Name_____

Test 1 Make-up
(250pts)

A. Tracing Code (60pts)

Write what output will appear in the box provided. If there is screen output and file output, be sure to place output for each in their correct boxes. Also, make sure you keep track of your variable states as you trace through the code. There are boxes provided for these also, please us them. It will be best to cross out old values as you update them rather than delete them as this will help you maintain a version history in case you need to retrace your steps.

1. (5pts)

```
public class Trace1{
  public static void main(String [] args){
    System.out.print("ha \n ha");
    System.out.println(" ha!");
    System.out.println("\t\thappy\\n");
  }
}
```

```
ha
 ha ha!
              happy\n
```

2. (5pts)

```
public class Trace2{
  public static void main(String [] args){
    int x = 32;
    int y = 55;
    int z = 0;
    int i = -1;
    boolean is = false;


    if(x > y || z > i){
      if(i > 0){
        System.out.print("a");
      } else if (i == -1){
        System.out.print("p");
        if(!is){
          System.out.print("i");
        } else {
          System.out.print("p");
        }
        if(true){
         System.out.println(“p”);
        }
      } else{
        System.out.println("d");
        if(x == 32 && y == 55 && z == 0){
          System.out.print("You made it!");
        } else {
          System.out.print("Next time...");
        }
      }
    } else {
      System.out.print("x is less than y");
    }
  }
}
```

```
pip
```

3. (5pts)

```
public class Trace3{
  public static void main(String [] args){
    int s = 4;
    int t = 3;
    int u = 13;
    int v = 6;

    System.out.println(Math.pow(s,t) + 7.0f *
(u / v * 2));
  }
}
```

```
64.0
4
92.0
```

4. (5pts)

```
public class Trace4{
  public static void main(String [] args){
    for(int i = 5; i > 1; i--){
      for(int j = 1; j < i; j++){
       //unicode for smiley face \u263A
        System.out.print("\u263A" + "\u263A" +
" ");
      }
        System.out.print("\n");
    }
  }
}
```

☺☺ ☺☺ ☺☺ ☺☺
☺☺ ☺☺ ☺☺
☺☺ ☺☺
☺☺

5. (5pts)

```
public class Trace5 {
  public static void main(String [] args){
    String test = "";
    int n = 3;

    if(true && true && true && true && false){
      test += "Do you ";
    } else {
      test += "understand ";
    }

    if(n == 1 + 1 + 1){
      test += "the risks ";
      n--;
    }

    for(int i = 0; i < n; i++){
      test += "you should \n";
    }

    System.out.println(test);
  }
}
```

```
understand the risks you should
you should
```

6. (5pts)

```
public class Trace6{
  public static void main (String [] args){
    int upper = 1;
    int lower = 0;

    int r = (int) (Math.random() * (upper -
lower)) + lower;

    System.out.println(r);
  }
}
```

0

7. (5pts)

```
public class Trace7{
  public static void main(String [] args){
    String tape = "aabbabaab";
    String res = "";

    for(int i = 0; i < tape.length(); i++){
      char c = tape.charAt(i); //get character
at position i

      if(c == 'a'){
        res += 'b';
      }

      if(c == 'b'){
        res += 'a';
      }
    }

    System.out.println(res);
  }
}
```

bbaababba

8. (5pts)

```
public class Trace8 {
  public static void main(String [] args){
    String a = "42";
    String b = "banana";

    int letter = 65;

    char c = 65;      //character A
    char d = (char) (letter + 1);
    char e = (char) (letter + 2);
    int x = 16;
    int y = 9;

    System.out.println(a + b);
    System.out.println(x + y);
    System.out.println(a + y);
    System.out.println(c + " " +  d + " " +
e);
  }
}
```

```
42banana
25
429
A B C
```

9. (5pts) The user enters: n, o, and t as input (one letter each time)

```
import java.util.Scanner;

public class Trace9 {
  public static void main(String [] args){
    Scanner s = new Scanner(System.in);

    String secret = "Melts in your mouth not
in your hand";
    String mask = "x";

    System.out.println("Welcome to
censor.exe");
    String input = s.nextLine();

    do{
      secret = secret.replace(input.charAt(0),
'x');
      System.out.println(secret);
      System.out.println("");
      input = s.nextLine();
    } while(!
input.equals("done").trim().toLowerCase());

    System.out.println("Thanks for censoring
content!");
    System.out.println("Here is your final
censored document:" );
    System.out.println("");
    System.out.println(secret);

  }
}
```

```
Welcome to censor.exe
n
Melts ix your mouth xot ix your haxd

o
Melts ix yxur mxuth xxt ix yxur haxd

t
Melxs ix yxur mxuxh xxx ix yxur haxd
```

