Content

USCSP301-USCS303:Operating System(OS)Practical-05

Practical-05: Thread

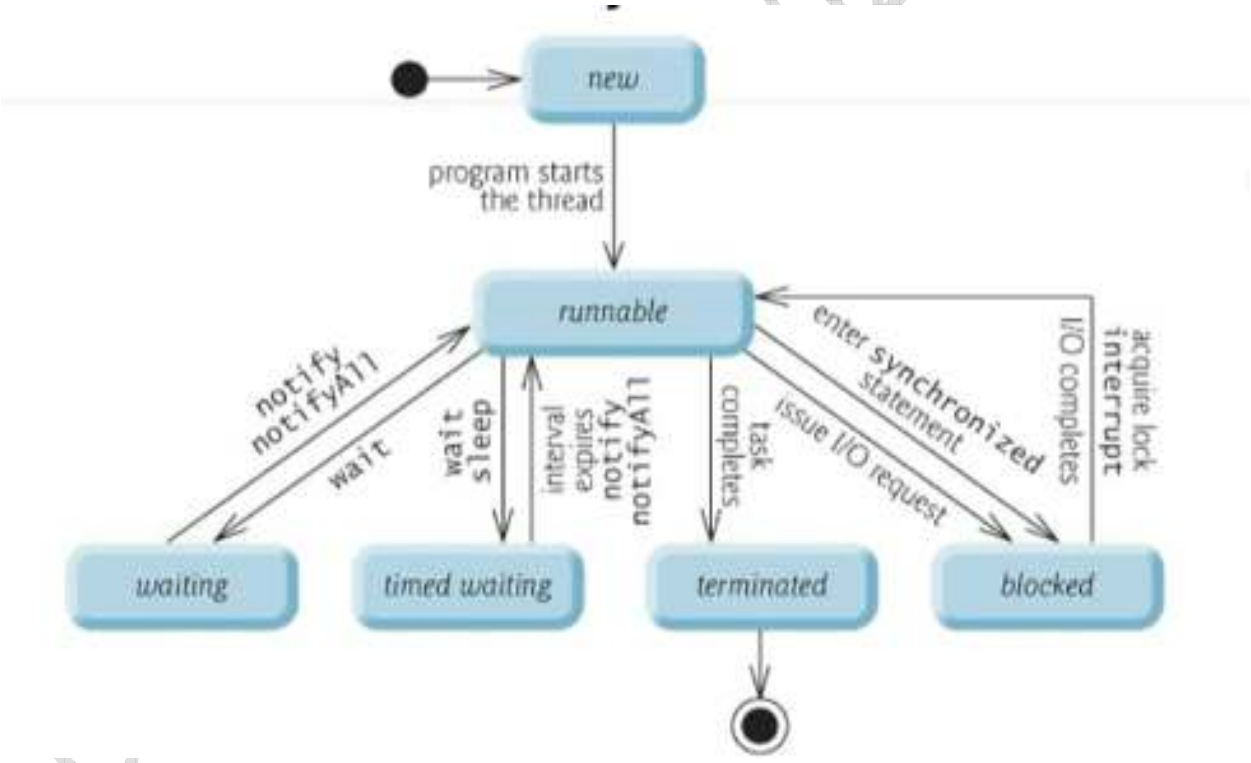
Practial Date: 14th Aug 2021

Practical Aim:Threads(Multi-Threading)

- **Content:**
  - Creating and executing Threads using Runnable interface.
- **Process:**
  - One can create and run multiple threads.
  - Us of various methods of Thread class like start,run,wait,sleep,join,etc.
- **Prior Knowledge:**
- Multi-threaded programming concepts.

➢ Thread States:Life Cycle of a Thread

- A java thread can be in any of the following thread states during it's life cycle i.e.
  - New,
  - Runnable,
  - Blocked,
  - Waiting,
  - Times Waiting or Terminated.
- These are also called life cycle events of a thread states.



