RMIT University
School of Computer Science & Information Technology

COSC1095 Programming Principles 2J / COSC1295 Java For Programmers

Final Examination Semester 1, 2005

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Date: 16th June 2005

Reading Time: 5.45pm to 6.00pm (15 minutes)

Exam Start Time: 6:00pm to 8:00pm

Duration of Exam: 2 hours

Number of Pages: 16 **Total Marks:** 100

Instructions to Candidates:

Contribution of this examination to the overall assessment is 60%.

- This is a closed book examination. You must not refer to any written or printed materials during the examination aside from the exam paper itself.
- Electronic devices are not permitted. Mobile phones must be switched off.
- Answer all questions in the space provided in this booklet.
- Marks for each question are shown.
- If you are unclear about a question ask for clarification. If you still feel that you need to make an assumption after clarification, state your assumption clearly with your answer.
- This entire exam paper must be handed in.
- Make sure your name and student number are entered at the top of this page

This examination consists of two sections:

• Multiple choice question	20 questions	30 marks
• Program writing	6 questions	70 marks

Part I (Multiple Choice) 30 marks (20 questions x 1.5 marks each)

For this part select the most correct response and circle it (A/B/C/D/E).

1. Which of the following is a valid identifier in Java?

A) `$meal`
B) `the total`
C) `is'nIt`
D) `3rdYear`
E) `&nDays`

2. Assume that `x` is an initialised `int` variable. The code fragment

```
if (x > 5) x *= 2;
if (x > 10) x = 0;
```

is equivalent to which of the following code fragments?

A)
```
x = 0
```
B)
```
if (x > 5) x = 0;
```
C)
```
if (x > 5) x *= 2;
```
D)
```
if (x > 5) x = 0; else x *= 2;
```
E)
```
if (x > 5) x *=2; else if (x > 10) x= 0;
```

3. What value does the following method return when called with `97`?

```
int perform (int n) {
   while (n > 9) {
        int m = 0;
        while (n>9) {
            m = m + n%10;
            n = n/10;
        }
        n = n+m;
   }
   return n;
}
```

A) 8
B) 17
C) 7
D) 16
E) none of the above

4. Five variables `x`, `y`, `z`, `b1` and `b2` are defined as follows.

```
int x = 2;
int y = 5;
boolean z = false;
boolean b1 = (x<y && y>=5) || z;
boolean b2 = !(x%2 == 0 || y%2 == 0);
```

What are the values of b1 and b2?

```
A)   b1=true; b2=true
B)   b1=true; b2=false;
C)   b1=false; b2=true;
D)   b1=false; b2=false;
E)   none of the above
```

5. What will be the output of the main method below?

```
public static void main(String args[]) {
    int a[] = {10,20,30,40};
    int b[] = {100,200,300,400};
    a[0] = b[0];
    a[1] = b[1];
    b = a;
    a[2] = b[2];
    a[3] = b[3];
    for (int i=0; i<4; i++)
       System.out.print(" "+b[i]);
}
```

```
A)  100 200 300 400
B)  10 20 30 40
C)  10 20 300 400
D)  100 200 30 40
E)  100 20 30 400
```

6. What will be the output of the code fragment below?

```
int x, j=0;
for (x=0; x<10; x+=3) {
     j += x;
}
System.out.println(x + " " + j);
```

```
A)  10 18
B)  12 18
C)  12 30
D)  10 30
E)  18 12
```

7. What will be the output after the following code is executed ?

```
int[]  a = {1, 2, 3, 4, 5} ;
for (int i=1; i<=4; ++i)
   a[i] = a[i-1];
System.out.println(a[3]);
```

```
A) 1
B) 2
C) 3
D) 4
E) 5
```

8. Consider the following class definitions:

```
public abstract class Shape {
   public Shape() { … }

   public abstract void draw();
}

public class Square extends Shape {
    public Square() { … }

    public void draw ( ) {
        System.out.println(“The square is being drawn.”);
    }
}
```

Which of the following statements does *not* cause a compile-time error?