10. (5pts)

15

```
public class Trace10{
  public static void main(String [] args){

    String five =   "xxxxx";
    String three =   "xxx";
    String res = "";

    for(int i = 0; i < five.length(); i++){
      for(int j = 0; j < three.length(); j++){
        res += "x";
      }
    }

    System.out.println(res.length());
  }
}
```

B. Debugging Code (28pts)
Rewrite the code below so that it is correct and will compile.

1.
```
string integer = “int”;
int string = 1920189147;
char s = 83; //ASCII number for the letter ‘S’
System.out.println(s + int + string);
```

```
String integer = “int”;
int string = 1920189147;
char s = 83;
System.out.println(s + int + string);
```

2.
```
for(int i = 0; i < 3; i++){
 for(int j = 0; j < 2; j+){
  System.out.print(“j”);
 }

 System.out.print(“\n”);
}
```

```
for(int i=0; i < 3; i++){
  for(int j=0; j < 2; j++){
    System.out.print(“j”);
  }

  System.out.print(“\n”);
}
```

3.
```
if(int i = 0; i < 10; i++){
System.out.print(‘alleluiah’);
}
```

```
for(int i=0; I < 10; i++){
  System.out.print(“alleluiah”);
}
```

4.
```
while(){
i++;
}
```

```
while(i < 10){
 i++;
}
```

5.
```
Scanner s = new Scanner(System.out);
int x = s.nextInt;
```

```
Scanner s = new Scanner(System.in);
int x = s.nextInt();
```

6.
```
char t = ‘today is monday’;
Sys.out.prnt(t);
```

```
char t = ‘t’;

System.out.println(t);
```

7.
```
System.out.println(3.0f * 2f / 3^3);
System.out.println(Math.pow());
```

```
System.out.println(3.0f * 2f / (float)Math.pow(3,3));
System.out.println(Math.pow(3,3));
```

C. Concepts (56pts)

1. After you are finished writing the source code for a computer program, list the steps that one must take in order for the program to execute.

1. Debug/Compile the .java files
2. Execute the main program

2. What is the difference between =, ==, and .equals() in Java?

= assigns values to variables

== compares two primitive variable values and resturns true if they are the same and false otherwise

.equals() is a method of the String class for comparing the value of two String objects, because Strings are objects and not primitives, == compares their address in memory rather than checking to see if their characters are the same.

3. What is the difference between a literal such as 32 or “Hello World!” and a variable such as int x?

A literal is the representation of a data value in your source code. Literals can be assigned to variables. A variable can change what data it contains throughout the life of a program.

4. What is the difference between arithmetic operators such as +, -, *, / and the logical operators ||, !, and && ?

arithmetic operators take numbers as input and return numbers as output, logical operators take any variable, including objects as input and return true or false

5. What are curly braces { } used for in Java?

Curly braces are used to enclose blocks of code. They mark the beginning and end of class and function bodies, as well as the instructions for control structures such as loops and if statements. The scope of a variable is marked by the curly braces that enclose it.

6. What is the difference between System.in and System.out? Why do they both start with the identifier System?

System.in is a public static object belonging to the class System. The object in is of type InputStream. It represents the standard input of the computer and can be used to accept input from the user.
System.out is a public static object belonging to the class System. The object out is of type PrintStream. It can be used to print output to the screen or a file.

7. What is the difference between byte, short, long, and int types?

byte is the smallest number type
short is the next smallest
int is the standard size we use most of the time
long is the largest

At the top of the list, the variable type byte consumes the least amount of memory but has the smallest range, at the bottom of the list, the variable type long consumes the most amount of memory but has the largest range.

8. What does the final keyword do in Java?

The final keyword presents the value of the variable from being changed or reassigned.

9. Math.abs(x) and System.out.println(x) both take x as a parameter and produce output. These are both examples of function calls. Math.pow(x, y) and x + y are also both function calls. Even though + invokes a function, it is written in a special way. + is called an operator. Operators are special functions that use infix notation for their parameters. Give an example of two other operators and describe what their inputs and outputs are. Please use specific examples to illustrate what you mean.

