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CPU Scheduling Algo: SRTF, HRRN & Priority Based

Comprehensive Course on Operating System for GATE - 2024/25

Vishvadeep Gothi • Lesson 6 • Apr 25, 2023

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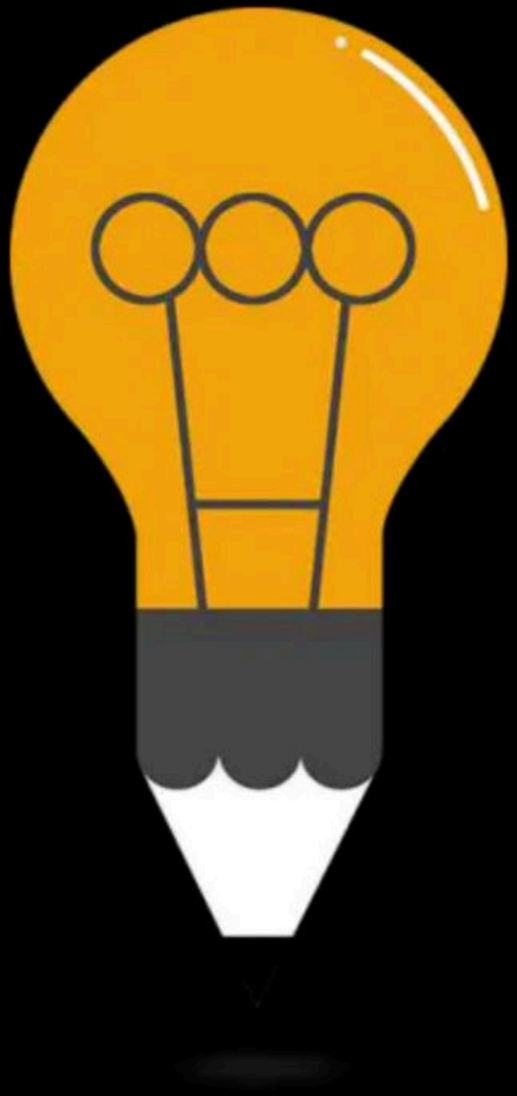

Operating System
CPU Scheduling
FCFS SJF SRTF

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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

SRTF (Shortest Remaining Time First)

Criteria:

Mode:

SRTF (Shortest Remaining Time First)

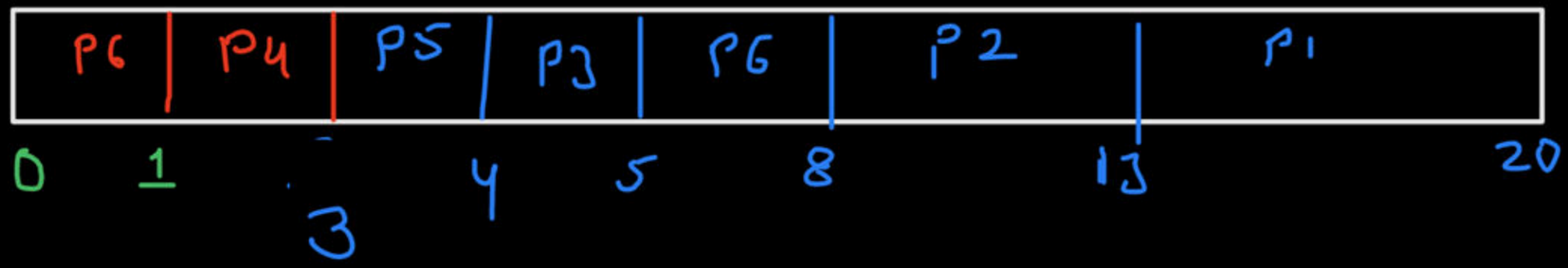
Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	8			
P2	1	5			
P3	2	1			
P4	3	2			
P5	4	1			
P6	5	4			

SRTF (Shortest Remaining Time First)

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

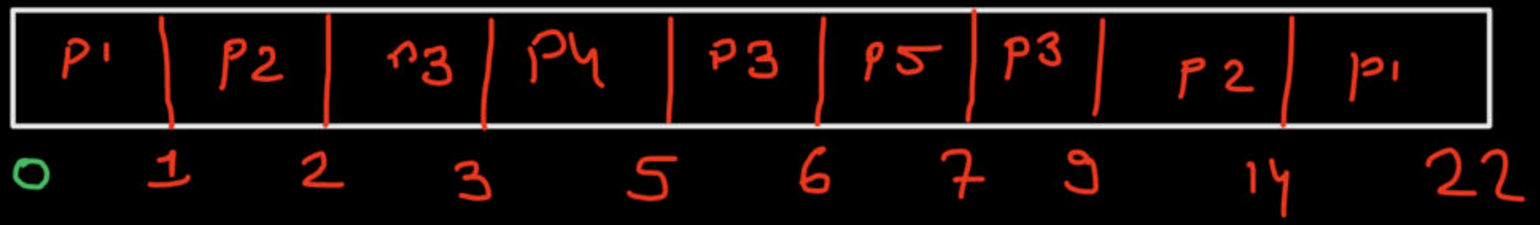
SRTF (Shortest Remaining Time First)

