CS & IT ENGINEERING

Operating System

CPU Scheduling

Lecture - 01

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Recap of Previous Lecture

- Topic: Process states
- Topic: Process State Transition
- Topic: Process Scheduling
- Topic: Types of Schedulers → STS

Topics to be Covered

- Topic: Process Scheduling
- Topic: Process Scheduling Algorithms
- Topic: FCFS Scheduling
- Topic: SJF Scheduling

[MCQ]

#Q. Which of the following scheduler reduces the degree of multiprogramming?

A Short-Term

B Long-Term

C Mid-Term

D Long-Term and Mid-Term both

[NAT]

1

#Q. Consider a system with n processes and [redacted] CPUs. Maximum and Minimum number of processes in each of the following states possible?

	max	min
1. Ready state ⇒	n	0
2. Running State ⇒	1	0
3. Blocked State ⇒	n	0

Topic : CPU Scheduling

Function:

- Make a selection of a process to run next on CPU among all ready processes.

Goal

- Minimize Wait time and Turn-around time
- Maximize CPU utilization (Throughput)
- Fairness
- Interactivity

Topic : CPU Scheduling Types

Non-preemptive

once a process scheduled to run then it can not be forcefully taken out of CPU.

preemptive

A running process can be taken out of CPU forcefully.

Topic : Scheduling Times

- Arrival Time (AT): Time at which process arrives
- Burst/Service Time (BT): Amount of time a process runs on CPU
- Waiting Time (WT): Amount of time for which process waits in Ready state
- Completion Time (CT): Time at which process completes
- Turn-Around Time (TAT): Amount of time process spends from arrival to completion.

$$TAT = CT - AT$$

$$WT = TAT - BT$$

Topic : Scheduling Times

- Response Time (RT): Amount of time from arrival till first time execution of process
- Scheduling Length (L): $\max(CT_i) - \min(AT_j)$
- Throughput: No. of processes executed per unit time

$$\text{Throughput} = \frac{\text{no. of processes executed}}{\text{scheduling length}}$$

Topic : Scheduling Algorithms

1. FCFS
2. SJF
3. SRTF
4. HRRN
5. Priority Based
6. Round Robin
7. Multilevel Queue Scheduling
8. Multilevel Feedback Queue Scheduling

Topic : FCFS (First Come First Serve)

Scheduling Criteria: whichever process has min. arrival time

↳ AT

Tie breaker ⇒ min. process id first

Type of Algorithm:

Non-preemptive

Topic : FCFS (First Come First Serve)

Process	Arrival Time	Burst Time
P1	0	27
P2	0	6
P3	0	6

Gantt chart :- It starts from 0 always

Topic : FCFS (First Come First Serve)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	27	27	27	0
P2	0	6	33	33	27
P3	0	6	39	39	33

$$\text{Avg. TAT} = \frac{27+33+39}{3} = 33$$

$$\text{Avg. WT} = \frac{0+27+33}{3} = 20$$

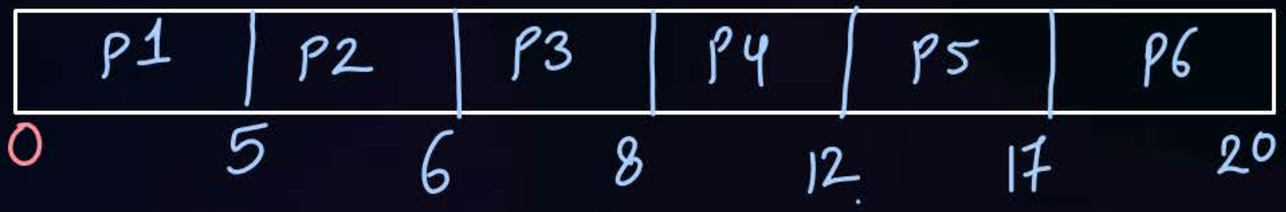
scheduling length = 39 − 0 = 39

Throughput = $\frac{3}{39} = \frac{1}{13}$

Topic : FCFS (First Come First Serve)

Process	Arrival Time	Burst Time	CT	TAT	WT
P1	0	5	5	5	0
P2	1	1	6	5	4
P3	2	2	8	6	4
P4	3	4	12	9	5
P5	4	5	17	13	8
P6	5	3	20	15	12

