JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

Lecture-15 By Vivek Dubey

Theory and Lab

COMPUTER SCIENCE AND ENGINEERING

CS403PC

COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

CS403PC

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Scheme of Operating System

S. No.	Course Code	Course Title	L	T	P	Credits
3	CS403PC	Operating Systems	3	0	0	3
6	CS406PC	Operating Systems Lab	0	0	3	1.5

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UNIT-2:

- **Process and CPU Scheduling –**
  - Process concepts and scheduling, Operations on Processes, Cooperating Processes, Threads, and Interposes Communication, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.
- **System call interface for process management-**
  - fork, exit, wait, waitpid, exec

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Scheduling Algorithms

Different Scheduling Algorithms

- *First Come First Serve (FCFS)*
- *Shortest Job First(SJF)*
- *Longest Job First(LJF)*
- *Shortest Remaining Time First(SRTF)*
- *Longest Remaining Time First(LRTF)*
- *Round Robin Scheduling*
- *Priority Based scheduling (Non-Preemptive)*
- *Highest Response Ratio Next (HRRN)*
- *Multilevel Queue Scheduling*
- *Multi level Feedback Queue Scheduling*

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First Come First Serve (FCFS) Scheduling Algorithm

- First in, first out (FIFO), also known as first come, first served (FCFS), ***is the simplest scheduling algorithm***.
- FIFO simply ***queues processes*** in the order *that they arrive in the ready queue*.
- **In this**, ***the process that comes first*** will be executed first and ***next process starts only*** after the previous gets fully executed.
- ***FCFS is*** a non-preemptive scheduling algorithm.

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Advantages of FCFS

1. FCFS algorithm doesn't include any complex logic, *it just puts the process requests* in a queue and *executes it one by one*.
2. Hence, FCFS is pretty simple and easy to implement.
3. Eventually, every process will get a chance to run, *so starvation doesn't occur.*

Disadvantages of FCFS

1. There is no option for pre-emtion of a process. *If a process is started, then CPU executes the process until it ends.*
2. Because there is no pre-emtion, if a process executes for a long time, *the processes in the back of the queue will have to wait for a log time before they get a chance to be executed*.

- Using FCFS scheduling algorithm,
  - Given *n processes with their arrival time and burst times*,
    - the task is to find
      - *average waiting time* and
      - *average turn around* time

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1.Completion Time:

- *Time at which process completes its execution*.

2.Turn Around Time:

- *Time Difference between completion time and arrival time*.
- Turn Around Time = Completion Time – Arrival Time

3.Waiting Time(W.T.):

- *Time Difference between turn around time and burst time.*
- Waiting Time = Turn Around Time – Burst Time

Example-1

- Consider the following Process Id and Their Burst Time
  - Find Average Waiting Time

Process ID	Burst Time
P1	24
P2	3
P3	3

Solution

Let Process Order is
P1,P2,P3

Process ID	Burst Time
P1	24
P2	3
P3	3

a chart in which a series of horizontal lines shows the amount of work

Now Make Gantt Chart

Process ID	P1	P2	P3
Time Unit 0	24	27	30

Waiting Time
P1=0, P2=24 and P3=27

Average Waiting Time is
=(0+24+27)/3
17

Example-2

- Consider the following Process Id and Their Burst Time
  - Find Average Waiting Time

Process ID	Burst Time
P1	24
P2	3
P3	3

Solution

Let Process Order is
P2,P3,P1

Process ID	Burst Time
P1	24
P2	3
P3	3

a chart in which a series of horizontal lines shows the amount of work

Now Make Gantt Chart

Process ID		P2	P3	P1
Time Unit	0	3	6	30

Waiting Time
P2=0, P3=3 and P1=6

It Means,
For Order P1,P2,P3 Avg WT is 17 and
For Order P2,P3,P1 Avg WT is 3

Average Waiting Time is
=(0+3+6)/3
3

Example-3

Consider the following Process Id and Their Burst Time
Find Average Waiting Time
Also Find Average Turn around Time

