CS & IT
ENGINEERING

OPERATING SYSTEMS

CPU Scheduling

Lecture No. 5

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TOPICS TO BE COVERED

- CPU Scheduling Techniques
- Priority Scheduling
- Round Robin; MLQ

Priority based Scheduling

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

Pre-Priority :

CPU	P_1	P_2	P_3	P_4	P_3	P_5	P_3	P_2	P_1	
	0	1	2	3	4	5	9	12	14	15

$$\text{Av. TAT} = \frac{15+13+10+1+4}{5} = \frac{43}{5} = 8.6$$

Av. WT =

Performance :

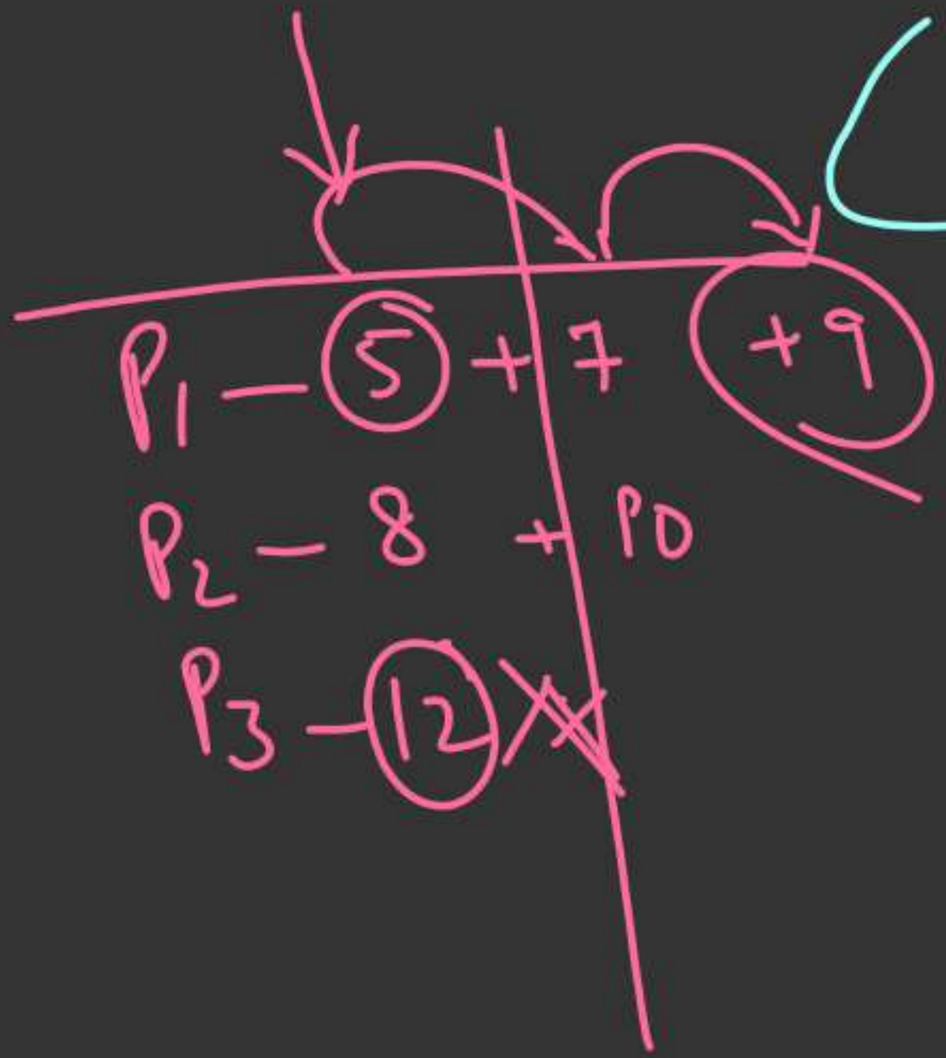
Causes Starvation to Low priority Processes;

Static Priority

Dynamic Priorities

Inc. the priority of Processes @ regular intervals of Time

< AGING - ALGO. >



Q.

