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USCS3P01:USCS303-Operating System(OS)Practical-01

Practical -01:First Come First Serve (FCFS) Scheduling Algorithm

Practical Date: 17th July,2021.

Practical Aim: Implement FCFS scheduling algorithm using java.

1) 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 theand 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 containing five process arrive at same time.

Process ID	Times new
P0	6
P1	3
P2	8
P3	3

P4	4
----	---

SOLVE:

Step 1: Process get execute according to their arrival time.

Step 2: Following show the scheduling and execute of process .

Step 2.1: At start p0 arrive and get execute for 6 second.

System time	0
Process Scheduled	P0
Turn around time	$6-0=6$
Waiting Time	$6-6=0$

Step 2.2: p1 arrive after completion of p0 , p1 is execute for 3.

System time	6
Process Scheduled	P0,p1
Turn around time	$9-0=9$
Waiting Time	$9-3=6$

Step2.3: p2 arrive after complete execution of process p1 for 8.

System time	9
Process Scheduled	P0,p1,p2
Turn around time	$17-0=17$
Waiting Time	$17-8=9$

Step 2.4: p3 arrive and gets execute for 3.

System time	Process	17
Scheduled		P0,p1,p2,p3
Turn around time		20-0=20
Waiting time		20-3=17

Step 2.5: similarly p4 arrives gets execute for 4.

System time		20
Process Scheduled		P0,p1,p2,p3,p4
Turn around time		24-0=24
Waiting time		24-4=20

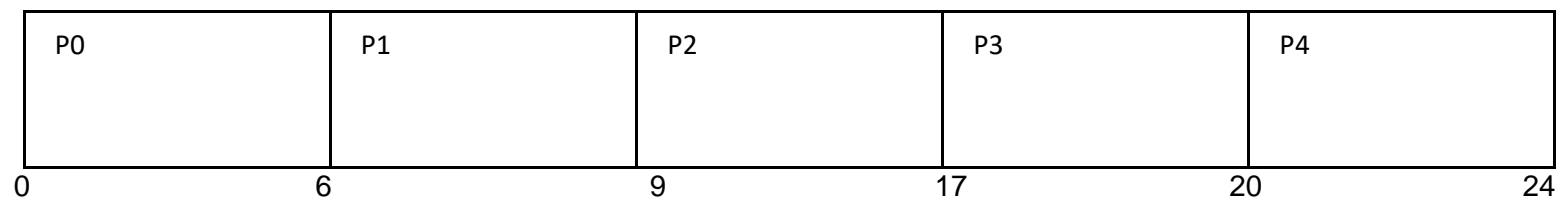
Step 3: calculate average waiting time and average turn around time.

<p>Average waiting time $= (0+6+9+17+20)/5$ $= 52/5$ $= 10.4$</p> <p>Average turn around time $= (6+9+17+20+24)/5$ $= 76/5$ $= 15.2$</p>
--

Gnatt Chart.

Step 4: after scheduling of all provided processes.

Process id	Burst time	Arrival time	Finish time	Turn Around time	Wating time
P0	6	0	$0+6=6$	$6-0=6$	$6-6=0$
P1	3	0	$6+3=9$	$9-0=9$	$9-3=6$
P2	8	0	$9+8=17$	$17-0=17$	$17-8=9$
P3	3	0	$17+3=20$	$20-0=20$	$20-3=17$
P4	4	0	$20+4=24$	$24-0=24$	$24-4=20$
AVERAGE				15.200000	10.400000



EXAMPLE 2:

Consider the following example contain five with varied arrive time.

Process id	Burst time	Arrival time
P0	6	2
P1	3	5
P2	8	1

P3	3	0
P4	4	4

Step 1: Process get execute according to their arrival time.

Step 2: Following show the scheduling and execute of process .

Step 2.2: At start p3 arrive and get execute for 0-3 second.

System time	0
Process Scheduled	P3
Turn around time	$3-0=3$
Waiting Time	$3-3=0$

Step 2.3: p0 arrives at time 4 sec but gets resource of cpu at 17 second for execution its execution period is 17-21 second.

System time	11
Process Scheduled	P3,p2,p0
Turn around time	$17-2=15$
Waiting Time	$15-6=13$

Step 2.4:p4 arrives at time 4 sec but gets resource of cpu at 17 second for execution period is 17-21 second. around time 21 second and last for a period 21-24 second.

System time	21
Process Scheduled	P3,p2,p0,p4,p1

Turn around time	$20-0=20$
Waiting time	$20-3=17$

Step 2.5: similarly p1 arrives at times 5 sec but its execution gets started turn around time 21 second and last for a period 21-24 second.

System time	21
Process Scheduled	P3,p2,p0,p4,p1
Turn around time	$24-5=19$
Turn around time	$19-5=14$

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

$$\begin{aligned} \text{Average waiting time} &= (0+2+9+13+16)/5 \\ &= 40/5 \\ &= 8 \\ \text{Average turn around time} &= (3+10+15+17+19)/5 \\ &= 64/5 \\ &= 12.8 \end{aligned}$$

Gantt Chart.

