CS & IT ENGINEERING

Operating System

CPU Scheduling

Lecture - 03

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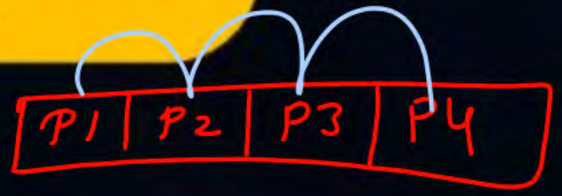
Recap of Previous Lecture

Topic SJF Scheduling

Topic SRTF Scheduling

Topics to be Covered



- **Topic** SRTF Scheduling
- **Topic** LJF & LRTF Scheduling
- **Topic** HRRN Algorithm
- **Topic** Priority based algorithm

for non-preemptive algo ⇒

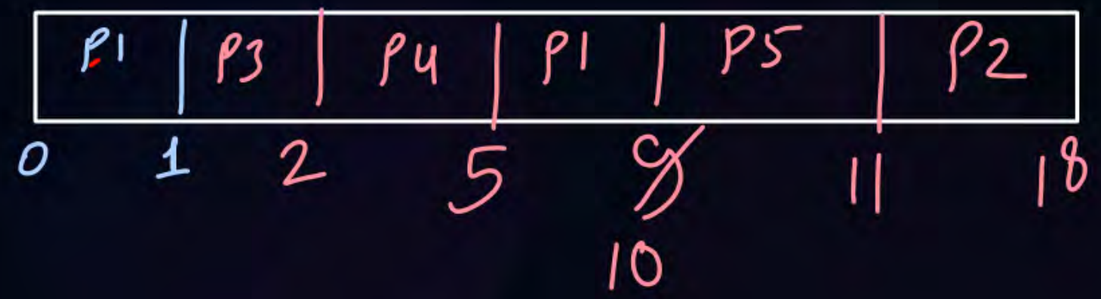
no. of context switches = no. of processes − 1

(considering no switch counted before first process after last process)

Topic : SRTF (Shortest Remaining Time First)

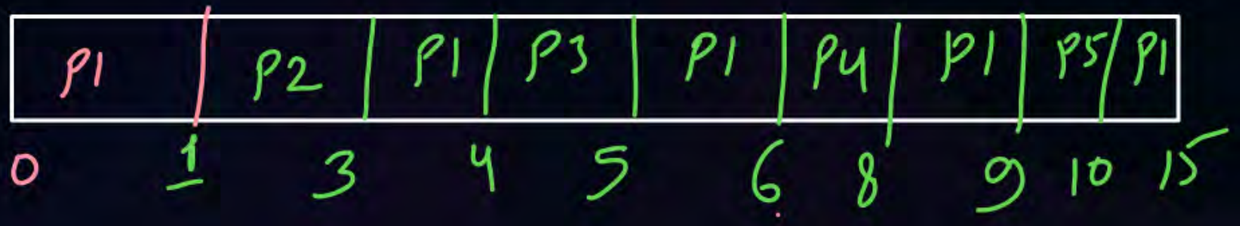
H.W. Questⁿ

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	6			
P2	0	7			
P3	1	1			
P4	2	3			
P5	9	1			



Topic : SRTF (Shortest Remaining Time First)

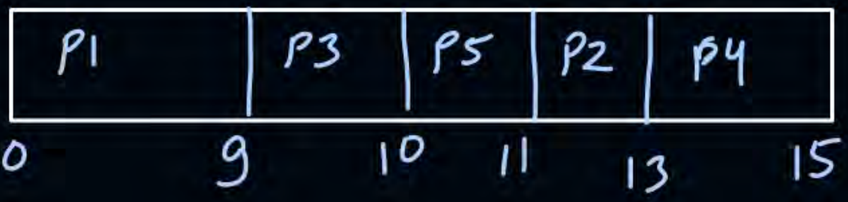
Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time	Response Time
P1	0	9	15	15	6	0
P2	1	2	3	2	0	0
P3	4	1	5	1	0	0
P4	6	2	8	2	0	0
P5	9	1	10	1	0	0



no. of context switches = 8
(except first & last)

	AT	BT	Response time	CT	TAT	WT
P1	0	9	0	9	9	0
P2	1	2	10	13	12	10
P3	4	1	5	10	6	5
P4	6	2	7	15	9	7
P5	9	1	1	11	2	1

SJF :- (non-preemptive)



equal for all processes

[NAT]

#Q. Response time of processes in non-preemptive scheduling algorithms are equal to waiting time of processes?

