

SMT.Chanadibai Himathmal Manuskhani College

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USCSP301: USCS303-Operating System(OS)

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Practical aim: Non-Preemptive CPU Scheduling algorithm where each process with the smallest burst time is executed time.

Algorithm:

CPU scheduling algorithm are used for scheduling different process present in the ready queue with available 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.

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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

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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	$6-0=6$

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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 16-24 second.

System time	16
Processes scheduling finish time	P1,p3,p3,p4,p0,p2

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Finish time	$16+8=24$
Wating time	$24-8=16$
Turn Around time	$24-0=24$

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

$$\begin{aligned}\text{Average waiting time} &= (0+3+6+10+16)/5 \\ &= 35/5 \\ &= 7\end{aligned}$$

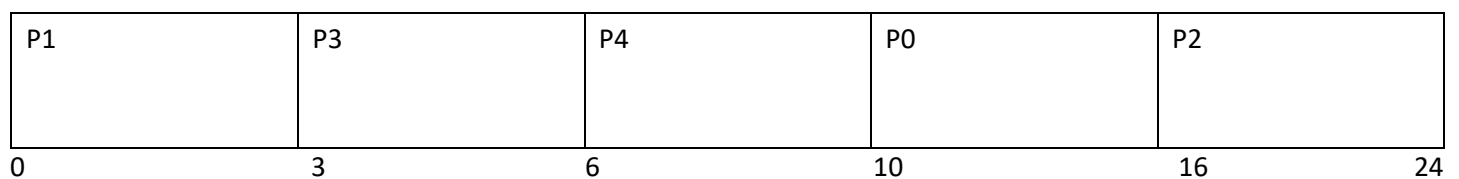
$$\begin{aligned}\text{Average turn around time} &= (3+6+10+16+24)/5 \\ &= 59/5 \\ &= 11.8\end{aligned}$$

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Gnatt Chart

Step 4: After scheduling of all provided processes.

Process id	Burst time	Arrival time	Finish time	Turn Around time	Waiting 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



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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	Waiting 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

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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

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P3	25	0	85	85	60	
P5	25	0	110	110	85	

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Average

53.3333

35.000000

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Gnatt chart:

Process id	Burst time	Arrival time	Finish time	Turn Around time	Wating 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

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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	Waiting 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

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Average				13.80000	7.800000
---------	--	--	--	----------	----------

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Gnatt chart:

Process id	Burst time	Arrival time	Finish time	Turn Around time
P2	2	0	2	2
P1	3	0	5	5
P0	7	0	12	12
P4	8	0	20	20
P3	10	0	30	30
Average				13.80000

P2	P1	P0	P4
----	----	----	----

2 5 12 20

0

Waiting time

0

2

5

12

P3

20

7.800000

30

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Implementation:

//Name: AbhishekNikam

//Batch:B2

//PRN: 2020016400805951

//Date:23/7/2021

//Prac-02: SJF(with no preemption)Algorithm

```
import java.util.Scanner;
```

```
public class P2_SJF_PD
```

```
{
```

```
int burstTime[]; int
```

```
arrivalTime[]={0};
```

```
String[] processId;
```

```
int numberOfProcess;
```

```
void getProcessData(Scanner input){
```

```
System.out.println("enter the number of process for
```

```
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();
```

```
}
```

```
}
```

Batch:b2

AbhishekNikam

Name:

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```
void sortAccordingBurstTime(int[] at,int[] bt,String[] pid){  
    boolean swapped;  
    int temp; String stemp; for (int  
    i=0;i<numberOfProcess;i++){  
        swapped=false; for (int j =  
        0;j<numberOfProcess-i-1;j++){  
            if(bt[j]>bt[j+1]){  
                temp=bt[j];  
                bt[j]=bt[j+1];  
                bt[j+1]=temp;  
                temp=at[j];  
                at[j]=at[j+1];  
                at[j+1]=temp;  
                stemp=pid[j];  
                pid[j]=pid[j+1];  
                pid[j+1]=stemp;  
                swapped=true;  
            }  
        }  
        if(swapped==false){  
            break;  
        }  
    }  
}  
  
void shortestJobFirstNPAlgorithm(){ int  
    finishTime[]=new int[numberOfProcess];  
    int bt[]=burstTime.clone();
```

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```
int at[]=arrivalTime.clone(); String
pid[]=processId.clone(); int waitingTime[]=new
int[numberOfProcess]; int
turnAroundTime[]=new int[numberOfProcess];
sortAccordingBurstTime(at,bt,pid);
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[i]=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;
System.out.println("SJF (with no preemption) Scheduling Algorithm :");
```

