USCS303 – OS: Practical – 03:RR Scheduling Algorithm

Round Robin (RR) Scheduling Algorithm

Round-robin (RR) scheduling Algorithm is mainly designed for time-sharing systems.

This algorithm is similar to FCF scheduling, but in Round-robin (RR) scheduling, preemption 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 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

Algorithm

Step 1: Input the number of processes 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 processes in the Ready queue. If the ready queue is empty and the current process is not complete, 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 process using RR.

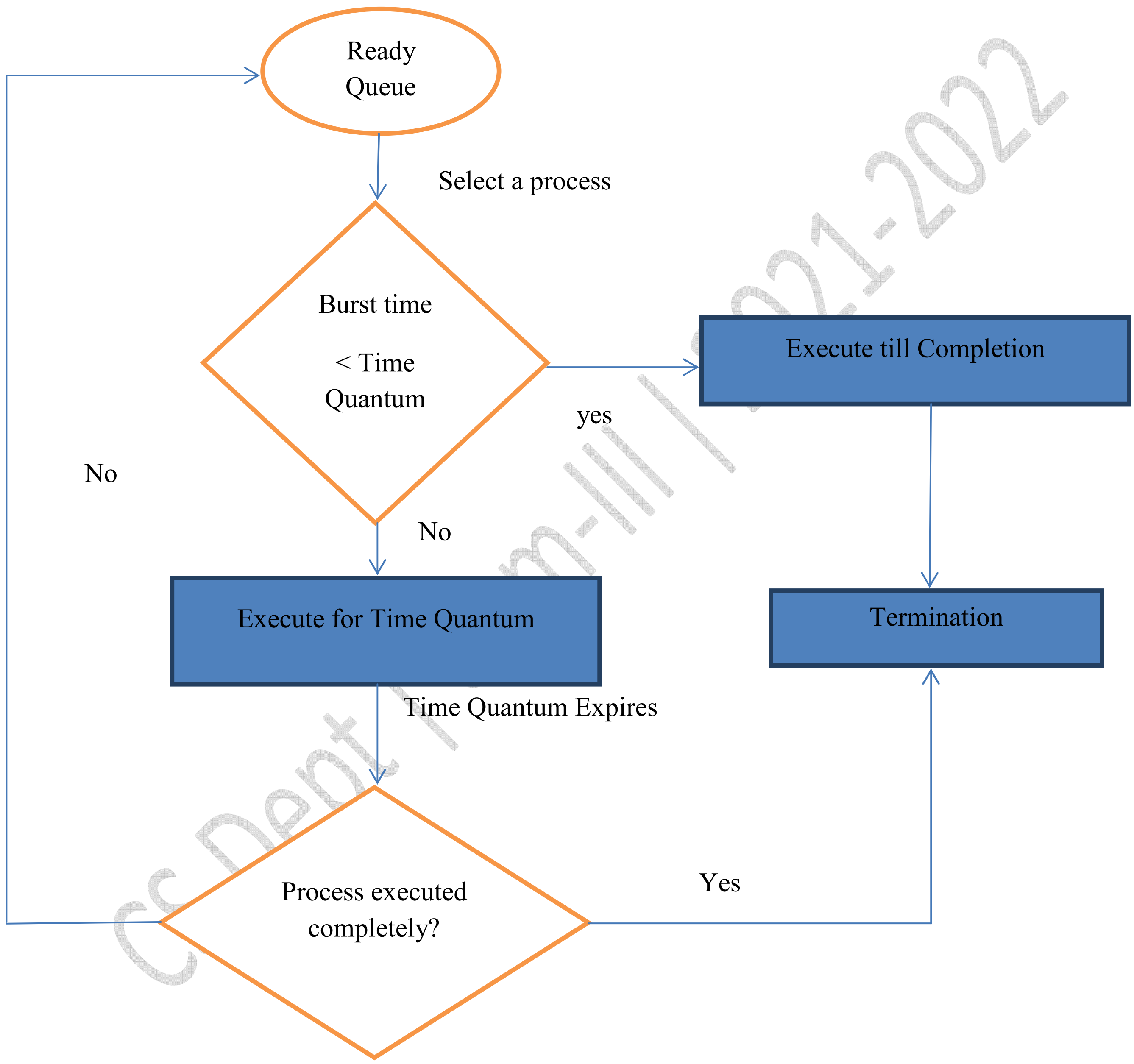
Step 5: Repeat all steps above from **Step 2** to **Step 4**.

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.

RR Flowchart:



Solved Example of the Round-robins Algorithm

Process ID	**Burst Time**
P0	24
P1	3
P2	3

Assume Time Quanta: 4ms

Step 1: Consider the time quanta/ time slice = 4ms.

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

Step2.1: P0 process arrives at 0 with 24ms as the burst time which is greater than time quanta = 4ms. So P0 executes for 4ms and goes in waiting queue.

