Contents

USCSP301: USCS303-Operating System (OS)

USCSP301_USCS303_Operating System(OS) Practical-02

Practical 02: Shortest Job First Scheduling Algorithm

Practical Date: 24th JULY ,2021.

Practical aim: Implement SJF (with no preemption) scheduling algorithm in java

Algorithm:

CPU scheduling algorithm are used for scheduling different process present in the ready queue withavailable resource in an optimal way so that each and every process get execute by CPU.

Scheduling algorithm are broadly classified into two main type namely preemptive and non-preemptive.

FIRST COME FIRST OUT(FCFS) is also know as FIRST IN FIRST OUT (FIFO) SCHEDUAL algorithm is the and simplest

CPU .

A process scheduling different process to be assigned to the CPU based on particular scheduling algorithm . There are six popular process scheduling algorithm which we are going to discuss in this chapter FIRST COME FIRST OUT(FCFS)scheduling.

Example 1: Consider the following example contain five processes .

Process Id	**Burst Time**
P0	6
P1	3
P2	8
P3	3
P4	4

Step 1: Processes get execute according to their lowest burst time first .

Process Id	**Burst Time**
P0	6
P1	3
P2	8
P3	3
P4	4

Step 2: Following shows the scheduling and execution of processes

Step 2.1: At start P1 shortest execution time which is 0-3 second.

System time	0
Processes scheduling finish time	P1
Finish time	0+3=3
Waiting time	3-3=0
Turn Around time	3-0=3

Step 2.2: next shortest execution time is for process P3 for duration 3-6 second.

System time	6
Processes scheduling finish time	P1,p3
Finish time	3+3=6
Waiting time	6-3=3
Turn Around time	6-0=6

Step 2.3: Next job with shortest execution time is P4 for a duration 6-10 second.

System time	10
Processes scheduling finish time	P1,p3’p4
Finish time	6+4=10
Waiting time	10-4=6
Turn Around time	10-0=10

Step 2.4: Next job with shortest execution time is p0 for duration of 10-16 second.

System time	10
Processes scheduling finish time	P1,p3,p3,p4,p0
Finish time	10+6=16
Waiting time	16-6=10
Turn Around time	16-0=16

Step 2.5 : Similarly next job with shortest execution time is P2 for duration of 16-24second.

System Time	16
Process Scheduling Finish Time	P1,p3,P3,P4,P0,P2
Finish Time	16+8=24
Waiting Time	24-8=16
Turn Around Time	24-0=24

Step 3: Calculate average wating time and average turn around time.

Average Waiting Time = (0+3+6+10+16)/5
= 35/5
=7

Average Turn Around Time =(3+6+10+16+24)/5
= 59/5
=11.8

Gnatt Chart

Step 4: After scheduling of all provided processes.

Process id	**Burst time**	**Arrival time**	**Finish time**	**Turn Aroundtime**	**Wating time**
P1	3	0	0+3=3	3-0=3	3-3=0
P3	3	0	3+3=6	6-0=6	6-3=3
P4	4	0	6+4=10	10-0=10	10-4=6
P0	6	0	10+6=16	16-0=16	16-6=10
P2	8	0	16+8=24	24-0=24	24-8=16
Average				11.8000000	7.000000

P1	P3	P4	P0	P2

0 3 6 10 16 24

Example 2: Consider the following example containing five processes arrive at same time.

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

Gnatt Chart

Process id	**Burst time**	**Arrival time**	**Finish time**	**Turn Around time**	**Wating time**
P1	1	0	1	1	1
P0	2	0	3	3	3
P2	6	0	9	9	9
Average				4.33333	1.33333

P1	P0	P2

0 1 3 9

Example 3: Consider the following example contain five processes arrive at same time .

Process ID	Burst Time
P0	25
P1	15
P2	10
P3	25
P4	10
P5	25

Process id	Burst time	Arrival time	Finish time	Turn Around time	Waiting time
P2	10	0	10	10	0
P4	10	0	20	20	10
P1	15	0	35	35	20
P0	25	0	60	60	35
P3	25	0	85	85	60

Gnatt chart:

Process id	**Burst time**	**Arrival time**	**Finish time**	**Turn Around time**	**Waiting time**
P2	10	0	10	10	0
P4	10	0	20	20	10
P1	15	0	35	35	20
P0	25	0	60	60	35
P3	25	0	85	85	60
P5	25	0	110	110	85
Average				53.3333	35.000000

P2	P4	P1	P0	P3	P5

0 10 20 35 60 85 110

Example 4: Consider the following example contain five processes arrive at same time .