I. `Shape s = new Shape();`
II. `Shape s = new Square();`
III. `Square s = new Shape();`

A) I only
B) II only
C) III only
D) I and II only
E) II and III only

9. What is the output of the following program?

```
class A {
   public A(Sring msg) {
      System.out.print("A " + msg);
   }
}

public class B extends A {
   public B(String msg) {
      System.out.print("B "+ msg + " ");
   }

   public static void main(String args[]) {
       B b = new B("Test");
   }
}
```

A) A Test
B) A Test B Test
C) B Test
D) B Test A Test
E) a compilation error occurs

10. What is the output the following program?

```
class Shape {
    public void draw() { System.out.println(“Shape”); }
}

public class Circle extends Shape{
    public void draw() { System.out.println(“Circle”); }
    public static void main (String[] args) {
        Shape s = new Circle();
        s.draw();
    }
}
```

A) Shape
B) Circle
C) Shape Circle
D) Circle Shape
E) A compilation error occurs

11. What is the output the following program?

```
class A {
    public void d() { e();}
    public void e() { System.out.println(“eA”);}
}
public class B extends A {
    public void e() { System.out.println(“eB”); }
    public static void main (String[] args) {
        B b = new B();
        b.d();
    }
}
```

A) eA
B) eB
C) eA eB
D) eB eA
E) A compilation error occurs

12. What will be the output of the program segment below ?

```
RandomAccessFile rafile = new
    RandomAccessFile("test.dat","rw");
// writing 3 int elements to array
for (int i=1; i<=3; i++)
    rafile.writeInt(i); //each int occupies 4 bytes

//  reading and updating values
rafile.seek( rafile.getFilePointer() - 4 * 2);
int x=rafile.readInt();

x = x + 10;

rafile.seek( rafile.getFilePointer() - 4 * 1);
```

```
        rafile.writeInt(x);

        rafile.seek(0);
        for (int i=1; i<=3; i++)
            System.out.println(" " + rafile.readInt());
```

A) 11 12 13
B) 1 12 3
C) 1 2 12
D) 1 2 3
E) 1 12 13

13. Consider the following code:

```
try
{
   method1();
   method2();
   method3();
}
catch (Exception1 e1)
{
   method4();
}
catch (Exception2 e2)
{
   method5();
}
finally
{
   method6();
}
method7();
```

If `method2` causes an exception, which of the following statements is true?

A) method3 is executed
B) if the exception isn't caught, method7 is executed
C) if the exception is caught in the catch clause, method6 is not executed
D) method6 is executed
E) no method is executed

14. What is the missing condition that will initialise the 2D array `m` as shown below?

```
public class Test2DArray {
   public static void main (String[] args) {
      int[][] m = new int[3][3];
       for (int i=0; i<3; i++)
         for (int j=0; j<3; j++)
          if ( ___________  ) // place here
               m[i][j] = 0;
          else m[i][j] = 1;
```

1	1	1
0	1	1
0	0	1

```
        }
    }
```

```
A)   i == j
B)   (i + j)%2 == 0
C)   (i+j) == 2
D)   j < i
E)   (i + j)/2 == 0
```

15. The following class has a static variable `svar`, instance variable `var`, static method `smeth()` and instance method `meth()`. Which statement (labelled A-D) will result in an error during compilation?

```
public class TestStatic {
   private static int svar = 10;
   private int var;
   public static void smeth() {
         var++;     //  A
         svar++;    //  B
   }
   public void meth() {
         var++;     //  C
         svar++;    //  D
   }
}
```

```
A) Statement labelled A
B) Statement labelled B
C) Statement labelled C
D) Statement labelled D
E) None of the above
```

