4.toUpperCase());
20         System.out.println(str4);
21
22         System.out.println(str3.length());
23         System.out.println(str4.charAt(str4.length() / 2));
24         System.out.println(str1.indexOf("a"));
25         System.out.println(str2.indexOf("e", 7));
26         System.out.println(str3.lastIndexOf("i", 10));
27     }
28 }
```

`Input a string: Far␣out␣in␣the␣uncharted␣reaches␣of␣the␣galaxy.`

Solution:

```
Far
␣out␣in␣the␣uncharted␣reaches␣of␣the␣galaxy.
␣out␣in␣
e␣uncharted␣reaches␣of␣the␣galaxy.
E␣UNCHARTED␣REACHES␣OF␣THE␣GALAXY.
e␣uncharted␣reaches␣of␣the␣galaxy.
8
e
1
10
5
```

3 Coding (15 Points Each)

1. Write a program that will randomly roll 5 6-sided dice and determine if all the dice are the same. It should print out the actual roll and a message that either all the dice are the same or that they are different.

```
Your Roll: 2 1 5 3 3
Dice are different.
```

```
Your Roll: 2 1 5 4 2
Dice are different.
```

```
Your Roll: 4 4 4 4 4
All dice are the same.
```

Solution:

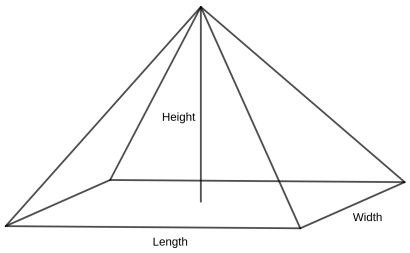
```java
public class FiveDice {

    public static void main(String[] args) {
        int die1 = (int) (Math.random() * 6) + 1;
        int die2 = (int) (Math.random() * 6) + 1;
        int die3 = (int) (Math.random() * 6) + 1;
        int die4 = (int) (Math.random() * 6) + 1;
        int die5 = (int) (Math.random() * 6) + 1;

        System.out.println("Your Roll: " + die1 + " " + die2 + " " + die3 + " " + die4 + " " + die5);

        if (die1 == die2 && die1 == die3 && die1 == die4 && die1 == die5)
            System.out.println("All dice are the same.");
        else
            System.out.println("Dice are different.");
    }
}
```

2. In a pyramid the base is a rectangle with sides of length, Length and Width, the other faces are triangles from each of the four sides of the base to a point above the base. The distance (perpendicular distance) from the top point to the base is of length, Height. The volume of a pyramid is one third the product of the length, width, and height. Write a program to calculate the volume of a pyramid. A sample run is below.



Sample Run

```
Input the Length: 3
Input the Width: 4
Input the Height: 6
The Volume is = 24.0
```

Solution:

```java
import java.util.Scanner;

public class HW01Pyramid {

    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        System.out.print("Input the Length: ");
        double L = keyboard.nextDouble();
        System.out.print("Input the Width: ");
        double W = keyboard.nextDouble();
        System.out.print("Input the Height: ");
        double H = keyboard.nextDouble();

        double Volume = (1.0 / 3.0) * L * W * H;

        System.out.println("The Volume is = " + Volume);
    }
}
```

3. Write a program that plays the (rather boring) game of High-Low. In an actual High-Low game you take a regular poker deck of 52 playing cards, shuffle them, then the players take consecutive cards off the top of the deck and compare them. Write a program that plays the game of High-Low. In High-Low two players are dealt one card each. The higher face value wins, with Ace being the top card. If the face values are equal then a Spade wins over a Diamond which wins over a Club which wins over a Heart. Since you will be generating the cards at random and not checking for duplicates there is also the possibility of two players getting the same card, in this case it is a draw. It would be like each player had their own deck of cards.

   Your program is to generate a random card using a random number generator for both Player 1 and Player 2, then you will have the program determine the winner of the game or a draw. Four sample runs are below. Your output should be formatted like the examples.

```
Player 1: 8 C      | Player 1: 9 C      | Player 1: 10 H     | Player 1: K C
Player 2: J H      | Player 2: 8 D      | Player 2: 10 D     | Player 2: K C
Player 2 Wins      | Player 1 Wins      | Player 2 Wins      | It is a draw.
```

Solution:

```
1  public class HighLow {
2
3      public static void main(String[] args) {
4          int player1CardFace = (int)(Math.random()*13+2);
5          int player1CardSuit = (int)(Math.random()*4+1);
6          int player2CardFace = (int)(Math.random()*13+2);
7          int player2CardSuit = (int)(Math.random()*4+1);
8
9          System.out.print("Player 1: ");
10         if(player1CardFace <= 10)
11             System.out.print(player1CardFace);
12         if(player1CardFace == 11)
13             System.out.print("J");
14         if(player1CardFace == 12)
15             System.out.print("Q");
16         if(player1CardFace == 13)
17             System.out.print("K");
18         if(player1CardFace == 14)
19             System.out.print("A");
20         System.out.print(" ");
21
22         if(player1CardSuit == 1)
23             System.out.print("H");
24         if(player1CardSuit == 2)
25             System.out.print("C");
26         if(player1CardSuit == 3)
27             System.out.print("D");
28         if(player1CardSuit == 4)
29             System.out.print("S");
30
31         System.out.println();
32
33         System.out.print("Player 2: ");
34         if(player2CardFace <= 10)
35             System.out.print(player2CardFace);
36         if(player2CardFace == 11)
37             System.out.print("J");
38         if(player2CardFace == 12)
39             System.out.print("Q");
40         if(player2CardFace == 13)
41             System.out.print("K");
42         if(player2CardFace == 14)
```

```
43              System.out.print("A");
44
45          System.out.print(" ");
46
47          if(player2CardSuit == 1)
48              System.out.print("H");
49          if(player2CardSuit == 2)
50              System.out.print("C");
51          if(player2CardSuit == 3)
52              System.out.print("D");
53          if(player2CardSuit == 4)
54              System.out.print("S");
55          System.out.println();
56
57          if(player1CardFace > player2CardFace)
58              System.out.println("Player 1 Wins");
59          else if(player1CardFace < player2CardFace)
60              System.out.println("Player 2 Wins");
61          else{
62              if(player1CardSuit > player2CardSuit)
63                  System.out.println("Player 1 Wins");
64              else if(player1CardSuit < player2CardSuit)
65                  System.out.println("Player 2 Wins");
66              else
67                  System.out.println("It is a draw.");
68          }
69      }
70  }
```