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

Step 4: After scheduling of all provided processes.

Process id	**Burst time**	**Arrival time**	**Finish time**	**Turn Around time**	**Wating time**
P2	2	0	2	2	0
P1	3	0	5	5	2
P0	7	0	12	12	5
P4	8	0	20	20	12
P3	10	0	30	30	20

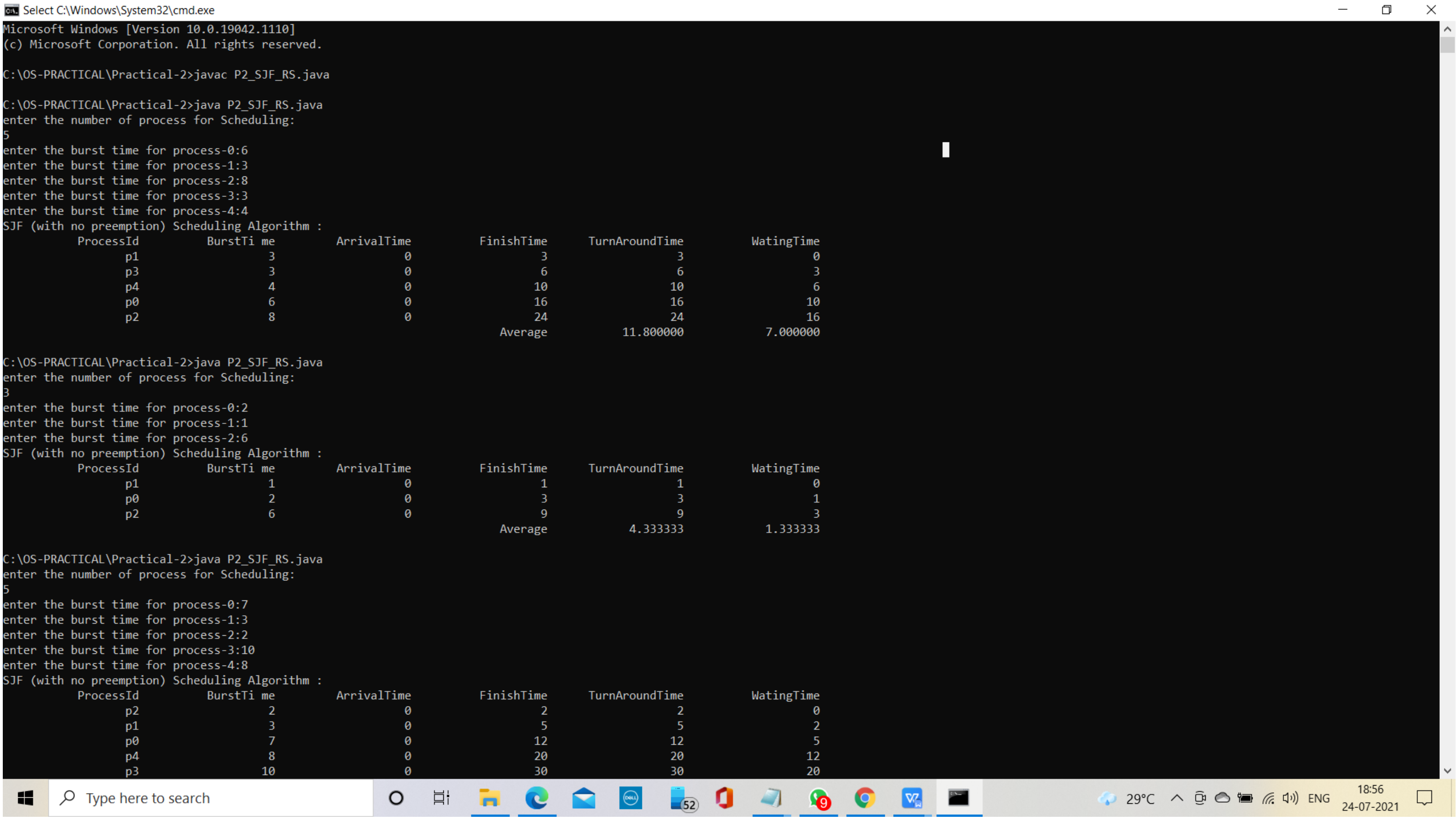
Average				13.80000	7.800000

Implementation:

```
// Name: Ritika Sahu
// Batch:B2
// PRN:2020016400783543
// Date:24th July,2021
// Prac-02:SJF (with no preemption) Algorithm

import java.util.Scanner;

public class P2_SJF_RS
{
// defining variables
int burstTime[];
int arrivalTime[]={0};
String[] processId;
int numberOfProcess;
void getProcessData(Scanner input) {
System.out.print("Enter the number of Process of Scheduling: ");
int inputNumberOfProcess=input.nextInt();
numberOfProcess=inputnumberOfProcess;
burstTime=new int[numberOfProcess];
arrivalTime=new int[numberOfProcess];
processId=new String[numberOfProcess];
String st="P";
for (int i=0;i<numberOfProcess;i++) {
processId[i]=st.concat(Integer.toString(i));
System.out.print("Enter the burst time for process-"+(i)+":");
burstTime[i]=input.nextInt(); }//for loop ends
}//getProcessData function ends
void sortAccordingBurstTime(int[]at,int[]bt,String[] pid) {
boolean swapped;
int temp;
String temp;
for(int i=0;i<numberOfProcess;i++){
swapped=false;
for(int j=0;j<numberOfProcess-i-1;j++){
if(bt[j]>bt[j+1]){
//swapping burst time
temp=bt[j];
bt[j]=bt[j+1];
bt[j+1]=temp;
//swapping arrival time
temp=at[j];
at[j]=at[j+1];
at[j+1]=temp;

//swapping process id
stemp=pid[j];
pid[j]=pid[j+1];
pid[j+1]=stemp;
//enchanced bubble sort swapped=true;
}//if ends
}//inner for(j) ends if (swapped==false){
break;
}
}//outer for(i) ends
}//sortAccordingBurstTime function ends
void shortestJobFirstNPAlgorithm(){
int finishTime[]=new int[numberOfProcess];
int bt[]=burstTime.clone();
int at[]=arrivalTime.clone();
String pid[]=processId.clone();
int waitingTime[]=new int[numberOfProcess];
int turnAroundTime[]=new int[numberOfProcess];
sortAccordingBurstTime(ab,bt,pid);
//calculating waiting & turn-around time for each process
finishTime[0]=at[0]+bt[0];
turnAroundTime[0]=finishTime[0]-at[0];
waitingTime[0]=turnAroundTime[0]-bt[0];
for (int i=1;i<numberOfProcess;i++){
finishTime[i]=bt[i]+finishTime[i-1];
turnAroundTime[i]=finishTime[i]-at[i];
waitingTime=turnAroundTime[i]-bt[i];
}
float sum=0;
for(int n:waitingTime){
sum+=n;
}
```

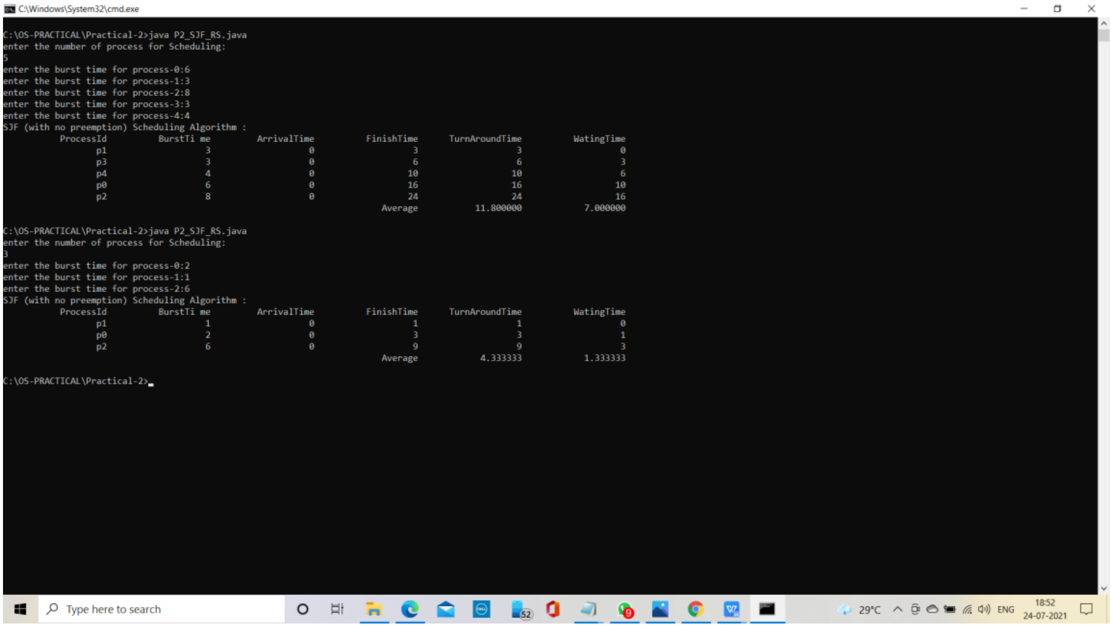
```
float averageWaitingTime=sum/numberOfProcess;
sum=0;
for (int n:turnAroundTime){
sum+=n;
}
float averageTurnAroundTime=sum/numberOfProcess;
//print on console the order of processes scheduled using
//Shortest Job First (with no preemption) Algorithm
Sytem.out.printIn("SJF (with no preemption) Scheduling Algorithm: ");
System.out.format("%20s%20s%20s%20s%20s%20s\n","ProcessId","BurstTime",
"ArrivalTime", "FinishTime", "TurnAroundTime", "WaitingTime");
for (int i=0;i<numberOfProcess;i++){
System.out.format("%20s%20d%20d%20d%20d%20d\n",
pid[i],bt[i],at[i],finidhTime[i],turnAroundTime[i],waitingTime[i]);
}
System.out.format("%80s%20f%20f\n",
"Average",averageTurnAroundTime[i],AveragewaitingTime);
}//shortestJobFirstNPAlgorithm function ends
public static void main(String[] args){
Scanner input=new Scanner(System.in);
P2_SJF_RS obj=new P2_SJF_RS();
obj.getProcessData(input);
obj.shortestJobFirstNPAlgorithm();
}//main ends
}//class ends P2_SJF_RS
```

