Contents

SMT.CHANDIBAI HIMATHMAL MASUKHANI COLLEGE

USCSP301_USCS303_OS_B1_RS_3

PRACTICAL 3: ROUND-ROBIN SCHEDULING ALGORITHM

Practical date: 27th July,2021.

Practical Aim: Implement RR scheduling algorithm in Java.

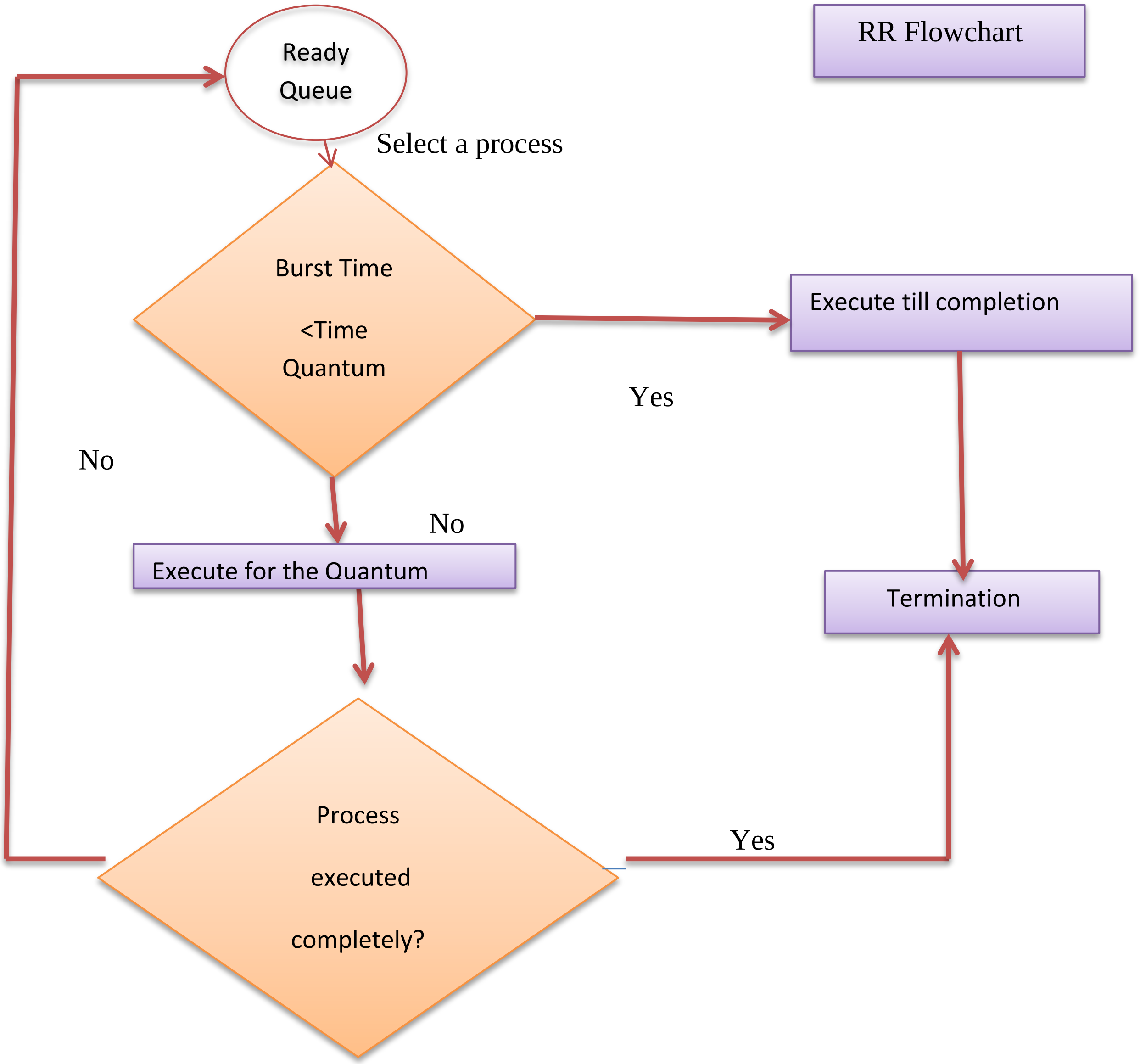
ALGORITHM:

Round-robin (RR) scheduling algorithm is mainly designedfor time-sharing systems.

