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 ?
   <u>Container for methods.</u>

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

3. What is the smallest unit of executable program code in Java ?
   <u>Statement.</u>

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

5. What can happen in an unsafe conversion ?
   <u>Loss of accuracy</u>

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

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

8. What is the meaning of this operator in Java: `!`
   <u>Not</u>

9. What is the result of the subtraction: `'c' - 'a'` ? (The answer must be a number)
   <u>2</u>

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

Question 2. (20 pts)

Suppose you are given the following variable definitions:

```
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 $= \underline{1 + -2 = -1}$

3. `k = (j = i++);`

    Correct: yes   result $= \underline{k = (j = 1)} = \underline{k = 1} = \underline{1}$

4. `a = 7/j;`

    Correct: yes   result $= \underline{a = 7/2} = \underline{a = 3} = \underline{3.0}$

5. `a = 7.0/j;`

    Correct: yes   result $= \underline{a = 7.0/2} = \underline{a = 3.5} = \underline{3.5}$

6. `k = 7%k`

    Correct: yes   result $= \underline{k = 7\%3} = \underline{k = 1}$

7.   `s = s + u;`

   Correct: yes   result = $\underline{s = \text{"abc"} + \text{"12"}} = \underline{s = \text{"abc12"}}$

8.   `s = u + i + j;`

   Correct: yes   result = $\underline{s = \text{"12"} + 1 + 2} = \underline{s = \text{"121"} + 2} = \underline{s = \text{"1212"}}$

9.   `s = u + i * j;`

   Correct: yes   result = $\underline{s = \text{"12"} + 1 * 2} = \underline{s = \text{"12"} + 2} = \underline{s = \text{"122"}}$

10.   `s = i - j + u;`

   Correct: yes   result = $\underline{s = 1 - 2 + \text{"12"}} = \underline{s = \text{-1} + \text{"12"}} = \underline{s = \text{"-112"}}$

Question 3 (20 pts)

- What (decimal) value is represented by the binary number 110101 ? (5 pts)

  1x1 + 0x2 + 1x4 + 0x8 +1x16 + 1x32 = 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.

  ```
  c = n%10;    // Get last digit is easy (1 pts)

  n = n/10;    // Get rid of the last digit in n

  b = n%10;    // This is the middle digit
  a = n/10;    // This is the first digit
  ```

- 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 !!!

  ```
  Math.abs( a - b ) < 0.001 &&  Math.abs( a - c ) < 0.001
      &&  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

```
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).

```
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:

$$s.length()$$

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 !

```
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)



   }
}
```