# TOPICS COVERED

1. Round Robin
2. Multilevel Queue scheduling

**Q.6**

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 | 1/3 | – 1 – | 1 | – 1 – | 3 | ⟨ 1; 4; 7; 10; ... |
| | 1/7 | – 2 – | 1 | – 2 – | 7 | ⟨ 1; 8; 15; ... |
| L | 1/20 | – 3 – | 1 | – 4 – | 20 | ⟨ 1; 21; 41, ... |

S=1

Idle time = 1 unit

$\therefore \ell = 1/52$

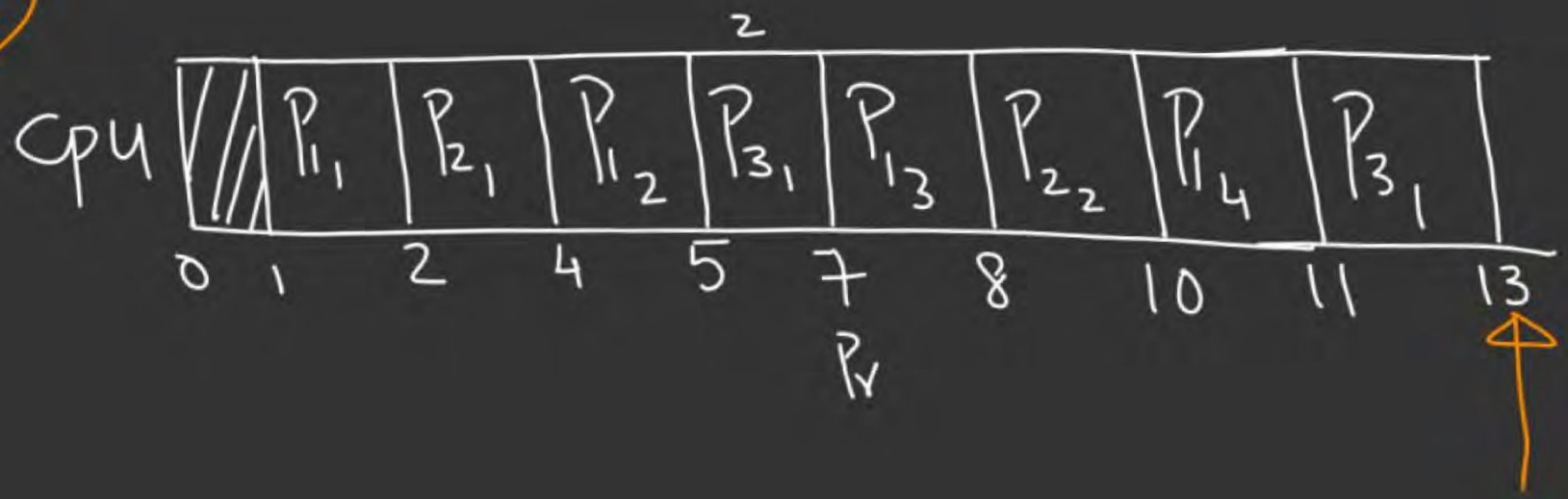
| | Prio | P.No | A.T | B.T | Period | Instances |
|---|---|---|---|---|---|---|
| H | $P_3$ | 1 | 1 | 1 | 3 | $\rightarrow \langle 1, 4, 7, 10, 13, \ldots \rangle$ |
| | $P_1$ | 2 | 1 | 2 | 7 | $\rightarrow \langle 1, 8, 15, \ldots \rangle$ |
| L | $P_2$ | 3 | 1 | 4 | 20 | $\rightarrow \langle 1, 21, 41, \ldots \rangle$ |