This algorithm is similar to FCFS 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 arrivrd in the quantum time that makes these scheduling fairly.

FLOWCHART


RR Flowchart
Ready Queue
Select a process
Burst Time
<Time Quantum
Execute till completion
Yes
No
No
Execute for the Quantum
Termination
Process executed completely?
Yes

SOLVED EXAMPLES :

Consider the following example containing three processes arriving at time t=0 m/s.

Step 1: 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 ang 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 3 ms which is greater than quanta time. So P1 executes and gets terminated.

System Time	4
Process Scheduled	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 Scheduled	P0,P1,P2
Remaining Time	3-4=-1=0
Waiting Time	7-0=7
Turn Around Time	4+3=7

Step 2.4: Now P0 turns comes again and it’s the only process for execution for 4 ms 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 4 ms. 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

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

System Time	18
Process Scheduled	P0,P1,P2,P0,P0,P0
Finish Time	12-4=8
Turn Around Time	18+4=22

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

System Time	22
Process Scheduled	P0,P1,P2,P0,P0,P0,P0
Finish Time	8-4=4
Turn Around Time	26+4=30

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

System Time	26
Process Scheduled	P0,P1,P2,P0,P0,P0,P0,P0
Finish Time	4-4=0
Turn Around Time	26+4=30

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

Average Waiting Time=(6+4+7)/3
=17/3
=5.6667

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		15.66667	5.6667

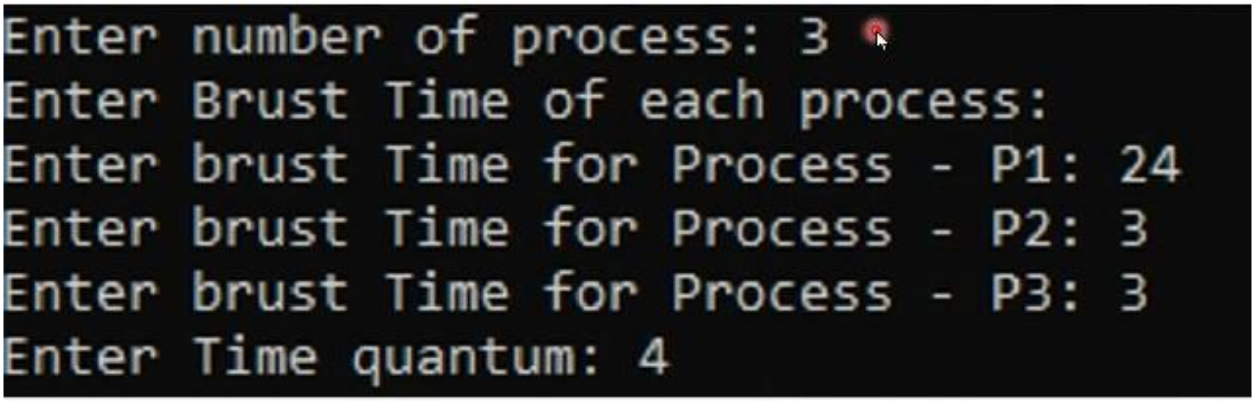
GANTT CHART:

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		15.6667	5.6667

P0	P1	P2	P0	P0	P0	P0	P0

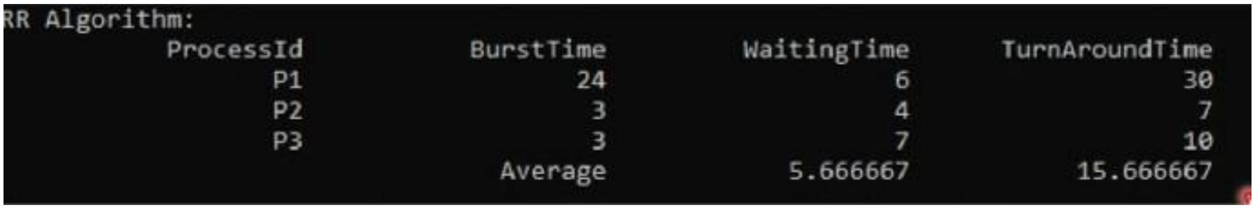
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

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
```

IMPLEMENTATION:

```
//Name:Ritika Sahu

//Batch : B1

//PRN:2020016400783543

//Date: 27TH JULY, 2021.