System Time	0
Process Scheduled	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 3ms which is greater than quanta time. So P1 executes and gets terminated.

System Time	4
Process Scheduled	P0,P1
Remaining Time	3-4 = 0
Waiting Time	4 – 0 = 4
Turn Around Time	4+3 = 7

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

System Time	7
Process Scheduled	P0,P1,P2
Remaining Time	3-4 = 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 4ms of quanta it gets executed.

System Time	10
Process Scheduled	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 4ms. Waiting for P0 will be zero.

System Time	14
Process Scheduled	P0,P1,P2,P0,P0
Remaining Time	16-4=12
Waiting Time	0
Turn Around Time	14+4=18

Step3: Calculate 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 = **16**

Step 4: After scheduling of all provided processes:

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		15.666667	5.666667

Gnatt Chart:

P0	P1	P2	P0	P0	P0	P0	P0
0	4	7	10		30		

Example 2

Sample Output – 2

Process ID	Burst time
P0	2
P1	1
P2	6

Assume Time Slice = 1ms

Process ID	**Burst time**	**Turn around time**	**Waiting time**
		(Finish time – Arrival time)	**(Turn Around time – Burst Time)**
P0	2	(4 – 0) = 4	(4 – 2) = 2
P1	1	(2 – 0) = 2	(2 – 1) = 1
P2	6	(9 – 0) = 9	(9 – 6) = 3
Average		2.000000	5.000000

Gnatt Chart :-

P0	P1	P2	P0	P2	P2	P2	P2	P2	
0	1	2	3	4	5	6	7	8	9

Sample Output – 3

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

Assume Time Slice = 3ms.

Process ID	**Burst time**	**Turn around time** (Finish time – Arrival time)	**Waiting time** (Turn Around time – Burst Time)
P0	7	(24 – 0) = 24	(24 – 7) = 17
P1	3	(6 – 0) = 6	(6 – 3) = 3
P2	2	(8 – 0) = 8	(8 – 2) = 6
P3	10	(30 – 0) = 30	(30 – 10) = 20
P4	8	(29 – 0) = 29	(29 – 8) = 21
Average		13.400000	5.000000

Gnatt Chart

P0	P1	P2	P3	P4	P0	P3	P4	P0	P3	P4	P3

0 3 6 8 11 14 17 20 23 24 27 29 30

Implementation
Source code:

```
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\\Date: 27th July, 2021

\\Prac-03: RR Scheduling Algorithm


import java.util.Scanner;


class P3_RR_SS{

        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 brust Time for Process -P" + (i+1) + ":");

            burstTime[i] = input.nextInt();

            a[i] = burstTime[i];

}

System.out.print("Enter Time quantum: ");
```

```
q= intput.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 t i.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 waitingTime+burstTime
for(i=0;i<n;i++)
     turnAroundTime[i]= waitingTime[i]+a[i];
 float total=0;
 for(int n= waitingTime){
       total+=n;
}
float averageWaitingTime= total/n;
total=0;
for(int n= turnAroundTime){
        total+=n;
}
float averageTurnAroundTime= total/n;
System.out.println("RR Algorithm: ")
System.out.format("%20s%20s%20s%20s\n", "ProcessId", "BurstTime". "WaitingTime",
"TurnAroundTime");
for (i=0; i<n;i++){
        System.out.format("%20s%20d%20d%20d\n",waitingTime[i],turnAroundTime[i]);
```

}

System.out.format("%40s%20f%20f\n", "Average", averageWaitingTime,averageTurnAroundTime);

}

}

INPUT:

```
Enter number of process: 3
Enter Brust Time of each process:
Enter brust Time for Process - P1: 24
Enter brust Time for Process - P2: 3
Enter brust Time for Process - P3: 3
Enter Time quantum: 4
```

OUTPUT:

```
RR Algorithm:
        ProcessId       BurstTime     WaitingTime  TurnAroundTime
               P1              24               6              30
               P2               3               4               7
               P3               3               7              10
                          Average        5.666667       15.666667
```

Sample output 01

```
[illegible]
Microsoft Windows [Version 10.0.19042.1110]
(c) Microsoft Corporation. All rights reserved.

C:\Users\[illegible]\OneDrive\Desktop\OS-PRACTICAL\Practical-3>javac P3_RR_OS.java

C:\Users\[illegible]\OneDrive\Desktop\OS-PRACTICAL\Practical-3>java P3_RR_OS.java
Enter number of process: 3
Enter Burst Time of 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
RR Algorithm:
          ProcessId          BurstTime          Waiting Time          TurnAroundTime
                 P0                 24                     6                      30
                 P1                  3                     4                       7
                 P2                  3                     7                      10
                               Average              5.666667               15.666667

C:\Users\[illegible]\OneDrive\Desktop\OS-PRACTICAL\Practical-3>_
```

