Sri Lanka Institute of Information Technology

B. Sc. Honours Degree in Information Technology

Final Examination (Online)

Year 2, Semester I (2020)

IT2030 – Object Oriented Programming

Duration: 3 Hours

Instructions to Candidates:

- This paper contains **Three** questions. **Answer All** Questions.
- Marks for each question are given in the paper.
- Total Marks: 100.
- Create a separate Project for each question. The name of the project is provided. Save each Java program using the class name given.
- This paper contains **06** pages with the Cover Page.

Instructions to Candidates when submitting:

- Save all your work.
- Create a folder from your student ID.
- Inside that, create 3 separate folders from the project name provided.
- Copy each project answer source codes(Only the .java files) in to respective folders.(There should be 3 folders name as **Question01**, **Question02**, **Question03** inside your ID folder, and in each folder should contain the answer.(.JAVA files ONLY).
- Zip the Student ID folder(Zip folder also should be the Student ID number).
- Upload into the correct link.

Question 1 (35 marks)

This question is based on the **Object-Oriented Programming (OOP) concepts**. You are going to implement a code for a "MenInblack" video game. There is an Alien class to represent a monster and an AlienPack class that represents a pack including different types of aliens. MenInBlack class has different types of agents who is going to kill the aliens and obtain the scores.

a) You can refer the output given in **Main** class and adjust your code accordingly.

```
public class Main {

    public static void main(String args[]) {

        //creating a alien pack with 5 different alians
        AlienPack pack1 = new AlienPack(5);
        pack1.addAlien(new MarshmalloAlien(), 0);
        pack1.addAlien(new OgreAlien(), 1);
        pack1.addAlien(new OgreAlien(), 2);
        pack1.addAlien(new SnakeAlien(), 3);
        pack1.addAlien(new MarshmalloAlien(), 4);

        MenInBlack AgentK = new MenInBlack(pack1);
        AgentK.kill();
        System.out.println("Your score is " + AgentK.getScore());
    }
}
```

```
put - Final2020 (run)  ⊠ | Test Results
run:
Your score is 55
BUILD SUCCESSFUL (total time: 0 seconds)
```

i). Implement the **Alien** interface and declare **getScore()** method.

(01 marks)

ii). Create three classes called **MarshmalloAlien**, **OgreAlien** and **SnakeAlien** and implement the **Alien** interface in each class. MarshmalloAlien has 15, OgreAlien has 10 and SnakeAlien has 5 as their scores.

(3 X 1 = 03 marks)

iii). Similarly create a class called **AlienPack** and implement the property of **aliens array (Alien[]).**

(03 marks)

iv). Implement the **constructor** in the AlienPack class. Distinguish the number of aliens.

(03 marks)

v). Implement the method called **addAlien** which accept a specific alien and the index.

(03 marks)

vi). Implement the method called **getAliens()** which returns the alien array.

(03 marks)

vii). Implement the **MenInBlack** class and implement the property of **score** and **alienpack(AlienPack).**

(03 marks)

viii). Implement the **constructor** in the MenInBlack class, which accept and initialize the alienpack. Make the starting agent score as zero.

(02 marks)

ix). Implement the getters and setters for score and alienpack.

(03 marks)

x). Implement the **kill()** method which kills the aliens in the alienpack and calculate the total score depending on each alien.

(03 marks)

b) "MenInblack" video game has another level where while the agent is killing the aliens, alien will do a damage for the agent and he will reduce the score accordingly.

i). Implement the **MenInBlackLevel2** class which is a child of the **MenInBlack** class.

(02 marks)

ii). Implement the **constructor** in the **MenInBlackLevel2** class, which accept and initialize the alienpack.

(02 marks)

iii). Override the kill method where it calculate the total score depending on each alien. Additionally, generate a random number for each alien. Each time the random number is an ODD, the total score will be reduce by 2.
*Hint: Math.random() *10 will generate a random decimal number between 1 and 10.*

(04 marks)

Save the project as **Question01**

Question 2 (30 marks)

This question is based on the **Collection Framework and Generics**.

i. You should implement a generic class, call MyMathClass , with a type and value parameter T, V where V is a numeric object type (e.g., Integer, Double, or any class that extends java.lang.Number).