//Practical 3: Round-Robin Scheduling Algorithm


import java.util.Scannner;


class P3_RR_RS {

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.printIn("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];

}

Sytem.out.print("Enter Time quantum: ");

q=input.nextInt();

for(i=0;i<n;i++)

waiting Time[i]=0;

int timer=0;//Current Time

//keep traversing processes in round robin manner

//until all of them are done.

do {

for(i=0;i<n;i++) {

//If burst time of a process is greater than 0 then they only need to process further

if (burstTime[i]>q) {

//Increase the value of t i.e. shows how much time fr 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!=1)&&(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!=1)&&(burstTime[j]!=0))
waitingTime[j]+=burstTime[i];
}
//As the process get 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:waiting Time) {

total +=n;

}

float averageWaitingTime=total/n;

total=0;

for(int n:turnAroundTime) {

total+=n;

}

float averageTurnAroundTime=total/n;

//print on console the order of processes scheduled using Round-robin Algorithm

System.out.printIn("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", "P"+(i+1), a[i], "WaitingTime",
"TurnAroundTime");

}

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

}

}
```

EXAMPLE 2 :

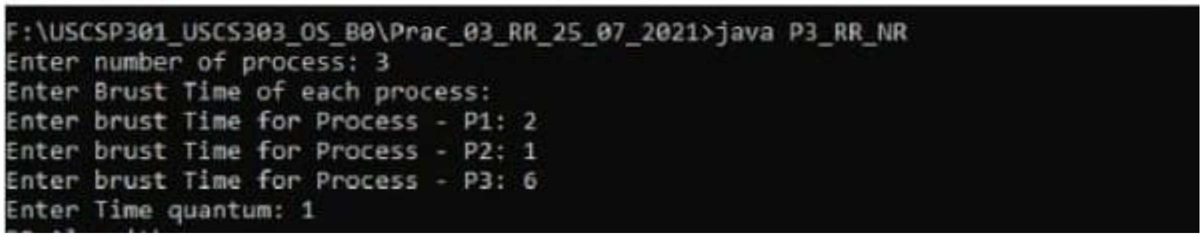
Consider the following example containing three processes arrive at same time having time slice as 1 ms.

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

GANTT CHART:

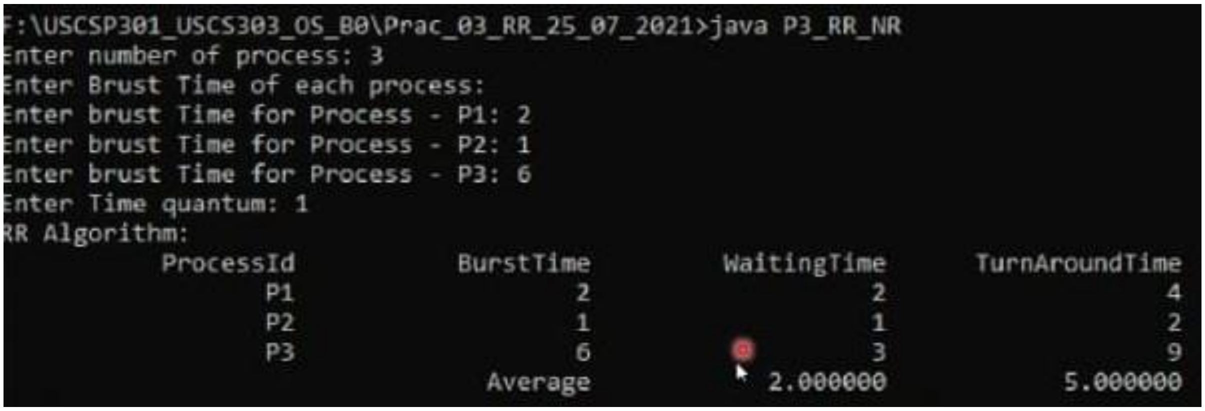
Process ID	**Burst Time**	**Turn Around Time**	**Waiting Time**
P0	2	4	2
P1	1	2	1
P2	6	9	3
Average		5	2

INPUT:



```
F:\USCSP301_USCS303_OS_B0\Prac_03_RR_25_07_2021>java P3_RR_NR
Enter number of process: 3
Enter Brust Time of each process:
Enter brust Time for Process - P1: 2
Enter brust Time for Process - P2: 1
Enter brust Time for Process - P3: 6
Enter Time quantum: 1
```

OUTPUT:



```
F:\USCSP301_USCS303_OS_B0\Prac_03_RR_25_07_2021>java P3_RR_NR
Enter number of process: 3
Enter Brust Time of each process:
Enter brust Time for Process - P1: 2
Enter brust Time for Process - P2: 1
Enter brust Time for Process - P3: 6
Enter Time quantum: 1
RR Algorithm:
            ProcessId           BurstTime           WaitingTime        TurnAroundTime
                   P1                   2                     2                     4
                   P2                   1                     1                     2
                   P3                   6                     3                     9
                              Average              2.000000              5.000000
```

EXAMPLE 3:

Consider the following example containing three processes arrive at same time. Time Quanta =3.

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

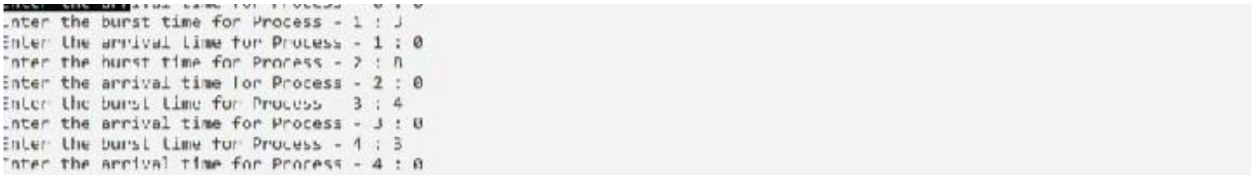
GANTT CHART:

Process ID	Burst Time	Turn Around time	Waiting Time
P0	7	7	14
P1	3	7	10
P2	2	6	8
P3	10	14	24

P4	8	19	27

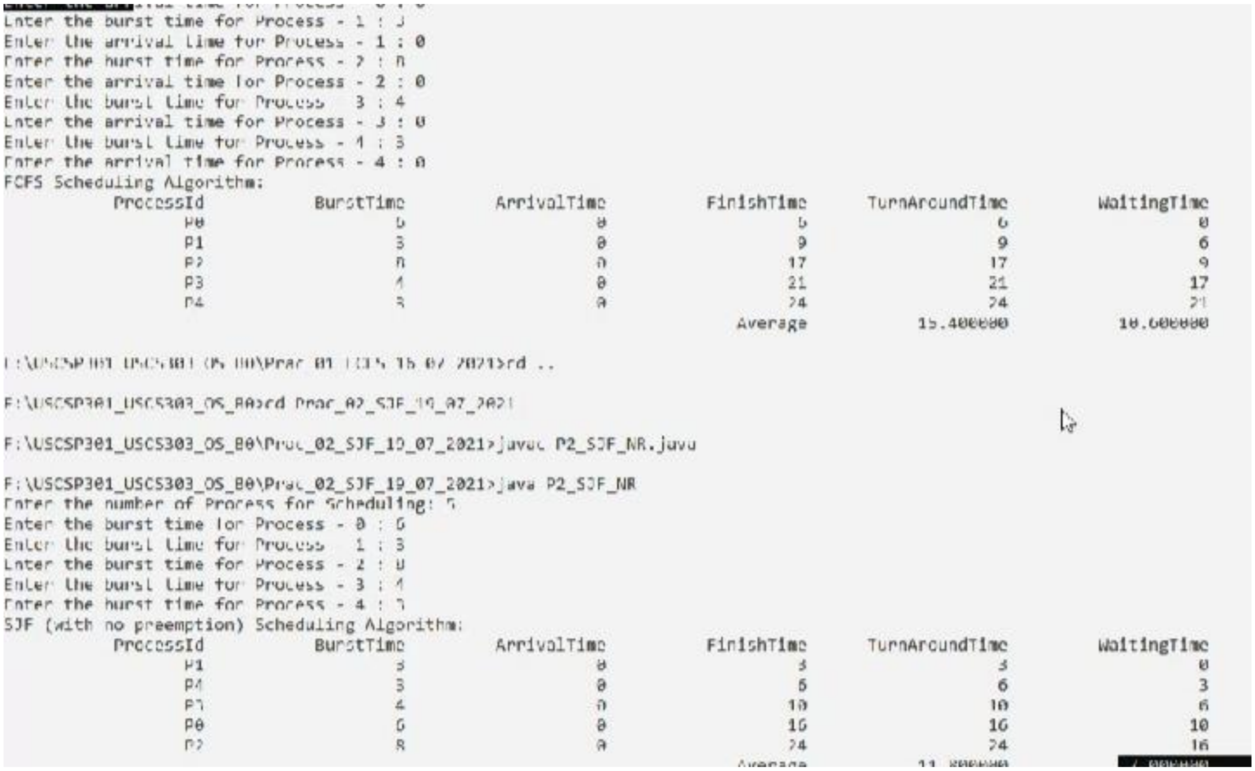
Average: 11.2 16.6

INPUT:



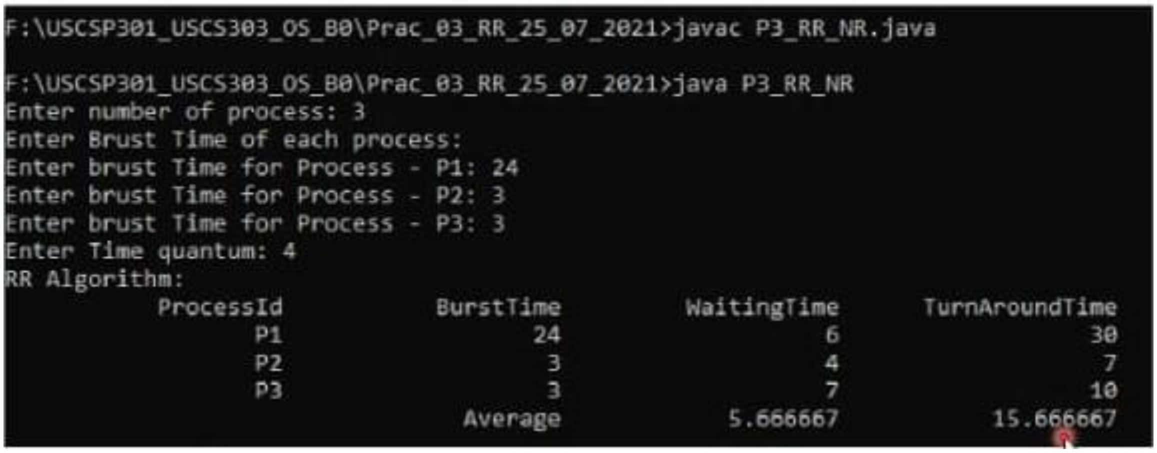
```
Enter the arrival time for Process - 0 : 0
Enter the burst time for Process - 1 : 3
Enter the arrival time for Process - 1 : 0