4 > 4 the greater than operator takes an two integers as input and produces a boolean as output, it returns true only if the first input is greater than the second input

isHappy && isSleeping the logical AND operator takes too booleans as input and produces a boolean as output. It returns true only if both boolean inputs are true

10. Describe what the following code does:

```
import java.util.Scanner;
import java.io.File;
import java.io.IOException;

public class Homoiconic {
   public static void main(String [] args) throws IOException{
       Scanner fileIn = new Scanner(new File("Homoiconic.java"));

       while(fileIn.hasNext()){
              System.out.println(fileIn.nextLine());
       }
   }
}
```

This code prints out the contents of the file Homoiconic.java to the screen.

12. Why do variables have minimum and maximum values in Java?

Standard variable types are represented as binary numbers of a certain length. The number of on and off bits in those numbers is finite and their combinations can thus only represent a finite maximum or minimum number. Variable types that consume more memory can store larger numbers but there is always a limited size when the numbers are represented this way as space in memory is finite. There are ways to make data-types that represent numbers of arbitrary sizes, but those representations require the value to be computed on demand rather than stored directly as a binary representation.

13. What is the difference between a primitive variable type like int or char and an object variable like Scanner or String?

A primitive variable type is a single point of data stored in memory. Object variable types are collections of primitive variable types along with some methods.

14. Do you foresee programming being a large part of your career in 5 years? How will you be using it?

Yes, to build decentralized networks and augmented reality games and simulations.

D. Writing Programs (120pts)

1. Write a computer program that counts by 4's. The program should print out every number between 1 and 100 that is a multiple of 4. You should use a loop so that your program could later be altered to count by fours past 100.

The output for the program should look like this:
4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88 92 96 100

```
public class Writing1{
  public static void main(String [] args){
    /*most efficient way*/
    for(int i = 4; i <= 100; i += 4){
      System.out.println(i);
    }

    /*Alternative but more computationally expensive way*/
    for(int i = 1; i <= 100; i++){
     if(i % 4 == 0){
       System.out.println(i);
     }
    }
  }
}
```

2. Write a program that randomly generates a 1 or a 0.

```
public class Writing2 {
  public static void main(String [] args){
   System.out.println(Math.round(Math.random()));

   /*alternatively*/
   double r = Math.random();

   if(r < 0.5){
    r = 0;
   } else {
    r = 1;
   }

   System.out.println(r);
  }

}
```

3. Write a program that shifts all of the letters in a String by 4 values in the ASCII/Unicode table. For instance, if the String provided as input is “ABCD” the output of the program should be “EFGH”

```
public class Writing3{
  public static void main(String [] args){
    String original = "abcdefghij";
    String shifted = "";

    for(int i = 0; i < original.length(); i++){
      shifted += (char) ((original.charAt(i) + 4));
    }

    System.out.println(shifted);
  }
}
```

4. Write a program that calculates and prints out the sum of all the odd numbers between 1 and 200

```
public class Writing4 {
  public static void main(String [] args){
    for(int i = 1; i <= 200; i++){
      if(i % 2 == 1){
        System.out.println(i);
      }
    }
  }
}
```

5. Write a program that prints out the following output using a nested for loop:
x x x x
 x x x
x x x x
 x x x
x x x x

```
public class Writing5 {
  public static void main(String [] args){
    for(int i = 0; i < 5; i++){

      boolean isRowIndexOdd = i % 2 == 1;

      if(isRowIndexOdd){
       System.out.print(" ");
      }

      for(int j = 0; j < 3; j++){
        System.out.print("x ");
      }

      if(!isRowIndexOdd){
        System.out.print("x ");
      }

      System.out.print("\n");
    }
  }
}
```

6. Write a program that asks a user how much they weigh and how tall they are. If the person is over 6ft and less than 150lbs. Have the program say “My how tall and skinny you are!” If the person is under 5ft and over 400lbs, have the program say “My how short and fat you are!” If the person is over 6ft and more than 500lbs, have the program say, “My how tall and fat you are!” If the person is under 5ft and less than 100lbs, have the program say, “My how short and skinny you are!” For any other weight and height, have the program remark, “You are very average! YAWN!”

```
import java.util.Scanner;

public class Writing6{
  public static void main(String [] args){
    Scanner s = new Scanner(System.in);

    double weight, height;

    System.out.println("How much do you weigh in lbs?");
    weight = Double.parseDouble(s.nextLine());

    System.out.println("How tall are you in feet?");
    height = Double.parseDouble(s.nextLine());

    if(height > 6 && weight < 150){
      System.out.println("My how tall and skinny you are!");
    } else if(height < 5 && weight > 400){
      System.out.println("My how short and fat you are!");
    } else if(height  > 6 && weight > 500){
      System.out.println("My how tall and fat you are!");
    } else if(height < 5 && weight < 100){
      System.out.println("My how short and skinny you are!");
    } else {
      System.out.println("You are very average! YAWN!");
    }
  }
}
```