SAMPLE OUTPUT 1



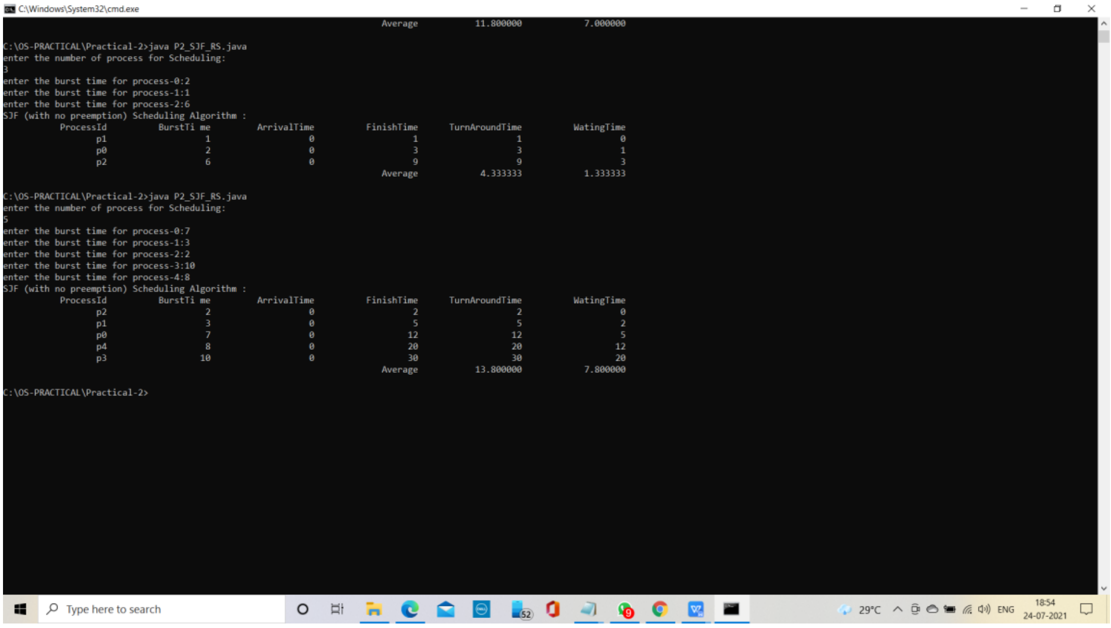
```
Microsoft Windows [Version 10.0.19042.1110]
(c) Microsoft Corporation. All rights reserved.

C:\OS-PRACTICAL\Practical-2>javac P2_SJF_RS.java

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
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-3:3
enter the burst time for process-4:4
SJF (with no preemption) Scheduling Algorithm :
           ProcessId          BurstTi me         ArrivalTime          FinishTime      TurnAroundTime          WatingTime
                  p1                   3                   0                   3                   3                   0
                  p3                   3                   0                   6                   6                   3
                  p4                   4                   0                  10                  10                   6
                  p0                   6                   0                  16                  16                  10
                  p2                   8                   0                  24                  24                  16
                                                                         Average           11.800000            7.000000

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
3
enter the burst time for process-0:2
enter the burst time for process-1:1
enter the burst time for process-2:6
SJF (with no preemption) Scheduling Algorithm :
           ProcessId          BurstTi me         ArrivalTime          FinishTime      TurnAroundTime          WatingTime
                  p1                   1                   0                   1                   1                   0
                  p0                   2                   0                   3                   3                   1
                  p2                   6                   0                   9                   9                   3
                                                                         Average            4.333333            1.333333

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
5
enter the burst time for process-0:7
enter the burst time for process-1:3
enter the burst time for process-2:2
enter the burst time for process-3:10
enter the burst time for process-4:8
SJF (with no preemption) Scheduling Algorithm :
           ProcessId          BurstTi me         ArrivalTime          FinishTime      TurnAroundTime          WatingTime