Pr - Priority based

5/11/2022
Session-1

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

Completion time of 1st Instance of $P_3$ is 13



Pr- FCFS

## *6) ROUND-ROBIN (Multi-programmed - Timeshared OS)

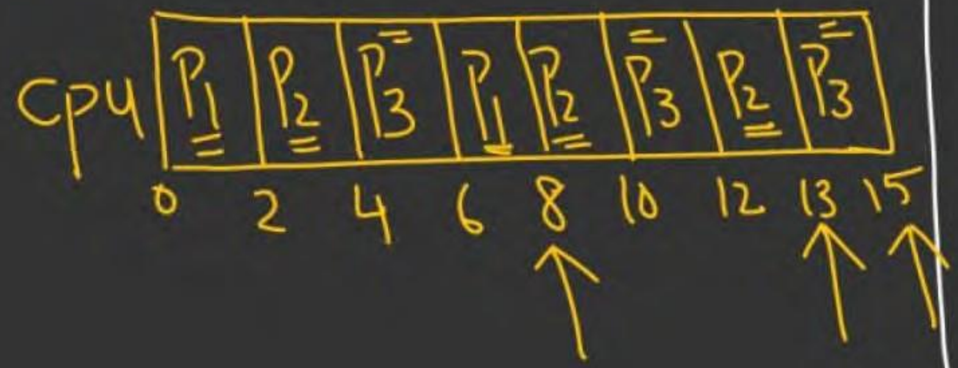
Sel. criteria: A.T + Time Quantum (TQ) → (Improve Interactiveness)

Mode: PreEmptive

TQ = 2  S = 0

| P.NO | A.T | B.T |
|---|---|---|
| 1 | 0 | ~~4~~ 2 |
| 2 | 0 | ~~5~~ ~~3~~ 1 |
| 3 | 0 | ~~6~~ ~~4~~ 2 |

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




→ Processes joins the R.Q in FIFO order

→ Each Process is alloted a fixed time quantum (TQ)

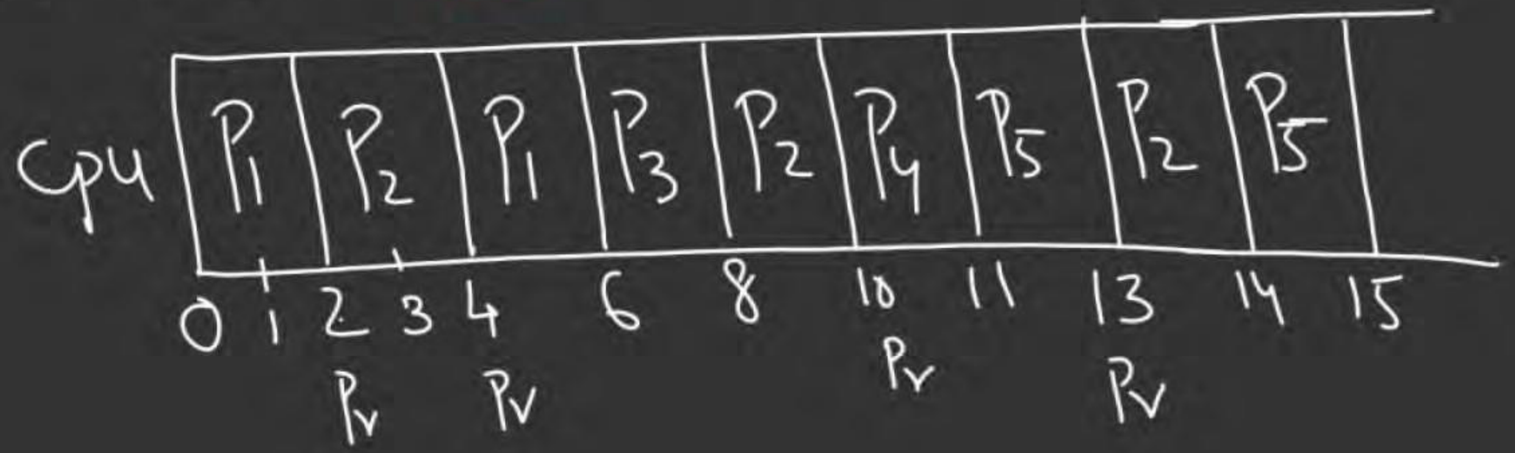
→ If Process does not Complete within TQ then it gets preEmpted & put back to the R.Q at the end

| P.NO | A.T | B.T |
|---|---|---|
| 1 | 0 | 4 |
| 2 | 1 | 5 |
| 3 | 3 | 2 |
| 4 | 5 | 1 |
| 5 | 6 | 3 |

TQ = 2

$L = 15$

<FIFO> R.Q : ~~P1~~ ; ~~P2~~ ; ~~P1~~ ; ~~P3~~ ; ~~P2~~ ; ~~P4~~ ; ~~P5~~ ; ~~P2~~ ; ~~P5~~



(*)

| P.No | A.T | < B.T ; IOBT ; BT > |
|---|---|---|
| 1 | 2 | < 4 ; 8 ; 2 > |
| 2 | 4 | < 5 ; 10 ; 3 > |
| 3 | 7 | < 2 ; 4 ; 4 > |