**

G

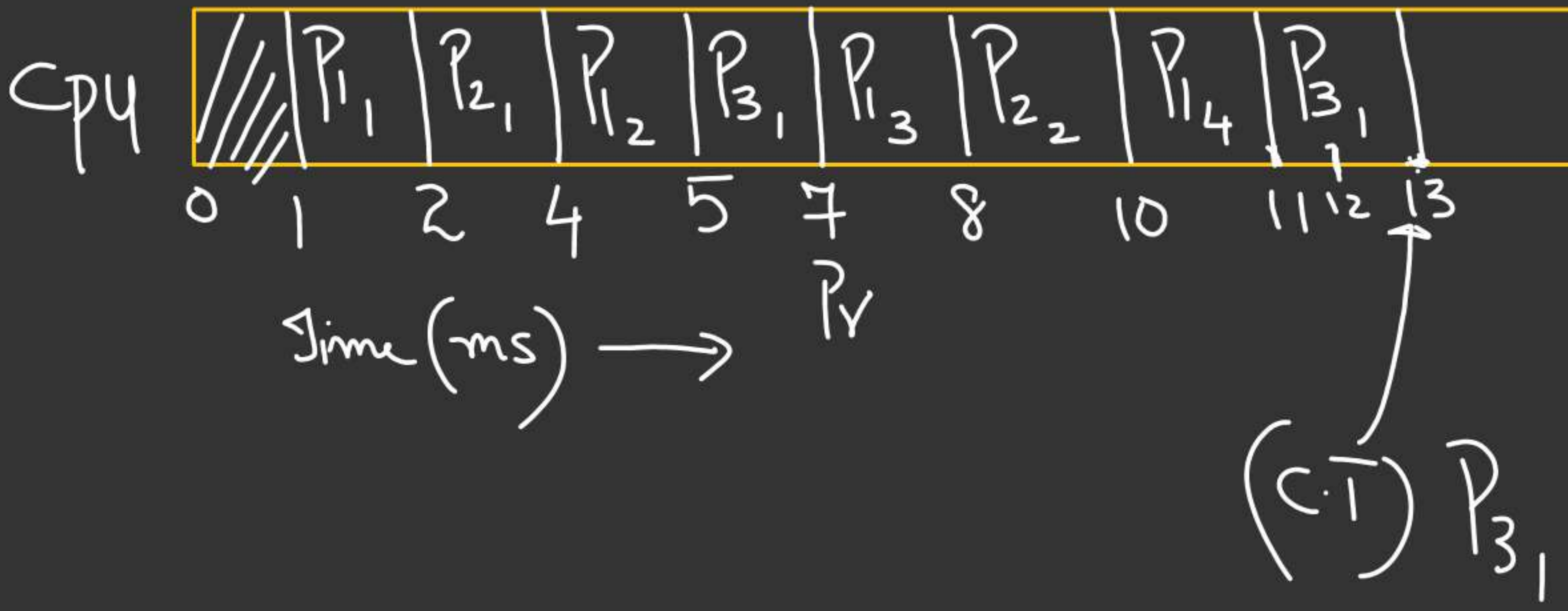
Consider a System with Preemptive Priority based Scheduling with 3 Processes P1, P2, P3 having infinite instances of them. The instances of these Processes arrive at regular intervals of 3, 7 & 20 ms respectively. The priority of the Process instances is the inverse of their periods. Each of the Process 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?

	Prio	Perid	P.No	A.T	B.T	other Instances
(H)	1/3	3	1	1	1	< 4 ; 7 ; 10 ; 13 ; 17 ... >
	1/7	7	2	1	2	< 8 ; 15 ; 22 ; - - - >
(L)	1/20	20	3	1	4	< 21 ; 41 ; 61 ; - - - >

Pre - Prio

Q: The first Instance of P_3 completes at the end of 12/13 ms ; (NAT)

