Midterm Examination 1
CS170: Introduction to Computer Science

Observe the Emory College Honor Code while taking this test.

Question 1. (20 pts)

1. What is the purpose/use of a class in Java?
   Container for methods.

2. What is the purpose/use of a method in Java?
   Container for statements.

3. What is the smallest unit of executable program code in Java?
   Statement.

4. What is an identifier?
   Name chosen by programmer to identify something (e.g., variable) in program

5. What can happen in an unsafe conversion?
   Loss of accuracy

6. What is the operator in Java to test if 2 integer numbers are equal?
   ==

7. Rank these operators according to their priorities (highest first): +=, +, ++, && and <=
   +=, +, <=, &&, +=

8. What is the meaning of this operator in Java: !
   Not

9. What is the result of the subtraction: ’c’ - ’a’? (The answer must be a number)
   2

10. What is the result of the following comparison: "abc".charAt(0) < "abc".charAt(2)
    ? (The answer is either true or false)
    'a' < 'c' which evaluates to: true
Question 2. (20 pts)

Suppose you are given the following variable definitions:

```java
short  x = 1,  y = 2,  z = 3;
int     i = 1,   j = 2,  k = 3;
double a = 1.0, b = 2.0, c = 3.0;
String s = "abc",  t = "ABC",  u = "12";
```

For each of the following assignment statement below,

1. State whether the statement is correct in Java (i.e., the Java compiler will not report an error)

2. If the statement is correct, give the resulting value that is assigned to the variable in the left hand side (do not give any answer if the statement is “not correct”).

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

**Expressions:**

1. `x = x + 1;`
   Correct: no because `x+1` is type `int`, cannot assign to `x` which is a `short`.

2. `a = i++ + j--;`  
   (Note: use the original value of `i = 1` and `j = 2`!)
   Correct: yes  
   result = \(1 + (-2) = -1\)

3. `k = (j = i++);`
   Correct: yes  
   result = \(k = (j = 1) = k = 1 = 1\)

4. `a = 7/j;`
   Correct: yes  
   result = \(a = 7/2 = a = 3 = 3\).0

5. `a = 7.0/j;`
   Correct: yes  
   result = \(a = 7.0/2 = a = 3.5 = 3.5\)

6. `k = 7\%k`
   Correct: yes  
   result = \(k = 7\%3 = k = 1\)
7. \( s = s + u; \)
   Correct: yes
   \[ \text{result} = s = "abc" + "12" = s = "abc12" \]

8. \( s = u + i + j; \)
   Correct: yes
   \[ \text{result} = s = "12" + 1 + 2 = s = "121" + 2 = s = "1212" \]

9. \( s = u + i \times j; \)
   Correct: yes
   \[ \text{result} = s = "12" + 1 \times 2 = s = "12" + 2 = s = "122" \]

10. \( s = i - j + u; \)
    Correct: yes
    \[ \text{result} = s = 1 - 2 + "12" = s = -1 + "12" = s = "-112" \]
Question 3 (20 pts)

- What (decimal) value is represented by the binary number 110101 ? (5 pts)
  \[ 1\times1 + 0\times2 + 1\times4 + 0\times8 + 1\times16 + 1\times32 = 1 + 4 + 16 + 32 = 53. \]

- Given an integer variable \( n \) that contains a value between 0 and 999 (i.e., a number with up to 3 digits) (that means you can use the variable \( n \) without defining it in the answer of the question !)
  Define 3 integer variables named \( a, b \) and \( c \) and write Java statements that: (5 pts)
  
  - Assign the first (left most) digit of \( n \) to the variable \( a \)
  - Assign the middle digit of \( n \) to the variable \( b \)
  - Assign the last (right most) digit of \( n \) to the variable \( c \)

  **Example:** if \( n = 135 \), then the outcome will be \( a = 1, b = 3 \) and \( c = 5 \). If \( n = 35 \),
  then the outcome will be \( a = 0, b = 3 \) and \( c = 5 \).

  \[
  \begin{align*}
  c &= n\%10; & \text{// Get last digit is easy (1 pts)} \\
  n &= n/10; & \text{// Get rid of the last digit in } n \\
  b &= n\%10; & \text{// This is the middle digit} \\
  a &= n/10; & \text{// This is the first digit}
  \end{align*}
  \]

- Given 3 double types variables \( a, b \) and \( c \). The variables have been given some arbitrary value already.

