Smt. Chandibai Himathmal Mansukhani College

Contents

USCS3PO1: USCS303 – Operating System (0S)

USCS303-OS:Practical -03:RR Scheduling Algorithm

Round- Robin(RR) Scheduling Algorithm

Practical Date: 28th July ,2021 (Wednesday)

Practical Aim : Implement RR scheduling algorithm

Round-robin (RR) scheduling,but in Round-robin (RR) scheduling ,pre-emption is added which enables the system to switch between processes.

This algorithm is similar to FCFS scheduling , but in Round-robin(RR)scheduling, pre-emption is added, which enables the system to switch between processes.

Round -robin scheduling algorithm is used to schedule process fairly each job a time slot or quantum and the interrupting the job a time slot or quantum and the interrupting the job if it is not completed by then the job come after the other job which is arrived in the quantum time that makes these scheduling fairly.

Name: Sahil Jadhav Batch:B2

Algorithm :

Step 1: Input the number of process and time quanta or time slice required to be scheduled using RR, burst time for each process.

Step 2: Choose the first process in the ready queue, set a timer to interrupt it after time quantum and dispatches it. Check if any other process request has arrived if a process request arrives during the quantum time in which another process is executing ,then add the new process to the ready queue.

Step 3: After the quantum time has passed ,check for any process in the Ready queue . If the ready queue is empty then continue the current process . If the queue not empty and the current process is completed, then add the current process to the end of the ready queue.

Step 4: Take the first process from the Ready queue and start executing it.Calculate the Turn Around Time and Waiting Time for each processing using RR.

Step 5: Reapeat all steps above from Step2 to Step4.

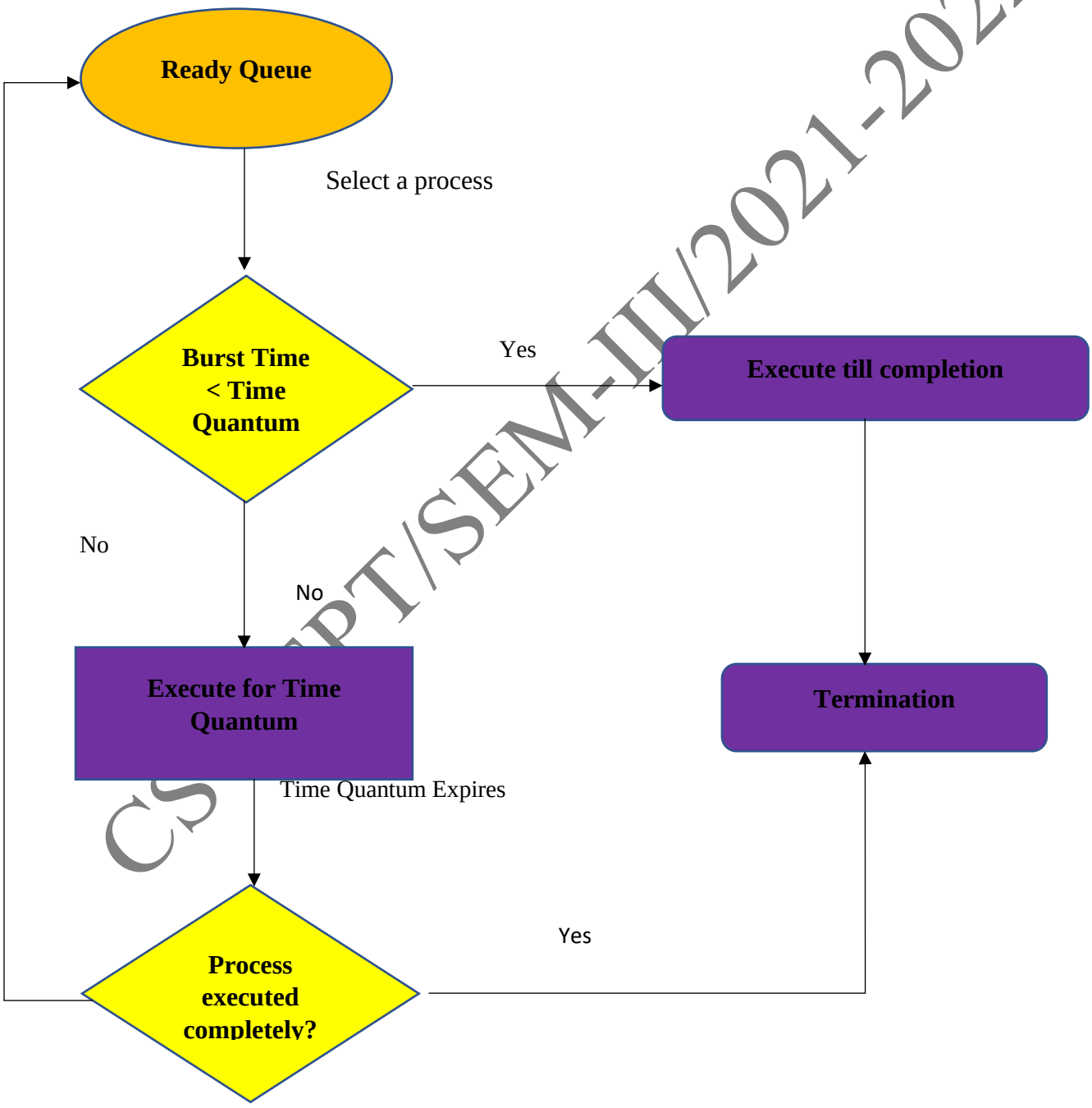
Step 6: If the process is complete and the ready queue is empty then the task is complete.