R.Q ~~P_{1_1}~~ ; ~~P_{2_1}~~ ; ~~P_{3_1}~~ ; ~~P_{1_2}~~ ; ~~P_{1_3}~~ ; P_{3_1} ; ~~P_{2_2}~~ ; ~~P_{1_4}~~



Yr

2000 1st Jan

Feb

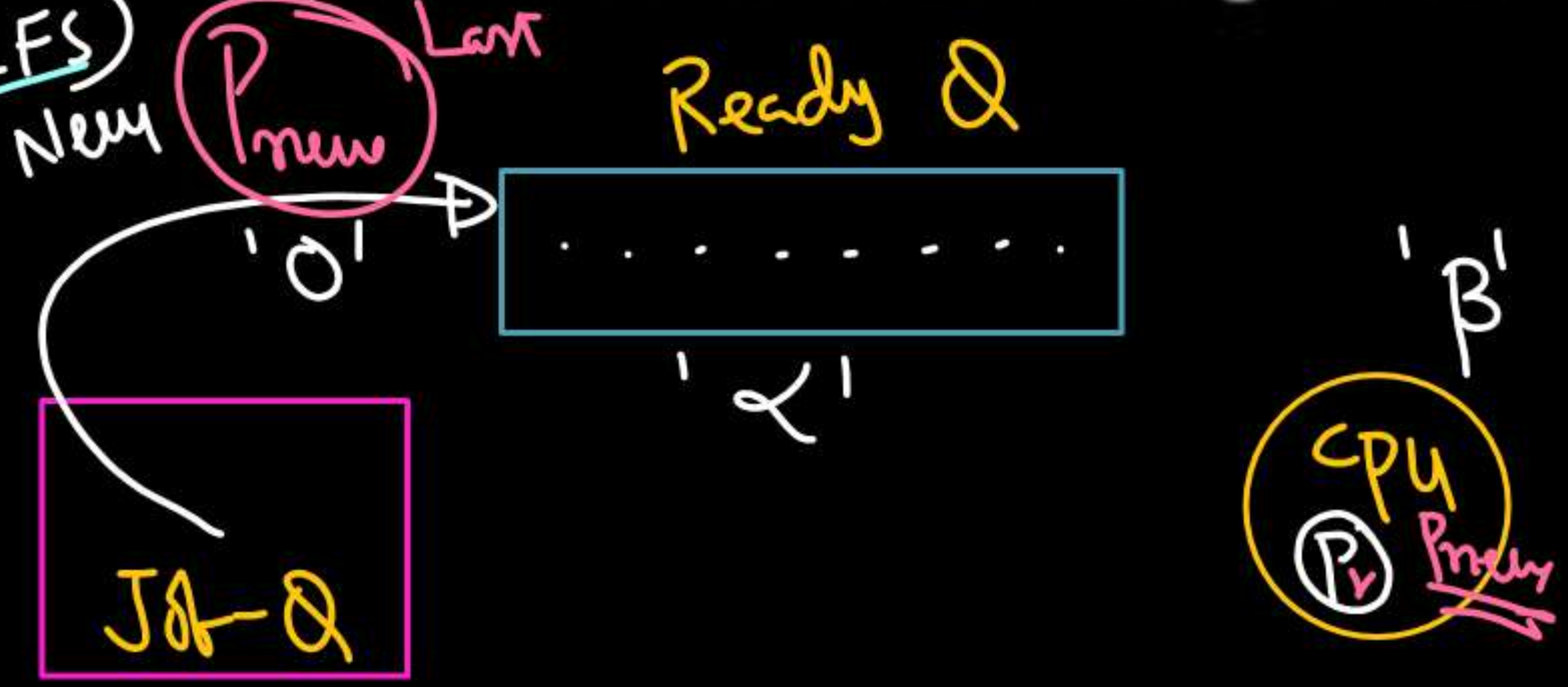
2000 31st dec

Q.

Consider a System using Preemptive Priority based scheduling with dynamically changing priorities. On its arrival a Process is assigned a priority of zero and Running Process Priority increases at the rate of ' β ' and Priority of the Processes in the ready Q increases at the rate of ' α '. By dynamically changing the values of α and β one can achieve different Scheduling disciplines among the Processes. What discipline will be followed for the following conditions.