I. New and Runnable States:

- A new thread begins its life cycle in the new state.
- It remains in this state until the program starts the thread, which places it in the runnable state.
- A thread in the runnable state is considered to be executing its task.

II. Waiting State:

- Sometimes a runnable thread transitions to the waiting state while it waits for another thread to perform a task.
- A waiting thread transitions back to the runnable state only when another thread notifies it to continue executing.

III. Timed Waiting State:

- A runnable thread can enter the timed waiting state for a specified interval of time. It transition back to the runnable state when that time interval expires or when the event it's waiting for occurs.
- Timed waiting and waiting threads cannot use a processor, even if one is available.
- A runnable thread can transition to the timed waiting state if it provides an optional wait interval when it's waiting for another thread to perform a task. Such a thread returns to the runnable state when it's notified by another thread or when the timed interval expires-whichever comes first.
- Another way to place a thread in the timed waiting state is to put a runnable thread to sleep. A sleeping thread remains in the timed waiting state for a designated period of time (called a sleep interval), after which it returns to the runnable state.

IV. Blocked State:

- A runnable thread transition to the blocked state when it attempts to perform a task that cannot be completed immediately and it must temporarily wait until that task completes.

V. Terminated State:

- A runnable thread enters the terminated state (sometimes called the dead state) when it successfully completes its task or otherwise terminates (perhaps due to an error).

- Question-01:

Write a multithreaded java program that determines the summation of a non-negative integer. The Summation class implements the Runnable interface. Thread creation is performed by creating an object instance of the Thread class and passing the constructor a Runnable object.

#Source Code:

FileName: P5_Q1_SummationTest_SS.java

```
//NAME: SHRADDHA SAWANT

//BATCH: B1

//PRN: 2020016400773862

//DATE: 14TH Aug 2021

//PRAC-05: THREADS



class P5_Q1_Summation_SS implements Runnable
{
  int upperLimit,sum;
  public P5_Q1_Summation_SS(int upperLimit)
  {
    this.upperLimit=upperLimit;
  }
   public void run()
  {
     for (int i=1; i<=upperLimit; i++)
       sum+=i;
```

```
    }
}//end of class P5_Q1_Summation_SS


public class P5_Q1_SummationTest_SS
{
  public static void main(String args[])
  {
     if(args.length <=0)
       System.out.println("Usage:   P5_Q1_SummationTest_SS <integervalue>");
     else
      {
        int upp= Integer.parseInt(args[0]);
        if(upp <=0)
          System.out.println("args[0]: " +args[0]+ " must be a positive number");
     else
     {
         P5_Q1_Summation_SS s=new P5_Q1_Summation_SS(upp);
         Thread t= new Thread(s);
         t.start();
         try{
                  t.join();
                  System.out.println("The sum of first  "+ upp +"  elements is "+(s.sum));
         }
          catch(Exception e){
```

```
            e.printStackTrace();

         }

        }//inner else ends

     }//outer else ends

  }//main ends

}//end of the class class P5_Q1_SummationTest_SS
```

Output:

```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
avac P5_Q1_SummationTest_SS.java

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
ava P5_Q1_SummationTest_SS 10
The sum of first  10  elements is 55

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
ava P5_Q1_SummationTest_SS 100
The sum of first  100  elements is 5050
```

```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
avac P5_Q1_SummationTest_SS.java

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
ava P5_Q1_SummationTest_SS
Usage:   P5_Q1_SummationTest_SS <integervalue>
```

```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
avac P5_Q1_SummationTest_SS.java

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q1_Summation_SS>j
ava P5_Q1_SummationTest_SS -15
args[0]: -15 must be a positive number
```

- Question-02:

Write a multithread Java program that output prime numbers. This program should work as follows: The user will run the program and will enter a number on the command line. The program will end then create a separate thread that outputs all the prime numbers less than or equal to the number entered by the user.