Gantt chart:-

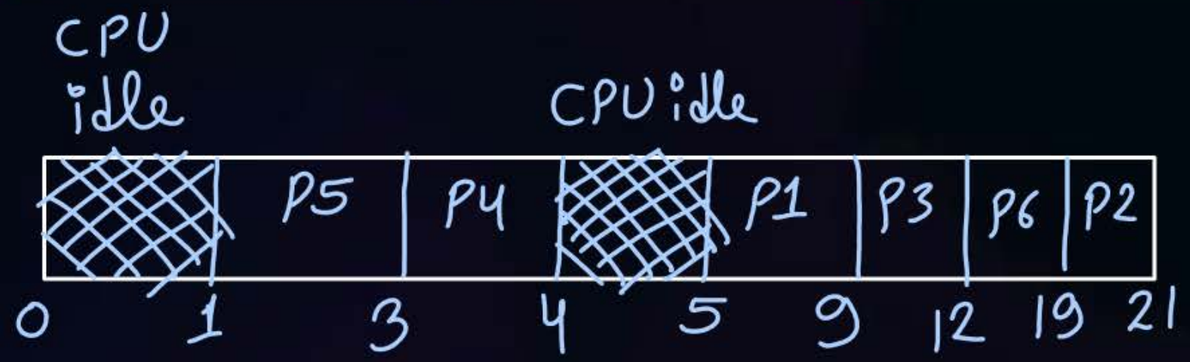


avg TAT = 53/6 = 8.83

avg WT = 33/6 = 5.5

Topic : FCFS (First Come First Serve)

Process	Arrival Time	Burst Time	CT	TAT	WT
P1	5	4	9	4	0
P2	8	2	21	13	11
P3	6	3	12	6	3
P4	3	1	4	1	0
P5	1	2	3	2	0
P6	7	7	19	12	5



$$\text{avg TAT} = \frac{38}{6} = 6.33$$

$$\text{avg WT} = \frac{19}{6} = 3.167$$

Topic : Convoy Effect

If a heavy (big) process is scheduled first then it delays all other process execution significantly; hence performance of the system slows down.

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only FCFS suffers from convoy effect.

Topic : SJF (Shortest Job First)

Scheduling Criteria: schedule process with smallest Burst time

⇓

Tie breaker ⇒ FCFS

Type of Algorithm:

⇓

non-preemptive

Topic : SJF (Shortest Job First)

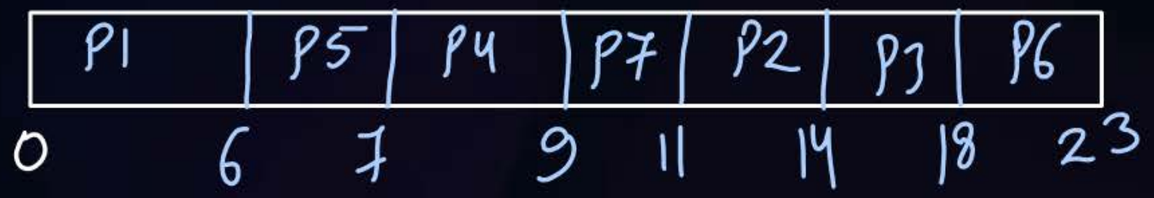
Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	27	39	39	12
P2	0	6	6	6	0
P3	0	6	12	12	6

$$\text{avg TAT} = \frac{57}{3} = 19$$

$$\text{avg WT} = \frac{18}{3} = 6$$

Topic : SJF (Shortest Job First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	6			
P2	1	3			
P3	2	4			
P4	4	2			
P5	5	1			
P6	6	5			
P7	8	2			



time	Ready state
0	P1
6	P2, P3, P4, P5, P6

→ select one process with smallest BT.

P1 scheduled at time 0 because it is the only process available for scheduling at 0. (all other processes will arrive later).

2 mins Summary

Topic Process Scheduling

Topic Process Scheduling Algorithms

Topic FCFS Scheduling

Topic SJF Scheduling

Happy Learning

THANK - YOU