Step 7: Calculate the Average Waiting Time and Average Turn Around Time .

Step 8: Stop.

Flowchart :

RR Flowchart



Solved Example

Consider the following example containing three processes arriving at time t= 0 ms

Process ID	Burst Time
P0	24
P1	3
P2	3

Assume Time Quanta :4ms

Step1: Consider the time quanta /time slice = 4 ms.

Step 2: Following shows the scheduling and execution of processes .

Step 2.1:P0 process arrives at 0 with 24 ms as the Burst time which is greater than time quanta = 4 ms. So P0 executes for 4 ms and goes in waiting queue .

System Time : 0

Process Schedule :P0

Remaining Time :24 - 4 =20

Waiting Time : 0 - 0 = 0

Turn Around Time : 0 + 4 =4

Step 2.2 : Next P1 process executes for 3 ms which is greater than quanta time. So P1 executes and gets terminated .

System Time : 4

Process Schedule : P0,P1

Remaining Time : 3 - 4 =-1=0

Waiting Time : 4 - 0 = 4

Turn Around Time : 4 + 3 =7

Step 2.3 : Next P2 process executes for 3 ms which is greater than quanta time. So P2 executes and gets terminated .

System Time : 7

Process Schedule :P0,P1,P2

Remaining Time :3 - 4 =-1= 0

Waiting Time : 7 - 0 = 7

Turn Around Time : 7 + 3 =10

Step 2.4 : Now P0 turns comes again and it's the only process for execution so for 4 ms of quanta it gets executed .

System Time : 10

Process Schedule :P0,P1,P2,P0

Remaining Time :20- 4 =16

Waiting Time : 0

Turn Around Time : 10 + 4 = 14

Step 2.5: Again , P0 continues to execute for next 4 ms . Waiting for P0 will be zero.

System Time : 14

Process Schedule :P0,P1,P2,P0,P0

Remaining Time :16 - 4 =12

Waiting Time : 0

Turn Around Time : 14 + 4 = 18

Step 2.6 : P0 continues to execute for next 4 ms.

System Time : 18

Process Schedule :P0,P1,P2,P0,P0,P0

Remaining Time :12 - 4 = 8

Waiting Time : 0

Turn Around Time : 18 + 4 =22

Step 2.7 : P0 continues to execute for next 4 ms.

System Time : 22

Process Schedule :P0,P1,P2,P0,P0,P0,P0

Remaining Time : 8 - 4 = 4

Waiting Time : 0

Turn Around Time : 22 + 4 = 26

Step 2.8 : P0 continues to execute for next 4 ms.

