COMPUTER SCIENCE & I.T

OPERATING SYSTEMS

CPU Scheduling

LECTURE 04

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- PRIORITY SCHEDULING,
- MLFQSA

Q.3

Consider the following processes, with the arrival time and the length of the CPU burst given in milliseconds. The scheduling algorithm used is preemptive Shortest Remaining-Time First (SRTF).

30/10/2022

Session - II

Process	Arrival Time	Burst Time
P1	0	10
P2	3	6
P3	7	1
P4	8	3

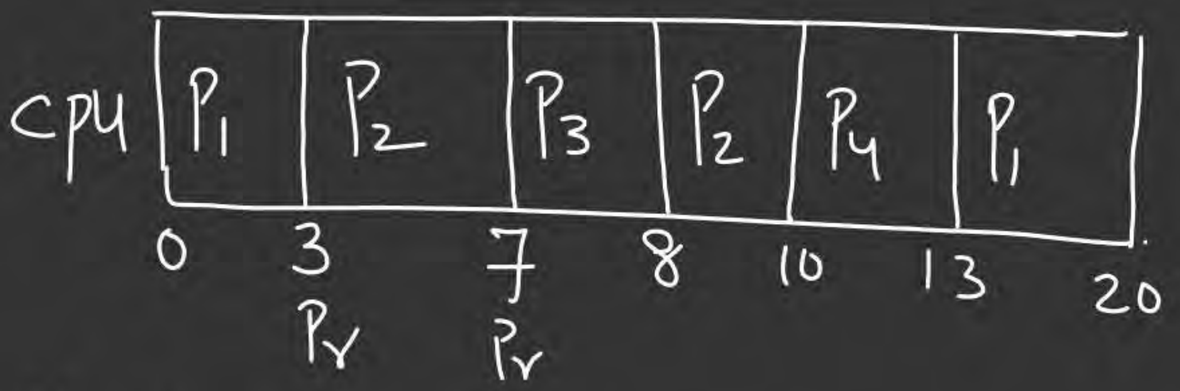
The average turnaround time of these processes is _____ milliseconds.

NAT

2M

P.No	A.T	B.T
1	0	~~10~~ 7 ✓
×2	3	~~6~~ 2 ✓
×3	7	1
×4	8	3 ✓

SRTF :



$$\text{Av. TAT} = \frac{20+7+1+5}{4} = \frac{33}{4} = 8.25$$

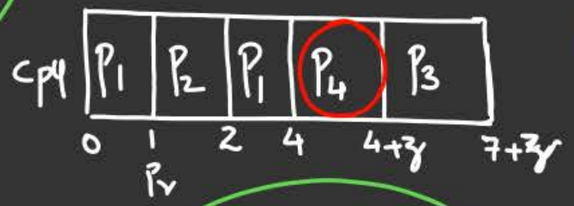
Q.4 Consider the following four processes with arrival times (in milliseconds) and their length of CPU bursts (in milliseconds) as shown below:

Process	P_1	P_2	P_3	P_4
Arrival time	0	1	3	4
CPU burst time	3	1	3	Z

These processes are run on a single processor using preemptive Shortest Remaining Time First (SRTF) Scheduling Algorithm. If the average waiting time of the processes is 1 millisecond, then the value of Z is