True or False

Justify your answer with appropriate explanation.

Topic : LJF (Longest Job First)

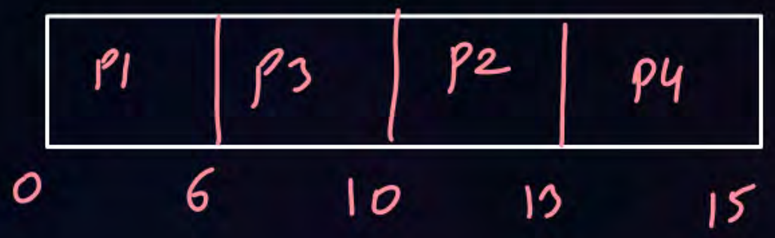
Scheduling Criteria: schedule process with longest B.T.

Tie breaker ⇓ FCFS

Type of Algorithm: Non-preemptive

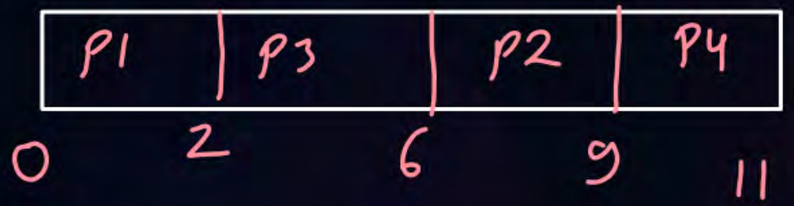
Topic : LJF (Longest Job First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	6			
P2	0	3			
P3	0	4			
P4	0	2			



Topic : LJF (Longest Job First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	2			
P2	1	3			
P3	2	4			
P4	3	2			



Advantages :-

→ None

Disadvantages :-

→ Suffers from convoy effect

→ starvation for shorter processes

→ Not practical because B.T. of processes are not known.

Topic : LRTF (Longest Remaining Time First)

Scheduling Criteria: schedule process with longest BT

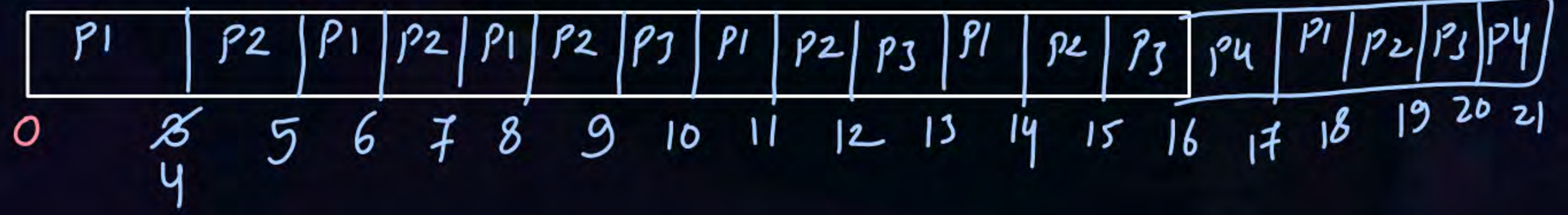
Tie breaker
⇓
FCFS

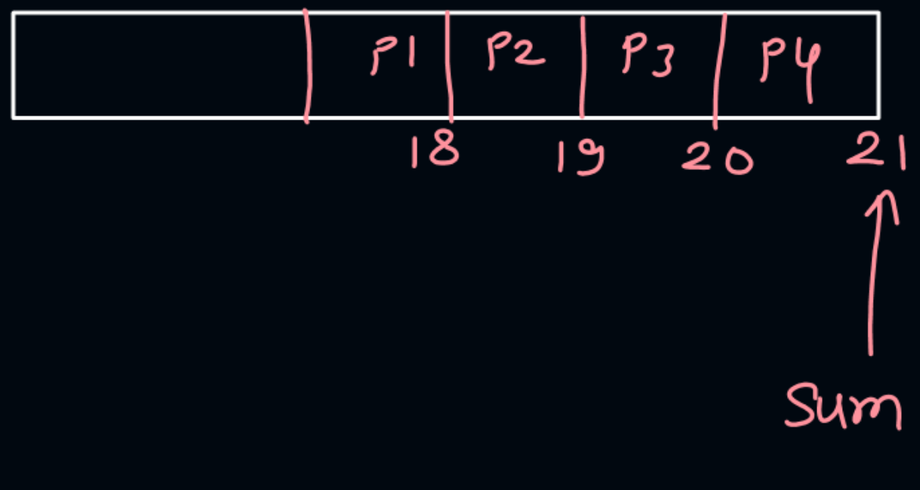
Type of Algorithm: Preemptive

Topic : LRTF (Longest Remaining Time First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	9			
P2	0	6			
P3	0	4			
P4	0	2			

