

EXAMINATIONS – 2024

TRIMESTER 1

<p>COMP 102 INTRODUCTION TO COMPUTER PROGRAM DESIGN</p>

Time Allowed: TWO HOURS

CLOSED BOOK

Permitted materials: Silent non-programmable calculators or silent programmable calculators with their memories cleared are permitted in this examination.

Printed foreign language–English dictionaries are permitted.

No other material is 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:

- | | |
|--------------------------|------|
| 1. Understanding Java | [27] |
| 2. Design a class | [20] |
| 3. Files | [23] |
| 4. ArrayLists of Objects | [30] |
| 5. Arrays and 2D Arrays | [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.

Question 1. Understanding Java**[27 marks]****(a) [4 marks] Calling methods.**

What will the following printStuff method print out?

```
public void printStuff (){
    Ul.println ("printing stuff");
    int x = 10;
    int y = 15;
    int z = y * 2;
    Ul.println ("z=" + z);
    z = this.myMethod(x, y);
    Ul.println ("x=" + x + " y="+ y + " z=" + z);
}

public int myMethod(int m, int n){
    m = n - m;
    return m;
}
```

```
printing stuff
```

(Question 1 continued on next page)

(Question 1 continued)**(b) [7 marks] Conditionals**

Write a method `shippingFee(...)` that calculates and returns the shipping cost for a delivery address. The method should have a parameter to specify the address, and should return the cost as follows:

- Local: \$10.00
- Nation-wide: \$20.00
- Rural: \$30.00
- International: \$50.00

The address is a string and it always contains "Wellington" for local, "New Zealand" or "NZ" for nation-wide, and "RD" for rural delivery. You may assume any other address strings are international.

```
public double shippingFee( String address) {
```

```
}
```

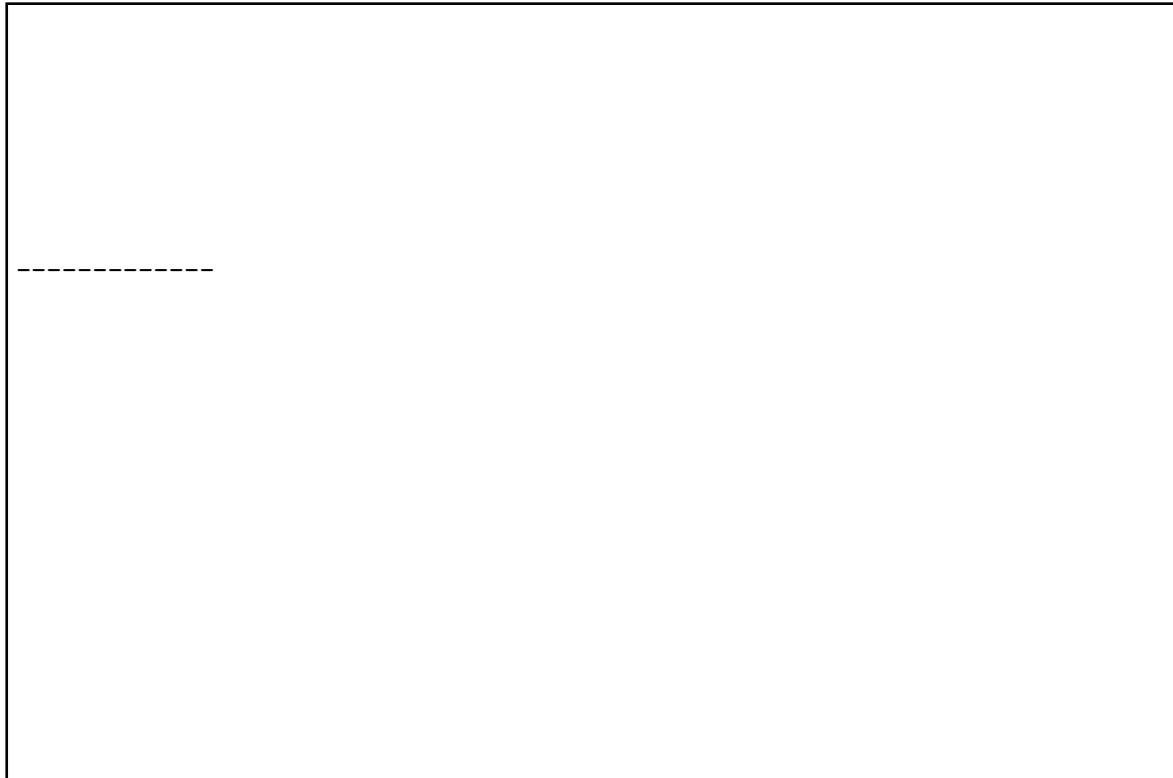
(Question 1 continued)**(c) [7 marks] Arrays.**

