OPERATING SYSTEM
IT-41033

CHAPTER – 5
Q&A

5.2 A CPU-scheduling algorithm determines an order for the execution of its scheduled processes. Given n processes to be scheduled on one processor, how many different schedules are possible? Give a formula in terms of n.

- $n!\,(n\ factorial = n \times n-1 \times n-2 \times \ldots \times 2 \times 1)$

5.4 What advantage is there in having different time-quantum sizes at different levels of a multilevel queueing system?

Processes that need more frequent servicing, for instance, interactive processes that can be in a queue with a small time quantum.

Processes with no need for frequent servicing can be in a queue with a larger quantum, requiring fewer context switches to complete the processing, and making more efficient use of the computer.

5.7 Explain the differences in how much the following scheduling algorithms discriminate in favor of short processes:

a. FCFS

b. RR

c. Multilevel feedback queues

- **FCFS**: Discriminates against short processes due to its first-in-first-out.
- **Round Robin**: Offers moderate discrimination favoring short processes, depending on the time quantum.
- **Multilevel Feedback Queues**: Strongly favors short processes through dynamic priority adjustments.

5.9 Which of the following scheduling algorithms could result in starvation?

a. First-come, first-served

b. Shortest job first

c. Round robin

d. Priority

(b.) Shortest job first and (d.) Priority

Explanation: why they are not?

FCFS*: processes tasks in the order they arrive. Every process get its turn to execute, regardless of its burst time or priority.*

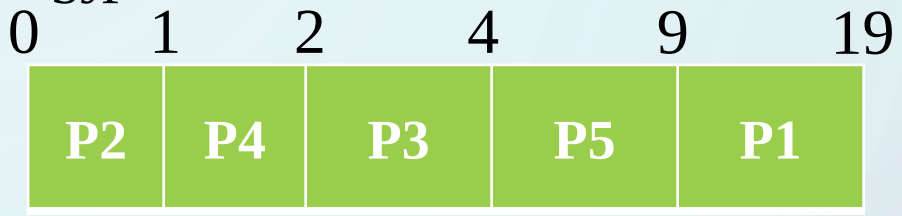
RR*: Low-priority processes never get executed if they are consistently outpaced by higher-priority tasks.*

5.13 (a) Grant Charts

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

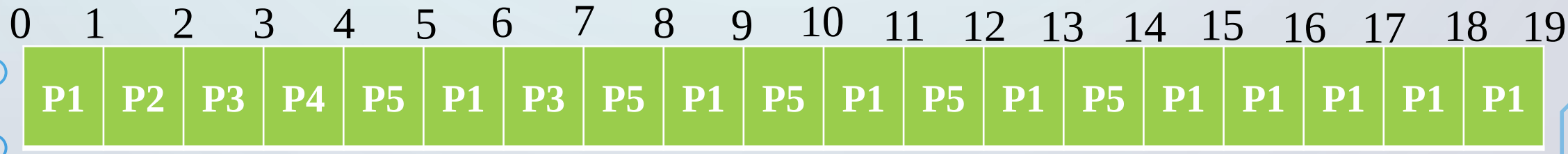
FCFS

SJF



Non-preemptive priority

RR *(T=1)*



5.13 (b) Turnaround Times

- Turnaround time = Completion time – Arrival time

  Note: (*arrival time is not given*)

