CS & IT ENGINEERING

Operating System

CPU Scheduling

Lecture -2

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Recap of Previous Lecture

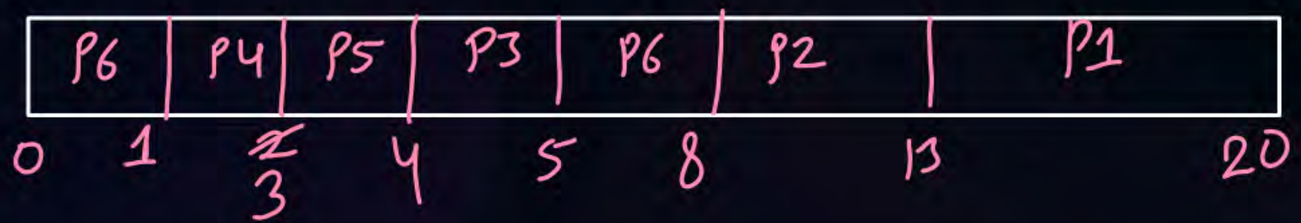
- **Topic** Process Scheduling
- **Topic** Process Scheduling Algorithms
- **Topic** FCFS Scheduling
- **Topic** SJF Scheduling

Topics to be Covered

- Topic: LJF Scheduling
- Topic: LRTF Algorithms
- Topic: HRRN
- Topic: Priority Based Scheduling

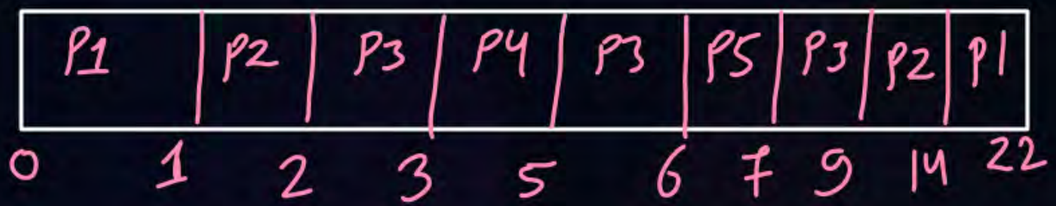
Topic : SRTF (Shortest Remaining Time First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time	RT
P1	4	7				9
P2	5	5				3
P3	3	1				1
P4	1	2				0
P5	2	1				1
P6	0	4				0



Topic : SRTF (Shortest Remaining Time First)

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



Topic : SRTF (Shortest Remaining Time First)

Advantages:

and min avg. TAT

1. Minimum average waiting time among all scheduling algorithm
2. Better throughput in continue run

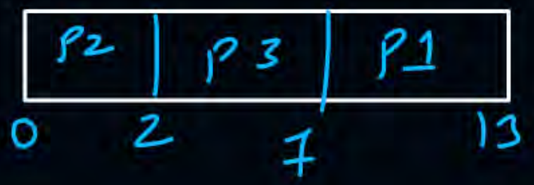
Disadvantages:

1. No practical implementation because Burst time is not known in advance
2. Longer Processes may suffer from starvation

Ques)

Pid	AT	BT
P1	0	6
P2	0	2
P3	0	5

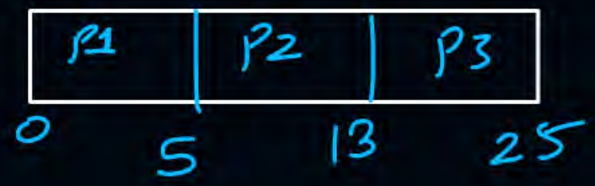
SRTF :-



Ques)

Pid	AT	BT
P1	0	5
P2	1	8
P3	3	12

SRTF :-



[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: Longest BT first | Tie breaker ⇒ FCFS