1. $\beta > \alpha > 0$: (FCFS)
2. $\alpha < \beta < 0$:

(LCFS / LIFO)



a) $\beta > \alpha > 0$

b) $\boxed{\alpha < \beta} < 0$

* ⑦ Round Robin : used in PreEmp - M·Pr - TimeShared O.S

Criteria : A·T + Time Quantum < Goal : Improve Interactiveness/Responsiveness >

TQ | Time Slice :

Mode of o/pn : PreEmptive

TQ = 2

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

R.Q ~~P1~~; ~~P2~~; ~~P3~~; ~~P1~~; ~~P2~~; ~~P3~~; ~~P2~~

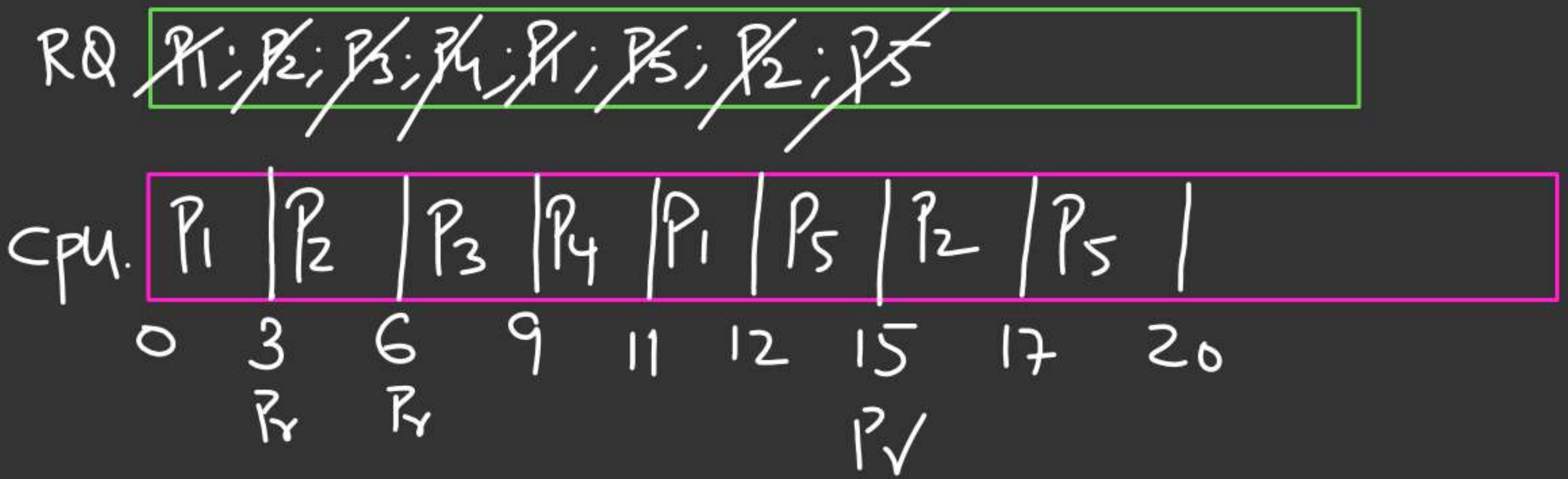
cpu

P1	P2	P3	P1	P2	P3	P2

0 2 4 6 8 10 11 12

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

TQ = 3



RQ ~~P1~~ ; ~~P2~~ ; ~~P3~~ ; ~~P4~~ ; ~~P1~~ ; ~~P5~~ ; ~~P2~~ ; ~~P5~~

P1	P2	P3	P4	P1	P5	P2	P5

CPU.

