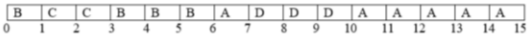
Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	6	1
B	0	4	2
C	1	2	1
D	7	3	1

**: Lower number means higher priority*

Suppose the Gantt chart shows the order in which processes are executed according to a specific scheduling algorithm. Match the correct scheduling algorithm with the corresponding Gantt chart:



A. First-Come- First Served.	B. Non-preemptive Shortest Job First.
C. Preemptive Shortest Job First.	D. Non-preemptive priority.
E. RR with time quantum 3ms.	F. RR with time quantum 1ms.
G. Preemptive priority/ RR with time quantum 1ms	

Note: When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.

Note: Choose ONLY ONE answer

- ☐ RR with time quantum 3ms.
- ☐ RR with time quantum 1ms.
- ☐ Non-preemptive Shortest Job First.
- ☐ Preemptive priority/ RR with time quantum 1ms
- ☐ First-Come- First Served.
- ☐ Non-preemptive priority.
- ☑ Preemptive Shortest Job First.

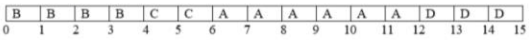
QUESTION 2

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	6	1
B	0	4	2
C	1	2	1
D	7	3	1

**: Lower number means higher priority*

Suppose the Gantt chart shows the order in which processes are executed according to a specific scheduling algorithm. Match the correct scheduling algorithm with the corresponding Gantt chart:



A. First-Come- First Served.	B. Non-preemptive Shortest Job First.
C. Preemptive Shortest Job First.	D. Non-preemptive priority.
E. RR with time quantum 3ms.	F. RR with time quantum 1ms.
G. Preemptive priority/ RR with time quantum 1ms	

Note: When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.

Note: Choose ONLY ONE answer

- ☐ Preemptive priority/ RR with time quantum 1ms
- ☐ RR with time quantum 3ms.
- ☐ First-Come- First Served.
- ☐ Non-preemptive priority.
- ☐ Preemptive Shortest Job First.
- ☑ Non-preemptive Shortest Job First.

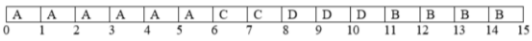
QUESTION 3

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	6	1
B	0	4	2
C	1	2	1
D	7	3	1

**: Lower number means higher priority*

Suppose the Gantt chart shows the order in which processes are executed according to a specific scheduling algorithm. Match the correct scheduling algorithm with the corresponding Gantt chart:



A. First-Come- First Served.	B. Non-preemptive Shortest Job First.
C. Preemptive Shortest Job First.	D. Non-preemptive priority.
E. RR with time quantum 3ms.	F. RR with time quantum 1ms.
G. Preemptive priority/ RR with time quantum 1ms	

Note: When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.

- ○ Non-preemptive Shortest Job First.
- ○ Preemptive Shortest Job First.
- ○ First-Come- First Served.
- ○ RR with time quantum 1ms.
- ◉ Non-preemptive priority.

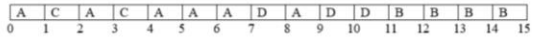
QUESTION 4

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	6	1
B	0	4	2
C	1	2	1
D	7	3	1

**: Lower number means higher priority*

Suppose the Gantt chart shows the order in which processes are executed according to a specific scheduling algorithm. Match the correct scheduling algorithm with the corresponding Gantt chart:



A. First-Come- First Served.	B. Non-preemptive Shortest Job First.
C. Preemptive Shortest Job First.	D. Non-preemptive priority.
E. RR with time quantum 3ms.	F. RR with time quantum 1ms.
G. Preemptive priority/ RR with time quantum 1ms	

Note: When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.

- ○ RR with time quantum 3ms.
- ○ Non-preemptive Shortest Job First.
- ○ Non-preemptive priority.
- ◉ Preemptive priority/ RR with time quantum 1ms

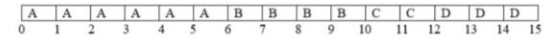
QUESTION 5

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	6	1
B	0	4	2
C	1	2	1
D	7	3	1

**: Lower number means higher priority*

Suppose the Gantt chart shows the order in which processes are executed according to a specific scheduling algorithm. Match the correct scheduling algorithm with the corresponding Gantt chart:



A. First-Come- First Served.	B. Non-preemptive Shortest Job First.
C. Preemptive Shortest Job First.	D. Non-preemptive priority.
E. RR with time quantum 3ms.	F. RR with time quantum 1ms.
G. Preemptive priority/ RR with time quantum 1ms	

Note: When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.

- ○ Preemptive priority/ RR with time quantum 1ms
- ○ Non-preemptive Shortest Job First.
- ◉ First-Come- First Served.