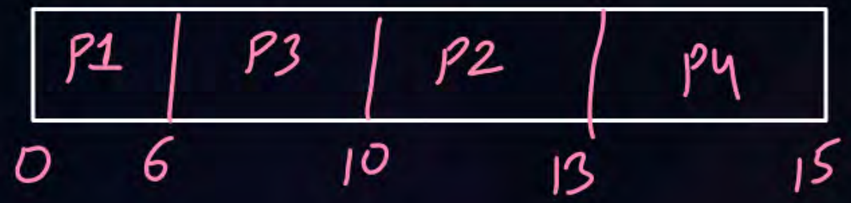
Type of Algorithm: Non-preemptive

→ suffers from convoy effect

→ —11— starvation

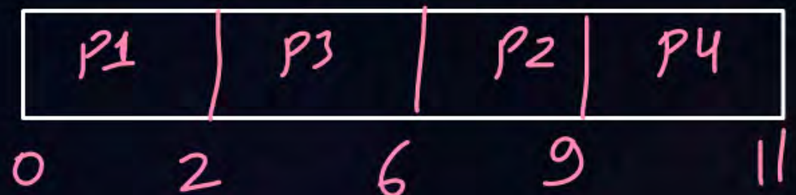
Topic : LJF (Longest Job First)

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			



Topic : LRTF (Longest Remaining Time First)

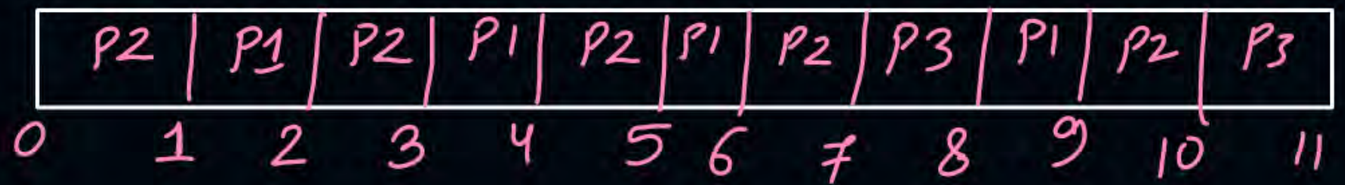
Scheduling Criteria: Biggest BT first | Tie breaker ⇒ FCFS

Type of Algorithm: Preemptive

Ques)

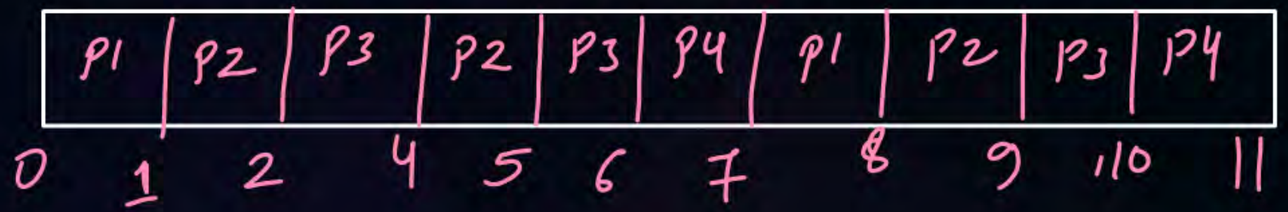
P id	AT	BT
P1	0	4
P2	0	5
P3	0	2

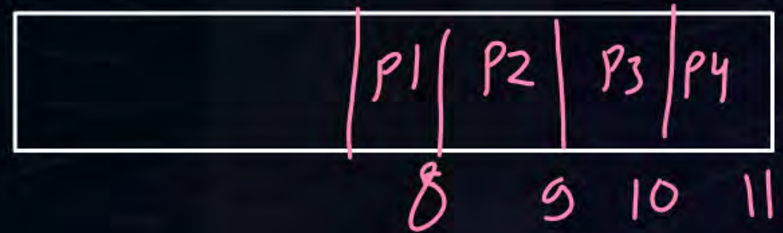
P1	4 3 2 1
P2	5 4 3 2 1
P3	2 1



Topic : LRTF (Longest Remaining Time First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	2	8		
P2	1	3	9		
P3	2	4	10		
P4	3	2	11		