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



SRTF (Shortest Remaining Time First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time	R_T
P1	0	9	22	22	13	0
P2	1	6	14	13	7	0
P3	2	4	9	7	3	0
P4	3	2	5	2	0	0
P5	6	1	7	1	0	0



SRTF (Shortest Remaining Time First)

Advantages:

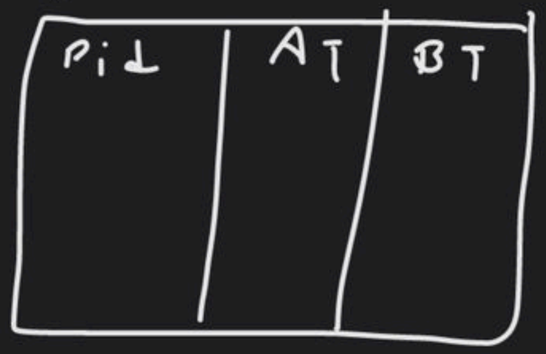
1. Minimum average waiting time among all scheduling algorithm
2. Better throughput in continue run

Disadvantages:

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

↳ no fairness

- If asked, for given process scenario



what can be the min. avg. waiting time?

⇓

Apply SRTF

- If asked, what can be the min. avg waiting time for non-preemptive execution of processes ⇒ Apply SJF

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LJF (Longest Job First)

Criteria: Largest BT first | Tie breaker => FCFS

Mode: Non-preemptive

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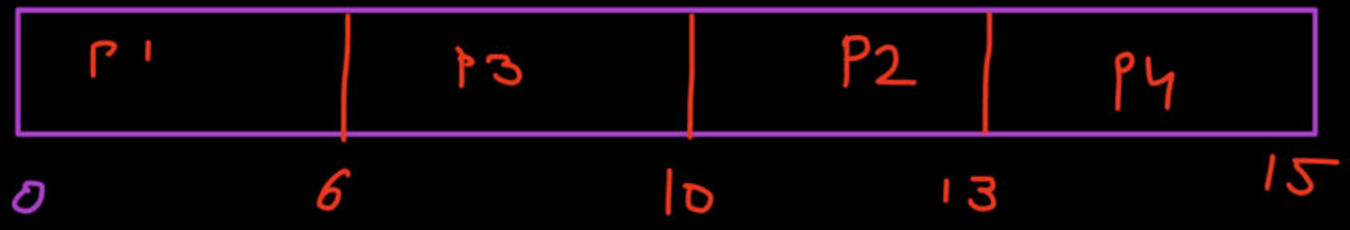
LJF (Longest Job First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	6	6	6	0
P2	0	3	13	13	10
P3	0	4	10	10	6
P4	0	2	15	15	13



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LJF (Longest Job First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	2	2	2	0
P2	1	3	9	8	5
P3	2	4	6	4	0
P4	3	2	11	8	6

LRTF (Longest Remaining Time First)

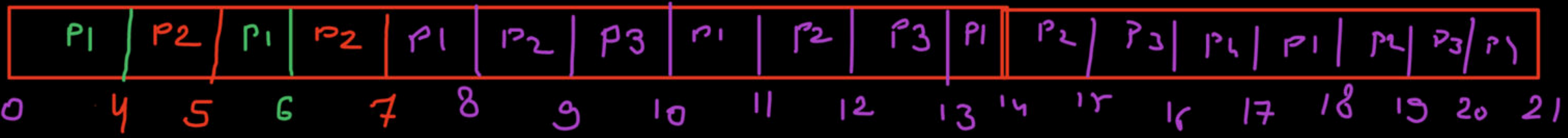
Criteria: largest BT first | Tie breaker => FCFS

Mode: Preemptive

LRTF (Longest Remaining Time First)

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time	RT
P1	0	9	18	18	9	0
P2	0	6	19	19	13	4
P3	0	4	20	21	16	9
P4	0	2	21	21	19	16