SRTF : Av. WT = 1

P.No	AT	B.T
1	0	~~2~~
2	1	1
3	3	3
4	4	3



i. if $(3 < 3)$ ✓

P.N	TAT	WT
1	4	1
2	1	0
3	4+3	1+3
4	3	0

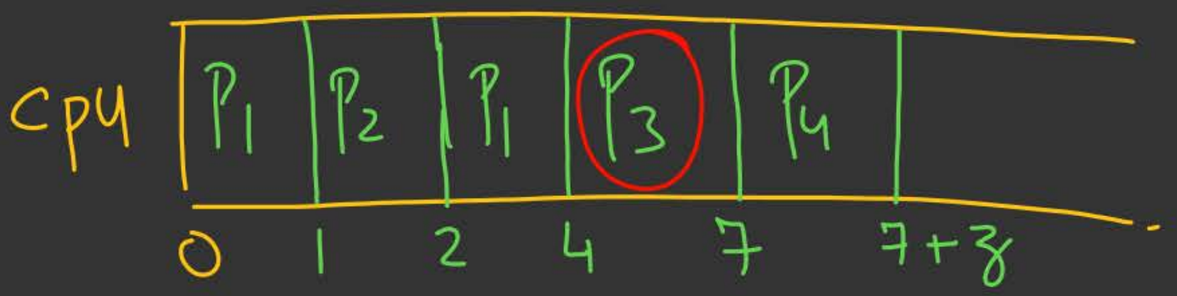
$Av.WT = \frac{1+0+1+3+0}{4}$

$4 = 3+2$

$\therefore 3 = 2$ ✓

2m

ii. if $(3 > 3)$ ×



P.No	TAT	WT
1	4	1
2	1	0
3	4	1
4	3+3	3
		5

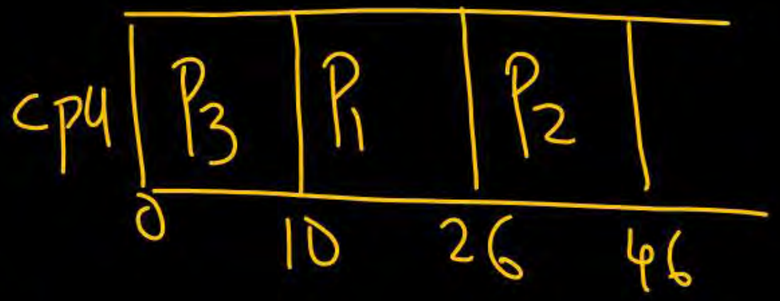
$Av.WT = \frac{5}{4} = 1.25$ ✓

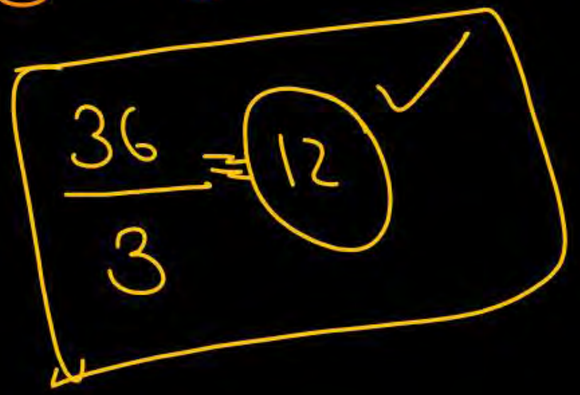
Q.5 Three Processes arrive at time zero with CPU bursts of 16, 20 and 10 milliseconds. If the scheduler has prior knowledge about the length of the CPU bursts, the minimum achievable average waiting time for these three processes in a Non-Preemptive Scheduler (rounded to nearest integer) is _____ milliseconds. (NAT)

SJF

WT	TAT	P.NO	A.T	B.T
10	26	1	0	16
26	46	2	0	20
0	10	3	0	10

36





5) Highest Response Ratio Next (HRRN)

Sel. Criteria: Response Ratio (RR) $= \frac{W+S}{S}$

W = waiting time of Process so far

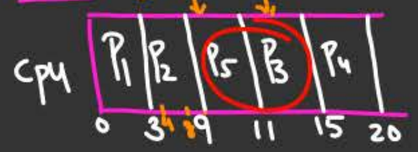
S = Service Time

Mode of opn: Non-Preemptive

[Not only favor Shorter Process, but also limit the waiting time of longer Process]

P.No	A.T	B.T
1	0	3
2	2	6
3	4	4
4	6	5
5	8	2

SJF: (favor shorter Process, Starv. to P_3)



