EXPERIMENT NO : 4

Name: Fale Manish Dinkar
Class: TE
Div: A
Roll No: T211036
Batch: A2

Problem Statement Write a program to simulate CPU Scheduling Algorithms:

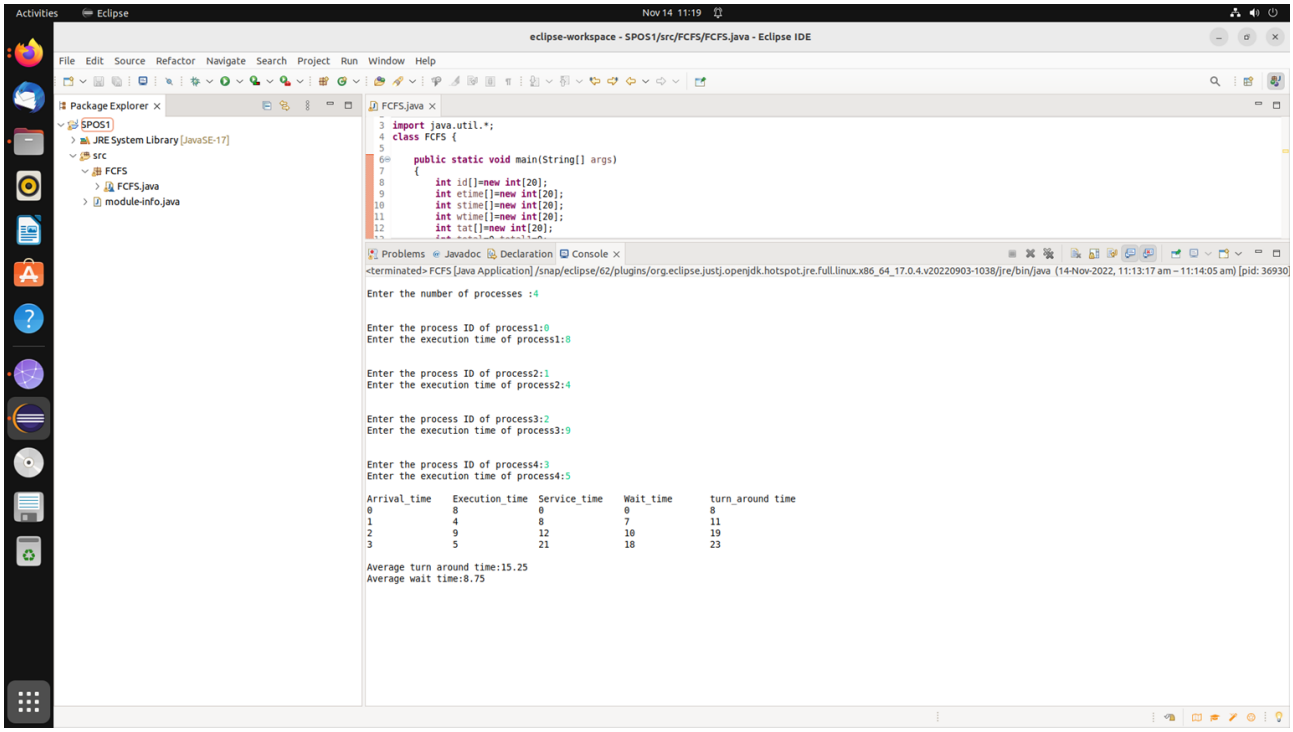
1. FCFS
2. SJF(Preemptive)
3. Priority(Non- Preemptive)
4. Round Robin(Preemptive)