0 3 6 9 11 12 15 17 20

Pr (3) Pr (6) P✓ (15)

P.No	A.T	B.T
1	4	4
2	15	5
3	8	6
4	3	3
5	5	4

TQ = 2

RQ: ~~P4~~; ~~P1~~; ~~P5~~; ~~P4~~; ~~P1~~; ~~P3~~; ~~P5~~; ~~P3~~; ~~P2~~; ~~P3~~; P2

CPU	▨	P4	P1	P5	P4	P1	P3	P5	P3	P2

0 3 5 7 9 10 12 14 16 18 20

Pr (5) Pr (7) Pr (9) Pr (14) Pr (18) Pr (20)

P3	P2	P2

20 22 24 25

Pr (24)

TQ = 2 ; Multiple-IOD

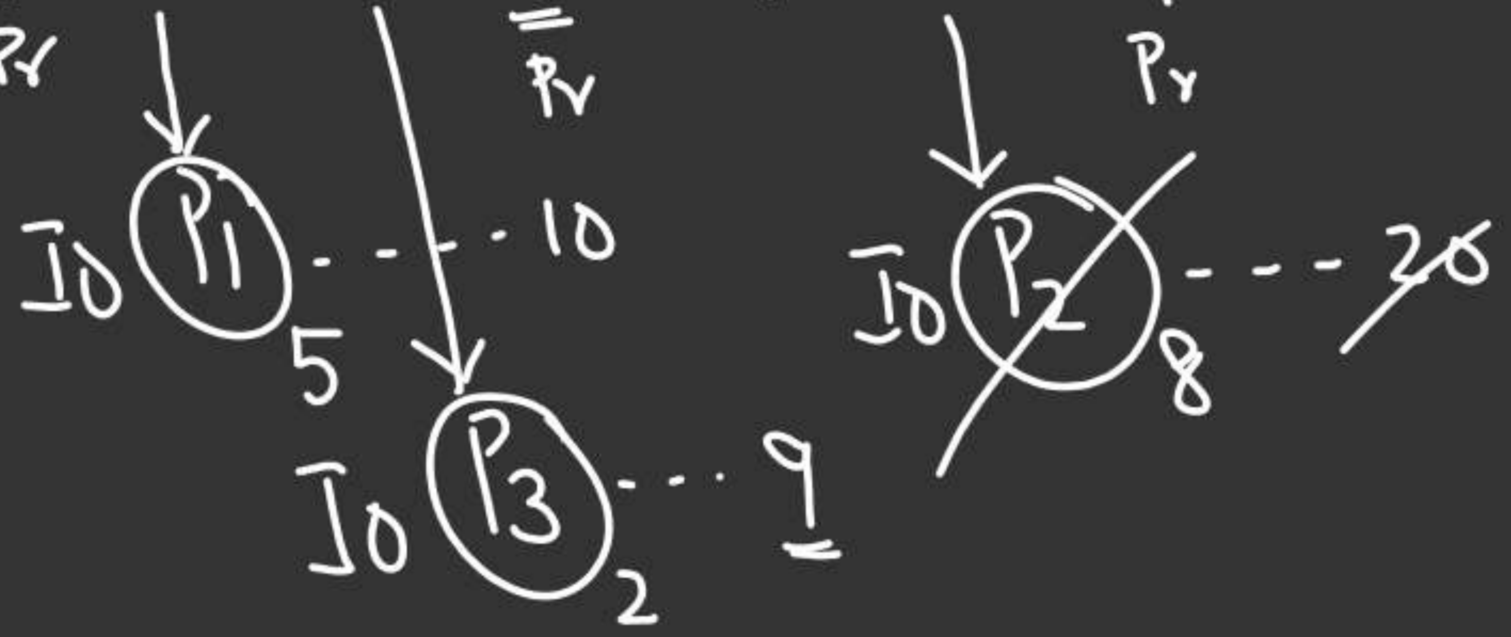
P.NO	A.T	<BT ; IOBT ; BT>
1	0	<3 ; 5 ; 4>
2	2	<5 ; 8 ; 1>
3	3	<2 ; 2 ; 2>

RQ: ~~P1~~ ; ~~P2~~ ; ~~P1~~ ; ~~P3~~ ; ~~P2~~ ; ~~P3~~ ; ~~P2~~ ; ~~P1~~ ; P1 ; P2

Cpu	P1	P2	P1	P3	P2	P3	P2	P1	P1	▨	P2

0 2 4 5 7 9 11 12 14 16 20 21

2 Pr, 4 Pr, 9 Pr, 14 Pr



Q.

