Formative Assessment 1
Operating Systems

1. Consider a set of three processes P_0, P_1 and P_2 having CPU burst times as shown below. Draw the Gantt Chart and calculate the average waiting time, average turn around time and average response time using FCFS algorithm given the following arrival arrangement:
    a. P_0, P_1, P_2 at time t = 0
    b. P_1, P_2, P_0 at time t = 0

Process	Burst Time (milliseconds)
P_0	13
P_1	3
P_2	6

2. Draw the Gantt Chat and find the average waiting time for the above data using RR scheduling with quantum = 4 ms.
3. Given below are the arrival and burst times of four processes P_1, P_2, P_3 and P_4. Draw the Gantt Chart using SJF preemptive and non-preemptive scheduling and calculate the average waiting time.

Process	Arrival Time	Burst Time
P_1	0	7
P_2	2	4
P_3	4	1
P_4	5	2

4. Given below are the burst times of three processes P_1, P_2 and P_3. Draw the Gantt Chart using RR scheduling and calculate the average waiting time, average turn around time and average response time. Quantum = 5 ms.

Process	Burst Time (milliseconds)
P_1	30
P_2	6
P_3	8

5. Given below are the burst times of four processes P1, P2, P3 and P4. Draw the Gantt Chart using RR scheduling and calculate the average waiting time. Quantum = 20 ms.

Process	Burst Time (milliseconds)
P_1	53
P_2	17
P_3	68
P_4	24

6. Given below are the burst times and priorities of five processes P_1, P_2, P_3, P_4 and P_5. Draw the Gantt Chart using priority scheduling and calculate the average waiting time, turn around time and response time. (Smaller priority number means higher priority).

Process	Burst Time	Priority
P_1	6	2
P_2	12	4
P_3	1	5
P_4	3	1
P_5	4	3

7. Consider the following set of processes P_1, P_2, P_3, P_4 (arriving in the order P_1, P_2, P_3, P_4) and their CPU burst times. Use FCFS and SJF algorithm to draw the Gantt

Chart and to calculate the average waiting time, average turn around time and average response time.

Process	Burst Time (milliseconds)
P_1	6
P_2	8
P_3	7
P_4	3

8. Given below are the arrival and burst times of four processes P_1, P_2, P_3 and P_4. Draw the Gantt Chart using FCFS, SJF preemptive, SJF non-preemptive and RR scheduling (Quantum = 4ms, no priority based preemption). Calculate the average waiting time, average turn around time and average response time.

Process	Arrival Time	Burst Time
P_1	0	8
P_2	1	4
P_3	2	9
P_4	3	5

9. Given below are the burst times ad priorities of four five processes P_1, P_2, P_3, P_4 and P_5. The processes are assumed to have arrived in the order P_1, P_2, P_3, P_4, P_5, all at time 0.

Process	Priority	Burst Time
P_1	3	10
P_2	1	1
P_3	3	2
P_4	4	1

P_5	2	5

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, non preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.
b. What is the turnaround time of each process for each of the scheduling algorithms?
c. What is the waiting time of each process for each of the scheduling algorithms?
d. Which of the schedules in part results in the minimal average waiting time?

10. Find the mean turn around time for the following data for each of the following algorithms.
    a. Round Robin (Quantum = 2 minutes)
    b. Priority Scheduling (5 priority is highest)
    c. First Come First Serve (In the order 10, 6, 2, 4 and 8)
    d. Shortest Job First

Process	Burst Time	Priority
A	10	3
B	6	5
C	2	2
D	4	1
E	8	4

11. Assume you have the following jobs to execute with one processor, with the jobs arriving in the order listed here:

Process	Burst Time	Priority
1	80	3

2	20	1
3	5	4
4	20	1
5	50	2

Suppose a system uses FCFS scheduling

a. Draw a Gantt Chart illustrating the execution of these processes.
b. What is the turnaround time for process 4?
c. What is the average wait time for the processes?

Now assume the system uses priority scheduling where a small integer means a high priority

d. Draw a Gantt Chart illustrating the execution of these processes.
e. What is the turnaround time for process 2?
f. What is the average wait time for the processes?

12. Consider the following set of processes, with the length of the CPU-burst time and the arrival time given in milliseconds. Draw a Gantt chart illustrating the execution of these processes using preemptive SJF scheduling algorithm.

Process	Arrival Time	Burst Time
1	0	75
2	10	40
3	10	25
4	80	20
5	85	45

13. Draw the Gantt chart for the Shortest Remaining Time Next SRTN scheduling policy and calculate the average turn around time, average waiting time, throughput and processor utilization for the following set of processes that arrive at a given arrival time shown in the following table.

Process	Arrival Time	Burst Time
P_1	0	2
P_2	1	1
P_3	3	2
P_4	4	3
P_5	6	5

14. For the processes listed below, find the average turnaround time and waiting time (rounding to the nearest hundredth) for round robin scheduling for a time quantum of 2.

Process	Arrival Time	Burst Time
P_1	0	3
P_2	1.001	6
P_3	4.001	4
P_4	6.001	2

15. The following series of processes with the given run-times arrives in the ready queue in the order shown. For FCFS and SJF scheduling policies, calculate the waiting time and the wit-time/run-time ratio of each process.

Process	Burst Time
P_1	10
P_2	50
P_3	2
P_4	100
P_5	5

16. Draw the Gantt chart for FCFS scheduling policy and calculate the average turn around time, average waiting time and average response time for the following set of processes that arrive at a time 0.

Process	Burst Time
P_1	5
P_2	24
P_3	16
P_4	10
P_5	3

17. Draw the Gantt chart for FCFS scheduling policy and calculate the average turn around time, and average response time for the following set of processes that arrive at a time given below.

Process	Arrival Time	Burst Time
P_1	0	3
P_2	2	6
P_3	4	4
P_4	6	5
P_5	8	2

18. Draw the Gantt chart for SJF scheduling policy and calculate the average turn around time, average waiting time and average response time for the following set of processes that arrive at a time 0.

Process	Burst Time
P_1	5
P_2	24

P_3	16
P_4	10
P_5	3

19. Draw the Gantt chart for RR scheduling policy with quantum = 5ms and calculate the average turn around time, average waiting time and average response time for the following set of processes that arrive at a time 0.

Process	Burst Time
P_1	3
P_2	6
P_3	8

20. Consider the following set of processes and CPU burst times. Calculate the average waiting time, average response time and average turnaround time for the algorithms FCFS, SJF, RR (quantum = 3 ms) and priority scheduling (1 = highest priority). Which one is the best algorithm?

Process	Burst Time	Priority
P_1	5	4
P_2	12	1
P_3	16	3
P_4	18	5
P_5	2	2