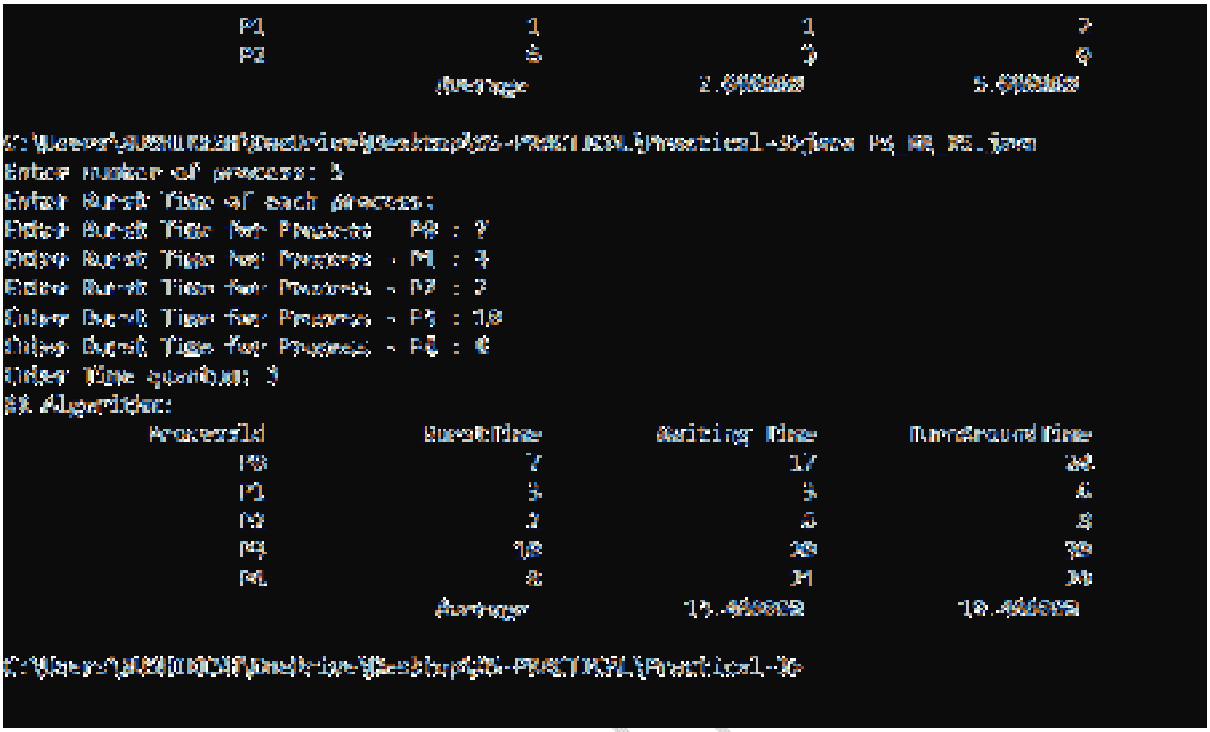
Sample output 02

```
                 P2                  3                     7                      10
                               Average              5.666667               15.666667

C:\Users\[illegible]\OneDrive\Desktop\OS-PRACTICAL\Practical-3>java P3_RR_OS.java
Enter number of process: 3
Enter Burst Time of each process:
Enter Burst Time for Process - P0 : 2
Enter Burst Time for Process - P1 : 1
Enter Burst Time for Process - P2 : 6
Enter Time quantum: 1
RR Algorithm:
          ProcessId          BurstTime          Waiting Time          TurnAroundTime
                 P0                  2                     [illegible]            [illegible]
                 P1                  1                     1                       2
                 P2                  6                     3                       9
                               Average              [illegible]            [illegible]

C:\Users\[illegible]\OneDrive\Desktop\OS-PRACTICAL\Practical-3>_
```

Sample output 03



```
P1        1        1        [illegible]
P2        [illegible]        [illegible]        [illegible]
          Average        [illegible]        [illegible]

C:\Users\[illegible]\OneDrive\Desktop\[illegible]-PRACTICAL\Practical-[illegible]>java [illegible].java
Enter number of process: 5
Enter Burst Time of each process:
Enter Burst Time for Process - P0 : 7
Enter Burst Time for Process - P1 : [illegible]
Enter Burst Time for Process - P2 : [illegible]
Enter Burst Time for Process - P3 : 10
Enter Burst Time for Process - P4 : [illegible]
Enter Time quantum: 3
RR Algorithm:
        ProcessId        BurstTime        Waiting Time        TurnAround Time
        P0        7        17        [illegible]
        P1        [illegible]        [illegible]        [illegible]
        P2        [illegible]        [illegible]        [illegible]
        P3        10        [illegible]        [illegible]
        P4        [illegible]        [illegible]        [illegible]
                  Average        [illegible]        [illegible]

C:\Users\[illegible]\OneDrive\Desktop\[illegible]-PRACTICAL\Practical-[illegible]>
```