TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VUW

VICTORIA

UNIVERSITY OF WELLINGTON

EXAMINATIONS – 2017

TRIMESTER 2

COMP 102

INTRODUCTION TO COMPUTER PROGRAM DESIGN

Time Allowed: TWO HOURS

CLOSED BOOK

Permitted materials: No Calculators permitted.
Brief Java documentation is provided with the exam script.
Printed foreign language-English dictionaries are permitted.

Instructions: Attempt ALL Questions.
The exam will be marked out of 120 marks.
Brief Java Documentation will be provided with the exam script
Answer in the appropriate boxes if possible — if you write your answer elsewhere, make it clear where your answer can be found.
There are spare pages for your working and your answers in this exam, but you may ask for additional paper if you need it.

Questions		Marks	
1.	Understanding Java	[45]	
2.	GUI programs	[12]	
3.	Writing programs with files	[13]	
4.	Writing programs with Objects, ArrayLists and Files	[28]	
5.	Writing programs using 2D arrays	[22]	
		TOTAL:	

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.

Question 1. Understanding Java [45 marks]

(a) **[3 marks]** What will be printed if the following testLoop() method is called?

```java
public void testLoop(){
    for ( int i = 0; i< 3; i++){
        for( int j=i; j<3; j++){
            UI. print ("*");
        }
        UI. println ();
    }
}
```

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

(b) **[3 marks]** What will be printed if testIf(7) is called?

```java
public void testIf ( int x){
    if (x>5 || x<= 0)){
            UI. println ("Correct");
    }
    else{
            UI. println ("Incorrect");
    }
}
```

```
Correct
```

(c) **[3 marks]** What will be printed if testBool(false, true) is called?

```java
public void testBool(boolean flag , boolean signal ){
    if (!( flag && signal)){
        UI. println ("Yes");
    }
    else {
        UI. println ("No");
    }
}
```

```
Yes
```

(Question 1 continued)

(d) **[5 marks]** The following testArray() method creates an array of names of colours, then modifies it, then prints out each value in the array. What will it print?

```
public void testArray (){
    String[ ] colours = new String[ ]{"red", "yellow", "green", "blue", "violet"};

    int n = 2;
    colours [n] = colours[n−1];

    for( int i=0; i < colours.length; i++){
        if ( colours [ i ]. length () < 5){
            colours [i] = colours[i+1];
        }
    }

    // print out the array
    for( String p : colours ){
        UI. println (p);
    }
}
```

```
yellow
yellow
yellow
violet
violet
```

(Question 1 continued)

(e) **[8 marks]** What will be printed if the following test2D() method is called?

```
public void test2D(){
        int [ ][ ] nums = new int [ ][ ]{    {12, 2, 1, 5},
                                              {31, 3, 6, 18},
                                              {14, 0, 17, 20}
                                        };
        for( int col=0; col<nums[0].length; col++){
            for( int row=0; row<nums.length; row++){
                UI. print (nums[row][col]+" ");
            }
            UI. println ();
        }

        UI. println ("= = = = =");

        nums[2][1]  = nums[1][2];

        for( int n=0; n<nums[0].length; n++){
            UI. print (nums[2][n]+" ");
        }
    }
}
```

```
12 31 14
2 3 0
1 6 17
5 18 20


= = = = =
14 6 17 20

```

(Question 1 continued)

(g) **[8 marks]** Consider the following Car class.

```java
public class Car {
    private int modelNum;
    private String modelName;
    public Car(){
        UI. println ("Constructor 1");
    }

    public Car( int num, String name){
        UI. println ("Constructor 2");
        this .modelName = name;
        this .modelNum = num;
    }

    public void printCarData(){
        UI. println ("Car No: " + this.modelNum + " Car Name: " + this.modelName);
    }
}
```

What will be printed out if the following testCars() method is called?

```java
public void testCars (){
    Car c1 = new Car(1123, "Mazda");
    c1.printCarData ();
    Car c2 = new Car();
    c2.printCarData ();
}
```

```
Constructor 2
Car No:  1123 Car Name:  Mazda
Constructor 1
Car No:  0 Car Name:  null
```