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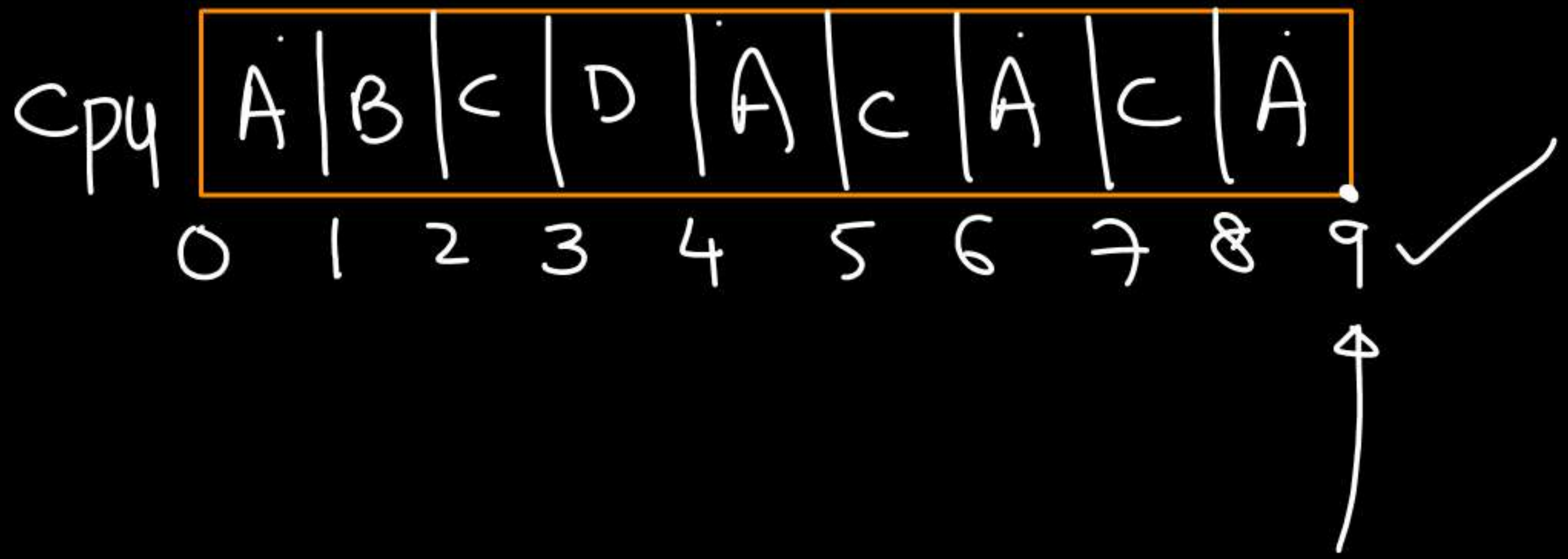
Consider a set of 4 Processes (A, B, C, D) arriving in the order at time 0^+. Their Burst Time requirements are 4, 1, 8, 1 respectively using Round Robin scheduling with time quantum of 1 unit, The Completion time of Process A is ______.

R.Q: A ; ~~B~~ ; C ; ~~D~~ ; A ; C



Q. Consider a System with ‘n’ Processes arriving at time 0^+ with substantially large Burst Times. The CPU scheduling overhead is ‘s’ seconds, Time Quantum is ‘q’ seconds. Using Round Robin scheduling, what must be the value of Time Quantum ‘q’ such that each Process is guaranteed to get its turn at the CPU exactly after ‘t’ seconds in its subsequent run-on CPU.

H/W 1

Q.

Consider a System using Round Robin Scheduling with 10 Processes all arriving at the time 0. Each Process is associated with 20 identical Request. Each Process request consumes 20 ms of CPU time after which it spends 10 ms of time on I/O, thereafter, initiates subsequent Request. Assuming Scheduling Overhead of 2 ms and Time Quantum of 20 ms, Calculate

i. Response time of the 1st request of the 1st Process : 22 ms ✓

ii. Response time of the 1st request of the last Process : 220 ms ✓

iii. Response time of the subsequent request of any Process.