[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

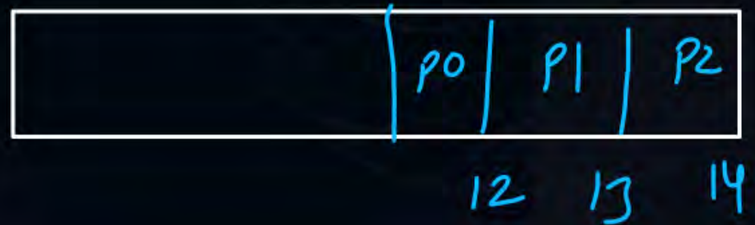
B. 14 units

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

avg = 13



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: Highest Respons Ratio first | Tie breaker ⇒ SJF

Type of Algorithm: Non – preemptive

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

W = Wait Time

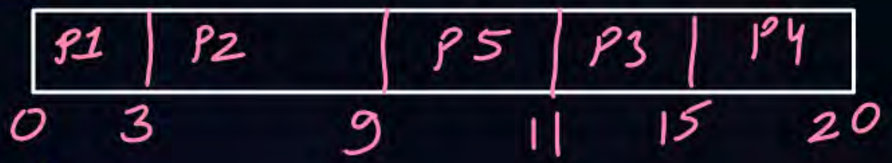
S = Service/Burst Time

→ No starvation

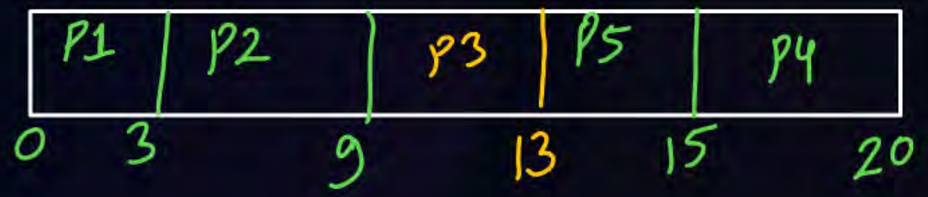
Topic : HRRN (Highest Response Ratio Next)

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

SJF :-



HRRN :-



At time 9 :-

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

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

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

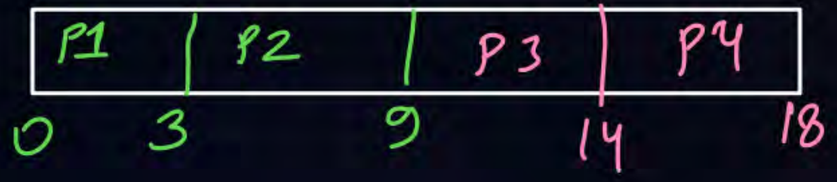
At time 13 :-

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

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

Topic : HRRN (Highest Response Ratio Next)

Process	Arrival Time	Burst Time
P1	0	3 ✗
P2	1	6 ✗
P3	2	5
P4	4	4



At time 3:-

$RR(P2) = \frac{2+6}{6} = \frac{8}{6} = 1.33$ (Highest)

$RR(P3) = \frac{1+5}{5} = 1.2$

At time 9:-

$RR(P3) = \frac{7+5}{5} = 2.4$ (Highest)

$RR(P4) = \frac{5+4}{4} = 2.25$

Topic : Priority Based Algorithm

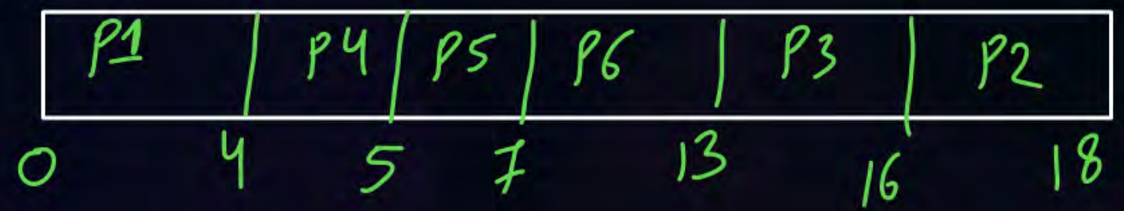
Scheduling Criteria: Highest Priority process first | Tie breaker ⇒ Given in Question