System Time : 26

Process Schedule :P0,P1,P2,P0,P0,P0,P0,P0

Remaining Time : 4 - 4 = 0

Waiting Time : 0

Turn Around Time : 26 + 4 = 30

Step 3: Calculate the Average Waiting Time and Average Turn Around Time.

Average Waiting Time =(6 + 4 + 7)/3

=17/3

=5.666667

Average Turn Around Time =(30 + 7 + 10)/3

=47/3

=15.6666667

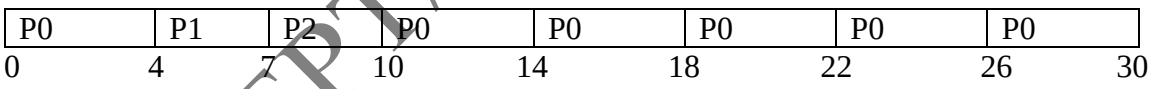
Step 4 : After Scheduling of all provided process:

Process ID	Burst Time	Turn Around Time (Completion Time – Arrival Time)	Waiting Time (Turn Around Time – Burst Time)
P0	24	30 – 0 = 30	30 – 24 = 6
P1	3	4 + 3 = 7	7 – 3 = 4
P2	3	7 + 3 = 10	10 – 3 = 7
Average		15.66666667	5.6666667

Gnatt Chart :

1.

Process ID	Burst Time	Turn Around Time (Completion Time – Arrival Time)	Waiting Time (Turn Around Time – Burst Time)
P0	24	30 – 0 = 30	30 – 24 = 6
P1	3	4 + 3 = 7	7 – 3 = 4
P2	3	7 + 3 = 10	10 – 3 = 7
Average		15.66666667	5.6666667



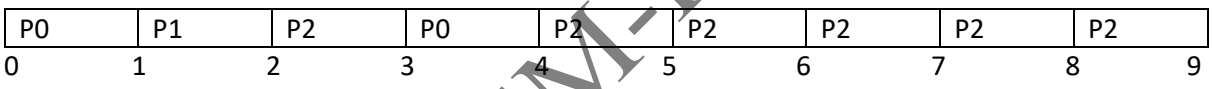
0 4 7 10 14 18 22 26 30

2.

Process ID	Burst Time
P0	**2**
P1	**1**
P2	**6**

Assume Time Quanta :1ms

Process ID	Burst Time	Turn Around Time (Completion Time – Arrival Time)	Waiting Time (Turn Around Time – Burst Time)
P0	2	4 – 0 = 4	30 – 24 = 2
P1	1	1 + 1 = 2	7 – 3 = 1
P2	6	4 + 5 = 9	10 – 3 = 3
Average		5.0000000	2.0000000



3.

Process ID	Burst Time
P0	7
P1	3
P2	2
P3	10
P4	8

Assume Time Quanta :3ms

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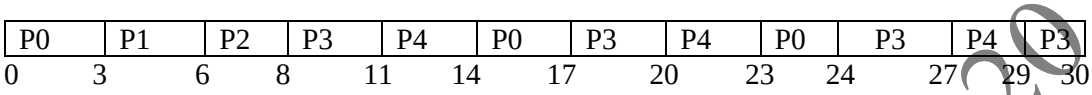
Process ID	Burst Time	Turn Around Time (Completion Time – Arrival Time)	Waiting Time (Turn Around Time – Burst Time)
P0	7	24 – 0 = 24	24 – 7 = 17
P1	3	3 + 3 = 6	6 – 3 = 3
P2	2	6 + 2 = 8	8 – 2 = 6
P3	10	30 – 0 = 30	30 – 10 = 20
P4	8	29 – 0 =29	29 – 8 = 21
Average		**19.40000000**	**13.4000000**