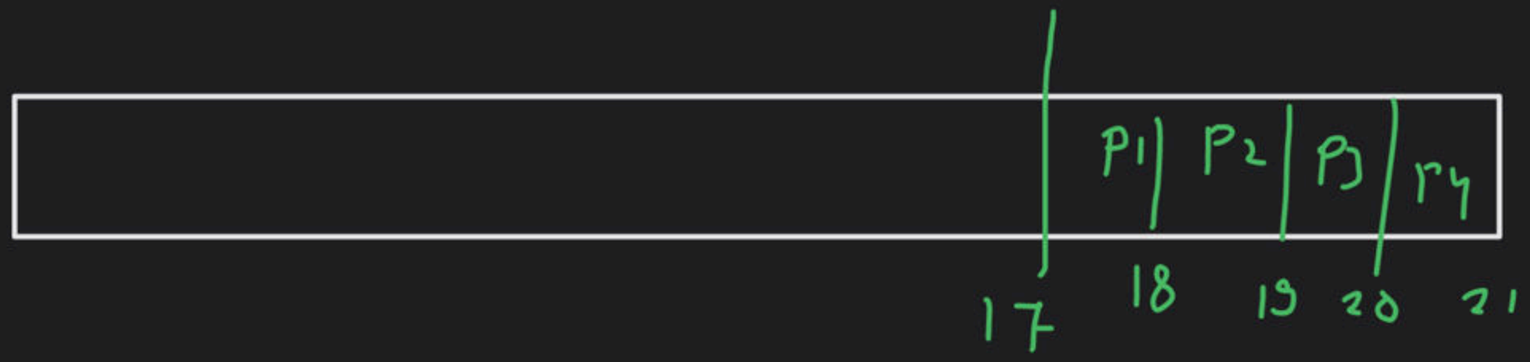
	RQ
0	P1, P2, P3, P4



no. of context switches = 17 (excluding before first process & after last process)

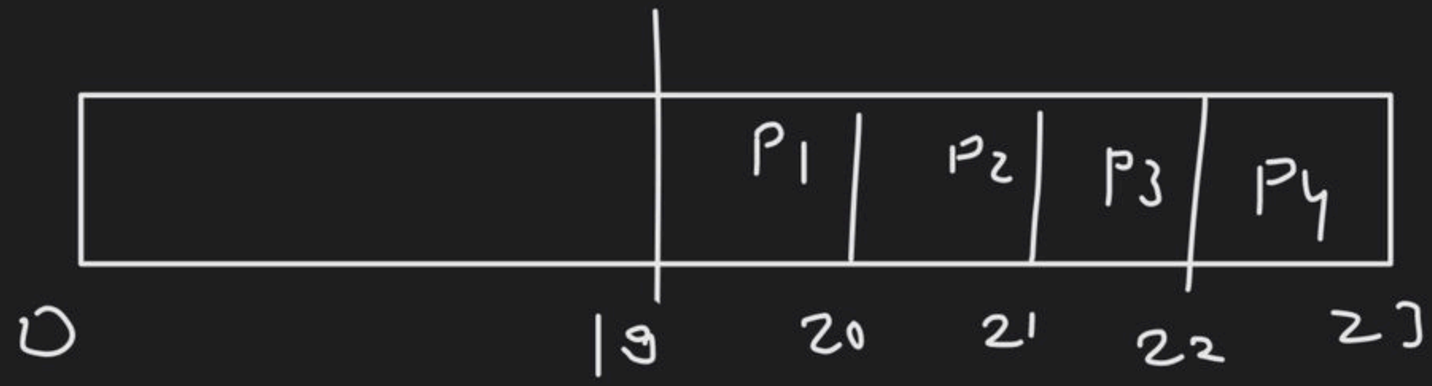
→ LJF & LRTF suffer from starvation

P_1	9	1
P_2	6	1
P_3	4	1
P_4	2	1



Ex:-

	AT	BT	
P1	0	6	5
P2	6	8	7
P3	0	4	3
P4	0	5	4

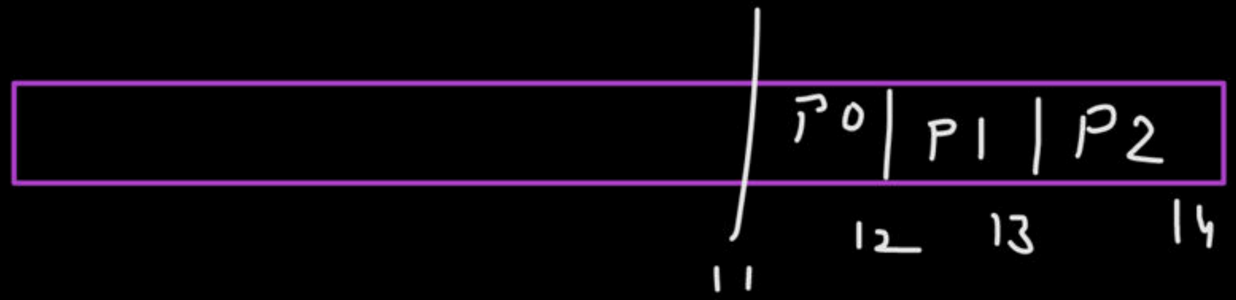


Trick does not work when a process completes before any other process arrives.