1. FCFS

```
package FCFS;
import java.util.*;
class FCFS {

	public static void main(String[] args)
	{
		int id[]=new int[20];
		int etime[]=new int[20];
		int stime[]=new int[20];
		int wtime[]=new int[20];
		int tat[]=new int[20];
		int total=0,total1=0;
		float avg,avg1;
		Scanner sn=new Scanner(System.in);
		System.out.print("\nEnter the number of processes :");
		int n=sn.nextInt();
		for(int i=0;i<n;i++)
		{
			System.out.println();
			System.out.print("\nEnter the process ID of process"+	i+1)+":");
			id[i]=sn.nextInt();
		System.out.print("Enter the execution time of process"+(i+1)+":");
		etime[i]=sn.nextInt();
		}
		stime[0]=0;
		for (int i=1;i<n;i++)
		{
			stime[i]=stime[i-1]+etime[i-1];
		}

		wtime[0]=0;
		for(int i=0;i<n;i++)
		{
```

```
                wtime[i]=stime[i]-id[i];
                total=total+wtime[i];
            }
            for(int i=0;i<n;i++)
            {
                tat[i]=wtime[i]+etime[i];
                total1=total1+tat[i];
            }
            avg=(float)total/n;
            avg1=(float)total1/n;

        System.out.println("\nArrival_time\tExecution_time\tService_time\tWait_time\tturn_around time");
            for(int i=0;i<n;i++)
            {


        System.out.println(id[i]+"\t\t"+etime[i]+"\t\t"+stime[i]+"\t\t"+wtime[i]+"\t\t"+tat[i]);
            }
            System.out.println("\nAverage turn around time:"+avg1+"\nAverage wait time:"+ avg);
        }
}
```

Output:



2. SJF(Preemptive)

```
import java.util.*;

public class SJFP {
   public static void main (String args[])
   {
      Scanner sc=new Scanner(System.in);
      System.out.println ("enter no of process:");
      int n= sc.nextInt();
      int pid[] = new int[n]; // it takes pid of process
      int at[] = new int[n]; // at means arrival time
      int bt[] = new int[n]; // bt means burst time
      int ct[] = new int[n]; // ct means complete time
      int ta[] = new int[n];// ta means turn around time
      int wt[] = new int[n];  // wt means waiting time
      int f[] = new int[n];  // f means it is flag it checks process is completed or not
      int k[]= new int[n];   // it is also stores brust time
      int i, st=0, tot=0;
      float avgwt=0, avgta=0;

      for (i=0;i<n;i++)
      {
         pid[i]= i+1;
         System.out.println ("enter process " +(i+1)+ " arrival time:");
         at[i]= sc.nextInt();
         System.out.println("enter process " +(i+1)+ " burst time:");
         bt[i]= sc.nextInt();
         k[i]= bt[i];
         f[i]= 0;
      }

      while(true){
         int min=99,c=n;
         if (tot==n)
            break;

         for ( i=0;i<n;i++)
         {
            if ((at[i]<=st) && (f[i]==0) && (bt[i]<min))
            {
               min=bt[i];
               c=i;
            }
         }

         if (c==n)
            st++;
         else
         {
            bt[c]--;
            st++;
```

```
            if (bt[c]==0)
            {
               ct[c]= st;
               f[c]=1;
               tot++;
            }
         }
      }

      for(i=0;i<n;i++)
      {
         ta[i] = ct[i] - at[i];
         wt[i] = ta[i] - k[i];
         avgwt+= wt[i];
         avgta+= ta[i];
      }

      System.out.println("pid  arrival  burst  complete turn waiting");
      for(i=0;i<n;i++)
      {
         System.out.println(pid[i] +"\t"+ at[i]+"\t"+ k[i] +"\t"+ ct[i] +"\t"+ ta[i] +"\t"+ wt[i]);
      }

      System.out.println("\naverage tat is "+ (float)(avgta/n));
      System.out.println("average wt is "+ (float)(avgwt/n));
      sc.close();
   }
}
```

Output:

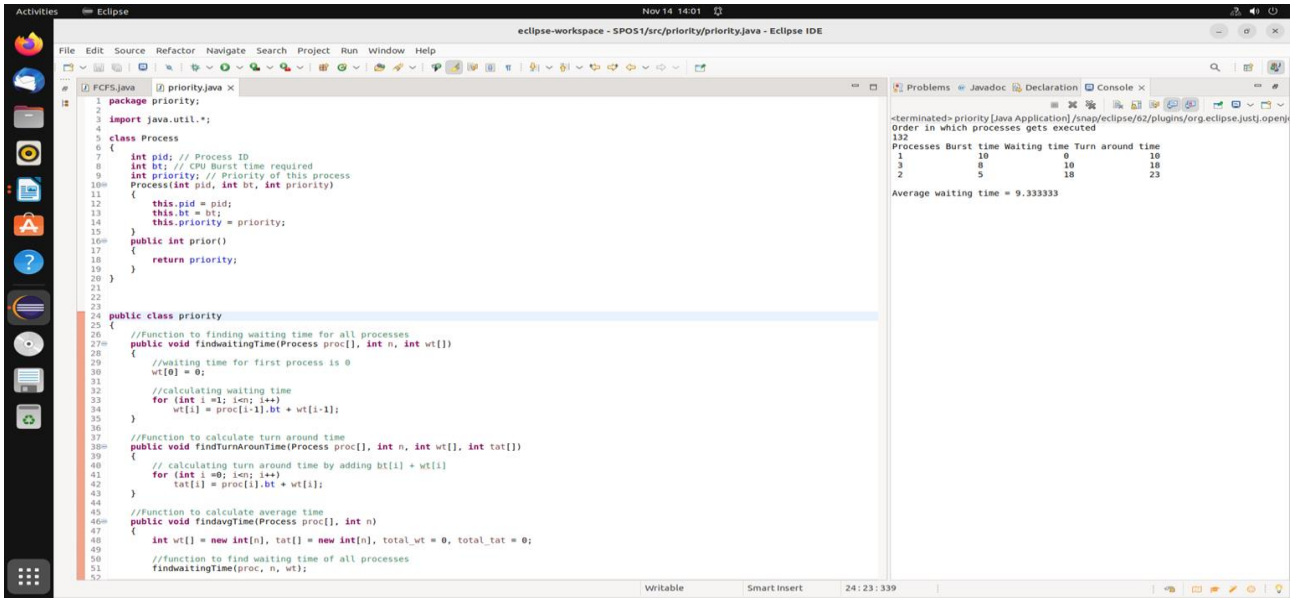
```
"C:\Program Files\Java\jdk-18.0.2\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2022.2\lib\idea_rt.jar=53717:C:\Program Files\JetBrains\
enter no of process:
4
enter process 1 arrival time:
2
enter process 1 brust time:
1
enter process 2 arrival time:
4
enter process 2 brust time:
5
enter process 3 arrival time:
7
enter process 3 brust time:
0
enter process 4 arrival time:
8
enter process 4 brust time:
3

pid  arrival brust  complete turn waiting
1   2   1   3   1   0
2   4   5   9   5   0
3   7   0   9   2   2
4   8   3   12  4   1

average tat is 3.0
average wt is 0.75
```

