# CSC 1051 Algorithms and Data Structures I

## Midterm Examination

*October 6, 2016*

**Name:**

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<thead>
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*Please answer questions in the spaces provided. If you make a mistake or for some other reason need more space, please use the back of pages and clearly indicate where the answer can be found. Good luck!*
1. [ /20] Refer to the program below. Next to each word in the list, choose the most fitting description:

• reserved word
• constant
• variable
• method

age  __________  int  __________
nextInt  __________  if  __________
scan  __________  println  __________
import  __________  public  __________
MINOR  __________  class  __________

import java.util.Scanner;

public class Age
{
   //---------------------------------------------------------------
   // Reads the user's age and prints comments accordingly.
   //---------------------------------------------------------------

   public static void main (String[] args)
   {
      final int MINOR = 21;

      Scanner scan = new Scanner (System.in);

      System.out.print ("Enter your age: ");
      int age = scan.nextInt();

      System.out.println ("You entered: " + age);

      if (age < MINOR)
         System.out.println ("Youth is a wonderful thing.");

      System.out.println ("Age is a state of mind.");
   }
}
2. [20] What output is produced by the following program?

```java
class OneMoreTime {
    public static void main (String[] args) {
        int x = 10, a = 20, b = 30, c = 40;

        System.out.println("Howdy, here are some numbers: ");
        System.out.println("x = " + x + " a = " + a + " b = " + b + " c = " + c);
        System.out.println ("I promise this is the last time ");

        System.out.print ("you have to do this ");
        System.out.println ("so please count the \"s carefully!");

        if (a>0)
            if (b<0)
                x = x + 5;
            else
                if (a>5)
                    x = x + 4;
                else
                    x = x + 3;
            else
                x = x + 2;

        System.out.println();
        System.out.println("Here are the numbers after the if/else: ");
        System.out.println("x = " + x + " a = " + a + " b = " + b + " c = " + c);
        System.out.println();
        c = a;
        a = b;
        b = 100;
        System.out.println("Here are the final values: ");
        System.out.println("x = " + x + " a = " + a + " b = " + b + " c = " + c);
    }
}
```

Output:

a) For each of the following expressions, indicate the order in which the operations are performed by writing a number beneath each operator.

\[
\begin{align*}
\text{a} / (b - d) & \times e + f \\
\text{a} / b + c / e - f \\
\end{align*}
\]

b) The code below is supposed to print the numbers from 1 to 10, but it has an error.

```java
int count = 1;
while (count <= 10)
    System.out.println (count);
count++;
```

i) Describe the error and how to correct it?

ii) If not corrected, what, if anything gets printed?

iii) Is this a syntax, runtime, or logical error?

c) Consider the following code fragments to compute the GPA of a student:

<table>
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<td>int qp = 28; int credits = 10; double gpa = (double) (qp / credits);</td>
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- Which version will compute the correct value for the GPA?
- What is the value calculated by the other one?

d) Given a Random object named `gen`, what range of values are produced by the following expressions?

- `gen.nextInt(8)`
- `gen.nextInt(50) + 10`
- `gen.nextInt(8) - 10`

```
e) Complete the code for the applet that produces the image to the left.
```

```java
import javax.swing.JApplet;
import java.awt.*;
public class Mystery extends JApplet {
    public void paint (Graphics page)
    {
        page.drawLine (10, 60, 90, 60);
    }
}
```
4. | /20] Trace through some computations.

Suppose you have the following declarations:

```java
String word = "kitten";
String line = "511.3";
String line2 = line.replaceAll(".","6");
int number = Integer.parseInt(line2);
```

What is the value of the following expressions?

- `word.length()`
- `word.charAt(1)`
- `word.charAt(0)`
- `word.toUpperCase()`
- `word.replace("e","E")`
- `line + 4`
- `line2 + 4`
- `number + 4`

```java
int a = 1;
while (a < 5)
{
    System.out.println(4*a);
    a++;
}

String hope = "puppy";
int n = 0;
while (n < hope.length())
{
    System.out.print(hope.charAt(n) + "x");
    n++;
}

String fear = "kitten";
int x = 0, y = fear.length() - 1;
while (x < y)
{
    System.out.print(fear.charAt(x));
    System.out.print(fear.charAt(y));
    x++;
    y--;
}
```

Output:

```
4
8
12
```

```
P p p p
```

```
k i t t e n
```

```
k i t t e n
```

```
k i t t e n

```
5. [_______/ 20]
Construct an algorithm that inputs several positive integers terminated with a -1 (sentinel value). The algorithm should print the numbers entered and determine and print the minimum value. After the minimum is printed, print a goodbye message. You can assume that the numbers entered will be between 1 and 100 (except for the terminating -1), so you do not need to check for mistakes in the input.

Example: If the numbers 25 86 13 54 -1 are entered as input, the algorithm should print:

```
25
86
13
54
Min = 13
Goodbye
```

[Note: that the terminating -1 should NOT be printed.]

Directions:
Write your algorithm by rearranging and structuring elements chosen from the list below, using indentation to show structure. Do not use anything else and note that not all of these are needed, but you may use one of them more than once, if necessary.

```
input num
input min
num = 0
min = 0
num = 100
num = num + 1
min = num
num = min
if (num < min)
if (num > min)
if (num != -1)
if (num != min)
else
while (num < min)
while (num > min)
while (num != -1)
while (num != min)
print "Min = " min
print "Min = " num
print num
print "Goodbye"
```
• An arc is defined by an oval, a start angle, and an arc angle.

