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CPU Scheduling Algo: Round Robin

Comprehensive Course on Operating System for GATE - 2024/25

Vishvadeep Gothi • Lesson 7 • Apr 26, 2023

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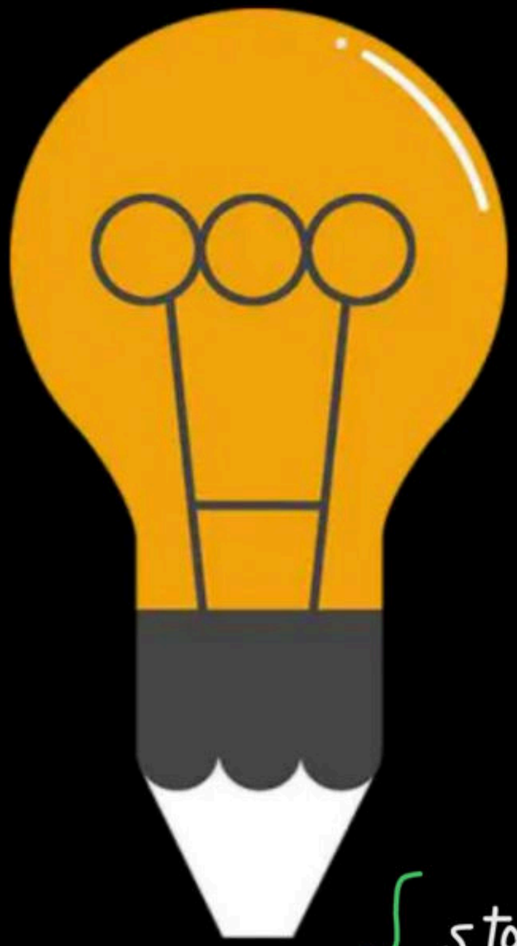


Operating System

CPU Scheduling: [redacted]

Priority based & RR

By: Vishvadeep Gothi

Sunday ⇒ OS Quiz 1

start → RR algo

Live

30 min

min 5 Questns

↳ 10 Questns

Priority Based Algorithm

Criteria: Priority | Tie breaker ⇒ given in Question

Mode: Preemptive/Non-preemptive

Priority:

1. Static :- Priority cannot be changed
2. Dynamic

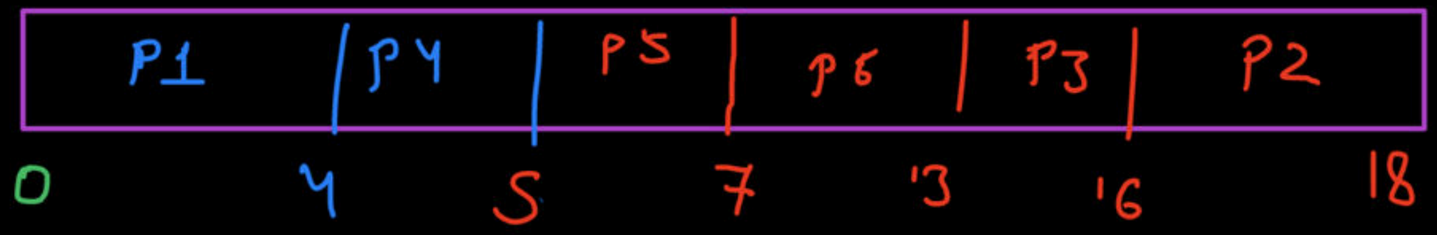
⇓

Priority can be changed

Process_id	AT	BT	Priority
P_1			1
P_2			4
P_3			2
P_4			5

Priority Based Algorithm : non-preemptive

Process	Arrival Time	Burst Time	Priority	CT	TAT	WT
P1	0	4	4	4	4	0
P2	1	2	5	18	17	15
P3	2	3	6	16	14	11
P4	3	1	10(Highest)	5	2	1
P5	4	2	9	7	3	1
P6	5	6	7	13	8	2



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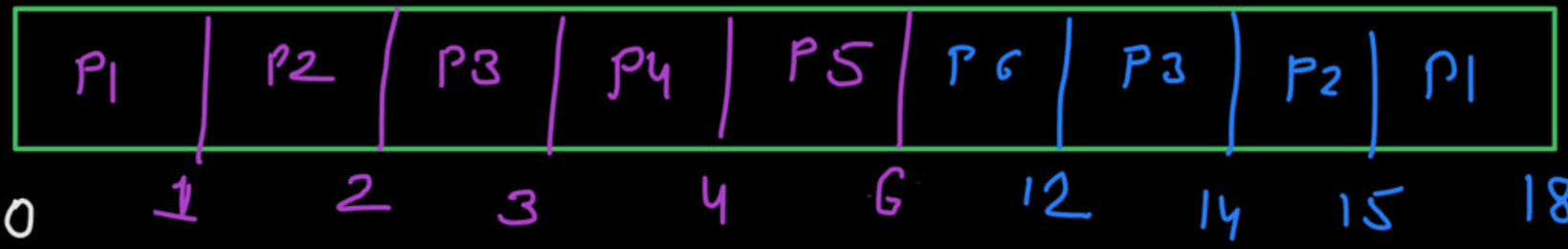
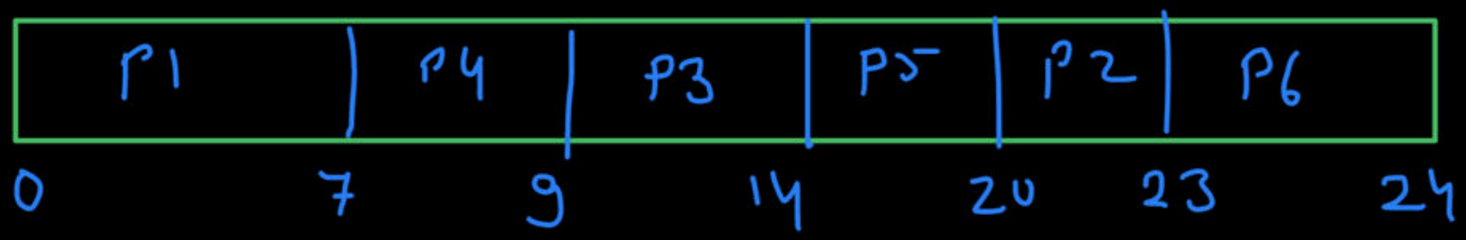
Priority Based Algorithm : Preemptive

Process	Arrival Time	Burst Time	Priority	CT	TAT	WT
P1	0	4	4	18	18	14
P2	1	2	5	15	14	12
P3	2	3	6	14	12	9
P4	3	1	10(Highest)	4	1	0
P5	4	2	9	6	2	0
P6	5	6	7	12	7	1



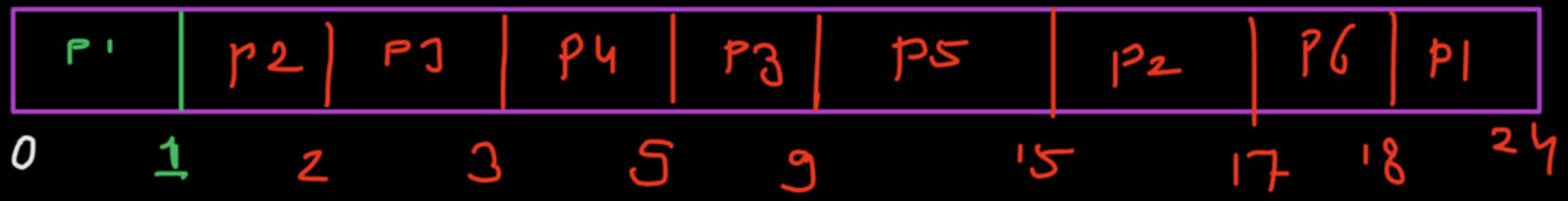
Priority Based Algorithm Question Non-Preemptive

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



Priority Based Algorithm Question Preemptive

Process	Arrival Time	Burst Time	Priority	CT	TAT	WT
P1	0	7	9	24	24	17
P2	1	3	4	17	16	13
P3	2	5	2	9	7	2
P4	3	2	1 (Highest)	5	2	0
P5	4	6	3	15	11	5
P6	5	1	8	18	13	12



Priority Based Algorithm

Advantages:

1. Better response for real time situations

Disadvantages:

1. Low Priority Processes may suffer from starvation

If OS has dynamic priority, then soln of starvation ⇒ Aging

→ If a process waits for a certain duration, then it's priority is increased by 1. After waiting for long, the process will become highest priority process.

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Round Robin (RR)

Criteria: AT + Quantum time (time slice)

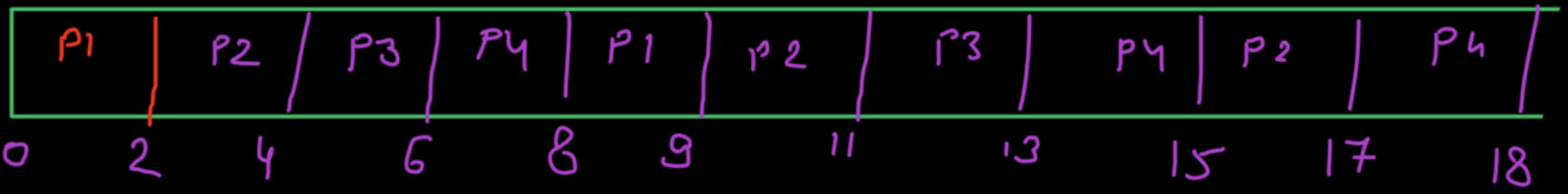
Mode: Preemptive

Round Robin (RR)

Q=2

Process	Arrival Time	Burst Time	CT	TAT	WT
P1	0	3	9	9	6
P2	0	6	17	17	11
P3	0	4	13	13	9
P4	0	5	18	18	13

R.Q. =>

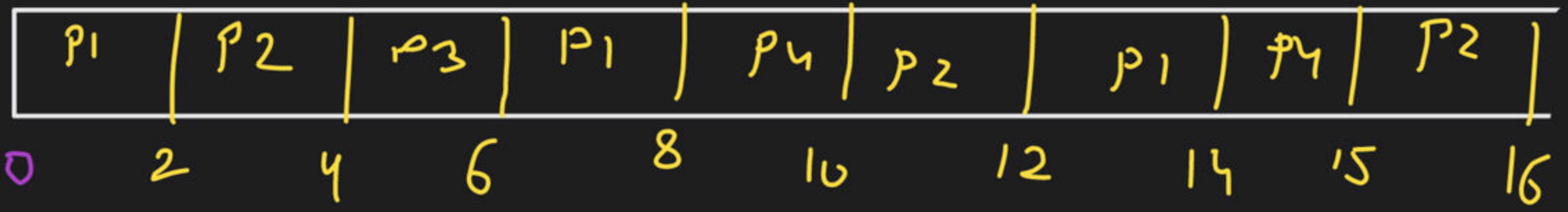


no. of context switch = 9

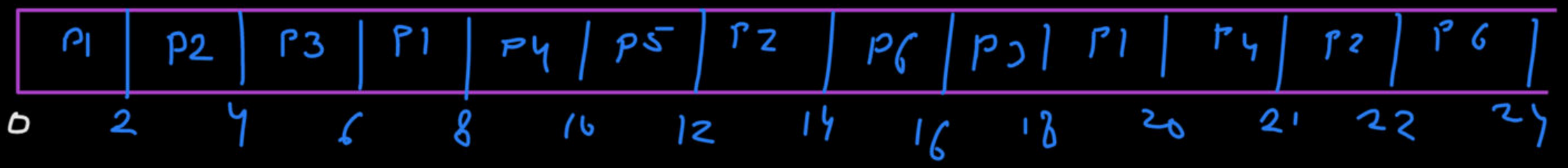
Q = 2

Process	AT	BT
P1	0	6
P2	1	5
P3	2	2
P4	3	3

	Ready Queue
0	~~P1~~
2	~~P2~~, P3, P1
4	~~P3~~, ~~P1~~, ~~P4~~, P2



Round Robin (RR)



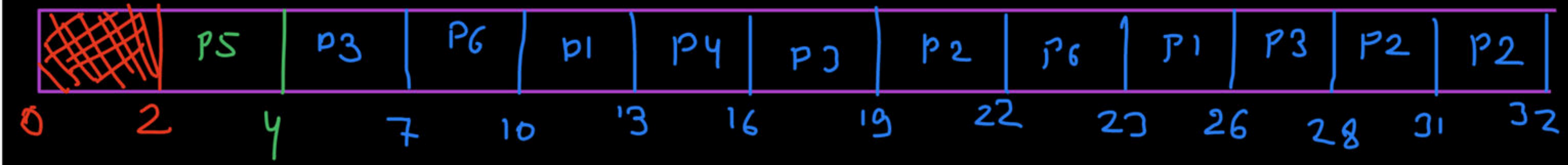
Q=2

Process	Arrival Time	Burst Time	
P1	0	6	⇒3
P2	1	5	⇒3
P3	2	4	⇒2
P4	3	3	⇒2
P5	4	2	⇒1
P6	5	4	⇒2

	RQ
0	P1
2	P2, P3, P1
4	P3, P1, P4, P5, P2
6	P1, P4, P5, P2, P6, P3

no. of context switches $= \left(\sum_{i=1}^{n} \left\lceil \frac{BT_i}{Q} \right\rceil \right) - 1$

Round Robin (RR)



Q=3

Process	Arrival Time	Burst Time
P1	5	6
P2	8	7
P3	3	8
P4	6	3
P5	2	2
P6	4	4

	Ready Queue
0	—
2	~~P5~~
4	P3, P6
7	P6, P1, P4, P3
10	P1, P4, P3, P2, P6

$L = \max(CT) - \min(AT)$

$= 32 - 2 = 30$

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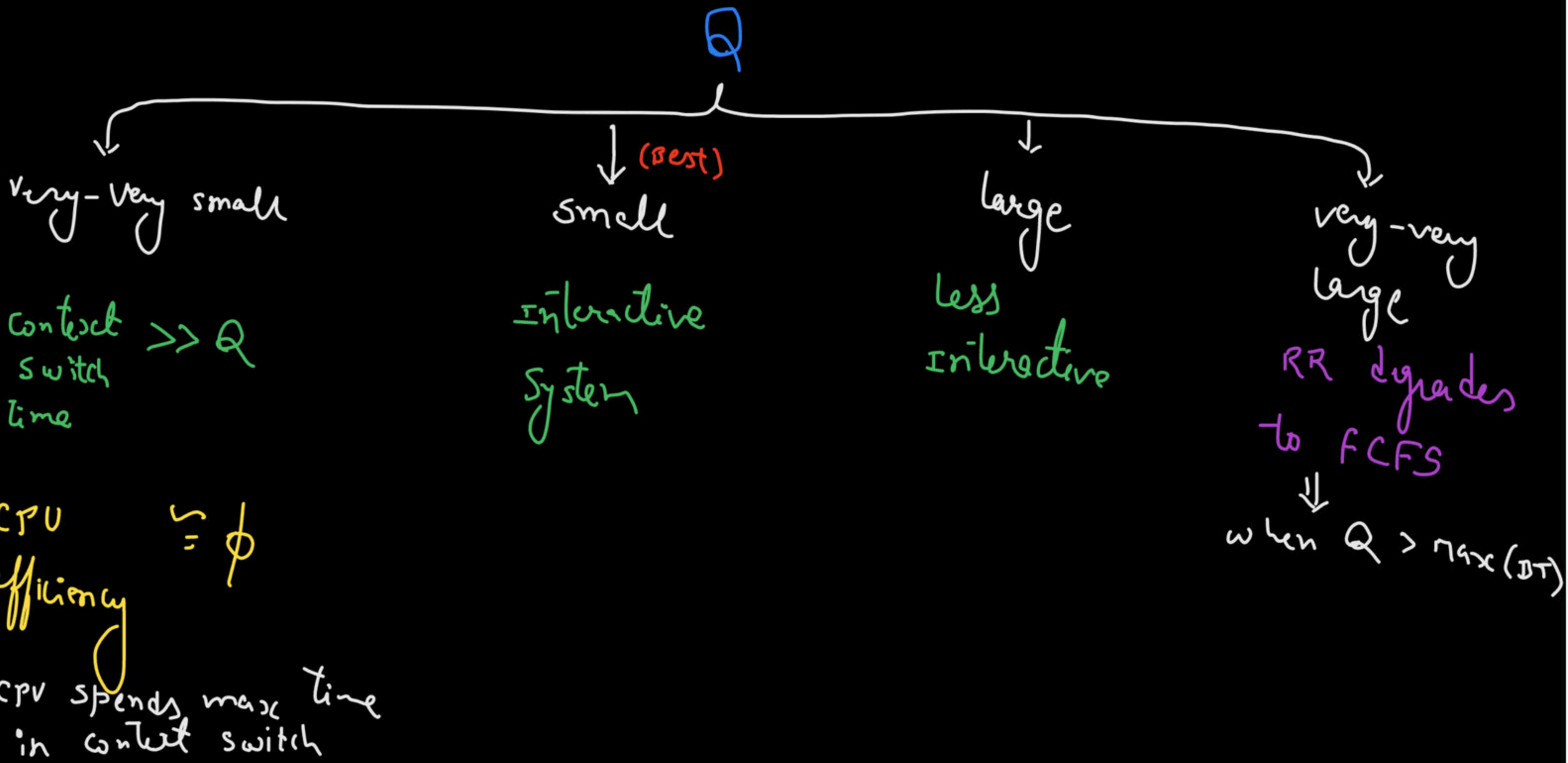
Round Robin (RR)

Homework

Q=3

Process	Arrival Time	Burst Time
P1	0	12
P2	0	5
P3	3	9
P4	5	6
P5	2	8
P6	4	2
P7	1	7

What Should Be the Quantum Value?



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RR

Advantages:

1. All processes execute one by one, so no starvation
2. Better interactiveness
3. Burst time is not required to be known in advance

Disadvantages:

1. Average waiting time and turnaround time is more
2. Can degrade to FCFS

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Question

If the time-slice used in the round-robin scheduling policy is more than the maximum time required to execute any process, then the policy will?

(A) degenerate to shortest job first

(B) degenerate to priority scheduling

(C) degenerate to first come first serve

(D) none of the above

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Question GATE-2013

A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero (the lowest priority). The scheduler re-evaluates the process priorities every T time units and decides the next process to schedule. Which one of the following is TRUE if the processes have no I/O operations and all arrive at time zero?

a) This algorithm is equivalent to the first-come-first-serve algorithm
b) This algorithm is equivalent to the round-robin algorithm.
c) This algorithm is equivalent to the shortest-job-first algorithm
d) This algorithm is equivalent to the shortest-remaining-time-first algorithm

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Multilevel Queue Scheduling

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Multilevel Queue Scheduling

System Processes

Foreground Processes

Background Processes

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Multilevel Queue Scheduling

1. Fixed priority preemptive scheduling method
2. Time slicing

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Multilevel Queue Scheduling

Queue 1: RR with Q=2
Queue 2: FCFS

Process	Arrival Time	Burst Time	Queue
P1	0	4	1
P2	0	3	1
P3	0	9	2
P4	9	4	1

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Multilevel Queue Scheduling

Queue 1: RR with Q=3
Queue 2: FCFS

Process	Arrival Time	Burst Time	Queue
P1	0	3	1
P2	0	3	1
P3	2	8	2
P4	10	4	1
P5	11	6	2
P6	11	3	1
P7	19	2	1
P8	13	5	2

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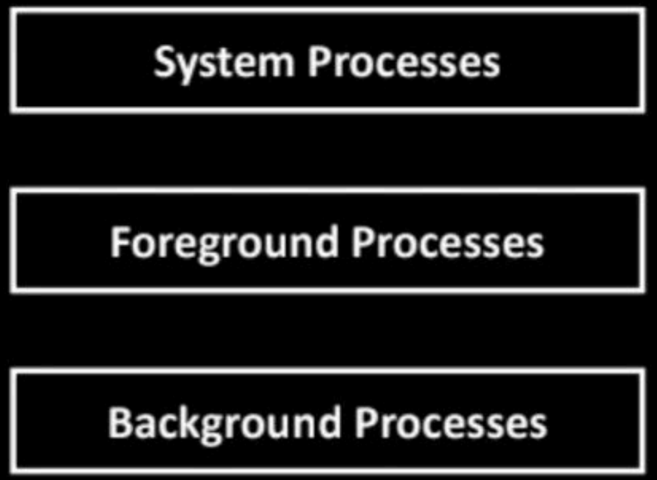
Multilevel Queue Scheduling

Disadvantages:

1. Some processes may starve for CPU if some higher priority queues are never becoming empty
2. It is inflexible in nature.

Multilevel Feedback Queue Scheduling

Multilevel Feedback Queue Scheduling



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Multilevel Queue Scheduling

Disadvantage:

1. Some processes may starve for CPU if some higher priority queues are never becoming empty.

Advantage:

1. Flexible

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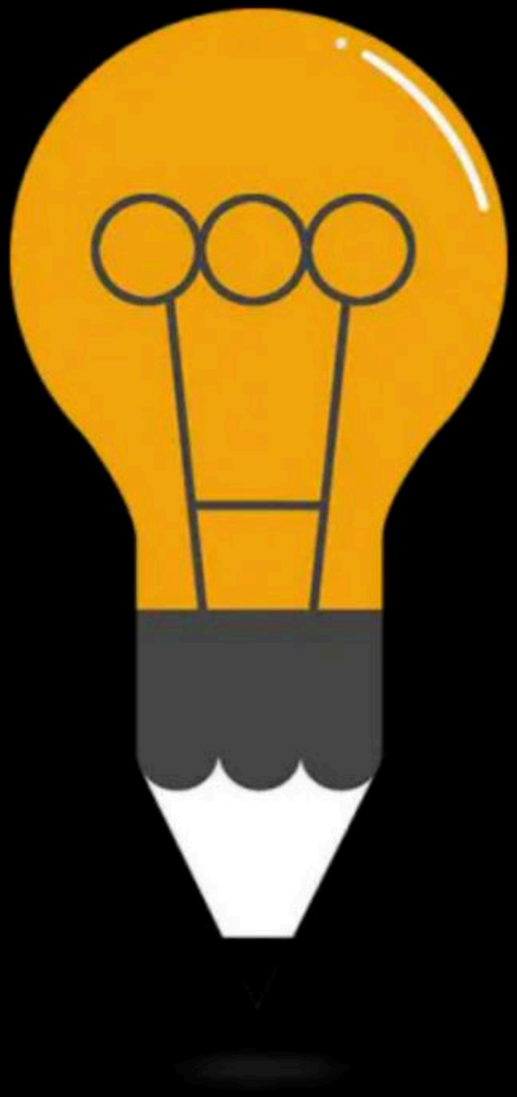

DPP

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Question 1

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	0	10ms
P2	0	29ms
P3	0	3ms
P4	0	7ms
P5	0	12ms

Calculate average waiting time for:
FCFS, Non-preemptive SJF, SRTF and Round-robin (quantum = 10ms)

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Question 2

Four processes to be executed on a single processor system arrives at time 0+ in the order A, B, C and D. Their CPU burst time requirements are 4, 1, 8, 1 time units respectively. The average waiting time of processes under Round-Robin scheduling with time slice of one time unit is?

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Question 3

Three processes with their respective process IDs given by P1, P2 and P3, having estimated burst time of 8ms, 4ms and 2ms respectively, enter a ready queue together in the order P1, P2 and P3. What is the average turn around time in Round Robin scheduling algorithm with time slice 2ms?

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Question 4

Consider a scheduling algorithm to select one of the ready processes for execution as follows:

1. If only one process is available in ready queue, then select is without any condition
2. If more than one processes are available in ready queue, then calculate waiting time of each process and select the process with maximum waiting time

The given algorithm is used on a system where a new process arrives every A nanoseconds after the first process arriving at time 0. Each process takes B nanoseconds to run on CPU. If A>=B then the given algorithm works as:

(A) FCFS
(B) FJF
(C) Non-preemptive Priority based algo with priority of process is inversely proportional to waiting time
(D) Non-preemptive Priority based algo with priority of process is proportional to waiting time

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Question 5

Consider a scheduling algorithm to select one of the ready processes for execution as follows:

1. If only one process is available in ready queue, then select is without any condition
2. If more than one processes are available in ready queue, then calculate waiting time of each process and select the process with minimum waiting time

The given algorithm is used on a system where a new process arrives every A nanoseconds after the first process arriving at time 0. Each process takes B nanoseconds to run on CPU. If A>=B then the given algorithm works as:

(A) FCFS
(B) FJF
(C) Non-preemptive Priority based algo with priority of process is inversely proportional to waiting time
(D) Non-preemptive Priority based algo with priority of process is proportional to waiting time

Question 6

On a system using round robin CPU scheduling, context-switch overhead is given by ‘s’. Time quantum is ‘q’. The CPU efficiency, if q=s is?

(A)50%
(B)Zero
(C)100%
(D)Not predictable

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Question 7

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	0	12
P2	1	8
P3	2	7
P4	3	2
P5	7	3

Calculate average waiting time for: SRTF

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Question 8

Consider the following set of processes:

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

Calculate average waiting time for: RR, Q=3

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Question 9

Consider the following set of processes:

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

Calculate average waiting time for: SRTF

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Question 10

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	0	12
P2	1	9
P3	2	10
P4	7	4

Calculate average waiting time for: RR, Q=2

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Happy Learning.!