(08 marks)

ii. Implement a method named Average that takes a HashMapt of type T, V and calculate the average of the HashMap values and display.

Hint: use doubleValue () method in the Number class to retrieve the value of each number as a double.

(07 marks)

iii. Implement another method call ConvertTo which convert and store HashMap values to an ArrayList. Method should take a HashMapt of type T, V and return the ArrayList.

(08 marks)

iv. Implement a class call Mymain which having the main method and test Average and ConvertTo methods with suitable data. Your program should generate a compile-time error if your Average is invoked on a HashMap that is defined for nonnumeric elements as value parameter (e.g., <Strings, String>).

(07 marks)

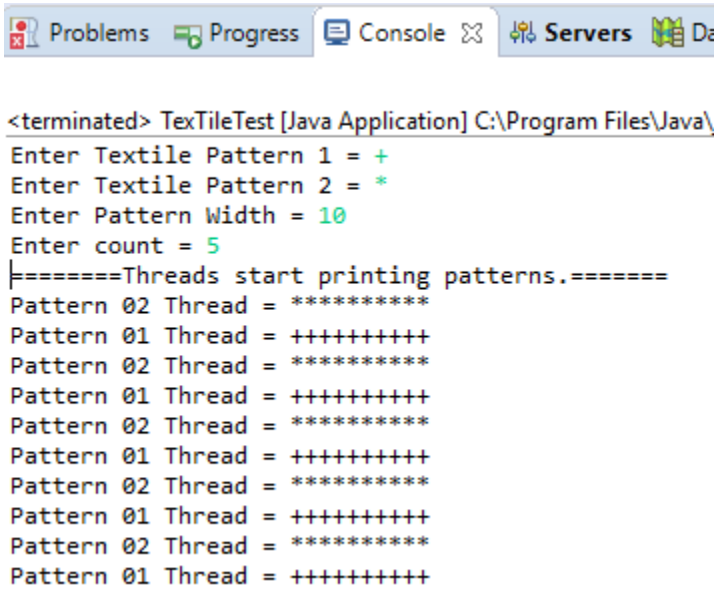
Save the project as **Question02**

Question 3 (35 marks)

This question is based on the **Threads** implementation.

1) A Textile company print two different patterns on clothes using two thread programs. Assume each thread print the selected pattern. You are allowed to enter patterns through keyboard input and you should select number of occurrences (count) to be printed and width of the pattern. Each thread should print patterns one after the other and you should print the Thread name as well. You can set names for the Threads as (Pattern 01 Thread, and Pattern 02 Thread). Please refer the below screenshot as well.

[**Assumption: - Thread synchronization is essential and both threads should print the output as synchronized manner. Correct implementation of *wait()*, *notify()* methods is compulsory to obtain full marks**]



Implementation of **PatternThread1 class.**

i). You have to overload the **PatternThread1** constructor with a lock (for synchronization), and use Textile pattern (String), width (int) and count (int) as parameters.

(02 mark)

ii). Override the **run()** method and implement the pattern print logic.

(10 marks)

iii). In each iteration the Thread should **sleep 1 second** of time interval and it should print the thread name and given values as per the given output.

(02 mark)

Implementation of **PatternThread2 class.**

iv). You have to overload the **PatternThread2** constructor with a lock (for synchronization), and use Textile pattern (String), width (int) and count (int) as parameters.

(02 mark)

v). Override the **run()** method and implement the pattern print logic.

(10 marks)

vi). In each iteration the Thread should **sleep 1 second** of time interval and it should print the thread name and given values as per the given output.

(02 mark)

Implementation of the **Main method.**

vii). Use Keyboard inputs to get the Textile Patterns, width and count.

(03 marks)

viii). Implement two Threads and set names **Pattern 01 Thread**, and **Pattern 02 Thread** and pass necessary parameters.

(04 marks)

Save the project as **Question03**

End of The Examination Paper