1 Short Answer (5 Points Each)

1. 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.

2. 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 input a non-numeric string when the Scanner is doing a nextDouble?
   Solution: Run-time error, since it will not automatically convert a string to a double.

3. What is the difference between a compiler and an interpreter? Also, discuss Java's method. In addition, explain why this makes Java a"platform-independent language."

   Solution:

   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.

   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 does ASCII stand for and what is it?

   Solution: American Standard Code for Information Interchange. It is a system where characters are associated with integers.

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

   (a) `if`
   Solution: `Invalid: if is a reserve word.`

   (b) `3blindmice`
   Solution: Invalid: cannot begin with a letter.

   (c) `GeorgeForman`
   Solution: Valid

   (d) `Tax$`
   Solution: Invalid: cannot use special characters except for the underscore.

(e) `Bus_Stop`
Solution: Valid

6. Write a single line of code that will compute $\sqrt{2+\sqrt{2}}$ and store the value in the variable `S`.
Solution:

```
double S = Math.sqrt(2 + Math.sqrt(2));
```

7. Convert the number 279 into binary.
Solution: 100010111

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         double w = y / x;
16         long t = y % x;
17         ++y;
18         int u = y + x--;
19         double r = z / x + y;
20
21         System.out.println(x + "  " + y + "  " + z);
22         System.out.println(w + "  " + t + "  " + u + "  " + r);
23     }
24 }
```

(a)
```
Input x: 5
Input y: 21
Input z: 4.5
```
Solution:
```
4  22  4.5
4.0  1  27  23.125
```

(b)
```
Input x: 5
Input y: 3
Input z: 2
```
Solution:
```
4  4  2.0
0.0  3  9  4.5
```

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 str = keyboard.nextLine();
10
11         System.out.println(str.length());
12         System.out.println(str.charAt(10));
13         System.out.println(str.indexOf("a"));
14         System.out.println(str.indexOf("e", 17));
15         System.out.println(str.lastIndexOf("e", 17));
16
17         String str2 = str.substring(5, 12);
18         String str3 = str.substring(25);
19
20         System.out.println(str2);
21         System.out.println(str3);
22         String str4 = str2 + str3;
23         System.out.println(str4);
24         System.out.println(str4.trim());
25         System.out.println(str4.toUpperCase());
26     }
27 }
```

`Input a string: Well,␣I␣have␣never␣been␣so␣insulted!`

Solution:

```
36
v
9
20
16
␣I␣have
o␣insulted!
␣I␣haveo␣insulted!
I␣haveo␣insulted!
␣I␣HAVEO␣INSULTED!
```

3 Coding (15 Points Each)

1. Write a program that will take in an entire sentence that has the word "and" in it. The program should then split the sentence at the word "and" and print out the two half sentences. A sample run is below, the user typed in `This class is very easy and I am going to ace this exam.`

```
Input a string with the word 'and' in it:
This class is very easy and I am going to ace this exam.
This class is very easy
and I am going to ace this exam.
```

```
1  import java.util.Scanner;
2
3  public class Lab04_Prog1 {
4
5      public static void main(String[] args) {
6          Scanner keyboard = new Scanner(System.in);
7
8          System.out.println("Input a string with the word \'and\' in it: ");
9          String str = keyboard.nextLine();
10
11         String firsthalf = str.substring(0, str.indexOf("and"));
12         String secondhalf = str.substring(str.indexOf("and"));
13
14         System.out.println(firsthalf);
15         System.out.println(secondhalf);
16     }
17 }
```

2. Write a program that will ask the user for three exam scores and a final exam score. The exams are worth 100 points each and the final is worth 200 points. Have the program calculate the student's percentage average and print it to the screen. Also have the program determine if the student earns an A for the class, an average of 90 or higher. If they do then have the program print out `Congratulations you earned an A.` and if the student did not earn an A have the program print out `You needed to work a little harder this semester.`

```java
import java.util.Scanner;

public class Exam01_Prog1_S19 {

    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);

        System.out.print("Input Exam 1 Score: ");
        double ex1 = keyboard.nextDouble();
        System.out.print("Input Exam 2 Score: ");
        double ex2 = keyboard.nextDouble();
        System.out.print("Input Exam 3 Score: ");
        double ex3 = keyboard.nextDouble();
        System.out.print("Input Final Exam Score: ");
        double fin = keyboard.nextDouble();

        double Average = (ex1 + ex2 + ex3 + fin) / 5;
        System.out.println("Your average is " + Average);

        if (Average >= 90)
            System.out.println("Congratulations you earned an A.");
        else
            System.out.println("You needed to work a little harder this semester."
                );
    }
}
```

3. Write a program that will play the following game. Have the computer simulate the rolling of two six-sided die and the flipping of two coins. If the coins are both heads have the program tell the user that they won and the dollar amount they won is the sum of the two dice. For example, if the player wins the message should look like, `Congratulations you win $6.00.` If the two coins are not both heads have the program print out `Sorry, you lose.`

```
1
2  public class Exam01_Prog2_S19 {
3
4      public static void main(String[] args) {
5          int roll1 = (int) (Math.random() * 6) + 1;
6          int roll2 = (int) (Math.random() * 6) + 1;
7          int coin1 = (int) (Math.random() * 2) + 1;
8          int coin2 = (int) (Math.random() * 2) + 1;
9
10         int coinsum = coin1 + coin2;
11         int rollsum = roll1 + roll2;
12
13         if (coinsum == 2)
14             System.out.println("Congratulations you win $" + rollsum + ".00.");
15         else
16             System.out.println("Sorry, you lose.");
17     }
18 }
```