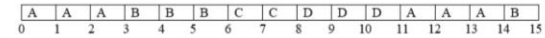
QUESTION 6

Consider the following set of processes:

Process#	Arrival Time	Burst Time (ms)	Priority
A	0	6	1
B	0	4	2
C	1	2	1
D	7	3	1

**: Lower number means higher priority*

Suppose the Gantt chart shows the order in which processes are executed according to a specific scheduling algorithm. Match the correct scheduling algorithm with the corresponding Gantt chart:



A. First-Come- First Served.	B. Non-preemptive Shortest Job First.
C. Preemptive Shortest Job First.	D. Non-preemptive priority.
E. RR with time quantum 3ms.	F. RR with time quantum 1ms.
G. Preemptive priority/ RR with time quantum 1ms	

Note: When a process finishes at the same time another process arrives, the new process will be submitted to the ready queue first.

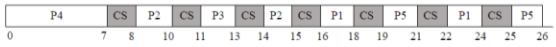
- ○ Preemptive Shortest Job First.
- ○ Preemptive priority/ RR with time quantum 1ms
- ○ Non-preemptive priority.
- ○ Non-preemptive Shortest Job First.
- ◉ RR with time quantum 3ms.

QUESTION 7

Consider the table below for five processes, and Gantt chart that shows the order in which a set of processes are executed based on a Priority scheduling algorithm with RR scheduling algorithm with time quantum 2 ms for the processes with the same priority.

Process#	Priority	Arrival Time
P1	3	0
P2	2	3
P3	2	4
P4	1	0
P5	3	10
*: Lower number means higher priority		

Note: *Assume the overhead of Context Switching (CS) is a one-time unit.*



a) Calculate the CPU burst, turnaround time, waiting time and response time of each process in the above scheduling algorithm Gantt chart, and then compute the average of waiting, turnaround and response times in ms by filling the table below:

Provide only the final value without adding any extra space or extra characters.

Process	CPU Burst	Turnaround Time ms	Waiting Time ms	Response Time ms
P1	4	24	20	16
P2			9	

a) Calculate the CPU burst, turnaround time, waiting time and response time of each process in the above scheduling algorithm Gantt chart, and then compute the average of waiting, turnaround and response times in ms by filling the table below:

Provide only the final value without adding any extra space or extra characters.

Process	CPU Burst	Turnaround Time ms	Waiting Time ms	Response Time ms
P1	4	24	20	16
P2	3	12	9	5
P3	2	9	7	7
P4	7	7	0	0
P5	3	16	13	9
Average Time in ms		13.6	9.8	7.4

.DONT add the unit and provide the final value with one digit after point e.g 12.3

Provide only the final value (1 rounded digit after the point. e.g 49.17 will be 49.2) without adding any extra space or special characters.

b) What is the CPU utilization rate (in percentage)?

CPU utilization = 73.1 %

QUESTION 8

Suppose a Multilevel Queue (MLQ) scheduling algorithm with two queues, interactive processes queue numbered as Q_1 and batch processes queue numbered as Q_2. Q_1 has a higher priority than Q_2. The scheduler follows Short-Job-First (SJF) scheduling algorithm for processes in Q_1 and Round Robin (RR) for Q_2 with time quantum **3**ms.

Consider the following set of processes with the lengths of the CPU bursts, arrival time given in milliseconds and queues number where processes are assigned permanently to each queue:

Process#	Arrival Time	CPU Burst	Queue number	Queue Priority
A	0	3	Q_1	1
B	0	2	Q_1	1
C	0	6	**Q_2**	2
D	8	2	Q_1	1
E	8	3	**Q_2**	2
*: Lower number means higher priority				

Draw the Gantt Chart that illustrates the execution order of these processes utilizing Multilevel Queue scheduling algorithm (MLQ). Then, fill the table below with start and completion time for each process.

provide the final value without adding any extra space or characters.

Process	Start Time	Completion Time
A	2	5
B	0	2
C	5	16
D	8	10
E	10	13

Note: *If a new process arrives at the same time that a process releases the CPU, then the new process will be added to the ready queue first.*

QUESTION 9

Suppose a Multilevel Feedback Queue (MLFQ) scheduling algorithm with three queues, numbered as Q_0, Q_1 and Q_2. Q_0 has a higher priority than Q_1, and Q_2 has the lowest priority. The scheduler follows Round Robin (RR) scheduling algorithm for Q_0 and Q_1 with time quantum **2ms** and **4ms**, respectively, whereas processes in Q_2 are scheduled using First-Come, First-Served (FCFS) scheduling algorithm.

Consider the following set of processes with the lengths of the CPU bursts and arrival time given in milliseconds:

Process#	Arrival Time	Burst Time
A	0	12
B	1	6
C	3	10
D	10	9

Draw the Gantt Chart that illustrates the execution order of these processes utilizing the Multilevel Feedback Queue scheduling algorithm (MLFQ). Then, fill the table below with start and completion time for each process.
Provide only the final value without adding any extra space or characters.

Process	Start Time	Completion Time
A	0	30
B	2	16
C	4	34
D	10	37