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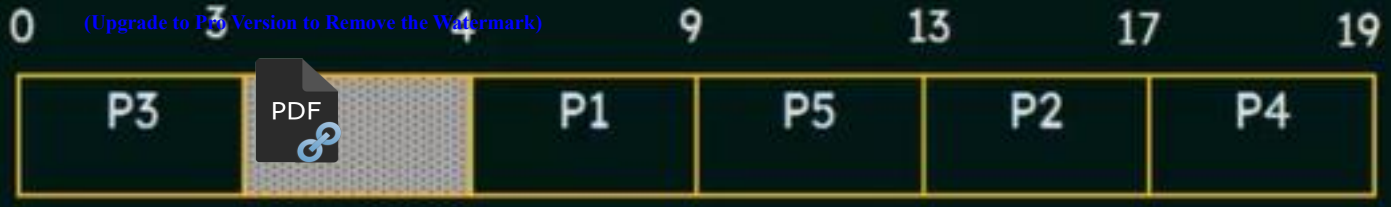
Process ID	Arrival Time	Burst Time
P1	4	5
P2	6	4
P3	0	3
P4	6	2
P5	5	4

Solution:

Process ID	Arrival Time	Burst Time
P1	4	5
P2	6	4
P3	0	3
P4	6	2
P5	5	4

Gantt Chart:



The shaded box represents the idle time of CPU

Turn Around time = Completion time - Arrival time

Waiting time = Turn Around time - Burst time

Process ID	Completion Time	Turnaround Time	Waiting Time
P1	9	9 - 4 = 5	5 - 5 = 0
P2	17	17 - 6 = 11	11 - 4 = 7
P3	3	3 - 0 = 3	3 - 3 = 0
P4	19	19 - 6 = 13	13 - 2 = 11
P5	13	13 - 5 = 8	8 - 4 = 4

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Process ID	Completion Time	Turnaround Time	Waiting Time
P1	9	9 - 4 = 5	5 - 5 = 0
P2	17	17 - 6 = 11	11 - 4 = 7
P3	3	3 - 0 = 3	3 - 3 = 0
P4	19	19 - 6 = 13	13 - 2 = 11
P5	13	13 - 5 = 8	8 - 4 = 4

Now,

Average Turn Around time = (5 + 11 + 3 + 13 + 8) / 5
= 40 / 5
= 8 units

Average waiting time = (0 + 7 + 0 + 11 + 4) / 5
= 22 / 5
= 4.4 units

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C Program - FCFS

- Assume
  - bt=burst Time,
  - wt = Waiting time,
  - avwt=Average WaitingTime
  - tat = Turnaround time
  - avtat=average Turnaround Time


```
int main()
{
    int n,bt[20],wt[20],tat[20],avwt=0,avtat=0,i,j;
    printf("Enter total number of processes(maximum 20):");
    scanf("%d",&n);

    printf("\nEnter Process Burst Time\n");
    for(i=0;i<n;i++)
        {
            printf("P[%d]:",i+1);
            scanf("%d",&bt[i]);
        }
```

```
/* Calculate Wait Time*/
wt[0]=0;

    for(i=1;i<n;i++)
    {
        wt[i]=0;
        for(j=0;j<i;j++) wt[i]+=bt[j];
    }
```

```
printf("\nProcesstBurst    TimetWaiting    Time      Turnaround Time\n");
```



```
   for(i=0;i<n;i++)
   {
      tat[i] = bt[i] + wt[i];
      avwt = avwt + wt[i];
      avtat = avtat + tat[i];
      printf("\nP[%d]\t\t%d\t\t%d\t\t%d",i+1,bt[i],wt[i],tat[i]);
   }

   avwt=avwt / i;
   avtat=avtat / i;
   printf("\n\nAverage Waiting Time:%d",avwt);
   printf("\nAverage Turnaround Time:%d",avtat);

   return 0;
}
```

Output

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Enter total number of processes(maximum 20):3
Enter Process Burst Time
P[1]:24
P[2]:3
P[3]:3

ProcesstBurst Timet	Waiting Time	Turnaround Time
P[1]	24	0	24
P[2]	3	24	27
P[3]	3	27	30

Average Waiting Time:17
Average Turnaround Time:27