Step 4: after scheduling of all provided processes.

Process id	Burst time	Arrival time	Finish time	Turn Around time	Waiting time
P3	3	0	$0+3=3$	$3-0=3$	$3-3=0$
P2	8	1	$3+8=11$	$11-1=10$	$10-8=2$
P0	6	2	$11+6=17$	$17-2=15$	$15-6=9$
P4	4	4	$17+4=21$	$21-4=17$	$17-4=13$

P1	3	5	21+3=24	24-5=19	19-3=16
AVERAGE				12.8000000	8.000000

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

0

3

11

17

21

24

EXAMPLE 3: Consider the following example containing five processes arrive at the same time .

Process id	Times new
P0	2
P1	1
P2	6

SOLVE:

Step 1: Process get execute according to their arrival time.

Step 2: Following show the scheduling and execute of process .

Step 2.1: At start p0 arrive and get execute for 2 second.

System time	0
Process Scheduled	P0
Turn around time	$2-0=2$
Waiting Time	$2-2=0$

Step 2.2: p1 arrive after completion of p0 , p1 is execute for 1.

System time	2
Process Scheduled	P0,p1
Turn around time	$3-0=3$
Waiting Time	$3-1=2$

Step2.3: p2 arrive after complete execution of process p1 for 6.

System time	3
Process Scheduled	P0,p1,p2
Turn around time	9-0=9
Waiting Time	9-6=3

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

<p>Average waiting time $= (0+2+3)/3$ $= 5/3$ $= 1.6666$</p> <p>Average turn around time $= (2+3+9)/3$ $= 14/3$ $= 4.6666$</p>
--

Gantt Chart.

Step 4: after scheduling of all provided processes.

Process id	Burst time	Arrival time	Finish time	Turn Around time	Waiting time
P0	2	0	0+2=2	2-0=2	2-2=0
P1	1	0	2+1=3	3-0=3	3-1=2
P2	6	0	3+6=9	9-0=9	9-6=3
AVERAGE				4.666	1.666

P0	P1	P2
0	2	3
		9

EXAMPLE 4: Consider the following example containing five process with varied arrival time.

Process id	Burst time	Arrival time
P0	4	3
P1	3	5
P2	2	0
P3	1	5
P4	3	4

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

<p>Average wating time $= (3+1+7+4+6)/5$ $= 21/5$ $= 4.2$</p> <p>Average turn around time $: (1+2+9+5+9)/5$ $= 26/5$ $= 5.2$</p>
--

Gnatt Chart.

Step 4: after scheduling of all provided processes.

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

P0	4	3	6	3	1
P1	3	5	12	7	4
P2	2	0	2	2	0
P3	1	5	13	8	7
P4	3	4	9	5	92
AVERAGE				5.0000	2.40000

P2	P0	P4	P1	P3	
2	6	9	12	13	0

IMPLEMENTATION:

```
import java.util.Scanner;

public class P1_FCFS_PD
{
int burstTime[];
int arrivalTime[];
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();
System.out.println("enter the arrival time for process-
"+(i)+":"); arrivalTime[i]=input.nextInt();
}
}

void sortAccordingArrivalTime(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(at[j]>at[j+1]){
            temp=at[j];
            at[j]=at[j+1];
            at[j+1]=temp;
            temp=bt[j];
            bt[j]=bt[j+1];
            bt[j+1]=temp;
            stemp=pid[j];
            pid[j]=pid[j+1];
            pid[j+1]=stemp;
            swapped=true;
        }
    }
    if(swapped==false){
        break;
    }
}

void firstComeFirstServeAlgorithm(){ 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];
sortAccordingArrivalTime(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("FCFS Scheduling algorithm :");

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]);

}

System.out.format("% 80s% 20f% 20f\n",

"Average", averageTurnAroundTime, averageWaitingTime); }

public static void main(String[] args){

Scanner input=new Scanner(System.in);

P1_FCFS_PD obj=new P1_FCFS_PD();

obj.getProcessData(input);

obj.firstComeFirstServeAlgorithm()

;}

}
```

INPUT:

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

C:\Users\SD CONSULTANTS\OneDrive\Desktop>javac P1_FCFS_PD.java

C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
enter the number of process for Scheduling:
5
enter the burst time for process-0:6
enter the arrival time for process-0:
2
enter the burst time for process-1:3
enter the arrival time for process-1:
5
enter the burst time for process-2:8
enter the arrival time for process-2:
1
enter the burst time for process-3:3
enter the arrival time for process-3:
0
enter the burst time for process-4:4
enter the arrival time for process-4:
4
```

OUTPUT:

```
FCFS Scheduling algorithm :
  ProcessId      BurstTime      ArrivalTime      FinishTime      TurnAroundTime      WatingTime
    p3              3              0              3              3              0
    p2              8              1             11             10              2
    p0              6              2             17             15              9
    p4              4              4             21             17             13
    p1              3              5             24             19             14
          Average              12.000000              8.000000
```


SAMPLE OUTPUT-01:

INPUT:

```
C:\Users\SD CONSULTANTS\OneDrive\Desktop>javac P1_FCFS_PD.java
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
enter the number of process for Scheduling:
3
enter the burst time for process-0:2
enter the arrival time for process-0:
0
enter the burst time for process-1:1
enter the arrival time for process-1:
0
enter the burst time for process-2:6
enter the arrival time for process-2:
0
FCFS Scheduling algorithm :
```

OUTPUT:

```
FCFS Scheduling algorithm :
ProcessId    BurstTime    ArrivalTime    FinishTime    TurnaroundTime    WaitingTime
p0           2             0              2             2             0
p1           1             0              3             3             2
p2           6             0              9             9             1
Average      4.666667      1.666667
```

SAMPLE OUTPUT-02:

```

C:\Users\SD CONSULTANTS\OneDrive\Desktop>javac P1_FCFS_PD.java
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
enter the number of process for Scheduling:
3
enter the burst time for process-0:2
enter the arrival time for process-0:
0
enter the burst time for process-1:1
enter the arrival time for process-1:
0
enter the burst time for process-2:6
enter the arrival time for process-2:
0
FCFS Scheduling algorithm :

```

ProcessId	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
p0	2	0	2	2	0
p1	1	0	3	3	2
p2	6	0	9	9	3
Average				4.666667	1.666667

INPUT:

```

C:\Windows\System32\cmd.exe

```

```

C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
enter the number of process for Scheduling:
5
enter the burst time for process-0:6
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-3:3
enter the arrival time for process-3:
0
enter the burst time for process-4:4
enter the arrival time for process-4:
0

```

OUTPUT:

```

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	3	0	20	20	17
p4	4	0	24	24	20
Average				15.200000	10.400000

SAMPLE OUTPUT 3:

```
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
Enter the number of process for Scheduling:
5
Enter the burst time for process-0:6
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-3:3
Enter the arrival time for process-3:
0
Enter the burst time for process-4:4
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        | 3         | 0           | 20         | 20             | 17          |
| p4        | 4         | 0           | 24         | 24             | 20          |
| Average   |           |             |            | 15.200000      | 10.400000   |


```

INPUT:

```
C:\Windows\System32\cmd.exe
C:\Users\SD CONSULTANTS\OneDrive\Desktop>javac P1_FCFS_PD.java
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
Enter the number of process for Scheduling:
5
Enter the burst time for process-0:4
Enter the arrival time for process-0:
3
Enter the burst time for process-1:3
Enter the arrival time for process-1:
5
Enter the burst time for process-2:2
Enter the arrival time for process-2:
0
Enter the burst time for process-3:1
Enter the arrival time for process-3:
5
Enter the burst time for process-4:3
Enter the arrival time for process-4:
4
```

OUTPUT:

```
FCFS Scheduling algorithm :


| ProcessId | BurstTime | ArrivalTime | FinishTime | TurnAroundTime | WaitingTime |
|-----------|-----------|-------------|------------|----------------|-------------|
| p2        | 2         | 0           | 2          | 2              | 0           |
| p0        | 4         | 3           | 6          | 3              | -1          |
| p4        | 3         | 4           | 8          | 5              | 2           |
| p1        | 3         | 5           | 12         | 7              | 4           |
| p3        | 1         | 5           | 11         | 8              | 7           |
| Average   |           |             |            | 5.000000       | 2.400000    |


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

SAMPLE OUTPUT 4:

```
C:\Users\SD CONSULTANTS\OneDrive\Desktop>javac P1_FCFS_PD.java
```

```
C:\Users\SD CONSULTANTS\OneDrive\Desktop>java P1_FCFS_PD.java
```

```
enter the number of process for Scheduling:
```

```
5
```

```
enter the burst time for process-0:4
```

```
enter the arrival time for process-0:
```

```
3
```

```
enter the burst time for process-1:3
```

```
enter the arrival time for process-1:
```

```
5
```

```
enter the burst time for process-2:2
```

```
enter the arrival time for process-2:
```

```
0
```

```
enter the burst time for process-3:1
```

```
enter the arrival time for process-3:
```

```
5
```

```
enter the burst time for process-4:3
```

```
enter the arrival time for process-4:
```

```
4
```

```
FCFS Scheduling algorithm :
```

ProcessId	BurstTime	ArrivalTime	FinishTime	TurnAroundTime	WaitingTime
p2	2	0	2	2	0
p0	4	3	6	3	-1
p4	3	4	9	5	2
p1	3	5	12	7	4
p3	1	5	13	8	7
		Average		5.000000	2.400000

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