Enter the burst time for Process - 2 : 8
Enter the arrival time for Process - 2 : 0
Enter the burst time for Process   3 : 4
Enter the arrival time for Process - 3 : 0
Enter the burst time for Process - 4 : 3
Enter the arrival time for Process - 4 : 0
```

OUTPUT:



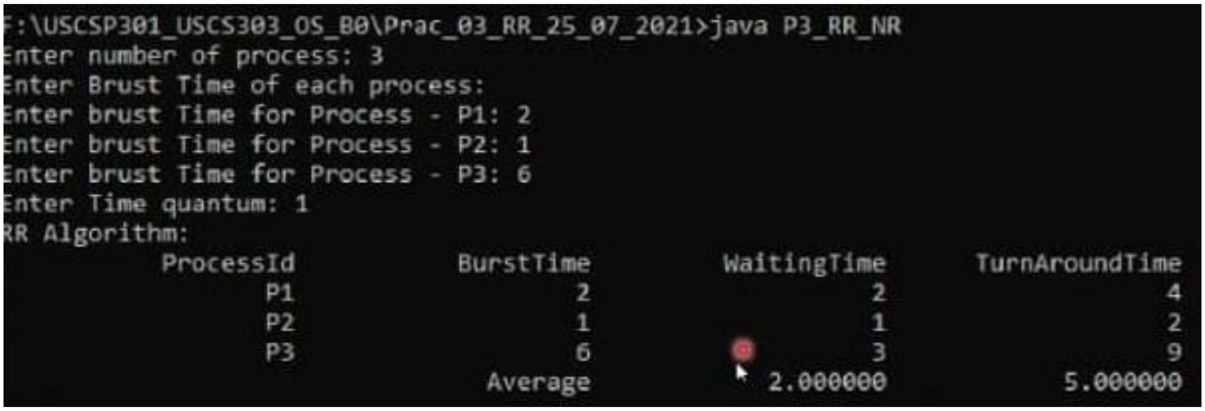
```
Enter the arrival time for Process - 0 : 0
Enter the burst time for Process - 1 : 3
Enter the arrival time for Process - 1 : 0
Enter the burst time for Process - 2 : 8
Enter the arrival time for Process - 2 : 0
Enter the burst time for Process - 3 : 4
Enter the arrival time for Process - 3 : 0
Enter the burst time for Process - 4 : 3
Enter the arrival time for Process - 4 : 0
FCFS Scheduling Algorithm:
          ProcessId          BurstTime         ArrivalTime          FinishTime      TurnAroundTime         WaitingTime
                 P0                  6                   0                   6                   6                   0
                 P1                  3                   0                   9                   9                   6
                 P2                  8                   0                  17                  17                   9
                 P3                  4                   0                  21                  21                  17
                 P4                  3                   0                  24                  24                  21
                                                                       Average           15.400000           10.600000