Question GATE-2006

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



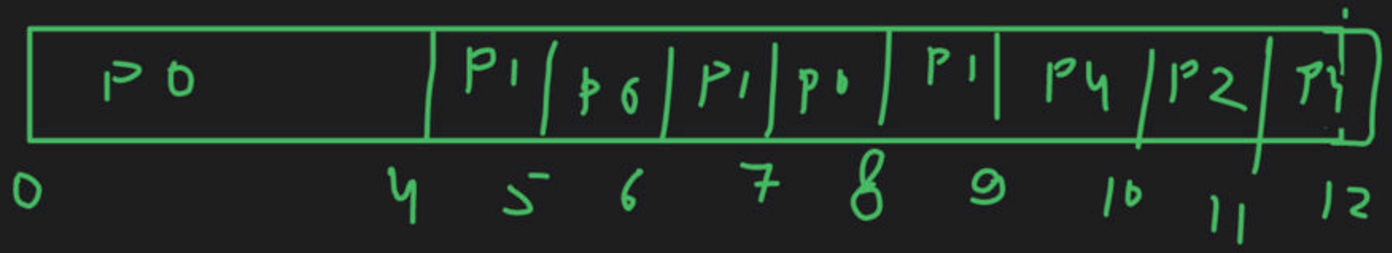
	AT	BT	CT	TAT
P0	0	2	12	12
P1	0	4	13	13
P2	0	8	14	14

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

= 13

Ques) LRTF

	AT	BT
P0	0	6
P1	1	3
P2	2	1
P4	9	2



HRRN (Highest Response Ratio Next)

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

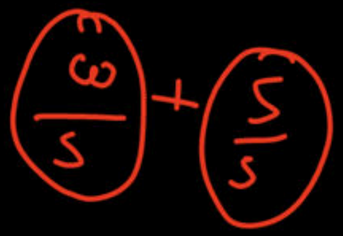
Criteria: Response Ratio

Tie breaker => SJF

Mode: Non-preemptive

Response ~~Response~~ $Ratio = \frac{W+S}{S}$

$\frac{W+S}{S}$



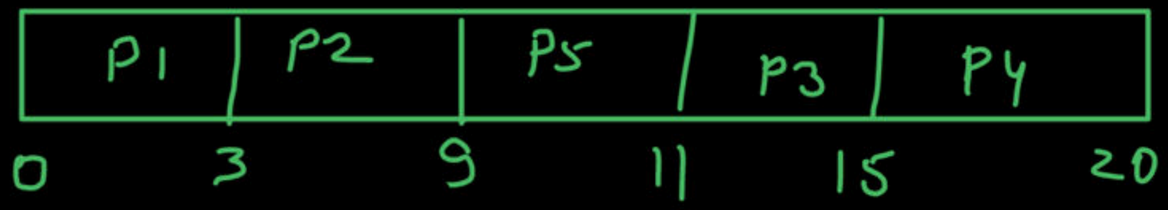
W = Wait Time

S = Service/Burst Time

HRRN (Highest Response Ratio Next)

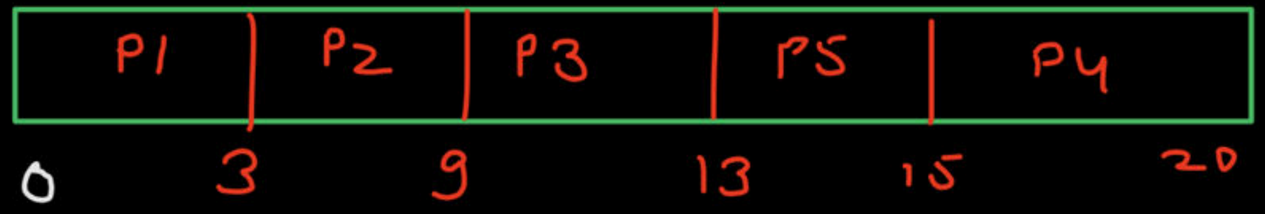
Process	Arrival Time	Burst Time
P1	0	3
P2	2	6
P3	4	4
P4	6	5
P5	8	2

SJF:-



HRRN (Highest Response Ratio Next)

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



At time 9:-

$R.R.(P3) = \frac{5+4}{4} = 2.25$ (highest)

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

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

At time 13:-

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

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

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Happy Learning.!