@ t_0: ~~P_1~~; ✓

@ t_3: ~~P_2~~; ✓

@ t_9: ~~P_3~~; P_4; P_5

@ t_{13}: P_4; P_5

$RR_4 = \frac{7+5}{5} = \frac{12}{5}$

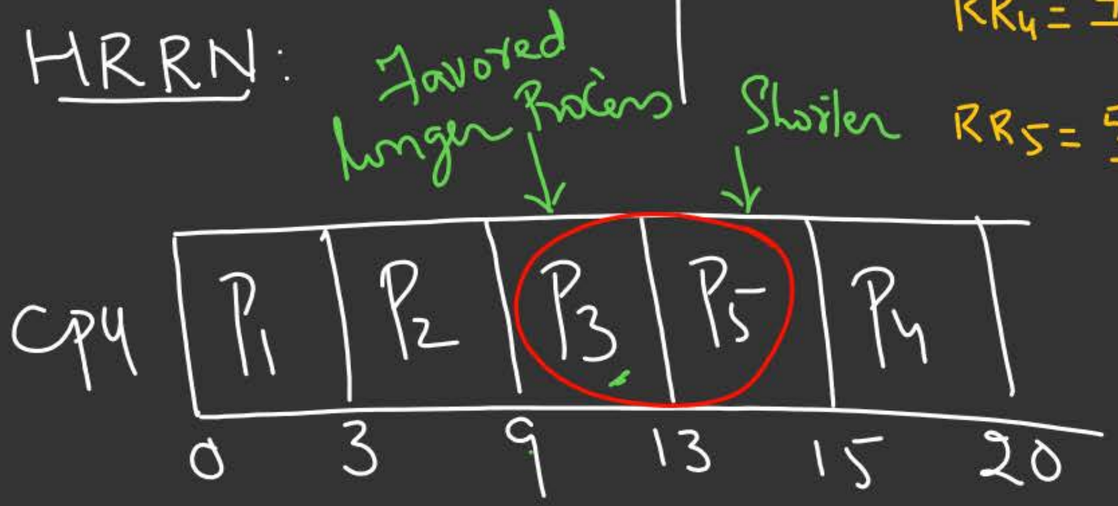
$RR_5 = \frac{5+2}{2} = \frac{7}{2}$ ✓

$RR_3 = \frac{5+4}{4} = \frac{9}{4}$ ✓

$RR_4 = \frac{3+5}{5} = \frac{8}{5}$

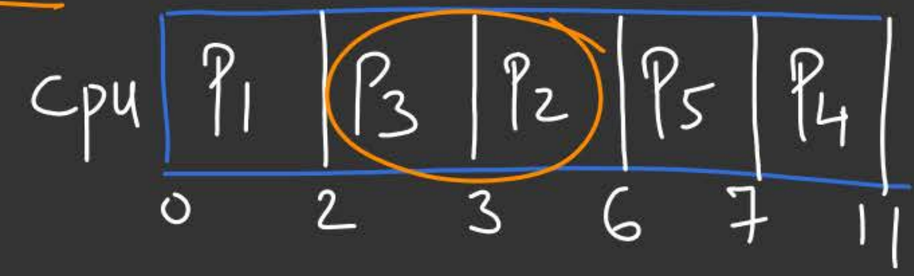
$RR_5 = \frac{1+2}{2} = \frac{3}{2}$

HRRN:

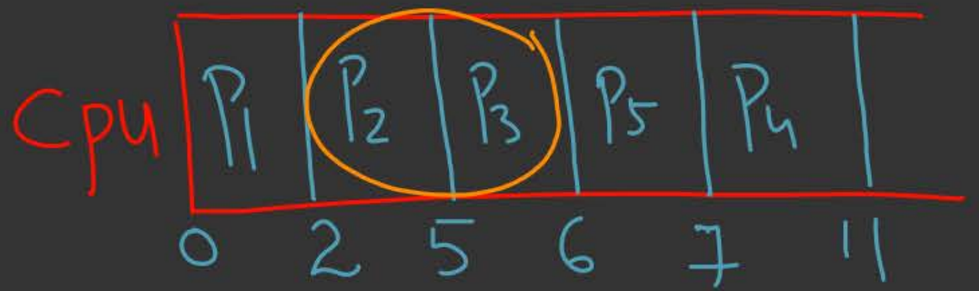


P.No	A.T	B.T
1	0	2
2	1	3
3	2	1
4	3	4
5	5	1

SJF



HRRN:



@t_0: ~~P1~~;

@t_2: ~~P2~~; P3;

$RR_2 = \frac{1+3}{3} = \frac{4}{3}$ ✓

$RR_3 = \frac{0+1}{1} = 1$

@t_5: ~~P3~~; P4; P5

$RR_3 = \frac{3+1}{1} = 4$ ✓

$RR_4 = \frac{2+4}{4} = 6/4 = 1.5$

$RR_5 = \frac{0+1}{1} = 1$

@t_6: P4; P5

$RR_4 = \frac{3+4}{4} = \frac{7}{4} = 1.75$

$RR_5 = \frac{1+1}{1} = 2$ ✓

6. Priority based Scheduling :

- indicate the level of importance of the process;
- is Computed as an integer value ;

Sel. Criteria : Priority ✓

Mode of opn : N-Pr | Pr

f(Type ; Size ; Resources-use, - - -)

Int_value = Priority

Static → Starvation

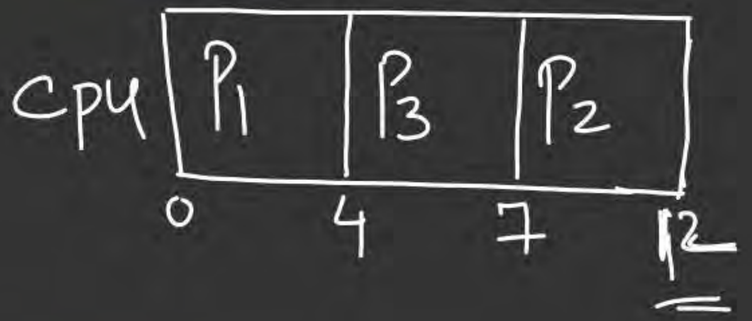
Dynamic → Aging Algo

"The working of Priority based Scheduling is same as SJF/SRTF, except that we use Priority value instead of B.T"