FCFS

Turnaround Time P1 = (10 - 0) = 10

Turnaround Time P2 = (11 – 0) = 11

Turnaround Time P3 = (13 - 0) = 13

Turnaround Time P4 = (14 - 0) = 14

Turnaround Time P5 = (19 - 0) = 19

SJF

Turnaround Time P1 = (19 - 0) = 19

Turnaround Time P2 = (1 – 0) = 1

Turnaround Time P3 = (4 - 0) = 4

Turnaround Time P4 = (2 - 0) = 2

Turnaround Time P5 = (9 - 0) = 9

Non-preemptive priority

Turnaround Time P1 = (16 - 0) = 16

Turnaround Time P2 = (1 – 0) = 1

Turnaround Time P3 = (18 - 0) = 18

Turnaround Time P4 = (19 - 0) = 19

Turnaround Time P5 = (6 - 0) = 6

RR

Turnaround Time P1 = (19 - 0) = 19

Turnaround Time P2 = (2 – 0) = 2

Turnaround Time P3 = (7 - 0) = 7

Turnaround Time P4 = (4 - 0) = 4

Turnaround Time P5 = (14 - 0) = 14

5.13 (c) Waiting Times

- Waiting time = Turnaround time – Burst time

FCFS

Waiting Time P1 = (10 - 10) = 0

Waiting Time P2 = (11 – 1) = 10

Waiting Time P3 = (13 - 2) = 11

Waiting Time P4 = (14 - 1) = 13

Waiting Time P5 = (19 - 5) = 14

- Average waiting time = (0+10+11+13+14) / 5 = 9.6

Non-preemptive priority

Waiting Time P1 = (16 - 10) = 6

Waiting Time P2 = (1 – 1) = 0

Waiting Time P3 = (18 - 2) = 16

Waiting Time P4 = (19 - 1) = 18

Waiting Time P5 = (6 - 5) = 1

- Average waiting time = (6+0+16+18+1) / 5 = 8.2

SJF

Waiting Time P1 = (19 - 10) = 9

Waiting Time P2 = (1 – 1) = 0

Waiting Time P3 = (4 - 2) = 2

Waiting Time P4 = (2 - 1) = 1

Waiting Time P5 = (9 - 5) = 4

- Average waiting time = (9+0+2+1+4) / 5 = 3.2

RR

Waiting Time P1 = (19 - 10) = 9

Waiting Time P2 = (2 – 1) = 1

Waiting Time P3 = (7 - 2) = 5

Waiting Time P4 = (4 - 1) = 3

Waiting Time P5 = (14 - 5) = 9

- Average waiting time = (9+1+5+3+9) / 5 = 5.4

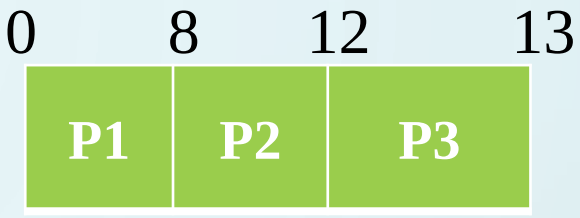
5.13 (d)

- Average waiting time of FCFS = 9.6
- Average waiting time of SJF = 3.2
- Average waiting time of Non-preemptive priority= 8.2
- Average waiting time of Round Robin = 5.4

- So, minimum waiting time is SJF algorithm result.

5.17 (a) FCFS

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1



- Turnaround time = Completion time – Arrival time

Turnaround Time P1 = (8 - 0) = 8

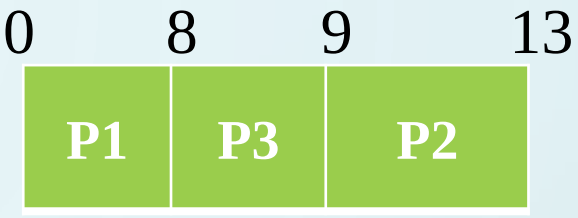
Turnaround Time P2 = (12 – 0.4) = 11.6

Turnaround Time P3 = (13 - 1) = 12

- Average turnaround time = (8+11.6+12) / 3 = 10.53

5.17 (b) SJF

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1



- Turnaround time = Completion time – Arrival time

Turnaround Time P1 = (8 - 0) = 8

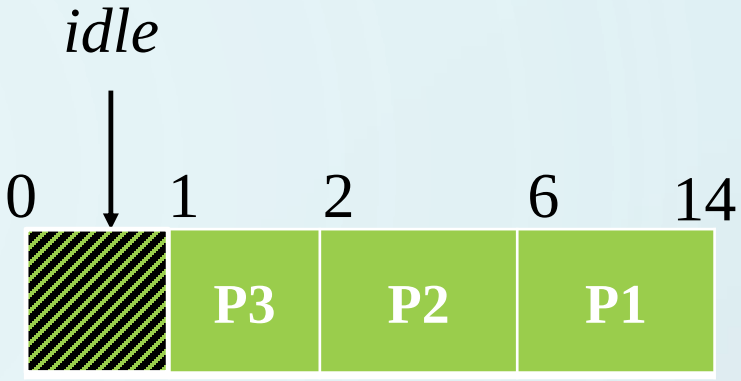
Turnaround Time P2 = (13 – 0.4) = 12.6

Turnaround Time P3 = (9 - 1) = 8

- Average turnaround time = (8+12.6+8) / 3 = 9.53

5.17 (c) SJF notices idle time

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1



- Turnaround time = Completion time – Arrival time

Turnaround Time P1 = (14 - 0) = 14

Turnaround Time P2 = (6 – 0.4) = 5.6

Turnaround Time P3 = (2 - 1) = 1

***Explanation**:*

Idle time is 0 to 1.

In time=1, P2 and P3 are available. So, choose P3(shortest), P2 and P1. Done.

- Average turnaround time = (14+5.6+1) / 3 = 6.86