What will the following arrayTest method print out?

```
public void arrayTest(){
    int [ ] nums = new int [ ]{5, 2, 4, 3, 1, 4, 9, 5};

    int n = 1;
    Ul. println (nums.length);
    Ul. println (nums[4]);
    Ul. println (nums[n+1]);
    Ul. println ("-----");

    for( int i = 2; i < 5; i++){
        nums[i] = nums[i] + nums[i-1];
        Ul. println (nums[i]);
    }
}
```



(Question 1 continued)**(d) [9 marks] ArrayLists.**

Complete the following `countStartsWithA()` method. It gets some words from the user and stores them in `words`. It will count the number of words that start with the letter A. Finally, it prints the result.

Your method should not be case sensitive.

For example, if the user enters the following words:

"An"

"accountant"

"went"

"2"

"prison"

It should print "2 words started with an A".

```
public void countStartsWithA() {  
    ArrayList<String> words = UI.askStrings("Enter words here: ");
```

```
}
```

Question 2. Design a class**[20 marks]**

Complete the following DrawBoxGUI class that allows the user to draw a single filled square on the graphics pane and then press a button to make it shrink.

- The fields should store the position and size of the square. Note, a square means the width and height are equal.
 - The code does not need to set the color of the square.
- Declare the fields so they cannot be accessed directly outside the class.
- The constructor and setupGUI() method have been written for you.
- The draw() method draws the square. It should be called every time the square has changed position or size.
- The doMouse method should draw a square at the position the user clicked, so that the middle of the square is where the user clicked (i.e. not top/left). The default starting size is 50.0.
- The shrink() method should shrink the square by 10, and redraw it. The square must never be drawn with a size of zero or lower, instead set the square's size to the default size (i.e. 50.0).
- Remember to clear the graphics pane before redrawing.

```
public class DrawBoxGUI {

    public DrawBoxGUI() { this.setupGUI(); }

    public void setupGUI(){
        UI.addMouseListener(this :: doMouse);
        UI.addButton("Shrink", this::shrink);
    }

    public void draw() {

    }

    public void doMouse(String action, double x, double y) {

    }

    public void shrink () {

    }

}
```


Question 3. Files**[23 marks]**

A data file `football.txt` is shown below. Each line contains a team name and three integer numbers. The first integer is the number of superbowl the team has played in. The second integer is the number of superbowl the team has won, and the last value is the number of touchdowns the team has scored in the superbowl they have played in.

```
Steelers 8 6 24
Patriots 11 6 30
49ers 8 5 31
Cowboys 8 5 26
```

(a) **[10 marks]** What will the following `printFromFile` method print out?

```
public void printFromFile(){
    try {
        List<String> lines = Files.readAllLines(Path.of("football.txt"));
        for (String str : lines) {
            Scanner scan = new Scanner(str);
            String s = scan.next();
            scan.next();
            scan.next();
            UI.println(s + " " + scan.next());
            scan.close();
        }
    } catch (IOException e) {UI.println("file error");}
}
```

(Question 3 continued on next page)

(Question 3 continued)

(b) [13 marks] Complete the following `highestRate()` method that will read `football.txt` and finds the team name with the highest rate of touchdowns per superbowl played, i.e. the last integer divided by the first integer in each line.

The result should be printed using either `UI.println()` or `UI.printf`, where the team name is printed together with the rate of touchdowns per superbowl.

For example, running `highestRate()` using the provided `football.txt` file must result in the following output:

"49ers 3.875"

```
public void highestRate(){
    try {
        List<String> lines = Files.readAllLines(Path.of("football.txt"));

        } catch(IOException e) {UI.println("file error");}
}
```

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.

Question 4. ArrayLists of Objects**[30 marks]**

A program has two classes: a Song class and a Radio class.

The Song class below defines Song objects.

```

class Song {
    private String performer;
    private String name;
    private int length; //in seconds
    private String style ;

    public Song(String p, String n, int l, String s) {
        this.performer = p;
        this.name = n;
        this.length = l;
        this.style = s;
    }

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

    public String getPerformer(){
        return this.performer;
    }

    public int getLength(){
        return this.length;
    }

    public String getStyle(){
        return this.style ;
    }
}

```

The Radio class declares a songs field to store the list of song objects:

```
private List<Song> songs = new ArrayList<Song>();
```

and some constants that must be used for the different styles of songs.

```

private static final String ROCK = "ROCK";
private static final String CLASSICAL = "CLASSICAL";
private static final String POP = "POP";
private static final String JAZZ = "JAZZ";

```

(Question 4 continued on next page)

(Question 4 continued)

