Smt.chandibai Himmathmal Mansukhani College

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

First Come First Serve(FCFS) Scheduling Algorithm

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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.

SOLVED EXAMPLES:

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

System time	0
Process Scheduled	P0
Turnaround 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
Turnaround time	9-9=0
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
Turnaround time	17-0=17
Waiting Time	17-8=9

Step 2.4:p3 arrive and gets execute for 3

System time	17
Process Scheduled	P0,p1,p2,p3
Turnaround time	P0,p1,p2,p3
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
Turnaround time	24-0=24
Waiting Time	24-4=20

Step 3: calculate average waiting time and average turnaround time.

Average wating time =(0+6+9+17+20)/5

=52/5

=10.4

Average turn around time :(6+9+17+20+24)/5

=76/5

=15.2

Step 4: after scheduling of all provided processes.

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

GNATT CHART.

P0	P1	P2	P3	P4

0 6 9 17 20

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
Turnaround 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
Turnaround 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.

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

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

System time	21
Process Scheduled	P3,p2,p0,p4,p1
Turnaround time	24-5=19
Waiting Time	19-5=19

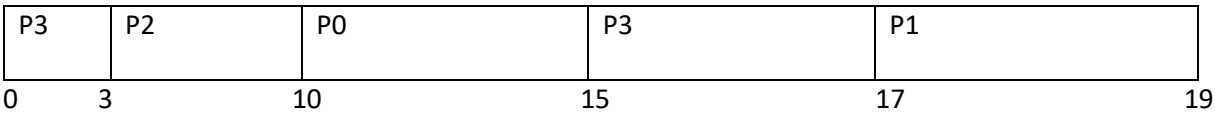
Step 3: calculate average wating time and average turn around time.

Average waiting time =(0+2+9+13+16)/5
=40/5
=8
Average turnaround time :(3+10+15+17+19)/5
=64/5
=12.8

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 1	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

Gnatt Chart.



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
Turnaround 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
Turnaround 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
Turnaround time	9-0=17
Waiting Time	9-6=3

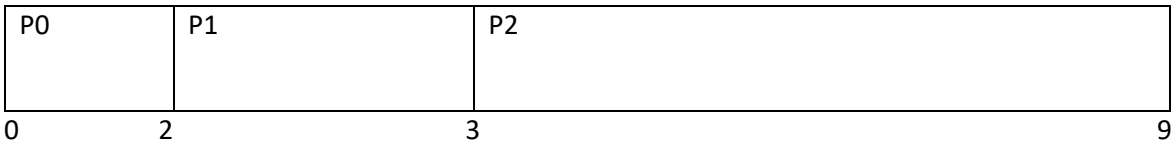
Step 3: calculate average waiting time and average turnaround time.

Average waiting time =(0+2+3)/3
=5/3
=1.6666
average turnaround time :(2+3+9)/
=14/3
=4.6666

Gnatt 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				4.666667	1.6666667



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

Average wating time =(3+1+7+4+6)/5
=21/5
=4.2
Average turn around time =(1+2+9+5+9)/5
=26/5
=5.2

Gnatt Chart.

Step 4: after scheduling of all provided processes.

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

IMPLEMENATION:

```
// Name: Bhupendra Kamble
// Batch: B2
// PRN: 2020016400925867
// Date: 17/07/2021
// Prac-01: FCFS Algorithm
import java.util.Scanner;
public class P1_FCFS_BK {
 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=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:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
5
enter the burst time for process0:6
enter the arrival time for process0:
0
enter the burst time for process1:3
enter the arrival time for process1:
0
enter the burst time for process2:8
enter the arrival time for process2:
0
enter the burst time for process3:3
enter the arrival time for process3:
0
enter the burst time for process4:4
enter the arrival time for process4:
0
```

OUTPUT:

```
CFS Scheduling algorithm :
         ProcessId          BurstTime        ArrivalTime         FinishTime      TurnAroundTime         WatingTime
                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

:\os practical>
```

Name: Bhupendra Kamble **Batch**: B2 **Date:** 17/07/2021

INPUT:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
5
enter the burst time for process0:6
enter the arrival time for process0:
2
enter the burst time for process1:3
enter the arrival time for process1:
5
enter the burst time for process2:8
enter the arrival time for process2:
1
enter the burst time for process3:3
enter the arrival time for process3:
0
enter the burst time for process4:4
enter the arrival time for process4:
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                 16
                                                                    Average          12.800000           8.000000