Name: Sahil Jadhav Batch:B2

Implementation

```
//Name:Jadhav Sahil
//Batch: B2
//PRN :2020016400783091
//Date :28th July ,2021
//Filename:P3_RR_SJ
import java.util.Scanner;
class P3_RR_SJ
{
public static void main(String args[])
{
Scanner input = new Scanner(System.in);
int i, j, k, q, sum = 0;
System.out.print("Enter number of process: ");
int n = input.nextInt();
int burstTime[] = new int[n];
int waitingTime[] = new int[n];
int turnAroundTime[] = new int[n];
int a[] = new int[n];
System.out.println("Enter Burst Time of each process: ");
for (i = 0; i < n; i++)
{
        System.out.print("Enter Burst Time for Process - P" + (i + 1) + ":");
        burstTime[i] = input.nextInt();
        a[i] = burstTime[i];
}
System.out.print("Enter Time quantum: ");
q=input.nextInt();
for (i = 0; i<n; i++)
        waitingTime[i] = 0;
int timer = 0; // Current time
// Keep traversing processes in round robin manner until all of them are not done.
do{
        for (i = 0; i<n; i++)
{
        // If burst time of a process is greater than 0 then only need to process further
        if (burstTime[i] > q)
        {
                // Increase the value of ti.e. shows how much time a process has been
processed
```

```
                timer += q;
                // Decrease the burst time of current process by quantum
                burstTime[i] -= q;
                for (j = 0; j<n; j++)
               {
                        if ((j!= i) && (burstTime[j] != 0))
                                waitingTime[j] += q;
             }
        } // if ends
// If burst time is smaller than or equal to quantum. Last cycle for this process
else
   {
        // Increase the value of t i.e. shows how much time a process has been processed
        timer += burstTime[i];
        for (j = 0; j<n; j++)
        {
            if ((j != i) && (burstTime[j] != 0))
                waitingTime[j] += burstTime[i];
       }
        // As the process gets fully executed make its remaining burst time = 0
      burstTime[i] = 0;
   } // else ends
}
sum = 0;
for (k = 0; k<n; k++)
sum += burstTime[k];
} while (sum != 0);
// calculating turnaround time by adding waiting Time + burst Time
for (i = 0; i<n; i++)
turnAroundTime[i] = waitingTime[i] + a[i];
float total = 0;
for (int x : waitingTime)
{
total += x;
}
float averageWaitingTime = total / n;
total = 0;
for (int y : turnAroundTime)
{
total += y;
}
```

```
float averageTurnAroundTime = total / n;
// print on console the order of processes scheduled using Round-robin Algorithm
System.out.println("RR Algorithm: ");
System.out.format("%20s%20s%20s%20s\n","Processld","BurstTime","Waiting
Time","TurnAroundTime");
for (i = 0; i<n; i++)
{
System.out.format("%20s%20d%20d%20d\n","P"+(i),a[i],
waitingTime[i],turnAroundTime[i]);
}
System.out.format("%40s%20f%20f\n","Average",averageWaitingTime,averageTurnAround
Time);
    }
}
```

Input:

Enter number of process : 3

Enter Burst Time for each process:

Enter Burst Time for process -P0: 24

Enter Burst Time for process -P1: 3

Enter Burst Time for process -P2: 3

Enter Time Quantum : 4

Output :

Process ID	**Burst Time**	**Turn Around Time (Completion Time – Arrival Time)**	**Waiting Time (Turn Around Time – Burst Time)**
P0	24	30 – 0 = 30	30 – 24 = 6
P1	3	4 + 3 = 7	7 – 3 = 4
P2	3	7 + 3 = 10	10 – 3 = 7
Average		15.66666667	5.6666667

Sample Output(Screenshots of all the examples) :

Question 1:

```
C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>javac P3_RR_SJ.java

C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>java P3_RR_SJ.java
Enter number of process: 3
Enter Burst Time of each process:
Enter Burst Time for Process - P1:24
Enter Burst Time for Process - P2:3
Enter Burst Time for Process - P3:3
Enter Time quantum: 4
RR Algorithm:
          Processld          BurstTime       Waiting Time      TurnAroundTime
                P0                 24                  6                  30
                P1                  3                  4                   7
                P2                  3                  7                  10
                                 Average           5.666667          15.666667
```