3. Priority(Non- Preemptive)

```
package priority;

import java.util.*;

class Process
{
	int pid; // Process ID
	int bt; // CPU Burst time required
	int priority; // Priority of this process
	Process(int pid, int bt, int priority)
	{
		this.pid = pid;
		this.bt = bt;
		this.priority = priority;
	}
	public int prior()
	{
		return priority;
	}
}
public class priority
{
	//Function to finding waiting time for all processes
	public void findwaitingTime(Process proc[], int n, int wt[])
	{
		//waiting time for first process is 0
		wt[0] = 0;

		//calculating waiting time
		for (int i =1; i<n; i++)
			wt[i] = proc[i-1].bt + wt[i-1];
	}

	//Function to calculate turn around time
	public void findTurnArounTime(Process proc[], int n, int wt[], int tat[])
	{
		// calculating turn around time by adding bt[i] + wt[i]
		for (int i =0; i<n; i++)
			tat[i] = proc[i].bt + wt[i];
	}

	//Function to calculate average time
	public void findavgTime(Process proc[], int n)
	{
		int wt[] = new int[n], tat[] = new int[n], total_wt = 0, total_tat = 0;

		//function to find waiting time of all processes
		findwaitingTime(proc, n, wt);

		//Function to find turn around time  for all process
		findTurnArounTime(proc, n, wt,tat);

		//Display processes along with all details
		System.out.print("\nProcesses Burst time Waiting time Turn around time\n");

		//Calculate total waiting time and toatl turnaround time
		for (int i = 0; i<n; i++)
```

```
		{
			total_wt = total_wt + wt[i];
			total_tat = total_tat + tat[i];
			System.out.print(" "+proc[i].pid + "\t\t" +proc[i].bt + "\t\t" + wt[i]+"\t\t" + tat[i] +"\n");
		}

		System.out.print("\nAverage waiting time = " +(float)total_wt / (float)n);
	}

public void priorityScheduling(Process proc[], int n)
{
	// Sort process by priority
	Arrays.sort(proc, new Comparator<Process>()
	{
		@Override
		public int compare(Process a, Process b)
		{
			return b.prior() - a.prior();
		}
	});
		System.out.print("Order in which processes gets executed \n");
		for (int i=0; i<n; i++)
			System.out.print(proc[i].pid + "");

			findavgTime(proc, n);
	}

	public static void main(String[] args)
	{
		priority ob = new priority();
		int n = 3;
		Process proc[] = new Process[n];
		proc[0] = new Process(1, 10, 2);
		proc[1] = new Process(2, 5, 0);
		proc[2] = new Process(3, 8, 1);
		ob.priorityScheduling(proc, n);
	}
}
```

Output:



4. Round Robin(Preemptive)

```
package RoundRobin;
import java.util.Scanner;
public class RoundRobin
{
public static void main(String args[])
{
	int n,i,qt,count=0,temp,sq=0,bt[],wt[],tat[],rem_bt[];
	float awt=0,atat=0;
	bt = new int[10];
	wt = new int[10];
	tat = new int[10];
	rem_bt = new int[10];
	Scanner s=new Scanner(System.in);
	System.out.print("Enter the number of process (maximum 10) = ");
	n = s.nextInt();
	System.out.print("Enter the burst time of the process\n");
	for (i=0;i<n;i++)
	{
		System.out.print("P"+i+" = ");
		bt[i] = s.nextInt();
		rem_bt[i] = bt[i];
	}
	System.out.print("Enter the quantum time: ");
	qt = s.nextInt();
	while(true)
	{
		for (i=0,count=0;i<n;i++)
		{
		temp = qt;
		if(rem_bt[i] == 0)
		{
			count++;
			continue;
		}
		if(rem_bt[i]>qt)
			rem_bt[i]= rem_bt[i] - qt;
		else
		if(rem_bt[i]>=0)
		{
			temp = rem_bt[i];
			rem_bt[i] = 0;
		}
	sq = sq + temp;
	tat[i] = sq;
	}
	if(n == count)
		break;
	}
	System.out.print("---------------------------------------------------------------------------");
```

```
        System.out.print("\nProcess\t Burst Time\t Turnaround Time\t Waiting Time\n");
        System.out.print("----------------------------------------------------------------------------------");
        for(i=0;i<n;i++)
        {
                wt[i]=tat[i]-bt[i];
                awt=awt+wt[i];
                atat=atat+tat[i];
                System.out.print("\n "+(i+1)+"\t "+bt[i]+"\t\t "+tat[i]+"\t\t "+wt[i]+"\n");
        }
        awt=awt/n;
        atat=atat/n;
        System.out.println("\nAverage waiting Time = "+awt+"\n");
        System.out.println("Average turnaround time = "+atat);
}
}
```

OUTPUT:-