Midterm Examination 1
CS170: Introduction to Computer Science

Observe the Emory College Honor Code while taking this test.

Question 1. (30 pts)

1. What is the function of a compiler?
   Translate a program in a high level language into machine language.

2. What is the command used to compile a Java program named MyProg.java?
   javac MyProg.java

3. What determines the encoding method used to interpret a number stored in a variable?
   the type of the variable

4. Give 3 types of statements in Java that we have learned so far.
   assignment statement, if-statement, if-else-statement, switch-statement

5. What is used in Java to contain methods?
   A class

6. Give 3 things in a Java program where you use an identifier to identify them?
   Classes, Methods, Variables

7. What is casting?
   Converting one data type into another type.

8. Give 3 comparison operators in Java
   ==, !=, <, <=, >, >=

9. Give 3 logical operators in Java
   !, &&, ||

10. What is a Boolean expression?
    A logical expression or An expression that evaluates to true or false
Question 2. (30 pts)

Suppose you are given the following variable definitions:

```java
int i = 1, j = 2, k = 3;
double a = 1.0, b = 2.0, c = 3.0;
String s = "abc";
```

Recall that an expression in Java returns a number and each of the assignment operators `=, +=, -=, ...` in Java returns a number.

For each of the following expression below,

1. State whether it is a legal expression in Java (i.e., the Java compiler will not report an error)
2. If the expression is legal, give the result of the evaluation of the expression (do not evaluate the expression if your answer is “not legal”)

Use the original values given above to answer each individual question below.

Expressions:

1. `a + i`
   - Legal: yes
   - if legal, result = 2.0

2. `a = ++i + 4.0`
   - (Note: use the original value of i = 1 !)
   - Legal: yes
   - if legal, result = 6.0

3. `(a = ++i) + 4.0`
   - Legal: yes
   - if legal, result = 6.0

4. `10/k`
   - Legal: yes
   - if legal, result = 3

5. `10.0/k`
   - Legal: yes
   - if legal, result = 3.333333333

6. `10%k`
   - Legal: yes
   - if legal, result = 1
7. $s < a$
   Legal: no

8. $s + i + j$
   Legal: yes  if legal, result = abc12

9. $s + i - j$
   Legal: no

10. $i + j + s$
    Legal: yes  if legal, result = 3abc
Question 3 (20 pts)
The method Math.random() in the Java’s library returns a random number between (0,1).
The method Math.max(x, y) in the Java’s library returns the maximum of two values x and y.
Complete the following Java program, that prints the largest of 5 randomly generated values.

```java
public class Question3 {
    public static void main(String[] args) {
        double a = Math.random();
        double b = Math.random();
        double c = Math.random();
        double d = Math.random();
        double e = Math.random();

        double largest;
        // Hint: do not nest the Math.max() method calls - if you
        //       nest 5 calls, the logic will become too difficult
        //       to handle.
        //
        // Complete the program here:

        largest = Math.max(a, b);
        largest = Math.max(largest, c);
        largest = Math.max(largest, d);
        largest = Math.max(largest, e);

        System.out.println("The maximum of the 5 numbers = " + largest);
    }
}
```
Question 4 (20 pts)

In homework 3, you have program the “Rot13” encoding method. Here is the solution for your reference:

```java
public static char rot13(char c) {
  if (c >= 'a' && c <= 'm' || c>= 'A' && c<= 'N') {
    // These letters need to shift right 13 places
    return (char) (c + 13);
  }
  else if (c >= 'n' && c <= 'z' || c>= 'N' && c<= 'Z') {
    // These letters need to shift left 13 places
    return (char) (c - 13);
  }
  else {
    // don’t shift non-letters - return c unchanged.
    return c;
  }
}
```

Julius Caesar used a much simpler code to transmit his military orders which I will call the “Shift3” code: every character is shifted 3 position further in a round robin manner (i.e., the letters “rap around”).

Here is a table of the mapping of the letters:

```
  ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz
  |   |   |
  v ... v ... v ... DEFGHIJKLMNOPQRSTUVWXYZabc defghi jklmnopqrstuvwxyzabc
```

**Question:**

Write a Java method Shift3 that returns the “Shift3” character for an input character c.

Use the next page for your answer.
public class Question4
{
    public static char shift3(char c)
    {
        // Method returns the "Shift3" character for the input c

        if (c >= 'a' && c <= 'w' || c >= 'A' && c <= 'W')
        {
            // These letters need to shift right 3 places
            return (char) (c + 3);
        }
        else if (c >= 'x' && c <= 'z' || c >= 'X' && c <= 'Z')
        {
            // These letters need to shift left 23 places
            return (char) (c - 23);
        }
        else
        {
            // don’t shift non-letters - return c unchanged.
            return c;
        }
    }
}