(a) [5 marks] What will the following method of the Radio class print when it is executed?

```
public void testing () {
    Song s1 = new Song("ABBA", "Waterloo", 164, POP);
    Song s2 = new Song("U2", "I Will Follow", 220, ROCK);
    Song s3 = new Song("Take 6", "Milky-White Way", 287, JAZZ);

    this.songs.clear ();
    this.songs.add(s1);
    this.songs.add(s2);
    this.songs.add(0, s3);
    this.songs.add(new Song("ABBA", "SOS", 202, POP));

    for(Song s: songs) {
        Ul.println (s.getPerformer ());
    }

    Ul.println (songs.get (0).getLength ());
}
```

(Question 4 continued on next page)

(Question 4 continued)

(b) [10 marks] Complete the following `returnSongsBy(...)` method that will find all songs by a particular performer, save them in a new `ArrayList`, and return the `ArrayList`.

```
public List<Song> returnSongsBy(String performer) {
```

```
}
```

(Question 4 continued)

(c) [15 marks] The following `findSongs(...)` method has three parameters which are the minimum length, maximum length, and style of songs that needs to be found.

Complete the `findSongs(...)` method so that it prints out all songs that have a length between the minimum and maximum length (both included) with the provided style.

For example, using `findSongs` after running `testing()` in (a), the following calls would print:

```
findSongs(100, 200, ROCK)
```

```
No songs found
```

```
findSongs(100,300,POP)
```

```
ABBA Waterloo
```

```
ABBA SOS
```

```
findSongs(100,200,POP)
```

```
ABBA Waterloo
```

```
public void findSongs(int minLength, int maxLength, String style ){
```

```
}
```

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.

Question 5. Arrays and 2D Arrays**[20 marks]**

A motel currently has 10 rooms. They are all in one row in one building. To remember the guest's first names, they have a board on the wall similar to the one below:

Name		Thor	Freya		Tane	Ngaio		Helen	Bill	
Room	1	2	3	4	5	6	7	8	9	10

Currently, rooms 1, 4, 7, and 10 are empty.

(a) **[6 marks]** A naive programmer has provided the below code to create a computer application to substitute the board on the wall. (The line numbers are provided for convenience.)

```

[01] public class Motel {
[02]     private static final int MAX_ROOM = 10;
[03]     private String[] names = new String[MAX_ROOM];
[04]
[05]     public void assignGuest(String name, int room){
[06]         this.names[room] = name;
[07]     }
[08]
[09]     public boolean isFree(int room){
[10]         return (this.names[room]==null);
[11]     }
[12]
[13]     public String getName(int room){
[14]         return (this.names[room]);
[15]     }
[16]
[17]     public boolean checkout(String name, int room){
[18]         if (this.names[room].equals(name)){
[19]             this.names[room] = null;
[20]             return true;
[21]         }
[22]         return false;
[23]     }
[24] }

```

The other classes that use the Motel class have been tested and will always call the Motel class' methods using a room number between 1 and MAX_ROOM and valid names (i.e. they do not call any methods with null as an argument).

Still there are bugs in Motel that will make the program crash when it runs. Changing two lines will remove the bugs. Please write the line numbers below:

(Question 5 continued on next page)

(Question 5 continued)

The motel is expanding and are building several rows of rooms, so that a physical name board would look similar to this:

Row 1	Name		Thor	Freya	Mo	Tane	Ngaio		Helen	Bill	
	Room	1	2	3	4	5	6	7	8	9	10
Row 2	Name	Bob	Joe			Jane	Eva				Pia
	Room	1	2	3	4	5	6	7	8	9	10
Row 3	Name		Moana		Monique			Ghassem		Karsten	
	Room	1	2	3	4	5	6	7	8	9	10

Rows are numbered 1 to MAX_ROW.

Instead of a physical board they want an application to do this.

(Question 5 continued)

(b) [8 marks] Complete MotelManyRows so that each method has the same functionalities as in (a). Make sure that the bugs in (a) are fixed. The names array must be changed to a 2d array.

```
public class MotelManyRows {
    private static final int MAX_ROOM = 10;
    private static final int MAX_ROW = 3;
    //Declare names as 2d array

    public void assignGuest(String name, int row, int room){

    }

    public boolean isFree(int row, int room){

    }

    public String getName(int row, int room){

    }

    public boolean checkout(String name, int row, int room){

    }

}
```

(Question 5 continued on next page)

(Question 5 continued)

(c) **[6 marks]** Complete the following `countEmptyRooms()` method that returns the number of empty rooms in the motel (with `MAX_ROW` number of rows of rooms). Room numbers are still between 1 and `MAX_ROOM`.

```
public int countEmptyRooms() {
```

```
}
```