(Question 1 continued)

(h) **[9 marks]** What will be printed if the following printData() method is called assuming that "numData.txt" is the file shown below?

```
public void printData(){
    try{
        Scanner scan = new Scanner (new File("numData.txt"));
        while ( scan.hasNextInt() ){
                int a = scan.nextInt ();
                if ( scan.hasNextInt() ) {
                        int b = scan.nextInt ();
                        UI. println ((a + b));
                }
                else{
                        UI. println ("Done");
                }
        }
    } catch(IOException e){UI. println ("Fail: " + e);}
}
```

The numData.txt file:

```
5 3 2 1
4 2 3
1 2
```

```
8

3

6

4

Done
```

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.

Question 2. GUI programs [12 marks]

Complete the following ImagePlacer program that allows the user to place images on the graphics pane. The program has a button, which when clicked, will open a file chooser dialogue box. From the dialogue box, the user can choose a file name that will be stored in a field. When the user releases the mouse on the graphics pane, the program will draw the image in the file at that place.

You need to

- declare a field,
- complete the constructor to add a button,
- complete the setFileName method,
- complete the doMouse method.

```java
public class ImagePlacer{

    private String fileName;

    public ImagePlacer(){
        UI.setMouseListener(this :: doMouse);
        UI.addButton("Set fileName", this::setFileName);



    }

    public void setFileName(){
        this.fileName = UIFileChooser.open();



    }

    public void doMouse(String action, double x, double y){
        if(action.equals("released") && this.fileName!=null){
            UI.drawImage(fileName, x, y);
        }




    }
}
```

Question 3. Writing programs with Files [13 marks]

Complete the following countWords(String fileName) method that takes a file name as a parameter, reads that file, and returns the number of words in that file assuming the file contains only strings.

For example, given the following file, the method would return 7.

```
Ali Andrew Monique Surinder
Pondy Stuart
Daniel
```

```java
public int countWords(String fileName){
    try{
        int count = 0;
        Scanner scan = new Scanner (new File(fileName));

        while ( scan.hasNext() ){
            scan.next ();
            count++;
        }
        return count;




    } catch(IOException e){UI. println ("Fail: " + e); return −1;}
}
```

Question 4. Writing programs with objects, ArrayLists and Files   **[28 marks]**

(a)   **[12 marks] Defining classes and writing methods with ArrayList**
For this question, you are to complete the Student class on the facing page, which is part of
a program for a university to keep track of student grades.

Define the following fields inside the Student class:
  • ID: an integer that represents the student's ID.
  • name: a string that represents the student's first name.
  • marks: an ArrayList of type Double that holds the marks of the student's courses.

Complete the constructor and four methods:
  • The constructor that creates a Student object with an empty list of marks and the given
    ID and name.
  • getName(): returns the name of the student.
  • getID(): returns the ID of the student.
  • addMark(double mark): adds the given mark to the list of student's marks.
  • computeAverage(): computes and returns the average of the marks the student has re-
    ceived. If a student has no marks, then it should return -1;

(Question 4 continued)

```java
public class Student {
    // Fields
    private int ID;                 // the student ID
    private String name;            // the student name
    private ArrayList<Double> marks; // The courses marks


    public Student(int id, String n){
        this.ID = id;
        this.name = n;
        this.marks = new ArrayList<Double>();


    }
    public String getName() {
        return this.name;


    }
    public int getID() {
        return this.ID;


    }
    public void addMark(double mark){
        this.marks.add(mark);


    }
    public double computeAverage(){
        if (this.marks.size() == 0 ){
            return -1;
        }
        else {
            double sum = 0;
            for(Double d : this.marks){
                sum += d;
            }
            return sum/this.marks.size();
        }


    }
}
```

(Question 4 continued)

(b)   **[16 marks]** The following StudentReporter class reads data about students from a file, and reports their average grades.

A student data file contains one line for each student:

- The first value on each line is a student ID, followed by
- The student first name, followed by
- The number of courses this student had, followed by
- All the grades this student has received.