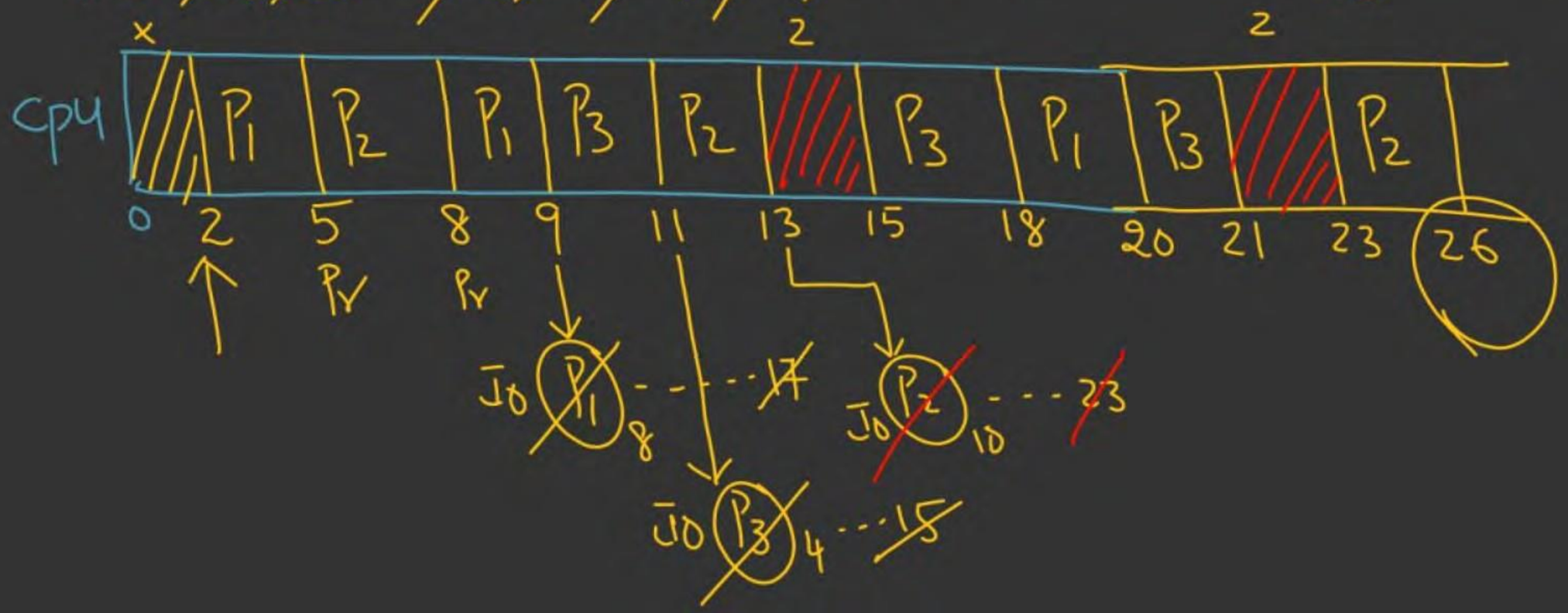
TQ = 3

Concurrent IO

$L = 26 - 2 = 24$ ✓

$\therefore$ CPU Idleness $= \frac{4}{L} = \frac{4}{24} = 1/6$

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

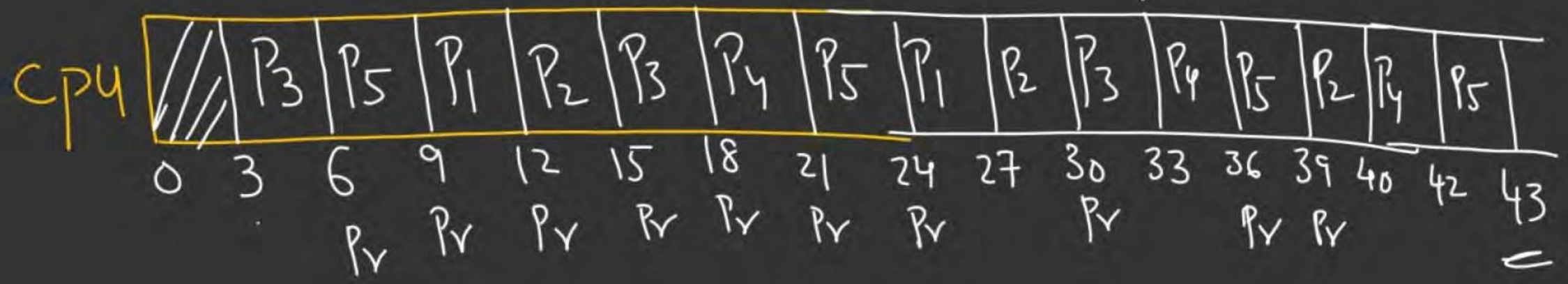


| P.NO | A.T | B.T |
|---|---|---|
| 1 | 5 | 6 |
| 2 | 6 | 7 |
| 3 | 3 | 9 |
| 4 | 8 | 8 |
| 5 | 4 | 10 |

TQ = 3

$L = 43 - 3 = 40$

R.Q : P3 ; P5 ; P1 ; P2 ; P3 ; P4 ; P5 ; P1 ; P2 ; P3 ; P4 ; P5 ; P2 ; P4 ; P5



# Performance of Round Robin

Time - Quantum

- **Very Small** → Efficiency ~ 0
- **Small** → More Context Switch overhead → Improve Interactiveness (Less Starvation)