  Write a Boolean expression that evaluates to true if all the 3 variables are approximately equal to each other (use 0.001 as “error tolerance” in your test. (5 pts)

  **Note:** your answer must be a Boolean expression (something that evaluates to true or false). Do **not** write an if-statement as answer !!!

  \[
  \text{Math.abs}( a - b ) < 0.001 \land \text{Math.abs}( a - c ) < 0.001 \land \text{Math.abs}( b - c ) < 0.001
  \]
• Given 3 `double` types variables `a`, `b` and `c`. The variables have been given some arbitrary value already and each variable contains a different value.

Write Java statement(s) that:

- prints “a” if the variable `a` contains the smallest value
- prints “b” if the variable `b` contains the smallest value
- prints “c” if the variable `c` contains the smallest value

```java
if ( a < b && a < c )
    System.out.println("a");
else if ( b < a && b < c )
    System.out.println("b");
else
    System.out.println("c");
```
Question 4 (20 pts)

Given a String variable s contains 4 (arbitrary) characters.

Question:

- Define a Boolean variable named eq and write Java statement(s) to assign the value true to eq if all 4 of the characters in s are the same character and assign the value false to eq otherwise.

Example: if s is equal to "aaaa", "bbbb", etc., then the variable eq must be assigned true. But if s is equal to "aaab", "aaba", etc., then the variable eq must be assigned false.

Note: s.charAt(i) will return the character code of the character at position i in the string s.

Note: You can use 1 if-statement or 3 if-statements. I recommend that you use 3 if-statements because you will prepare yourself for the next question. You do not need to use nested if-statements.

Note: test your answer with s = "aaaa" and s = "abaa" to make sure it's correct (execute your Java statement(s) on paper by hand).

```java
public class Question4
{
  public static void main(String[] args)
  {
    String s;
    s = "????"; // s is a string of 4 arbitrary characters
    // Define a Boolean variable named eq
    boolean eq;
    // Write statement(s) according to question
    eq = true; // Assume the fact is true
    if ( s.charAt(1) != s.charAt(0) )
      eq = false; // This observation will make the fact false
    if ( s.charAt(2) != s.charAt(0) )
      eq = false; // This observation will make the fact false
    if ( s.charAt(3) != s.charAt(0) )
      eq = false; // This observation will make the fact false
  }
}
```
**Question 5 (20 pts)**

Given a String variable \( s \) that contains some string (the string contains at least 2 characters and its content – the characters in the string – is arbitrary).

**Note:** you can find the length of the string \( s \) (i.e., the number of characters in the string) using the `length()` method as follows:

```java
s.length()
```

**Question:**

- Define a `Boolean` variable named \( eq \) and write Java statement(s) to assign the value `true` to \( eq \) if every character in \( s \) is the same character and assign the value `false` to \( eq \) otherwise.

**Note:** the only way to handle this question is using a loop statement!

```java
public class Question5 {
    public static void main(String[] args) {
        String s;
        s = "??...?"; // s has been initialized to a string
        // s.length() will return the length of the string

        // Define a Boolean variable named eq
        boolean eq;
        // Write statement(s) according to question
        eq = true; // Assume the fact is true
        for (i = 1; i < s.length(); i++) {
            if (s.charAt(i) != s.charAt(0)) {
                eq = false; // This observation will make the fact false
                break; // This break is optional (alg. is still correct without using "break";
            }
        }

        // When the program reach here:
        // eq = true if every character s.charAt(i) == s.charAt(0)
        // eq = false if SOME character i: s.charAt(i) != s.charAt(0)
    }
}
```