#Source Code 1:

```
//NAME: SHRADDHA SAWANT

//BATCH: B1

//PRN: 2020016400773862

//DATE: 14TH Aug 2021

//PRAC-05: THREADS


import java.io.*;

import java.util.*;

public class P5_Q2_Primes_SS{

    public static void main(String args[]){

        try{

            P5_Q2_PrimeThread_SS pt=null;

            System.out.print("Enter a number > ");

            Scanner scan= new Scanner(System.in);

            int limit= scan.nextInt();

            System.out.print("Enter a file name to store the results > ");

            String fName= scan.next();

            if(fName.length() >0)

              pt= new P5_Q2_PrimeThread_SS(limit, new FileOutputStream(fName));
```

```
            else
                pt= new P5_Q2_PrimeThread_SS(limit);
             pt.run();
           }catch(Exception e){
                  e.printStackTrace();
           }
      }//main ends
}//class ends
```

#Source code 2:

```
//NAME: SHRADDHA SAWANT
//BATCH: B1
//PRN: 2020016400773862
//DATE: 14TH Aug 2021
//PRAC-05: THREADS

import java.io.*;

class P5_Q2_PrimeThread_SS extends Thread{
    private PrintStream pOut= null;
    private int limit= 0;

   //default constructor.does nothing
   public P5_Q2_PrimeThread_SS(){
   }
```

```
//construct to set the number below which to generate primes
public P5_Q2_PrimeThread_SS(int I){
   limit= I;
   try {
         pOut= System.out;
   } catch(Exception e){
         e.printStackTrace();
   }
 }

 //consrtuct that sets both the number, as above, and specifies an output stream
 public P5_Q2_PrimeThread_SS(int I, OutputStream outS){
        limit= I;
         try{
            if(outS!= null){
                        pOut= new PrintStream(outS);
                }else{
                        pOut= System.out;
                }
         }catch(Exception e){
                e.printStackTrace();
         }
   }
```

```
    //method that performs the work of the thread
     public void run(){
                boolean numbers[]= new boolean[limit+1];
                numbers[0]= false;
                numbers[1]= false;
                for(int i=2; i<numbers.length; i++){
                    numbers[i]= true;
              }
        for(int i= 2; i<numbers.length; i++){
          if(numbers[i]){
            for(int j=(2*i); j<numbers.length; j+=i){
                 numbers[j]= false;
             }//inner for ends
          }//if ends
        }//outer for ends
        for(int i=0; i<numbers.length; i++){
          if (numbers[i])
            pOut.println(i);
        }//for ends
    }//run ends
}//class ends
```

Input:

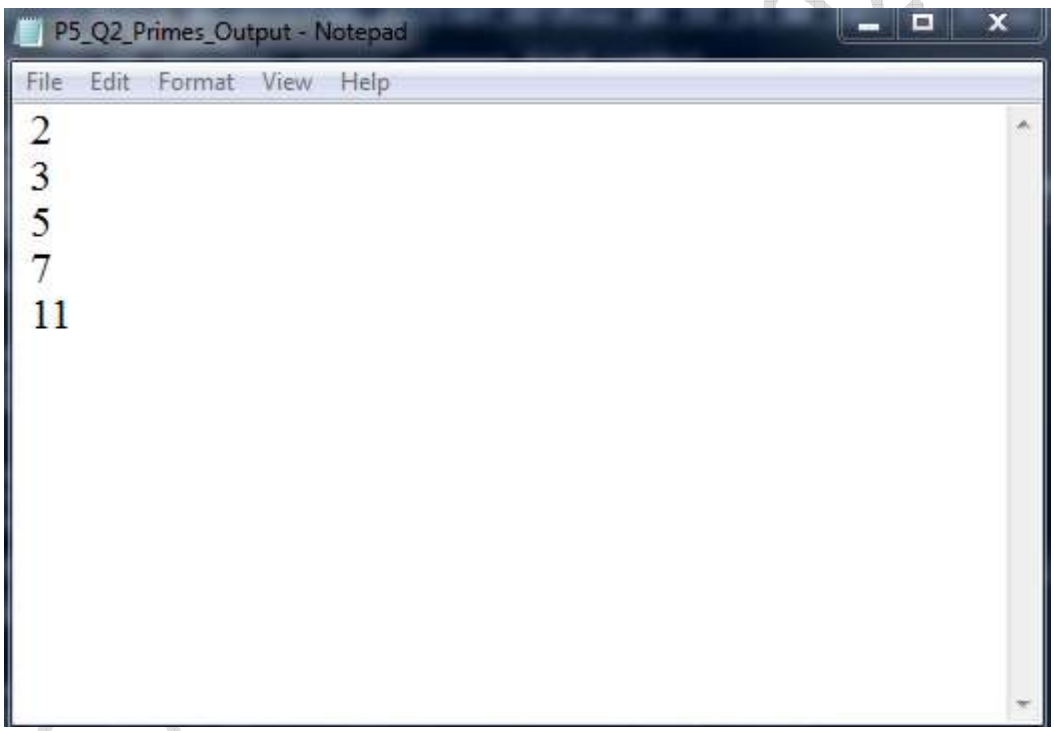
```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q2_Prime_SS>javac
 P5_Q2_Primes_SS.java

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q2_Prime_SS>java
P5_Q2_Primes_SS
Enter a number > 12
Enter a file name to store the results > P5_Q2_Primes_Output.txt
```