Question 2:

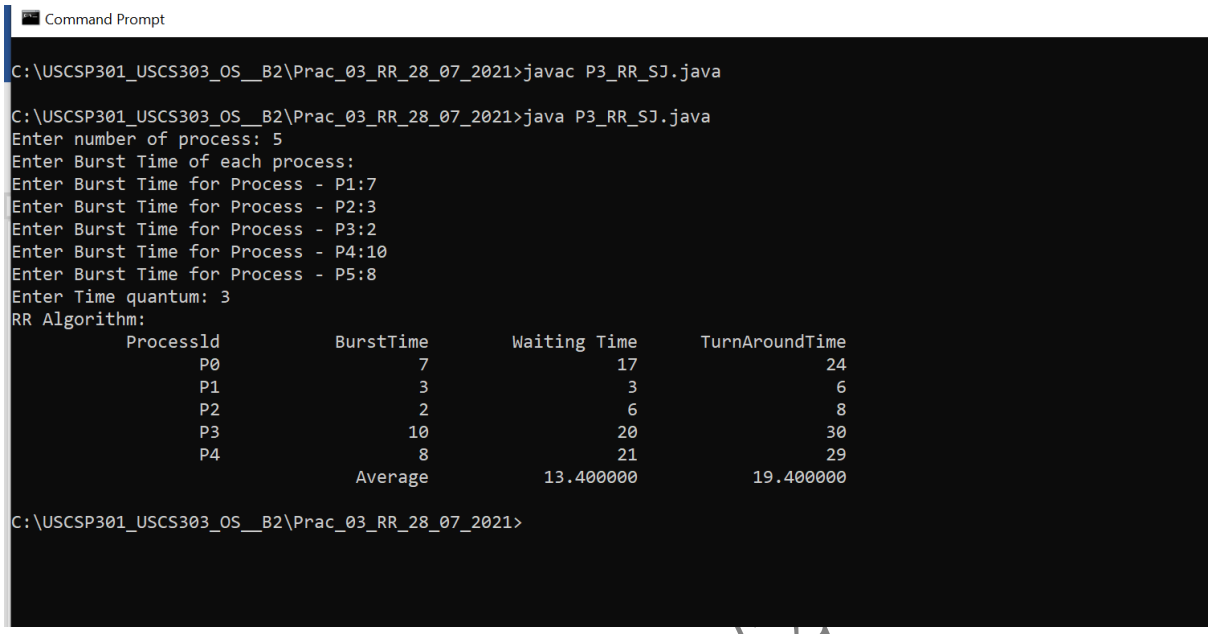
```
C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>javac P3_RR_SJ.java

C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>java P3_RR_SJ.java
Enter number of process: 3
Enter Burst Time of each process:
Enter Burst Time for Process - P1:2
Enter Burst Time for Process - P2:1
Enter Burst Time for Process - P3:6
Enter Time quantum: 1
RR Algorithm:
          Processld          BurstTime       Waiting Time      TurnAroundTime
                P0                  2                  2                   4
                P1                  1                  1                   2
                P2                  6                  3                   9
                                 Average           2.000000          5.000000

C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>javac P3_RR_SJ.java
```


Name: Sahil Jadhav Batch:B2

Question 3:



```
Command Prompt

C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>javac P3_RR_SJ.java

C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>java P3_RR_SJ.java
Enter number of process: 5
Enter Burst Time of each process:
Enter Burst Time for Process - P1:7
Enter Burst Time for Process - P2:3
Enter Burst Time for Process - P3:2
Enter Burst Time for Process - P4:10
Enter Burst Time for Process - P5:8
Enter Time quantum: 3
RR Algorithm:
          ProcessId          BurstTime       Waiting Time      TurnAroundTime
                P0                  7                 17                  24
                P1                  3                  3                   6
                P2                  2                  6                   8
                P3                 10                 20                  30
                P4                  8                 21                  29
                             Average          13.400000          19.400000

C:\USCSP301_USCS303_OS__B2\Prac_03_RR_28_07_2021>
```