(210 ms) ✓

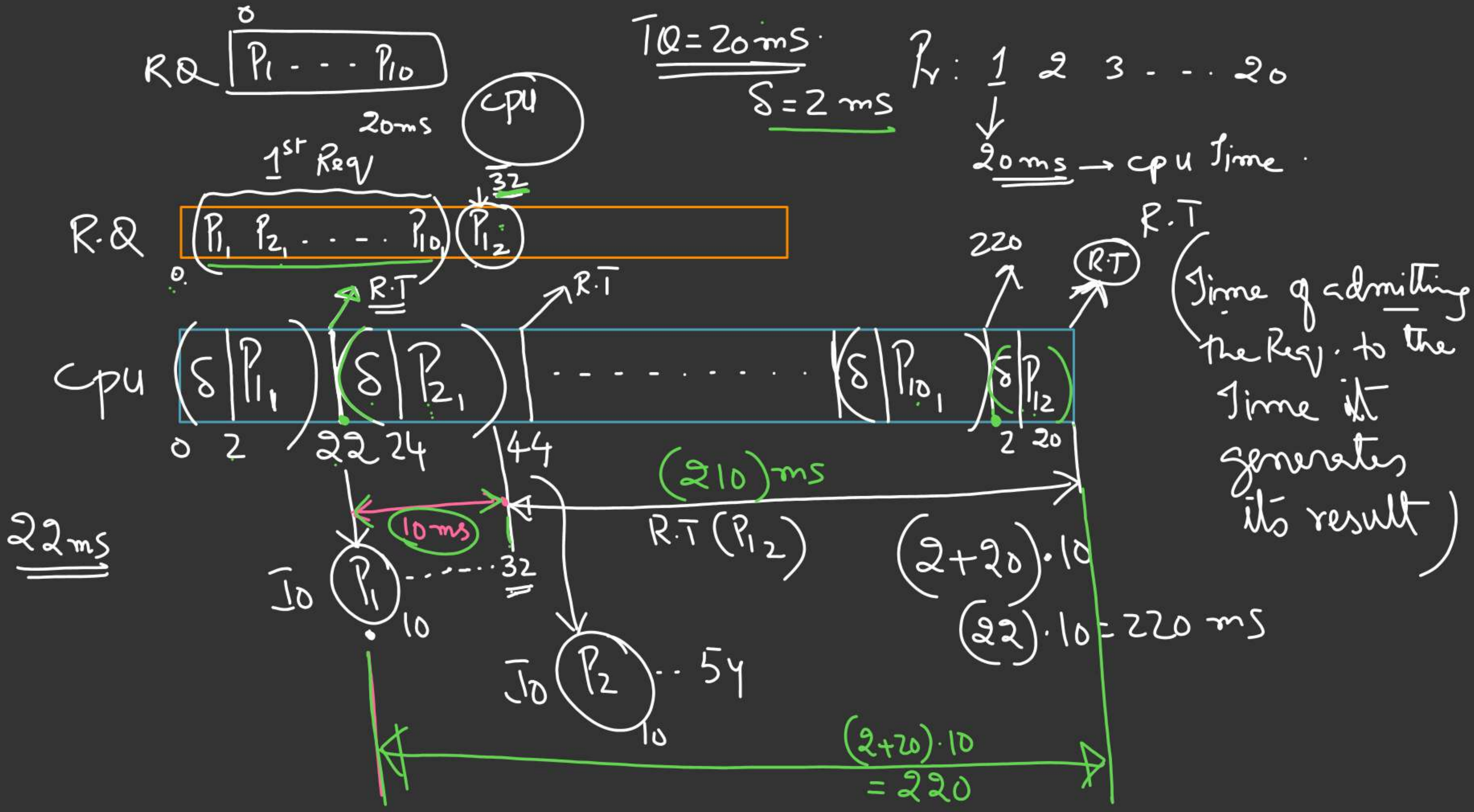
TQ = 20 ms

δ = 2 ms

Pr : 1 2 3 . . . 20

20 ms → cpu time

R.T (time of admitting the Req. to the time it generates its result)



THANK YOU
GW
SOLDIERS !