F:\USCSP301_USCS303_OS_B0\Prac_01_FCFS_15_07_2021>cd ..

F:\USCSP301_USCS303_OS_B0>cd Prac_02_SJF_19_07_2021

F:\USCSP301_USCS303_OS_B0\Prac_02_SJF_19_07_2021>javac P2_SJF_NR.java

F:\USCSP301_USCS303_OS_B0\Prac_02_SJF_19_07_2021>java P2_SJF_NR
Enter the number of Process for Scheduling: 5
Enter the burst time for Process - 0 : 6
Enter the burst time for Process - 1 : 3
Enter the burst time for Process - 2 : 8
Enter the burst time for Process - 3 : 4
Enter the burst time for Process - 4 : 3
SJF (with no preemption) Scheduling Algorithm:
          ProcessId          BurstTime         ArrivalTime          FinishTime      TurnAroundTime         WaitingTime
                 P1                  3                   0                   3                   3                   0
                 P4                  3                   0                   6                   6                   3
                 P3                  4                   0                  10                  10                   6
                 P0                  6                   0                  16                  16                  10
                 P2                  8                   0                  24                  24                  16
                                                                       Average           11.800000            7.000000
```

SAMPLE OUTPUT 1:



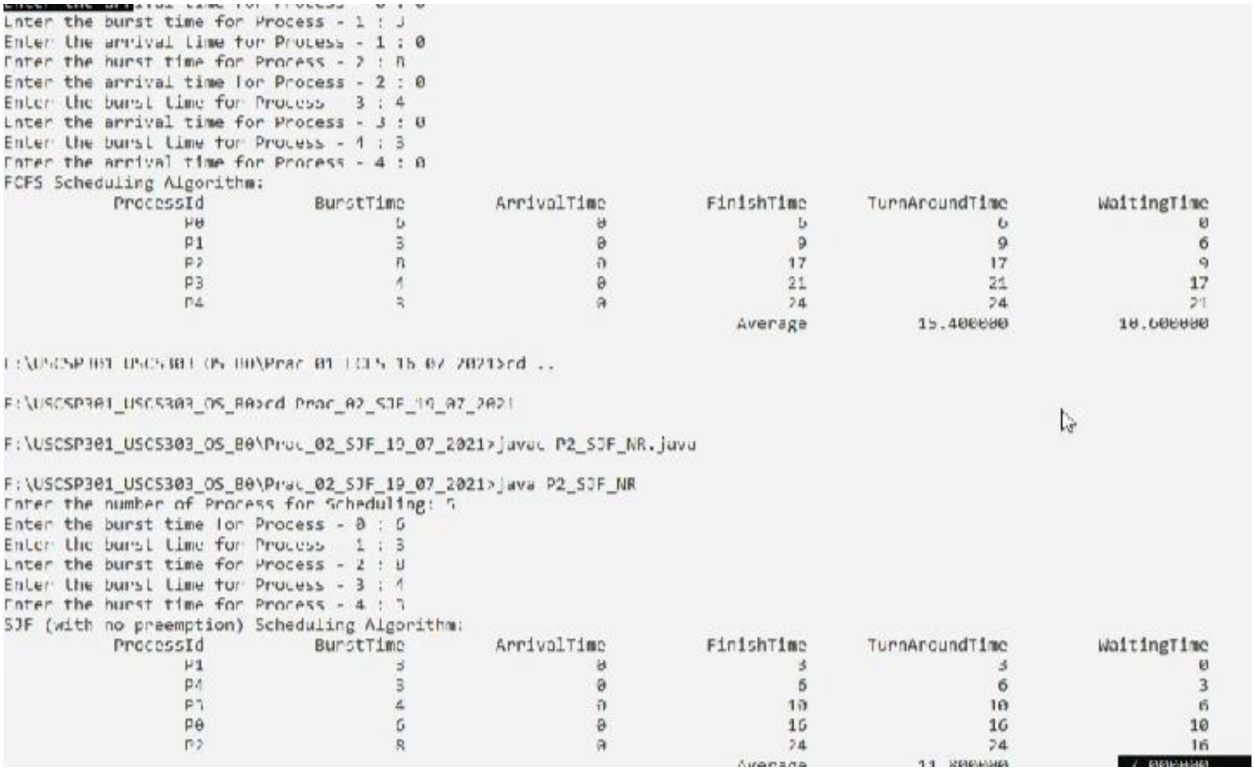
```
F:\USCSP301_USCS303_OS_B0\Prac_03_RR_25_07_2021>javac P3_RR_NR.java