7. Write a program that keeps asking the user for money until they enter the amount 3.50 at which point the program will thank the user, print out the total amount of money given, and exit.

```
import java.util.Scanner;

public class Writing7{
  public static void main(String [] args){
    Scanner s = new Scanner(System.in);

    double amount = 0;
    double total = amount;

    while(amount != 3.50){
      System.out.println("I'm a poor computer program, please give me some money!");
      amount = Double.parseDouble(s.nextLine());
      total += amount;
    }

    System.out.println("Thank you so much for your generous contribution!");
    System.out.println("The total amount of money given was $" + total);
  }
}
```

8. Write a program that takes a number of inches as input and converts the number into feet and inches. For instance, if the user enters the number 49, the program will report that 50 inches is 4ft and 2 inches (There are 12 inches in 1 foot.)

```
import java.util.Scanner;

public class Writing8{

  public static int INCHES_PER_FOOT = 12;

  public static void main(String [] args){

    Scanner s = new Scanner(System.in);

    String input;
    int feet, inches, inputAsInt;

    System.out.println("Give me the number of inches you would like to convert to feet.");
    input = s.nextLine();

    inputAsInt = Integer.parseInt(input);

    feet = inputAsInt / INCHES_PER_FOOT;
    inches = inputAsInt % INCHES_PER_FOOT;

    System.out.println(input + " inches is " + feet + "ft and " + inches + " inches.");


  }
}
```

9. Write a program that asks the user for a sentence and then prints out the sentence backwards. So for instance. The user may type in: “Who watches the watchmen?” and the program will print out: “? nemhctaw eht sehctaw ohW” Remember the library function charAt() which will return a character at a particular position in a String.

```
import java.util.Scanner;

public class Writing9{
  public static void main(String [] args){
    Scanner s = new Scanner(System.in);
    String input = s.nextLine();
    String reversed = "";

    System.out.println("Give us a string: ");

    for(int i = input.length() - 1; i >= 0; i--){
      reversed += input.charAt(i);
    }

    System.out.println(reversed);
  }
}
```

10. Write a program that reads the contents of the file elon-musk.csv.

```
import java.util.Scanner;
import java.io.File;
import java.io.IOException;

public class Writing10 {
   public static void main(String [] args) throws IOException{
       Scanner fileIn = new Scanner(new File("elon-musk.csv"));

       while(fileIn.hasNext()){
              System.out.println(fileIn.nextLine());
       }
   }
}
```

Assignment (54pts)
Write a program that asks a user for 5 different letters and a String size. After the 5 letters and String size are taken as input from the user, the program should generate a String of random characters using only the 5 characters provided by the user. The String should be the length specified by the user.

So for instance, if the user specifies that their characters should be l, m, n, o, and p and that their string should be of length 10. The program should randomly output something like this:

moopnlnlom

where each character was randomly chosen. After the program outputs the random String, the program should ask the user if they would like another String. If the user types yes or y (ignoring whitespace and capitalization), another random String should be produced (using the same set of characters) and the program should asked again if they would like another String. This should continue until the user types ‘done’ or ‘exit’, the program should understand the request regardless of whitespace and capitalization.

```
import java.util.Scanner;
import java.util.Random;

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


        Scanner s = new Scanner(System.in);
        Random r = new Random();

        String input = "";

        String c1, c2, c3, c4, c5;

        System.out.println("Give me a letter");
        c1 = s.nextLine();

        System.out.println("Give me another letter");
        c2 = s.nextLine();

        System.out.println("Give me another letter");
        c3 = s.nextLine();

        System.out.println("Give me another letter");
        c4 = s.nextLine();

        System.out.println("Give me another letter");
        c5 = s.nextLine();


        while (!(input.toLowerCase().trim().equals("done") ||
input.toLowerCase().trim().equals("exit"))) {
            String randomString = "";

            for (int i = 0; i < 10; i++) {
                switch (r.nextInt(5)) {
                    case 0:
                        randomString += c1;
                        break;
                    case 1:
                        randomString += c2;
```

```
                    break;
                case 2:
                    randomString += c3;
                    break;
                case 3:
                    randomString += c4;
                    break;
                case 4:
                    randomString += c5;
                    break;
            }
        }
        System.out.println("Your random string is: " + randomString);

        System.out.println("");
        System.out.println("If you are finished type done or exit");
        input = s.nextLine();
    }
  }
}
```