E:\os practical>
```

INPUT:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
3
enter the burst time for process0:2
enter the arrival time for process0:
0
enter the burst time for process1:1
enter the arrival time for process1:
0
enter the burst time for process2:6
enter the arrival time for process2:
0
```

OUTPUT:

```
CFS Scheduling algorithm :
        ProcessId          BurstTime        ArrivalTime         FinishTime      TurnAroundTime          WatingTime
               p0                  2                  0                  2                  2                  0
               p1                  1                  0                  3                  3                  2
               p2                  6                  0                  9                  9                  3
                                                                   Average           4.666667           1.666667

:\os practical>
```

INPUT:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
5
enter the burst time for process0:2
enter the arrival time for process0:
0
enter the burst time for process1:4
enter the arrival time for process1:
3
enter the burst time for process2:3
enter the arrival time for process2:
4
enter the burst time for process3:3
enter the arrival time for process3:
5
enter the burst time for process4:1
enter the arrival time for process4:
5
```

OUTPUT:

```
FCFS Scheduling algorithm :
         ProcessId          BurstTime        ArrivalTime         FinishTime      TurnAroundTime          WatingTime
                p0                  2                  0                  2                  2                   0
                p1                  4                  3                  6                  3                  -1
                p2                  3                  4                  9                  5                   2
                p3                  3                  5                 12                  7                   4
                p4                  1                  5                 13                  8                   7
                                                                    Average           5.000000            2.400000

E:\os practical>
```

SAMPLE OUTPUT 1:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
5
enter the burst time for process0:6
enter the arrival time for process0:
0
enter the burst time for process1:3
enter the arrival time for process1:
0
enter the burst time for process2:8
enter the arrival time for process2:
0
enter the burst time for process3:3
enter the arrival time for process3:
0
enter the burst time for process4:4
enter the arrival time for process4:
0
FCFS Scheduling algorithm :
          ProcessId          BurstTime         ArrivalTime         FinishTime      TurnAroundTime          WatingTime
                 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

E:\os practical>
```

SAMPLE OUTPUT 2:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
5
enter the burst time for process0:6
enter the arrival time for process0:
2
enter the burst time for process1:3
enter the arrival time for process1:
5
enter the burst time for process2:8
enter the arrival time for process2:
1
enter the burst time for process3:3
enter the arrival time for process3:
0
enter the burst time for process4:4
enter the arrival time for process4:
4
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                  16
                                                                    Average          12.800000            8.000000

E:\os practical>
```

SAMPLE OUTPUT 3:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
3
enter the burst time for process0:2
enter the arrival time for process0:
0
enter the burst time for process1:1
enter the arrival time for process1:
0
enter the burst time for process2:6
enter the arrival time for process2:
0
FCFS Scheduling algorithm :
          ProcessId          BurstTime        ArrivalTime         FinishTime      TurnAroundTime          WatingTime
                 p0                  2                  0                  2                  2                  0
                 p1                  1                  0                  3                  3                  2
                 p2                  6                  0                  9                  9                  3
                                                                     Average          4.666667           1.666667

E:\os practical>
```

SAMPLE OUTPUT 4:

```
E:\os practical>javac P1_FCFS_BK.java

E:\os practical>java P1_FCFS_BK.java
enter the number of process for Scheduling:
5
enter the burst time for process0:2
enter the arrival time for process0:
0
enter the burst time for process1:4
enter the arrival time for process1:
3
enter the burst time for process2:3
enter the arrival time for process2:
4
enter the burst time for process3:3
enter the arrival time for process3:
5
enter the burst time for process4:1
enter the arrival time for process4:
5
FCFS Scheduling algorithm :
          ProcessId          BurstTime        ArrivalTime         FinishTime      TurnAroundTime         WatingTime
                p0                  2                  0                  2                  2                  0
                p1                  4                  3                  6                  3                 -1
                p2                  3                  4                  9                  5                  2
                p3                  3                  5                 12                  7                  4
                p4                  1                  5                 13                  8                  7
                                                                    Average           5.000000           2.400000

E:\os practical>
```