                  p2                   2                   0                   2                   2                   0
                  p1                   3                   0                   5                   5                   2
                  p0                   7                   0                  12                  12                   5
                  p4                   8                   0                  20                  20                  12
                  p3                  10                   0                  30                  30                  20
```

SAMPLE OUTPUT 2:



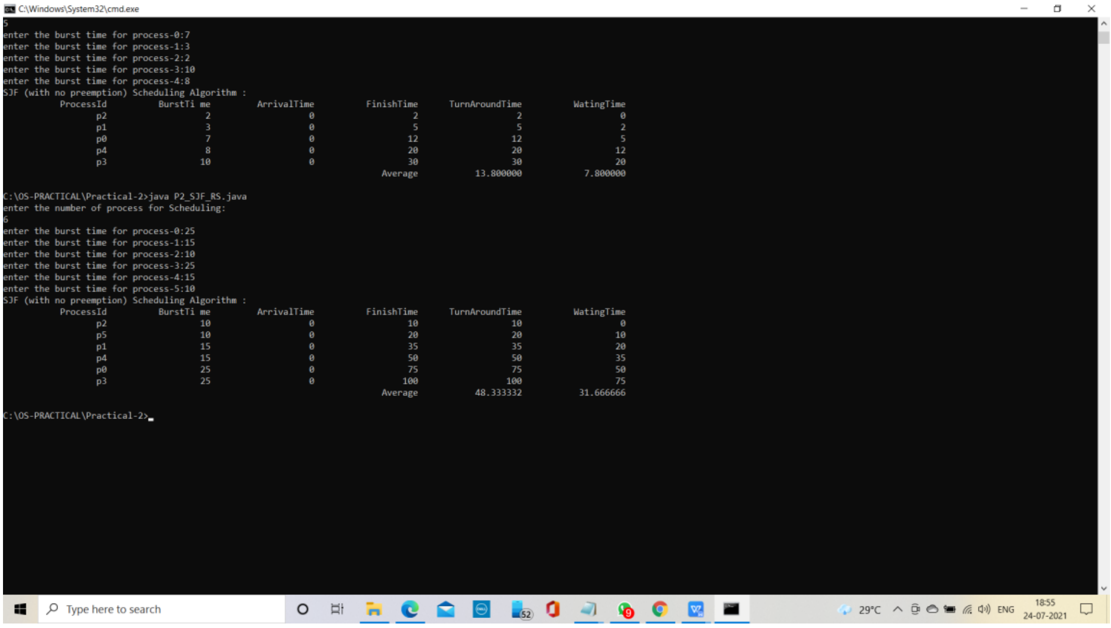
```
C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
5
enter the burst time for process-0:6
enter the burst time for process-1:3
enter the burst time for process-2:8
enter the burst time for process-3:3
enter the burst time for process-4:4
SJF (with no preemption) Scheduling Algorithm :
        ProcessId      BurstTi me      ArrivalTime             FinishTime      TurnAroundTime          WatingTime
               p1               3                0                      3                   3                   0
               p3               3                0                      6                   6                   3
               p4               4                0                     10                  10                   6
               p0               6                0                     16                  16                  10
               p2               8                0                     24                  24                  16
                                                                  Average           11.800000            7.000000

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
3
enter the burst time for process-0:2
enter the burst time for process-1:1
enter the burst time for process-2:6
SJF (with no preemption) Scheduling Algorithm :
        ProcessId      BurstTi me      ArrivalTime             FinishTime      TurnAroundTime          WatingTime
               p1               1                0                      1                   1                   0
               p0               2                0                      3                   3                   1
               p2               6                0                      9                   9                   3
                                                                  Average            4.333333            1.333333

C:\OS-PRACTICAL\Practical-2>_
```