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```
System.out.format("%20s%20s%20s%20s%20s%20s\n","ProcessId","BurstTime"
,"ArrivalTime","FinishTime","TurnAroundTime","WatingTime"); for(int
i=0;i<numberOfProcess;i++){
System.out.format("%20s%20d%20d%20d%20d%20d\n",pid[i],bt[i],at[i]
,finishTime[i],turnAroundTime[i],waitingTime[i]);
```

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```
}  
  
System.out.format("%80s%20f%20f\n", "Average",averageTurnAroundTime,averageWaitingTime);  
  
}  
  
public static void main(String[] args){  
Scanner input=new Scanner(System.in); P2_SJF_PD  
obj=new P2_SJF_PD(); obj.getProcessData(input);  
obj.shortestJobFirstNPAlgorithm();  
}  
}
```


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**Batch:b2
AbhishekNikam**

Name:

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Input 1:

```
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P2_SJF_PD.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
```

Output :

```
SJF (with no preemption) Scheduling Algorithm :
ProcessId      BurstTime  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
```

Sample output 01:

```
C:\Windows\System32\cmd.exe
SJF (with no preemption) Scheduling Algorithm :
ProcessId      BurstTime  ArrivalTime  FinishTime  TurnAroundTime  WatingTime
p3              4          0              4            4              0
p4              4          0              8            8              4
p5              4          0             12           12              8
p0              5          0             17           17             12
p1              5          0             22           22             17
p2              5          0             27           27             22
Average          15.000000  10.500000

C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P2_SJF_PD.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      BurstTime  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:\Users\SD CONSULTANTS\OneDrive\Desktop>
```

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Input 2:

```
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	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
-----------	-----------	-------------	------------	----------------	-------------

Input 3:

```
SJF (with no preemption) Scheduling Algorithm :
```

ProcessId	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
p1	1	0	1	1	0
p0	2	0	3	3	1
p2	6	0	9	9	3
Average				4.333333	1.333333

Sample output 2:

```
C:\Windows\System32\cmd.exe
Average 11.800000 7.000000
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P2_SJF_PD.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	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
p1	1	0	1	1	0
p0	2	0	3	3	1
p2	6	0	9	9	3
Average				4.333333	1.333333

```
C:\Users\SD CONSULTANTS\OneDrive\Desktop>
```

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Input 3:

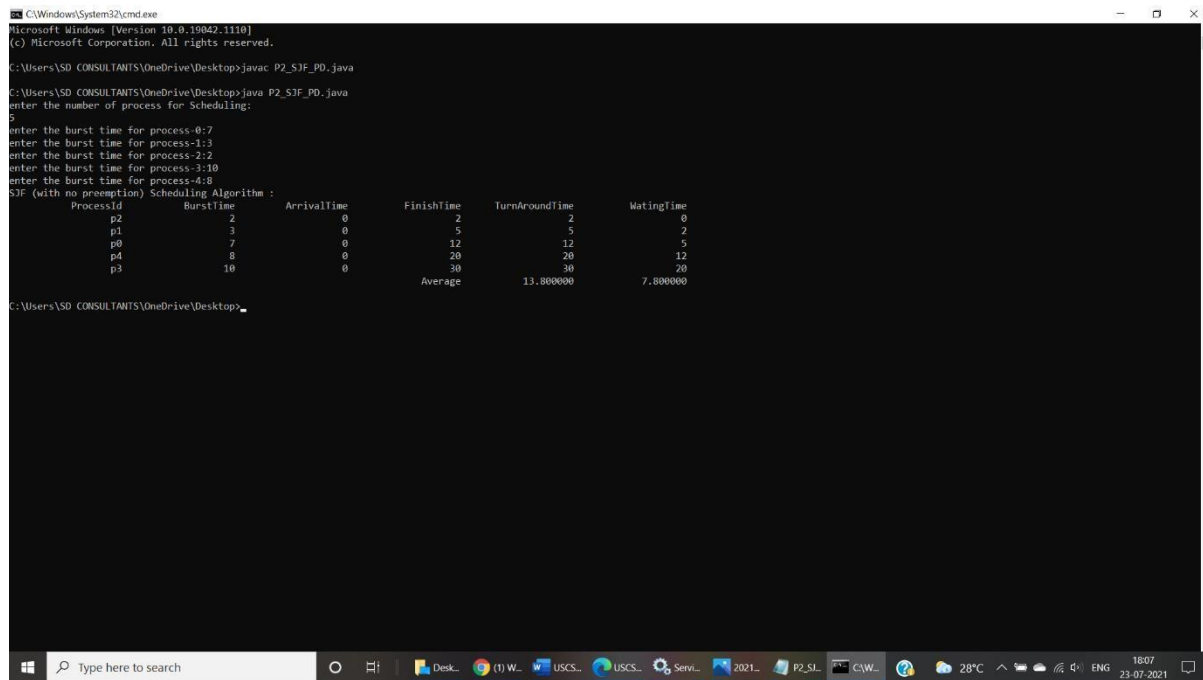
```
enter the burst time for process-0:7
enter the burst time for process-1:3
enter the burst time for process-2:2
enter the burst time for process-3:10
enter the burst time for process-4:8
SJF (with no preemption) Scheduling Algorithm :
```