- **large** → Less context switch overhead → more Starvation
- **very large** → R.R works like FCFS

$$\text{Efficiency} = \frac{\text{useful Comp}}{\text{useful + ovhd}} = \frac{0.4}{8.4} = \frac{4}{84} = \frac{1}{21} = 5\%$$

| Proto | A.T | B.T |
|---|---|---|
| 1 | 0 | 2 |
| 2 | 0 | 3 |
| 3 | 0 | 4 |

I. TQ = 5 ✓ FCFS


II. TQ = 0.1 ; S = 2

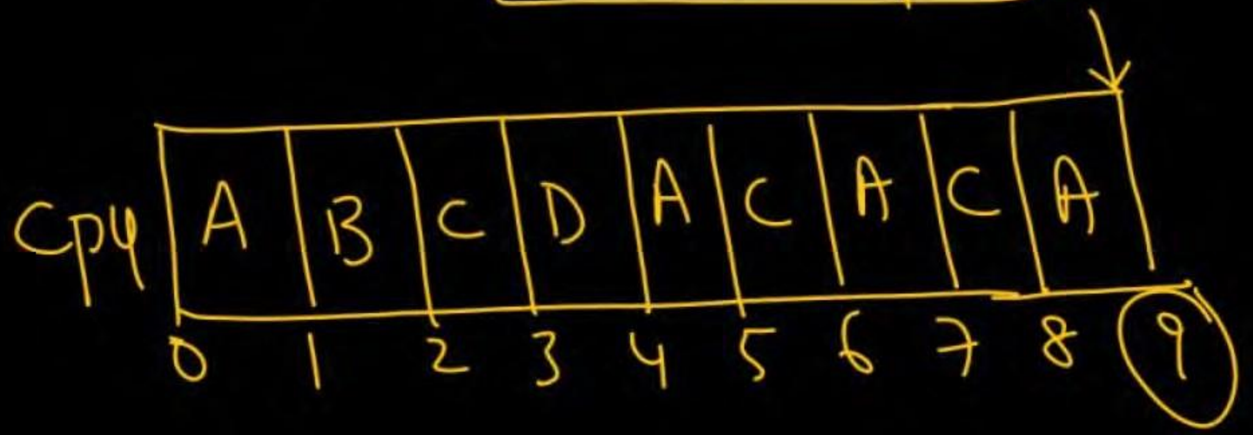
**Q.7** Consider a set of 4 Processes A, B, C, D arriving in the order at time $0^+$. Their Burst Time requirements are 4, 1, 8, 1 respectively using Round Robin scheduling with time quantum of 1 unit, The Completion time of Process A is _____.