P1	~~9~~ ~~6~~ ~~5~~ 4
P2	~~6~~ ~~5~~ 4
P3	4
P4	2

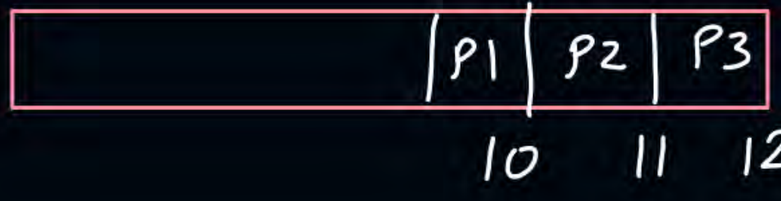



P1
P2
P3
P4
18
19
20
21
Sum of all BTs

ex:-

	AT	BT
P1	0	3
P2	0	5
P3	0	4

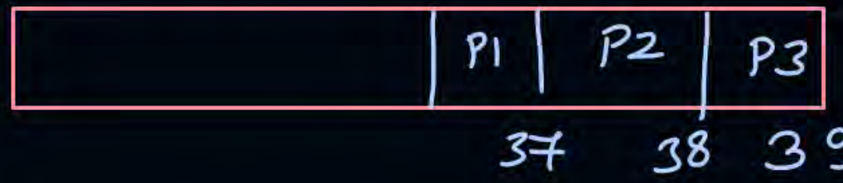
only LRTF



ex:-

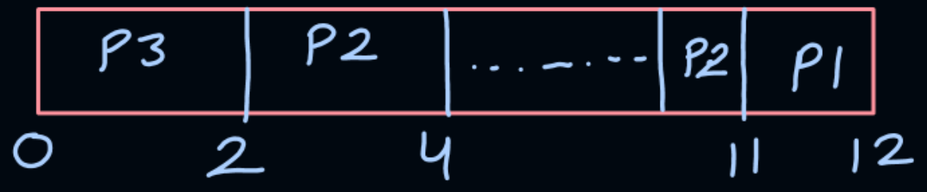
	AT	BT
P1	0	15
P2	1	6
P3	2	18

only LRTF



when all processes arrive before any process completes.

	AT	BT
P1	3	4
P2	2	6
P3	0	2



Here P3 arrives & Completes before any other process arrives. } ⇒ draw full gantt chart

[MCQ]

GATE - PYQ

#Q. Consider three processes (process id 0, 1, 2 respectively) with compute time bursts 2, 4 and 8 time units. All processes arrive at time zero. Consider the longest remaining time first (LRTF) scheduling algorithm. In LRTF ties are broken by giving priority to the process with the lowest process id. The average turn around time is:

A. 13 units

B. 14 units

C. 15 units

D. 16 units

	AT	BT	CT	TAT
P0	0	2	12	12
P1	0	4	13	13
P2	0	8	14	14

$$\text{avg TAT} = \frac{12+13+14}{3}$$

$$= 13$$

Adv. :-

→ none

Disadv :-

→ starvation

→ convoy effect

→ Not practical

Topic : HRRN (Highest Response Ratio Next)

Objective: Not only favors short jobs but decreases the WT of longer jobs.

Topic : HRRN (Highest Response Ratio Next)

Scheduling Criteria: Response Ratio | Tie breaker ⇒ SJF

Type of Algorithm: Non-preemptive

$$\text{Resonse Ratio} = \frac{W + S}{S}$$

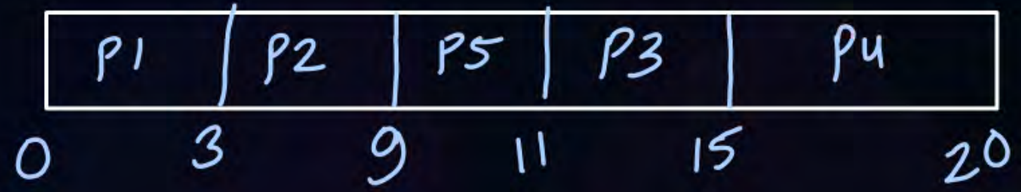
W = Wait Time

S = Service/Burst Time

Topic : HRRN (Highest Response Ratio Next)