For example, in the file

```
3001 David 5 25.3 48.5 25.1 93 74
3023 Lindsay 2 20.3 50.5
3022 Monique 1 99
```

David's ID is 3001 and he has taken 5 courses with the marks 25.3, 48.5, 25.1, 93, and 74.

You may assume that for each student, the number of marks matches exactly the number of courses.

Complete the following methods in the StudentReporter class:

- loadStudentFile(*String* fileName): loads all the data about the students from the given file into the list of Students in stdList.
- printAverageMarks(): prints out the name, ID, and average mark for each student in stdList. It should use the computeAverage() method in the Student class.

(Question 4 continued)

```java
public class StudentReporter {

    private ArrayList<Student> stdList = new ArrayList<Student>();  // list of Students

    public void loadStudentFile ( String fileName){
        try{
            Scanner scan = new Scanner (new File(fileName));
            while(scan.hasNext()){
                int ID = scan.nextInt ();
                String name = scan.next();
                int count = scan.nextInt ();
                Student s = new Student(ID, name);
                for( int i = 0; i<count; i++){
                    s.addMark(scan.nextDouble());
                }
                this. stdList .add(s);
            }
        }




        } catch(Exception e){UI. println ("Fail: " + e);}
    }

    public void printAverageMarks(){
        for (Student s : this. stdList ){
            UI. println (s.getName() + " " + s.getID() + " " + s.computeAverage());
        }



    }
}
```
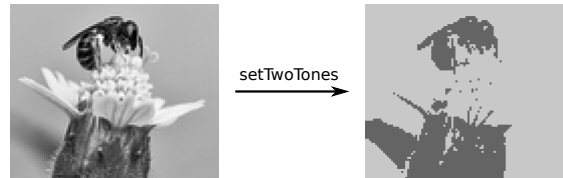
Question 5. Writing programs using 2D arrays   **[22 marks]**

This question deals with images that are represented by 2D arrays of integers between 0 and 255. Each integer represents the value of one pixel.

(a) **[10 marks]** Complete the following setTwoTones method which converts a greyscale image to either dark grey or light grey, as in the following images.

The parameter of setTwoTones is a 2D array of pixel values.
A pixel is set to dark grey (pixel value of 100) if it is less than 150, otherwise it is set to light grey (pixel value of 200). You may assume that the array is not null.

```java
public void setTwoTones(int [ ][ ] img){
        for( int row = 0; row < img.length; row++){
            for( int col = 0; col < img[row].length; col++){
                if (img[row][col]<150){
                    img[row][col] = 100;
                }
                else{
                    img[row][col] = 200;
                }
            }
        }

}
```

(Question 5 continued on next page)

(Question 5 continued)

(b)   **[12 marks]** Complete the following horizontalBlur method which performs a horizontal blur operation on an image to create a new image. Such an operation can achieve the following effect:
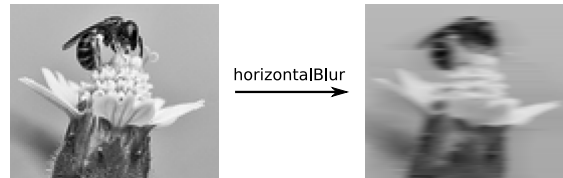
horizontalBlur is passed an image represented by 2D array of integers, and creates a new image in which each pixel (except the ones on the left and right borders) are the average of the value of the corresponding pixel in the original image and the values of the pixel to the left and the right. The pixels on the left and right should be copies of the corresponding pixels in the original image. Finally, the method returns the new image.

Hint: Do not modify the original image.

```java
public int [ ][ ] horizontalBlur ( int [ ][ ] img){
    if (img==null){return null;}
    int rows = img.length;
    int cols = img[0].length;

    int [ ][ ] temp = new int [rows][cols ];
    for( int row = 0; row < rows; row++){
        for( int col = 1; col < cols−1; col++){
            temp[row][col ] = (img[row][col −1]+img[row][col]+img[row][col+1])/3;
        }
    }
    return temp;
    }

}
```

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