TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

EXAMINATIONS — 2005

END-OF-YEAR

COMP 102
INTRODUCTION TO
COMPUTER PROGRAM DESIGN

SOLUTIONS Q1–3

Time Allowed: 3 Hours

Instructions: Attempt ALL Questions.

Answer in the appropriate boxes if possible — if you write your answer elsewhere, make it clear where your answer can be found.

The exam will be marked out of 180 marks.

Non-programmable calculators without a full alphabetic key pad are permitted.

Non-electronic foreign language dictionaries are permitted.

There are spare pages for your working and your answers in this exam.

Questions

	Marks
1. Understanding Java programs	[45]
2. Writing simple Java Programs	[25]
3. Classes and objects	[20]
4. Arrays of objects	[15]
5. Inheritance	[15]
6. Files	[20]
7. GUI	[20]
8. Recursion	[20]

Student ID: .....

Question 1. Understanding Java programs [45 marks]

In parts **(a)** to **(g)**, you should assume each method is declared in a suitable class and called on an object of this class. The name and other details of this class are unimportant as the methods do not refer to fields or other methods of the class.

(a) [3 marks] What will be printed when the following method `Q1a` is called?

```
public void Q1a() {
  int x = 4;
  int y = 3;
  int z = x*y;
  x = x+y;
  y = x-y;
  System.out.println("x = " + x);
  System.out.println("y = " + y);
  System.out.println("z = " + z);
}
```

```
x = 7
y = 4
z = 12
```

(b) [4 marks] What will be printed when the following method `Q1b` is called?

```
public void Q1b() {
  String s = "javax.swing.*";
  System.out.println( s.length() );
  System.out.println( s.charAt(7) );
  int k = s.indexOf('a');
  System.out.println( k );
  System.out.println( s.indexOf('a', k+1) );
}
```

```
13
w
1
3
```

Student ID: .....

(c) [6 marks] Consider the following method definition:

```
public void Q1c(int a, int b) {
  int c = 0;
  int d;
  if ( a < b) {
    c = a+b;
  }
  d = 2*b;
  if ( a > c )
    c = a;
  else
    d = b;
  System.out.println(c + " " + d);
}
```

(i) [2 marks] What will be printed when method `Q1c` is called with **5** and **0** as its arguments?

```
5 0
```

(ii) [2 marks] What will be printed when method `Q1c` is called with **3** and **3** as its arguments?

```
3 6
```

(iii) [2 marks] What will be printed when method `Q1c` is called with **2** and **1** as its arguments?

```
2 2
```

Student ID: .....

(d) [5 marks] What will be printed when the following method `Q1d` is called?

```
public void Q1d() {
  int x = 0;
  int y = 30;
  while ( x < y ) {
    x = x + 2;
    y = y - x;
    System.out.println( x + " " + y);
  }
}
```

```
2 28
4 24
6 18
8 10
10 0
```

(e) [4 marks] What will be printed when the following method `Q1e` is called?

```
public void Q1e() {
  char[] a = {'a', 'b', 'c', 'd', 'e', 'f'};
  for (int k = 0; k < a.length/2; k++) {
    System.out.println(a[k] + " " + a[2*k+1]);
  }
}
```

```
a b
b d
c f
```

Student ID: .....

(f) [8 marks] What will be printed when the following method `Q1f` is called?

```
public void Q1f() {
  int[] a = new int[8];
  for (int k = 0; k < a.length; k++) {
    a[k] = 8-k;
    System.out.print(a[k] + " ");
  }
  System.out.println();
  int s = 0;
  for (int k = 0; k < a.length; k=k+2) {
    s = s + a[k];
    System.out.println(s);
  }
}
```

```
8 7 6 5 4 3 2 1
8
14
18
20
```

(g) [9 marks] What will be printed when the following method `Q1g` is called?

```
public void Q1g() {
  int m = 3;
  int[][] a = new int[m][m];
  for (int i = 0; i < m; i++) {
    for (int j = 0; j < m; j++) {
      a[i][j] = m*i-j;
      System.out.print(a[i][j] + " ");
    }
    System.out.println();
  }
  for (int i = 0; i < m; i++) {
    System.out.print(a[i][m-i-1] + " ");
  }
  System.out.println();
}
```

Student ID: .....

```
0 -1 -2
3 2 1
6 5 4
-2 2 6
```

Student ID: .....