Type of Algorithm: Preemptive and non-preemptive

Topic : Priority Based Algorithm

Non-preemptive

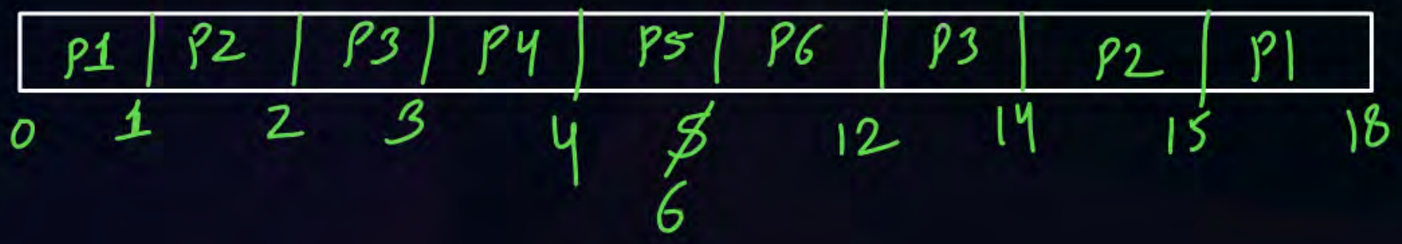
Process	Arrival Time	Burst Time	Priority
P1	0	4	4
P2	1	2	5
P3	2	3	6
P4	3	1	10(Highest)
P5	4	2	9
P6	5	6	7



Topic : Priority Based Algorithm

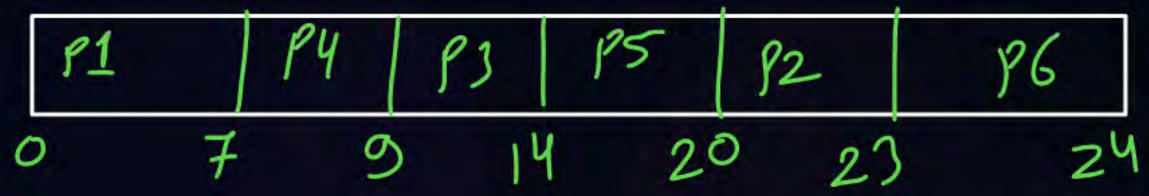
Preemptive

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



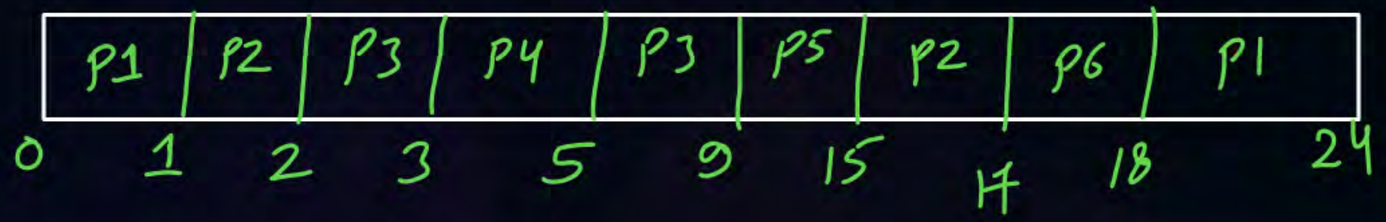
Topic : Priority Based Algorithm Question Non-Preemptive

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



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

Soln ⇒ Aging (possible with dynamic priority of processes)

H.W

Ques)

Pid	AT	BT
P1	0	15
P2	2	1
P3	6	2
P4	10	3

FCFS,
SJF,
SRTF

Ques)

Pid	AT	BT	Priority
P1	0	9	5
P2	1	1	4
P3	4	3	3
P4	9	1	2
P5	11	2	1 (Highest)

1. Priority based for Premp. & non-Premp.
2. FCFS
3. SJF
4. SRTF

2 mins Summary

Topic LJF Scheduling

Topic LRTF Algorithms

Topic HRRN

Topic Priority Based Scheduling

Happy Learning

THANK - YOU