Process	Arrival Time	Burst Time
P1	0	3
P2	2	6
P3	4	4
P4	6	5
P5	8	2

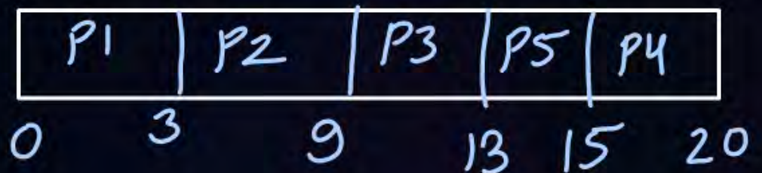
SJF :-



Topic : HRRN (Highest Response Ratio Next)

Process	Arrival Time	Burst Time
P1	0	3
P2	2	6
P3	4	4
P4	6	5
P5	8	2

HRRN :-



At time 9 :-

$$RR(P3) = \frac{5+4}{4} = 2.25 \quad [\text{Highest}]$$

$$RR(P4) = \frac{3+5}{5} = 1.6$$

$$RR(P5) = \frac{1+2}{2} = 1.5$$

At time 13 :-

$$RR(P4) = \frac{7+5}{5} = 2.4$$

$$RR(P5) = \frac{5+2}{2} = 3.5 \quad [\text{Highest}]$$

Adv :-

→ No starvation

→ No Convoy effect

Dis :-

→ Not practical

Topic : Priority Based Algorithm

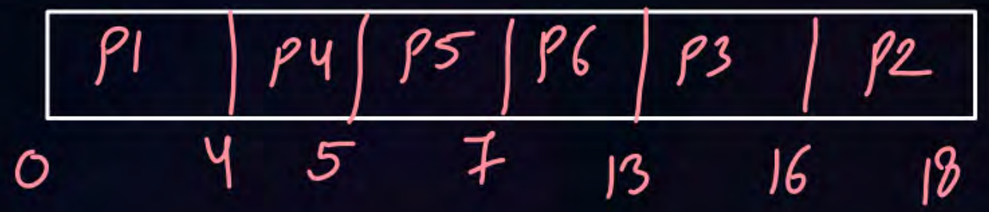
Scheduling Criteria: Highest priority process first | Tie breaker ⇒ given in Question

Type of Algorithm:
- Non-preemptive
- Preemptive

Topic : Priority Based Algorithm

non-preemptive

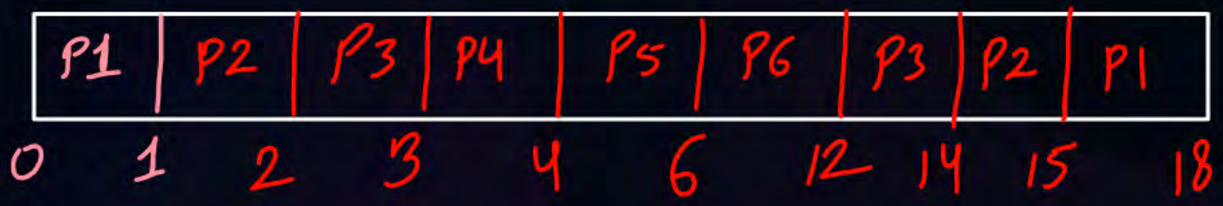
Process	Arrival Time	Burst Time	Priority
P1	0	4	4
P2	1	2	5
P3	2	3	6
P4	3	1	10(Highest)
P5	4	2	9
P6	5	6	7



Topic : Priority Based Algorithm

Preemptive :-

Process	Arrival Time	Burst Time	Priority
P1	0	4	4
P2	1	2	5
P3	2	3	6
P4	3	1	10(Highest)
P5	4	2	9
P6	5	6	7



H.W.

Topic : Priority Based Algorithm Question Non-Preemptive

Process	Arrival Time	Burst Time	Priority
P1	0	7	9
P2	1	3	4
P3	2	5	2
P4	3	2	1 (Highest)
P5	4	6	3
P6	5	1	8

H. W.

Topic : Priority Based Algorithm Question Preemptive

Process	Arrival Time	Burst Time	Priority
P1	0	7	9
P2	1	3	4
P3	2	5	2
P4	3	2	1 (Highest)
P5	4	6	3
P6	5	1	8

Topic : Priority Based Algorithm

Advantages:

1. Better response for real time situations

Disadvantages:

2. Low Priority Processes may suffer from starvation

2 mins Summary

Topic SJF Scheduling

Topic SRTF Scheduling

Topic HRRN Algorithm

Topic Priority based algorithm

/vishvadeepsir

Happy Learning

THANK - YOU