Name: _____

Write all of your responses on these exam pages. If you need extra space please use the backs of the pages.

1 Short Answer (5 Points Each)

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

2. Write a single line of code (not an entire program) that declares an integer variable `num1` and assigns to it a random integer between -17 and 19, inclusively.

3. Write a single line of code (not an entire program) that declares a double variable called `pi` and stores in it the value of $\frac{\pi}{6}$.

4. What does ASCII stand for and what is it?

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

   (a) What is overloading and underloading a double?

   (b) What happens when you overload a double?

   (c) What happens when you underload a double?

   (d) What happens when you input a number when the Scanner is doing a nextLine?

   (e) What happens when you input a decimal number when the Scanner is doing a nextInt?

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

   (a) `hgY3_4qwt%p`

   (b) `item5`

   (c) `HelpMe`

   (d) `void`

   (e) `Help Me`

7. Write a few lines of code (not an entire program) that will take an input string from the user (an entire line of text) and printout the number of occurrences of the letter `a` in the string, this is to be case insensitive, so it should count the number of both `a` and `A`. You may assume that a Scanner object has been created with name `kb`. Hint: if you remove every `a` in the string then the number of letters `a` in the original string will be the difference in the lengths of the original string and the string with no letter `a`.

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 kb = new Scanner(System.in);
7          System.out.print("Input a number: ");
8          int a = kb.nextInt();
9          System.out.print("Input a number: ");
10         double b = kb.nextDouble();
11         System.out.print("Input a number: ");
12         int c = kb.nextInt();
13
14         if (a >= b) {
15             System.out.println("Block 1");
16             c = a / 2;
17             --a;
18             b = b + a;
19         } else if (b > c) {
20             System.out.println("Block 2");
21             c = a++ * c;
22             b = b / 2;
23         } else {
24             System.out.println("Block 3");
25             Math.pow(a, c);
26             b = --b - 1;
27             a = c;
28             c = a;
29         }
30
31         System.out.println(a + "  " + b + "  " + c);
32     }
33 }
```

(a)
```
Input a number: 4
Input a number: 3
Input a number: 2
```

(b)
```
Input a number: 5
Input a number: 8
Input a number: 9
```

(c)
```
Input a number: 7
Input a number: 12
Input a number: 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 Exam1Trace2 {
4
5      public static void main(String[] args) {
6          Scanner kb = new Scanner(System.in);
7          System.out.print("Input a string: ");
8          String s = kb.nextLine();
9          System.out.print("Input a string: ");
10         String t = kb.nextLine();
11         System.out.print("Input a string: ");
12         String r = kb.nextLine();
13
14         int pos = s.indexOf(r);
15         System.out.println(pos);
16         if (pos >= 0) {
17             t = t.substring(pos / 2) + s.substring(pos);
18             s = s.substring(0, pos);
19             r.toUpperCase();
20         } else {
21             pos = t.length() / 2;
22             t = t.substring(pos);
23         }
24
25         System.out.println(s);
26         System.out.println(t);
27         System.out.println(r);
28
29         System.out.println(s.endsWith(r));
30         System.out.println(t.indexOf("o"));
31
32         if (s.compareToIgnoreCase(t) > 0) {
33             System.out.println(s.charAt(1));
34         }else {
35             System.out.println(t.charAt(1));
36             System.out.println(r.charAt(1));
37         }
38     }
39 }
```

(a)
```
Input a string: The␣quick␣gray␣fox␣jumped
Input a string: over␣the␣lazy␣dog
Input a string: ick
```

(b)
```
Input a string: a␣very␣tricky␣question
Input a string: can␣have␣a␣tricky␣answer
Input a string: rick
```

3 Coding (15 Points Each)

1. Write a program that will take as input the cost of the food bill at a restaurant. The state tax for the food is 6%, the restaurant has an additional restaurant tax that is 5% if the bill is under $200. If the bill is $200 or more then the restaurant does not include the restaurant tax. If the bill is under $50 then the tip is 15% of the food cost, if the bill is $50 up to but not including $100 then the tip is 17.5% of the food cost, and if the bill is $100 or more then the tip is 20% of the food cost. Have the program print out the food cost, the two taxes, tip, and total. The output of all the costs should have two decimal places and the decimal points should line up vertically, as in the three runs below. You may assume that the cost of any meal is less than $500.

```
Bill = 45.23                 | Bill = 154.39                | Bill = 237.90
     Food Cost =  45.23      |      Food Cost = 154.39      |      Food Cost = 237.90
           Tax =   2.71      |            Tax =   9.26      |            Tax =  14.27
Restaurant Tax =   2.26      | Restaurant Tax =   7.72      | Restaurant Tax =   0.00
           Tip =   6.78      |            Tip =  30.88      |            Tip =  47.58
    Total Cost =  56.99      |     Total Cost = 202.25      |     Total Cost = 299.75
```

```
import java.util.Scanner;

public class Exam01_1 {

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









    }
}
```

2. Write a program that will take in five numbers as input and print out the largest, smallest, and product of the numbers. The product of the numbers is simply all of them multiplied together.

```
Input five numbers: 2.7 9.8 12 1.7 4.2
Minimum = 1.7
Maximum = 12.0
Product = 2267.0928
```

```
import java.util.Scanner;

public class Exam01_2 {

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









    }
}
```

3. Write a program that will take an input string from the user (an entire line of text) and a single word (string with only one word). Have the program remove the last occurrence of the word from the sting and print out the new string. Make sure that this program will also work if the word is not in the string. Two runs are below.

```
Input a string: the quick brown fox jumped over the lazy dog
Input a word: the
the quick brown fox jumped over  lazy dog

Input a string: the quick brown fox jumped over the lazy dog
Input a word: pizza
the quick brown fox jumped over the lazy dog
```

```
import java.util.Scanner;

public class Exam01_3 {

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









    }
}
```