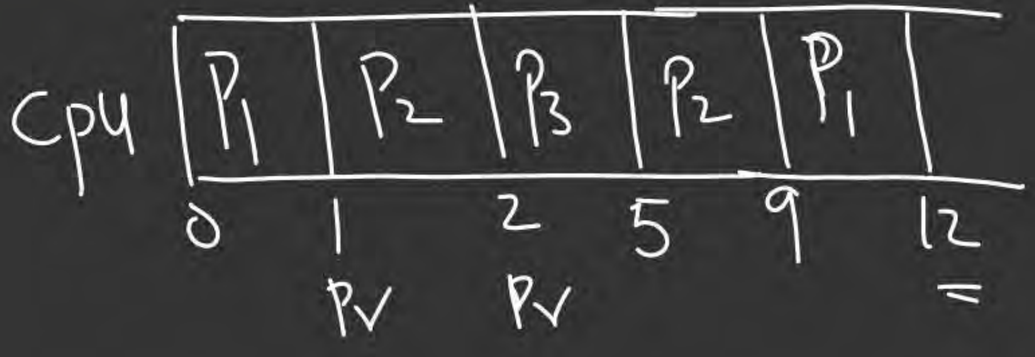
Prio	P.No	A.T	B.T
4	1	0	4
5	2	1	5
8	3	2	3

Higher no. is higher Priority

1) N-Pr-Prio

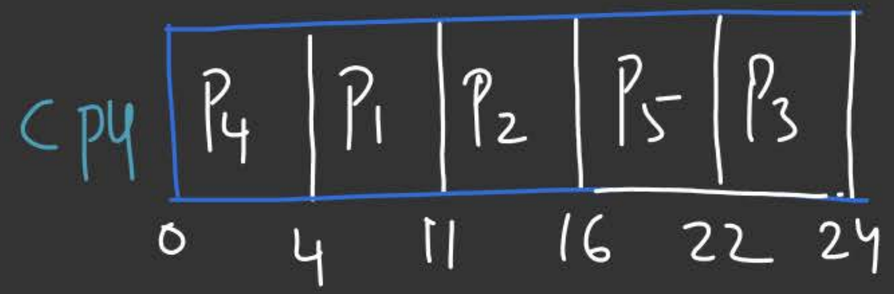


2) Pr-Prio



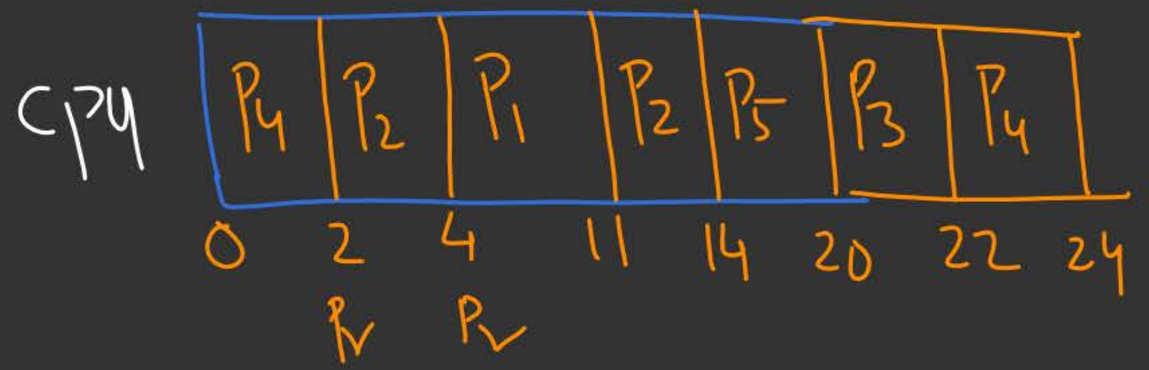
Prio	P.No	A.T	B.T
× 8	1	4	7
7	2	2	5
6	3	6	2
4	4	0	4
7	5	3	6

N-Pr-Prio



Pr-Prio

<4; 2; 1; 2; 5; 3; 4>



Q.6

(**)

2m

Consider a System with Preemptive Priority based Scheduling with 3 Processes P1, P2, P3 having infinite instances of them. The instances of these Processes arrive at regular intervals of 3, 7 & 20 ms respectively. The priority of the Process instances is the inverse of their periods. Each of the Process instance P1, P2, P3 consumes 1, 2 & 4 ms of CPU time respectively. The 1st instance of each Process is available at 1 ms. What is the Completion time of the 1st instance of Process P3? (NAT)

	P.No	P.NO	A.T	B.T	Period	Instances Availability
H	P1	1	1	1	3	1; 4; 7; 10; ....
	P2	2	1	2	7	1; 8; 15; ....
L	P3	3	1	4	20	1; 21; 41, ...

Idle-time = 1 unit

$\therefore$ $\ell_1 = 1/52$

End of Session : 30/10/2022

THANK YOU!