

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
SECOND SEMESTER 2017-2018
LAB - 09
OBJECT ORIENTED PROGRAMMING (CS F213)

DATE: 05th Nov 2020

TIME: 120 Min

Problem Description: Read the following specification which explains **HEADS & TAILS** which is a multi-player game.

- A. **Description of how the game is played:** In this game there are two primary entities involved (a) Monitor and (b) Player. There is just one Monitor and there can be multiple Players. Each Player tosses a coin only once and communicates the result (Head = 1, Tail = 0) to the Monitor. The Monitor keeps the count of number of heads and number of tails. Every time the Monitor receives the result from a player it inspects the result and increment number of heads or tails by one. Having received the results from all the players the Monitor publishes the final results. writes the final results (Number of heads = X, Number of tails = Y) in an output file named out.txt.
- B. **Description of Concurrent Tasks:** Both the Monitor and Players run as separate threads. Given below is the description of both the threads.

Monitor carries out the following tasks

- The Monitor thread continues to execute until all the players don't communicate the results of their coin toss.
- The Monitor thread must wait for a Player thread (the one which is scheduled currently) to toss a coin.
- The Monitor thread updates count for number of heads and number of tails.

Player carries out the following activities

- The Player thread tosses a coin and communicate the result to the waiting Monitor.
- Other Player threads must wait for the Monitor to process the result obtained from previous Player thread (if any).

WE WANT A STRICT SCHEDULE: Player Monitor Player Monitor Player Monitor ... until number of players

Partial code is given to you. Please write code only for boxed questions.

1. **class Data:** This class represents shared data object. The Player and Monitor threads are going to use the object of this class for the purpose of communication. The meaning of instance variable *lock: Object* is self-explanatory.

```
public class Data {
    // store the result of coin toss
    private int result;
    // set if it is player's chance
    private boolean pChance;
    // set if it is monitor's chance
    private boolean mChance;
    // number of players
    private int nOp;
    private Object lock;
    public Data() {
        // Fig.1 (input.txt)
        -1    // initial value of result
        true  // player chance flag
        false // monitor chance flag
        10    // number of Players
    }
    // GETTER AND SETTER METHODS ARE ALREADY PROVIDED
}
```

Q.1 Initialize the first four state variables by reading data from a file named "input.txt". See Fig.1 for file format.

2. **class Monitor:** This class encapsulates the logic of Monitor thread. Provide implementation for the boxed questions i.e. Q.2 (a), Q.2. (b), Q.2. (c), Q.2. (d) and Q.2. (e).

```
public class Monitor implements Runnable {
```

```
    private Data d;           // shared object
    private int tails = 0;    // count number of tails
    private int heads = 0;    // count number of heads
    public Monitor(Data d){ this.d = d; } // constructor
```

```
    public void run() {
```

Q.2 (a) How long should this thread run?

Q.2 (b) How to access the shared object?

Q.2 (c) What is the reason for the monitor to wait?

```
        System.out.println("monitor is going to read value ...");
        if(d.getResult() == 0) tails++;      else heads++;
```

Q.2 (d) The monitor should do some important work after reading the result of last player and before attempting to read the result of current player in the next iteration

Q.2 (e) Write the results i.e., number of heads and number of tails to a file named "out.txt"

```
    } // end of run method
```

```
} // end of class definition
```

3. **class Player:** This class encapsulates the logic of Player thread. Provide implementation for the boxed questions i.e. Q.3 (a), Q.3. (b) and Q.3. (c).

```
public class Player implements Runnable{
```

```
    private Data d;           // shared object
    Random rand = new Random(); // random number generator
    public Player(Data d) { this.d = d; } // constructor
```

```
    public void run() {
```

Q.3 (a) How to access the shared object?

Q.3 (b) What is the reason for the monitor to wait?

```
        d.setResult(rand.nextInt(2)); //tossing coin and writing result
```

Q.3 (c) The player should do some important work after writing the result of coin toss to the shared object

```
    } //end of run method
```

```
}
```

4. **class Lab10:** This class is the driver class.

```
public class Lab10 {
```

```
    public static void main(String[] args){
        Data d = new Data();
        Thread[] players;
        Thread monitor;
```

Q.4 (a) Create and start player threads

Q.4 (b) Create and start monitor thread

```
}
```

```
}
```

***** BEST OF LUCK *****