16. Which one of the following statements about Overloading and Overriding is FALSE?

```
A)   Overloading deals with multiple methods with the same
     name in the same class
B)   Overriding deals with two methods, one in a parent class
     and one in a child class
C)   Overriding lets you re-define an operation in superclass
D)   Overloading allows methods to have the same signature
E)   Java supports both overloading and overriding
```

17. To support multithreading in Java Applet programming, we can:

```
A) let the applet “implements” the Thread interface
B) let the applet “implements” the Runnable interface
C) let the applet “extends” the Thread class
D) let the applet “extends” the Runnable class
E) none of the above
```

18. In the Java Collection Framework, a collection that cannot contain duplicated elements is called:

A) Set
B) Map
C) List
D) LinkedList
E) HashTable

19. Which one of the following statements about Interface and Abstract Class is FALSE?

A) All methods in an abstract class must be abstract.
B) An interface cannot implement any methods, whereas an abstract class can.
C) An interface cannot have instance variables, whereas an abstract class can.
D) A Java class can extend only one direct superclass.
E) A Java class can implement more than one interface.

20. What is the output of the following program?

```
public class ExceptionTest {
      public static void NumberTest (int num) throws RangeException {
         if (num  <0 || num >9)
               throw new RangeException("Number out of range!");
         else
               System.out.print("A valid number!");
        }
        public static void main(String args[]) throws RangeException{
         try {
               NumberTest(-3);
               NumberTest(3);
         } catch (RangeException e) {
               System.out.print("Error!");
         }
         System.out.println("Finish!");
        }
}
class RangeException extends Exception {
   public RangeException(String s) {super(s); System.out.print(s);}
}
```

A) A valid number!Finish!
B) Number out of range!Error!Finish!
C) Number out of range!A valid number!Error!Finish!
D) Number out of range!Error!
E) Error!Finish!

Part II (Program Writing) 70 marks

21. Write a code fragment to print the pattern of stars below. You should use nested *for* loops.

```
*******
 *****
  ***
   *
```

(10 marks)

22. The *Fibonacci sequence* is defined by the following rule. The first two values in the sequences are 1 and 1. Every subsequent value is the sum of the two values preceding it. For example, the third value is 1 + 1 = 2, the fourth value is 1 + 2 = 3, and the fifth value is 2 + 3 = 5. If f_n denotes the *n*th value in the Fibonacci sequence, then:

$f_1 = 1$
$f_2 = 1$
$f_n = f_{n-1} + f_{n-2}$ (if n>2)

Write a public method `Fibonacci(int n)`, which generates and returns the *n*th value in the Fibonacci sequence. Assuming the parameter n is always a non-zero positive number.

(10 marks)

23. Consider the Frog example described in the lecture:

```
public class Frog {
   private FrogBehavior behavior; // behavior state

   public Frog() { behavior = new TadpoleBehavior(); }
   public void grow() {  // see if behavior should change
      behavior = behavior.changeBehavior();
      behavior.grow();
      behavior.swim();
   }
   public static void main(String[] args) {
     Frog aFrog = new Frog();
     for (int i=0; i<20; i++)
          aFrog.grow();
   }
}
abstract class FrogBehavior {
   static int age = 0;
   public void grow() {age++;};
   abstract public void swim();
   abstract public FrogBehavior changeBehavior ();
}
class TadpoleBehavior extends FrogBehavior {
   public void swim() {
      System.out.println("The tadpole is swimming");
   }
   public FrogBehavior changeBehavior () {
      if (age > 18) return new AdultFrogBehavior();
      else return this;
   }
}
class AdultFrogBehavior extends FrogBehavior {
   public void swim() {
      System.out.println("The adult frog is swimming in an adult style");
   }
  public FrogBehavior changeBehavior () {
      return this;
   }
}
```

The above program assumes that a Frog has two behavior states Tadpole and Adult. It simulates the behavior of a frog from day 1 to day 20.