(h) [6 marks] What will the following program print out?

```
public class Q1h {
  public static void main(String[] args) {
    Thing[] things  = new Thing[3];
    things[0] = new Thing(0, 2);
    things[1] = new Thing(1, 3);
    things[2] = new Thing(4, 5);
    for (int k = 0; k < things.length; k++) {
      System.out.println(things[k].f() + " " + things[k].g());
    }
  }
}

class Thing {
  private int x, y;
  public Thing(int xx, int yy) {
    x = xx;
    y = yy;
  }
  public int f() {
    return x+y;
  }
  public int g() {
    return x*y;
  }
}
```

```
2 0
4 3
9 20
```

Student ID: .....

SPARE PAGE FOR EXTRA ANSWERS

Cross out rough working that you do not want marked.
Specify the question number for work that you do want marked.

Student ID: .....

Question 2. Writing simple Java programs [25 marks]

(a) [15 marks] **Strings and conditionals**

You are to write a program that reads a string and analyses it, as follows:

- If the string is empty, the program should print `NULL`.
- If the string starts and ends with a digit, the program should print `NUMBER`.
- If the string starts and ends with a letter, the program should print `WORD`.
- Otherwise, the program should print `OTHER`.

Complete the following program so that it behaves as described above.

You should print output using `System.out.println`.

You can test whether a character `c` is a digit with the call `Character.isDigit(c)`, and you can test whether `c` is a letter with the call `Character.isLetter(c)`.

```
import javax.swing.*;
public class StringAnalyser {
  public static void main(String[] args) {
    // Read and analyse a string
    String s = JOptionPane.showInputDialog("Enter string");









  }
}
```

Student ID: .....

(b) [10 marks] **Loops and arrays**

You are to write a method, `checkArray`, that takes a two dimensional array of integers as its argument and prints a message showing the largest value in the array and the number of zeros in the array.

For example, if the method was called as follows:

```
int[][] vals = { { 1, 0, 2, 9 },
                 { 0, -1, 9, 6 },
                 { 3, 0, 0, 8 } };
checkArray(vals);
```

the output would be something like:

```
Largest value = 9
Number of zeros = 4
```

Complete the following method so that it behaves as described above.

You should print output using `System.out` methods.

```
public void checkArray(int[][] a) {









}
```

Student ID: .....

Question 3. Classes and Objects [20 marks]

You are required to complete the `Student` class shown on the facing page.

The `Student` class is intended to be used for recording and printing student marks. The `Student` constructor takes as arguments the name of the student and the number of marks to be recorded. The `enterMark` method takes one mark as its argument and records it. The `printResults` method checks whether the correct number of marks have been recorded — if so, `printResults` prints the student's name, marks and total mark; if not, it prints an error message showing the student's name and the number of marks that were recorded.

For example, executing the program shown below on the left should produce the output shown below on the right.

```
public class StudentMarks {
  public static void main(String[] args) {
    Student s = new Student("Bill", 3);
    s.enterMark(3);
    s.enterMark(5);
    s.enterMark(2);
    s.printResults();
    Student t = new Student("Fred", 3);
    t.enterMark(4);
    t.enterMark(1);
    t.enterMark(7);
    t.printResults();
    Student x = new Student("Chris", 3);
    Student y = new Student("Dave", 3);
    y.enterMark(0);
    x.enterMark(0);
    y.enterMark(1);
    x.enterMark(1);
    y.enterMark(2);
    y.enterMark(3);
    x.printResults();
    y.printResults();
  }
}
```

```
Bill
  Marks: 3 5 2
  Total: 10
Fred
  Marks: 4 1 7
  Total: 12
Error: Chris has 2 marks
Error: Dave has 4 marks
```

You should print output using `System.out` methods.

You should think carefully about what fields the `Student` class needs in order to record information about a student, and how these fields should be used and/or updated by the constructor and the two methods.

Student ID: .....

```
public class Student {









    public Student(String s, int n) {









    }

    public void enterMark(int m) {









    }

    public void printResults() {

















    }

}
```

****