GATE 15

TQ = 1

A → 4
~~B~~ → 1
C → 8
~~D~~ → 1

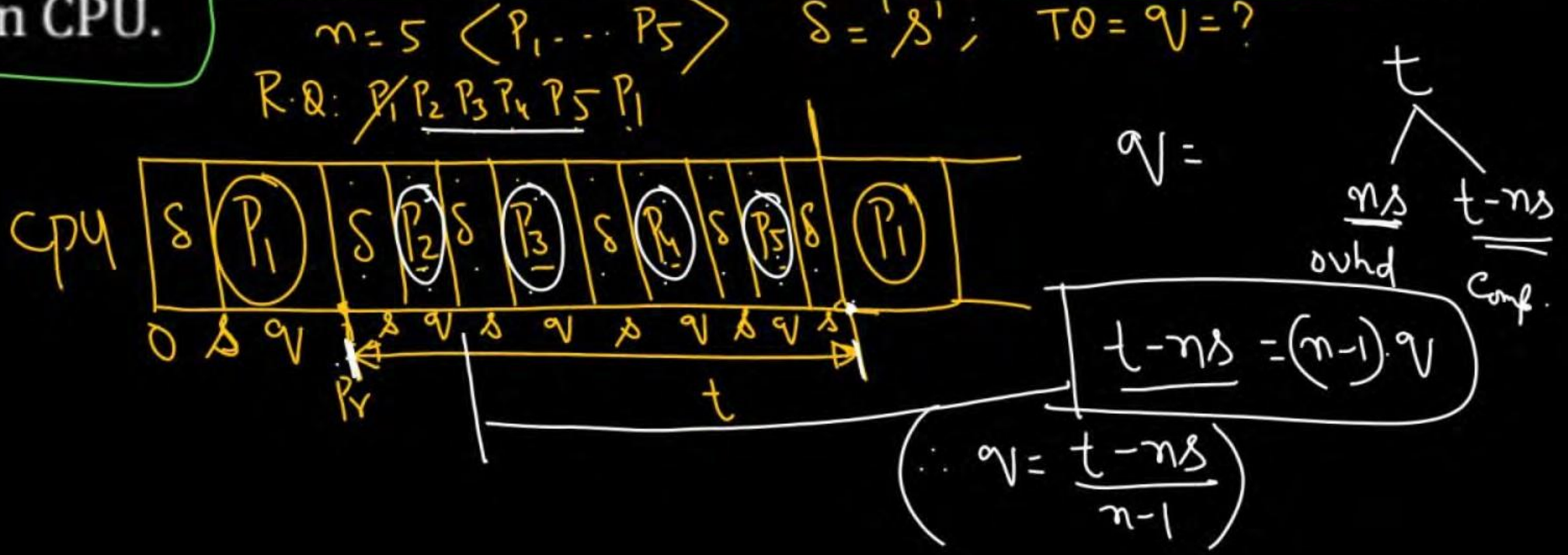
R.Q: ~~A~~ ~~B~~ ~~C~~ ~~D~~ | A | C |



**Q.8**

G/2M

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.



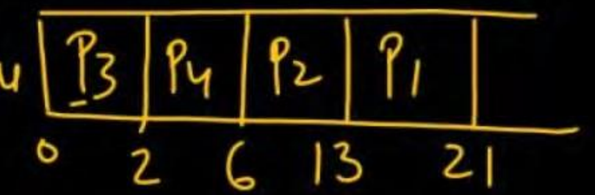
**Q.9** (8:15 pm)

Consider the following set of Processes, assumed to have arrived at time 0 . Consider the CPU scheduling algorithms Shortest Job First (SJF) and Round Robin (RR). For *RR* assume that the processes are scheduled in the order $P_1, P_2, P_3, P_4$. (5:25) ✓

G (NAT)

| Processes | $P_1$ | $P_2$ | $P_3$ | $P_4$ |
|---|---|---|---|---|
| Burst time (in ms) | 8 | 7 | 2 | 4 |

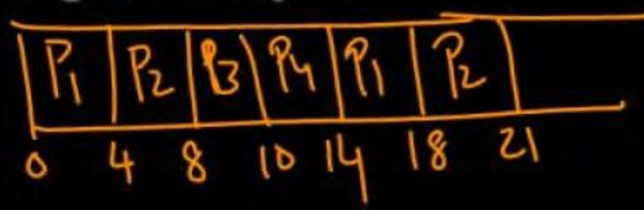
SJF




If the time quantum for *RR* is 4 ms, then the absolute value of the difference between the average turnaround times (in *ms* ) of *SJF* and *RR* (round off to 2 decimal places) is

RR: P1 P2 P3 P4 P1 P2 1

R.R:



**Q.10**

challenge #1
GATE '22

Consider four Processes P, Q, R, and S scheduled on a CPU as per Round Robin Algorithm with a Time Quantum of 4 units. The Processes arrive in the order P, Q, R, S, all at time t = 0. There is exactly one context switch from S to Q, exactly one context switch from R to Q, and exactly two context switches from Q to R. There is no context switch from S to P. Switching to a ready process after the termination of another process is also considered a context switch. Which one of the following is NOT Possible CPU BTs of these Processes?

(A) P = 4, Q = 10, R = 6, S = 2

(B) P = 2, Q = 9, R = 5, S = 1

(C) P = 4, Q = 12, R = 5, S = 4

(D) P = 3, Q = 7, R = 7, S = 3