Drawing a Line

```
page.drawLine (10, 20, 150, 45);
page.drawLine (150, 45, 10, 20);
```

Drawing a Rectangle

```
page.drawRect (50, 20, 100, 40);
```

Drawing an Oval

```
page.drawOval (175, 20, 50, 80);
```

Drawing an Arc
## Reference Material

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<td>boolean</td>
<td><code>isEmpty()</code></td>
<td>Returns true if, and only if, <code>length()</code> is 0.</td>
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1. [ /20] Refer to the program below. Next to each word in the list, choose the most fitting description:

- reserved word
- constant
- variable
- method

```java
import java.util.Scanner;

class Age {
    // Reads the user's age and prints comments accordingly.
    public static void main (String[] args) {
        final int MINOR = 21;

        Scanner scan = new Scanner (System.in);

        System.out.print ("Enter your age: ");
        int age = scan.nextInt();

        System.out.println ("You entered: " + age);

        if (age < MINOR)
            System.out.println ("Youth is a wonderful thing.");

        System.out.println ("Age is a state of mind.");
    }
}
```

2. [ /20] What output is produced by the following program?

```java
public class OneMoreTime
{
    public static void main (String[] args)
    {
        int x = 1, a = 2, b = 3, c = 4;

        System.out.println("Howdy, here are some numbers: ");
        System.out.println("x = " + x + " a = " + a + " b = " + b + " c = " + c);
        System.out.println ("I promise this is the last time");

        System.out.println ("you have to do this ");
        System.out.println ("so please count the \"s carefully!");

        if (a>0)
            if (b<0)
            else
                if (a>5)
                    x = x + 4;
                else
                    x = x + 3;
            else
                x = x + 2;

        System.out.println();
        System.out.println("Here are the numbers after the if/else: ");
        System.out.println("x = " + x + " a = " + a + " b = " + b + " c = " + c);
        System.out.println();
        c = a;
        a = b;
        b = 100;
        System.out.println("Here are the final values: ");
        System.out.println("x = " + x + " a = " + a + " b = " + b + " c = " + c);
    }
}
```

Output:

a) For each of the following expressions, indicate the order in which the operations are performed by writing a number beneath each operator.

\[
\frac{a}{b - d * e + f} \quad \frac{a}{(b + c) / e - f}
\]

b) The code below is supposed to print the numbers from 1 to 10, but it has an error.

```java
int count = 1;
while (count <= 10) {
    System.out.println (count);
    count++;
}
```

i) Describe the error and how to correct it? __

ii) If not corrected, what, if anything gets printed? __

iii) Is this a syntax, runtime, or logical error? ______

c) Consider the following code fragments to compute the GPA of a student:

```
Version A
int qp = 35;
int credits = 10;
double gpa = (double) qp / credits;
```

```
Version B
int qp = 35;
int credits = 10;
double gpa = (double) (qp / credits);
```

• Which version will compute the correct value for the GPA? __________
• What is the value calculated by the other one? __________

d) Given a Random object named `gen`, what range of values are produced by the following expressions?

- `gen.nextInt(4)`
- `gen.nextInt(20) + 100`
- `gen.nextInt(4) - 15`

```
int count = 1;
while (count <= 10) {
    System.out.println (count);
    count++;
}
```

e) Complete the code for the applet that produces the image to the left.

```java
import javax.swing.JApplet;
import java.awt.*;
public class Mystery extends JApplet {
    public void paint(Graphics page) {
        page.drawLine (10, 60, 90, 60);
    }
}
```

Suppose you have the following declarations:

```java
String word = "dance";
String line = "B52";
String line2 = line.replaceAll("B","7");
int number = Integer.parseInt(line2);
```

What is the value of the following expressions?

```java
word.length()  word.charAt(1)  word.charAt(0)  
word.toUpperCase()  word.replace("e","E")  
line  line2  
number  
line + 4  line2 + 4  number + 4  
```

```java
String hope = "someday";
int n = 0;
while (n < hope.length())
{
    System.out.print(hope.charAt(n) + "*");
    n++;
}
```

```java
int a = 1;
while (a < 4)
{
    a++;
    System.out.println(5*a);
}
```

```java
String fear = "someday";
int x = 0, y = fear.length() - 1;
while (x < y)
{
    System.out.print(fear.charAt(x));
    System.out.print(fear.charAt(y));
    x++;
    y--;
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5. [________/ 20]
Construct an algorithm that inputs several positive integers terminated with a -1 (sentinel value). The algorithm should print the numbers entered and determine and print the minimum value. After the minimum is printed, print a goodbye message. You can assume that the numbers entered will be between 1 and 100 (except for the terminating -1), so you do not need to check for mistakes in the input.

Example: If the numbers 25 86 13 54 -1 are entered as input, the algorithm should print:
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Min = 3
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[Note: that the terminating -1 should NOT be printed.]

Directions:
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input num
input min
num = 0
min = 0
num = 100
min = 100
num = num + 1

if (num != -1)
if (num != min)
else
while (num < min)
while (num > min)
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print "Min = ", min
print "Min = ", num
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print "Goodbye"
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\[ \text{page.drawLine (10, 20, 150, 45);} \]

\[ \text{page.drawLine (150, 45, 10, 20);} \]

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\[ \text{page.drawRect (50, 20, 100, 40);} \]

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- An arc is defined by an oval, a start angle, and an arc angle:

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