SAMPLE OUTPUT 3:



```
                                                                  Average           11.800000            7.000000

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
3
enter the burst time for process-0:2
enter the burst time for process-1:1
enter the burst time for process-2:6
SJF (with no preemption) Scheduling Algorithm :
        ProcessId      BurstTi me      ArrivalTime             FinishTime      TurnAroundTime          WatingTime
               p1               1                0                      1                   1                   0
               p0               2                0                      3                   3                   1
               p2               6                0                      9                   9                   3
                                                                  Average            4.333333            1.333333

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
5
enter the burst time for process-0:7
enter the burst time for process-1:3
enter the burst time for process-2:2
enter the burst time for process-3:10
enter the burst time for process-4:8
SJF (with no preemption) Scheduling Algorithm :
        ProcessId      BurstTi me      ArrivalTime             FinishTime      TurnAroundTime          WatingTime
               p2               2                0                      2                   2                   0
               p1               3                0                      5                   5                   2
               p0               7                0                     12                  12                   5
               p4               8                0                     20                  20                  12
               p3              10                0                     30                  30                  20
                                                                  Average           13.800000            7.800000

C:\OS-PRACTICAL\Practical-2>
```

SAMPLE OUTPUT 4:



```
5
enter the burst time for process-0:7
enter the burst time for process-1:3
enter the burst time for process-2:2
enter the burst time for process-3:10
enter the burst time for process-4:8
SJF (with no preemption) Scheduling Algorithm :
           ProcessId          BurstTi me         ArrivalTime          FinishTime      TurnAroundTime          WatingTime
                  p2                   2                   0                   2                   2                   0
                  p1                   3                   0                   5                   5                   2
                  p0                   7                   0                  12                  12                   5
                  p4                   8                   0                  20                  20                  12
                  p3                  10                   0                  30                  30                  20
                                                                         Average           13.800000            7.800000

C:\OS-PRACTICAL\Practical-2>java P2_SJF_RS.java
enter the number of process for Scheduling:
6
enter the burst time for process-0:25
enter the burst time for process-1:15
enter the burst time for process-2:10
enter the burst time for process-3:25
enter the burst time for process-4:15
enter the burst time for process-5:10
SJF (with no preemption) Scheduling Algorithm :
           ProcessId          BurstTi me         ArrivalTime          FinishTime      TurnAroundTime          WatingTime
                  p2                  10                   0                  10                  10                   0
                  p5                  10                   0                  20                  20                  10
                  p1                  15                   0                  35                  35                  20
                  p4                  15                   0                  50                  50                  35
                  p0                  25                   0                  75                  75                  50
                  p3                  25                   0                 100                 100                  75
                                                                         Average           48.333332           31.666666

C:\OS-PRACTICAL\Practical-2>
```