Now suppose we have the following new requirements:
a) Suppose the life span of a Frog is 40 days.
b) Suppose a Frog has three behavior states: Tadpole (1-18), Adult(19-30), and Old (31-40).
c) If the frog is old, it will swim in an old frog style (i.e., the `swim` method will display the message "The old frog is swimming in an old frog's style").

Modify the above Frog program to simulate the behavior of a frog from day 1 to day 40.

(10 marks)

24. Complete the class below to read a Java program and compute the total number of lines of source code. The user can specify the input program through the command line argument (`args[0]`). If the specified program does not exist, an error should be reported. You can do this by catching and handling the `FileNotFoundException`, which is thrown when an attempt to open a file has failed.

(10 marks)

```
// This program reads a given Java program line by line
// and computes the total number of lines.

import java.io.*;

public class ProgramLineCounter {

 public static void main(String[] args) throws IOException
 {
     int totalLines = 0;
     BufferedReader bufr;









 } // main
}
```

25. Consider the MyLinkedList class given as follows:

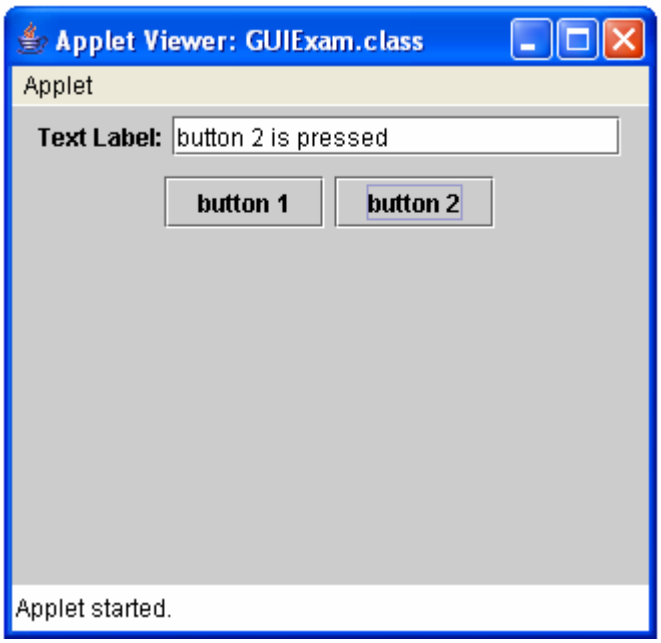
```
public class IntNode{
    public int data;
    public IntNode next;

    public IntNode (int n){
        data = n;
        next = null;
    }
}

public class MyLinkedList{
    private IntNode head;

    public MyLinkedList (){
        head = null;
    }

    public void add (int n) {
        IntNode newNode = new IntNode(n);
        newNode.next = head;
        head = newNode;
    }

    public int calculateSum() {
         …   // to be completed
    }

    public boolean findData(int data) {
         …  // to be completed
    }

    public void deleteLast() {
         …  // to be completed
    }

}
```

You are to complete the following methods defined in the `MyLinkedList` class:

- The `calculateSum()` method, which computes and returns the sum of all the nodes' data.
- The `findData(int data)` method, which scans the linked list and searches for the specified *data*. If found, this method returns true, otherwise false is returned.
- The `deleteLast()` method, which deletes the last node (tail) in the linked list.

(15 marks)

26. Write a Java Applet that contains a label, a text field and two buttons. A sample GUI is shown below.



The label and the text field shall be contained in a panel called Panel1. The two buttons shall be contained in a panel called Panel2. Panel2 is always below the Panel1 no matter how the window is resized (therefore, you need to use the BorderLayout layout manager).

If the button 1 is pressed, a message "Button 1 is pressed" should be displayed in the text field and the background color of the text field should turn red (`Color.red`).

If the button 2 is pressed, a message "Button 2 is pressed" should be displayed in the text field and the background color of the text field should turn white (`Color.white`).

All components should be implemented as Java Swing components. The sizes of the components are not important and you may choose your own.

(15 marks)

END OF EXAM