F:\USCSP301_USCS303_OS_B0\Prac_03_RR_25_07_2021>java P3_RR_NR
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
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 2:



```
F:\USCSP301_USCS303_OS_B0\Prac_03_RR_25_07_2021>java P3_RR_NR
Enter number of process: 3
Enter Brust Time of each process:
Enter brust Time for Process - P1: 2
Enter brust Time for Process - P2: 1
Enter brust Time for Process - P3: 6
Enter Time quantum: 1
RR Algorithm:
         ProcessId           BurstTime         WaitingTime      TurnAroundTime
                P1                   2                   2                   4
                P2                   1                   1                   2
                P3                   6                   3                   9
                               Average            2.000000            5.000000
```

SAMPLE OUTPUT 3:



```
Enter the arrival time for Process - 0 : 0
Enter the burst time for Process - 1 : 3
Enter the arrival time for Process - 1 : 0
Enter the burst time for Process - 2 : 8
Enter the arrival time for Process - 2 : 0
Enter the burst time for Process - 3 : 4
Enter the arrival time for Process - 3 : 0
Enter the burst time for Process - 4 : 3
Enter the arrival time for Process - 4 : 0
FCFS Scheduling Algorithm:
         ProcessId           BurstTime         ArrivalTime          FinishTime      TurnAroundTime         WaitingTime
                P0                   6                   0                   6                   6                   0
                P1                   3                   0                   9                   9                   6
                P2                   8                   0                  17                  17                   9
                P3                   4                   0                  21                  21                  17
                P4                   3                   0                  24                  24                  21
                                                                       Average           15.400000           10.600000

F:\USCSP301_USCS303_OS_B0\Prac_01_FCFS_15_07_2021>cd ..

F:\USCSP301_USCS303_OS_B0>cd Prac_02_SJF_19_07_2021

F:\USCSP301_USCS303_OS_B0\Prac_02_SJF_19_07_2021>javac P2_SJF_NR.java

F:\USCSP301_USCS303_OS_B0\Prac_02_SJF_19_07_2021>java P2_SJF_NR
Enter the number of Process for Scheduling: 5
Enter the burst time for Process - 0 : 6
Enter the burst time for Process - 1 : 3
Enter the burst time for Process - 2 : 8
Enter the burst time for Process - 3 : 4
Enter the burst time for Process - 4 : 3
SJF (with no preemption) Scheduling Algorithm:
         ProcessId           BurstTime         ArrivalTime          FinishTime      TurnAroundTime         WaitingTime
                P1                   3                   0                   3                   3                   0
                P4                   3                   0                   6                   6                   3
                P3                   4                   0                  10                  10                   6
                P0                   6                   0                  16                  16                  10
                P2                   8                   0                  24                  24                  16
                                                                       Average           11.800000            7.000000
```