Output:

```
Enter a file name to store the results > P5_Q2_Primes_Output.txt

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q2_Prime_SS>P5_Q2
_Primes_Output.txt
```



- Question-03:

The Fibonacci sequence is the series of numbers 0,1,1,2,3,5,8,...Formally, it can be expressed as:fib0= 0,fib1= 1, fibn= fibn-1 + fibn-2. Write a multithreaded program that generates the Fibonacci sequence using either the Java.

#Source code:

```
//NAME: SHRADDHA SAWANT

//BATCH: B1

//PRN: 2020016400773862

//DATE: 14TH Aug 2021

//PRAC-05: THREADS


import java.util.ArrayList;

import java.util.Scanner;


public class P5_Q3_Fibo_SS

{

   public static void main(String args[]){

     Scanner scan= new Scanner(System.in);

     ArrayList al= new ArrayList();

     int a;

     System.out.print("Enter the number: ");

     a= scan.nextInt();

     P5_Q3_FiboThread_SS fibTh= new P5_Q3_FiboThread_SS(a);

     fibTh.start();
```

```
    try{
          fibTh.join();
    }catch(InterruptedException ex){
          ex.printStackTrace();
    }
      int fseries[]= fibTh.arr;
       System.out.println("First" +a+ "fibonacc numbers are: ");
      for(int i= 0; i<a; i++){
          System.out.print(fseries[i]+ "  ");
    }
  }//main ends
}//class ends
class P5_Q3_FiboThread_SS extends Thread
{
   private int a, i;
   Thread t;
    int arr[];

   public P5_Q3_FiboThread_SS(int a) {
    this.a = a;
    arr=new int[a];
 }
  public void run(){
      arr[0]= 0;
```

```
        arr[1]= 1;

       for(i= 2; i< a; i++){

           arr[i]= arr[i- 1]+arr[i-2];

       }

    }//run ends

}//class ends
```

Output:

```
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q3_Fibonacci_SS>j
avac P5_Q3_Fibo_SS.java

D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q3_Fibonacci_SS>j
ava P5_Q3_Fibo_SS
Enter the number: 10
First10fibonacc numbers are:
0  1  1  2  3  5  8  13  21  34
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q3_Fibonacci_SS>j
ava P5_Q3_Fibo_SS
Enter the number: 15
First15fibonacc numbers are:
0  1  1  2  3  5  8  13  21  34  55  89  144  233  377
D:\OS Pract\Batch 01\USCSP301_USCS303_OS\Prac_05_SS_14_08_2021\Q3_Fibonacci_SS>
```