Output:

```
SJF (with no preemption) Scheduling Algorithm :
ProcessId      BurstTime  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:\Users\SD CONSULTANTS\OneDrive\Desktop>_

Sample output 3:



```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19042.1110]
(c) Microsoft Corporation. All rights reserved.

C:\Users\SD CONSULTANTS\OneDrive\Desktop>javac P2_SJF_PD.java
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P2_SJF_PD.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      BurstTime  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:\Users\SD CONSULTANTS\OneDrive\Desktop>_
```

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**Batch:b2
AbhishekNikam**

Name:

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Input:

```
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-4:10
enter the burst time for process-5:25
SJF (with no preemption) Scheduling Algorithm :
```

ProcessId	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
-----------	-----------	-------------	------------	----------------	-------------

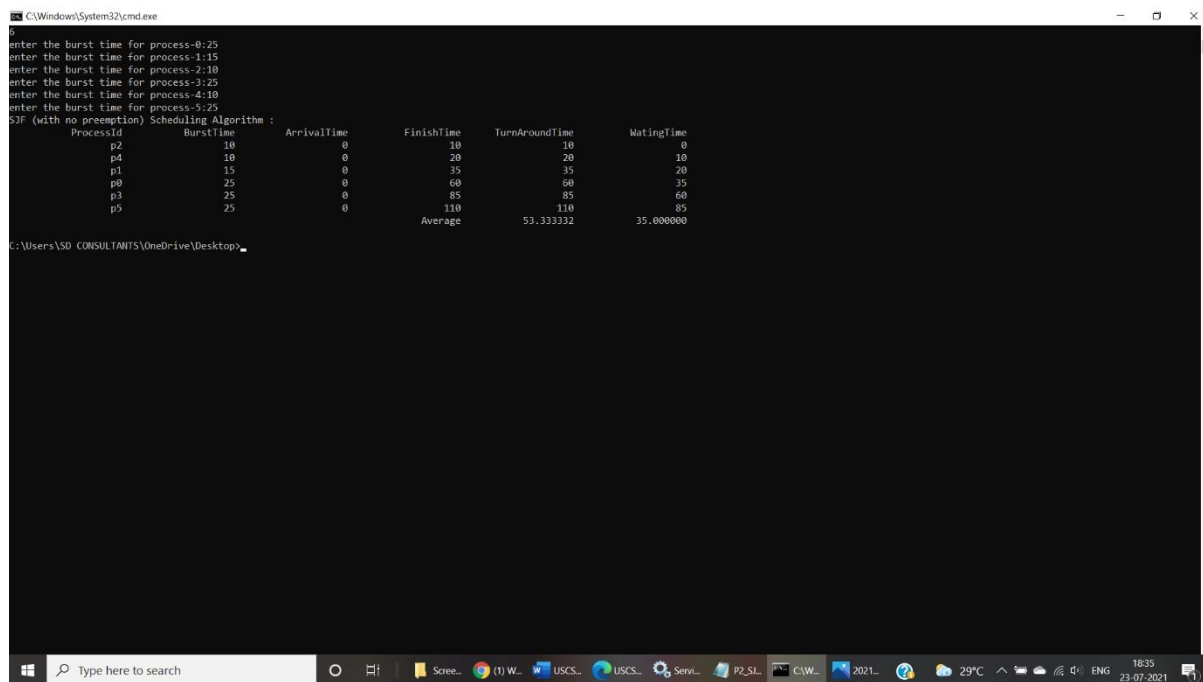
Output :

```
SJF (with no preemption) Scheduling Algorithm :
```

ProcessId	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
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				53.333332	35.000000

C:\Users\SD CONSULTANTS\OneDrive\Desktop>

Sample output 4:



The screenshot shows a Windows command prompt window titled "C:\Windows\System32\cmd.exe". The user has entered the following commands and received the corresponding output:

```
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-4:10
enter the burst time for process-5:25
SJF (with no preemption) Scheduling Algorithm :
```

ProcessId	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
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				53.333332	35.000000

C:\Users\SD CONSULTANTS\OneDrive\Desktop>

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**Batch:b2
AbhishekNikam**

Name: