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Operating System

Scheduling Algorithm Questions:

Questions:

Question:1

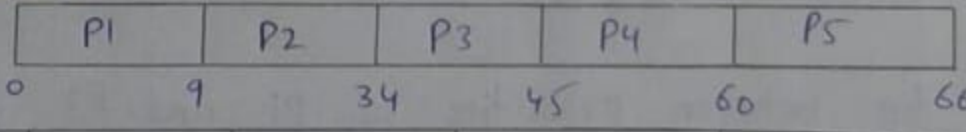
Consider the following set of processes.

Process	Burst Time	Priority	Arrival time
P1	9	3	0
P2	25	1	0
P3	11	3	0
P4	15	4	0
P5	6	2	0

Calculate Turn around time, waiting time, minimum average waiting time for FCFS, SJF (non-preemptive) and RR (quantum = 5.5ms).

First Come First Serve (FCFS):

Gantt chart:



Process	Burst Time	Arrival time	Completion time	Turn around time	wait time
P1	9	0	9	9	0
P2	25	0	34	34	9
P3	11	0	45	45	34
P4	15	0	60	60	45
P5	6	0	66	66	60

Average waiting time = $\frac{0+9+34+45+60}{5}$

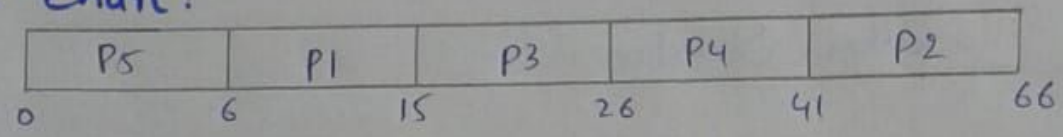
= 29.6 ms

Average Turn around time = $\frac{9+34+45+60+66}{5}$

= 42.8 ms

Shortest Job First (SJF) [Non-preemptive]:

Gantt chart:



(SJF)

Process	Burst Time	Arrival Time	Completion time	Turn Around time	waiting time
P1	9	0	15	15	6
P2	25	0	66	66	41
P3	11	0	26	26	15
P4	15	0	41	41	26
P5	6	0	15	15	9

Average waiting time = $\frac{6+41+15+26+9}{5}$

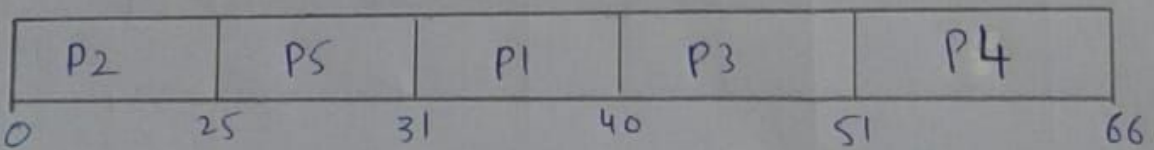
= 19.4 ms

Average Turn around time = $\frac{15+66+26+41+15}{5}$

= 32.6 ms

There is a tie between priorities of P1 and P3, if P1 is scheduled first.

Gantt chart:



Process	Burst time	Arrival Time	Priority	Completion time	Turn around time	wait time
P1	9	0	3	40	40	31
P2	25	0	1	25	25	5
P3	11	0	3	51	51	40
P4	15	0	4	66	66	51
P5	6	0	2	31	31	25

Average waiting time = $\frac{31 + 5 + 40 + 51 + 55}{5}$

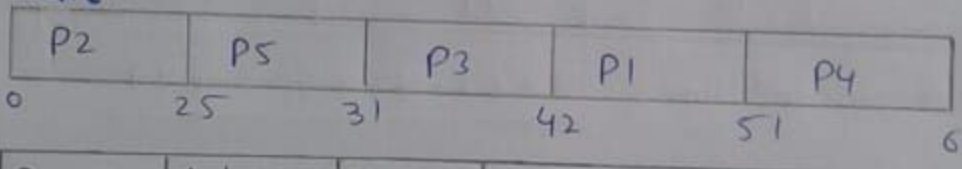
= 36.4 ms

Average turn around time = $\frac{40 + 25 + 51 + 66 + 33}{5}$

= 43 ms

if P3 is scheduled first:

Gantt chart:



Process	Burst Time	Arrival time	Priority	completion time	Turn Around time	Wait time
P1	9	0	3	51	51	42
P2	25	0	1	25	25	0
P3	11	0	3	42	42	31
P4	15	0	4	66	66	51
P5	6	0	2	31	31	25

Average Waiting time = $\frac{42 + 0 + 31 + 51 + 25}{5}$

= 29.8 ms

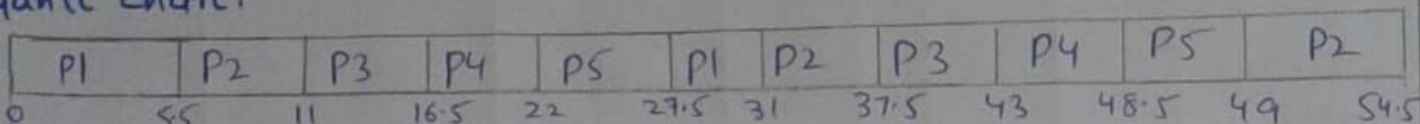
Average Turn around time = $\frac{51 + 25 + 42 + 66 + 31}{5}$

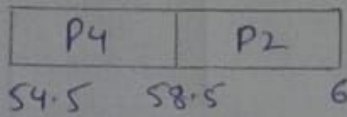
= 43 ms

Round Robin (RR):

Quantum = 5.5ms.

Gantt chart:





Process	Burst time	Arrival time	Completion Time	Turn Around time	waiting time
P1	9	0	31	31	22
P2	25	0	67	67	42
P3	11	0	43	43	32
P4	15	0	58.5	58.5	43.5
P5	6	0	49	49	43

Average Turn around time = $\frac{31 + 67 + 43 + 58.5 + 49}{5}$

$= 49.7$ ms

Average waiting time = $\frac{22 + 42 + 32 + 43.5 + 43}{5}$

$= 36.5$ ms

Overall Average waiting Time (Minimum):

Overall Average minimum waiting Time is of SJF = 19.4ms

Question: 2

Differentiate b/w preemptive and non-preemptive scheduling, Example.

Preemptive Scheduling	Non-preemptive Scheduling
A processor can be preempted to execute the different processes in the middle of any current process execution.	once the processor starts its execution, it must finish it before executing the other. It can't be paused in the middle.

Preemptive Scheduling	Non-preemptive scheduling
• CPU utilization is more efficient compared to Non-preemptive scheduling	• CPU utilization is less efficient compared to preemptive scheduling
• Waiting and response time of preemptive scheduling is less.	• waiting and response time of non-preemptive scheduling is higher
• preemptive scheduling is prioritized. The highest priority process is a process that is currently utilized	• when any process enters the state of running the state of that process is never deleted from the scheduler unit it finishes its jobs.
• Preemptive scheduling is flexible.	• Non-preemptive scheduling is rigid
• Preemptive scheduling algorithm can be preempted that is the process can be scheduled.	• In non-preempted scheduling process can't be scheduled
• In this process, the CPU is allocated to the processes for a specific time period.	• In this process, CPU is allocated to the process until it terminates or switches to the waiting state.
• Preemptive scheduling has the overhead of switching the process from the ready state to the running state and vice-versa.	• Non-preemptive scheduling has no such overhead of switching the process from running into the ready state.
• **Example**: Shortest Remaining Time First, Round Robin etc.	• **Example**: First come First serve, shortest job first, priority Scheduling.

Question: 3

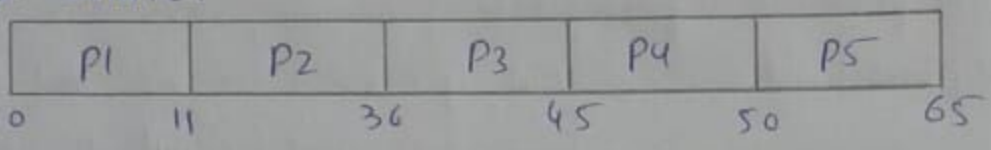
process	Burst Time (ms)
P1	11
P2	25
P3	9
P4	5
P5	15

All 5 processes arrives at time = 0 ; calculate wait Time ; Turn around Time for [FCFS, R.R (Quantum = 2.5ms), SJF (non-preemptive)]. Also calculate minimum average waiting time.

Answer:

First come First Serve (FCFS):

Gantt chart:



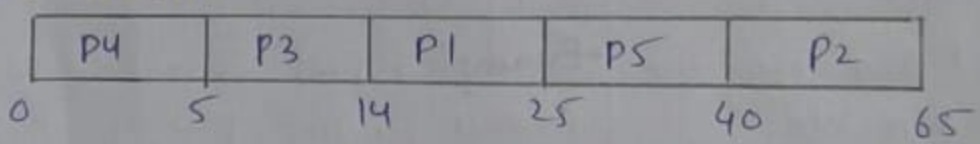
Process	Burst Time	Arrival time	Completion time	Turn around time	wait time
P1	11	0	11	11	0
P2	25	0	36	36	11
P3	9	0	45	45	36
P4	5	0	50	50	45
P5	15	0	65	65	50

Average waiting Time = $\frac{0+11+36+45+50}{5}$

= 28.4 ms

Shortest Job First (SJF) [Non-preemptive]:

Gantt chart:



Turn Around time = Completion time - Arrival time

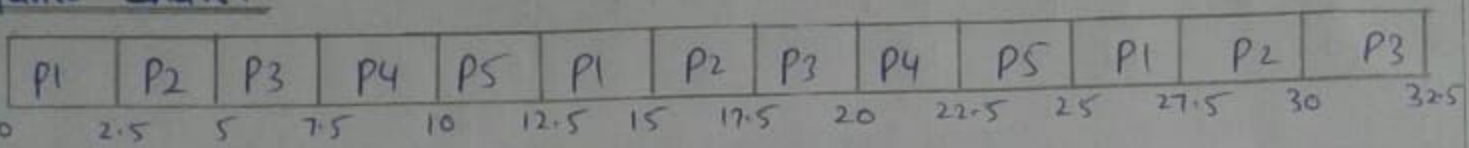
waiting time = Turn around time - Burst time

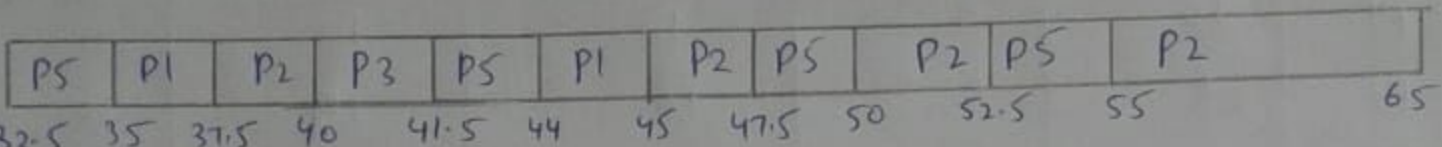
Process	Burst time	Arrival time	Completion time	Turn around time	wait time
P1	11	0	25	25	14
P2	25	0	65	65	40
P3	9	0	14	14	5
P4	5	0	5	5	0
P5	15	0	40	40	25

Round Robin (R.R):

Quantum = 2.5ms

Gantt chart:





Process	Burst Time	Arrival time	Completion time	Turn Around time	wait time
P1	11	0	45	45	34
P2	25	0	65	65	40
P3	9	0	41.5	41.5	32.5
P4	5	0	22.5	22.5	17.5
P5	15	0	55	55	40

Average waiting Time = $\frac{34 + 40 + 32.5 + 17.5 + 40}{5}$

= 32.8 ms.

Minimum Average waiting Time:

Average waiting Time of SJF = $\frac{14 + 40 + 5 + 0 + 25}{5}$

= 16.8 ms.

minimum average waiting is of SJF = 16.8ms.

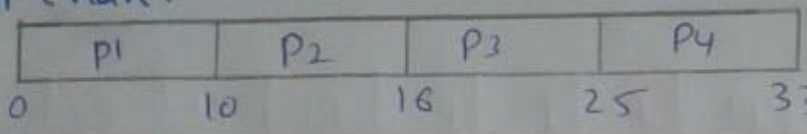
Question: 4

Process	Burst Time (ms)	Arrival time
P1	10	0
P2	6	2
P3	9	2
P4	8	5

Calculate average waiting time, turn around time for (FCFS, R.R (q=1.5), SJF (non-preemptive)).

First Come First Serve:

Gantt chart:



Process	Burst Time	Arrival Time	Completion time	Turn around time	wait time
P1	10	0	10	10	0
P2	6	2	16	14	8
P3	9	2	25	23	14
P4	8	5	33	28	20

Average waiting Time = $\frac{0 + 8 + 14 + 20}{4}$

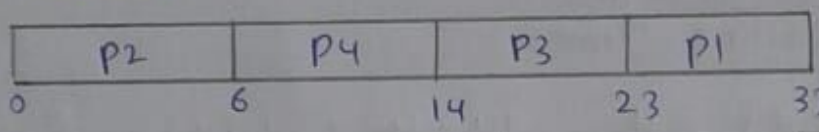
= 10.5 ms

Average Turn around Time = $\frac{10 + 14 + 23 + 28}{4}$

= 16.5ms

Shortest Job First (SJF):

Gantt chart:



Process	Burst Time	Arrival Time	Completion Time	Turnaround Time	wait time
P1	10	0	33	33	23
P2	6	2	6	4	2
P3	9	2	23	21	12
P4	8	5	14	9	1

Average waiting Time = $\frac{23 + 2 + 12 + 1}{4}$

= 9.5ms

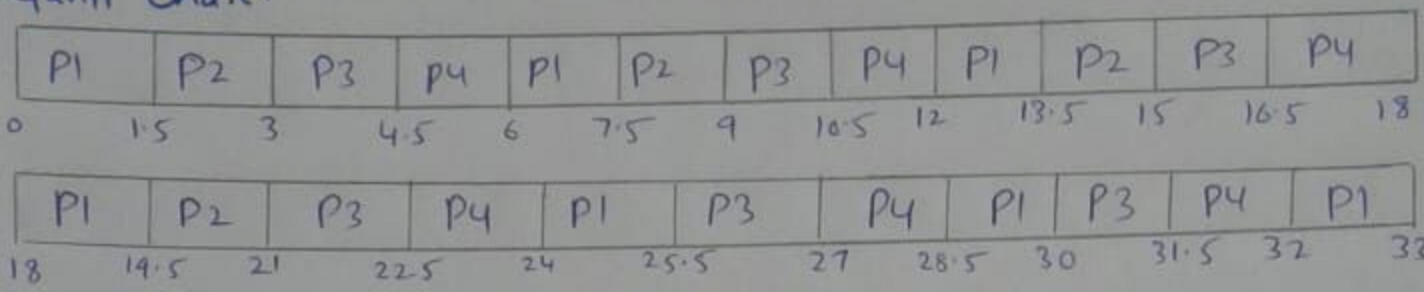
Average Turn around time = $\frac{33 + 4 + 21 + 9}{4}$

= 16.75ms

Round Robin (R.R):

Quantum = 1.5 ms

Gantt chart:



Process	Burst time	Arrival time	Completion time	Turn around time	wait time
P1	10	0	33	33	23
P2	6	2	21	19	13
P3	9	2	31.5	29.5	20.5
P4	8	5	32	27	19

Average waiting Time = $\frac{23 + 13 + 20.5 + 19}{4}$

= 18.875 ms

Average Turn around time = $\frac{33 + 19 + 29.5 + 27}{4}$

= 27.125 ms.