King Saud University
Department of Computer Science
CSC227: Operating Systems
Tutorial – Chapter 6: CPU Scheduling

Exercise 1:

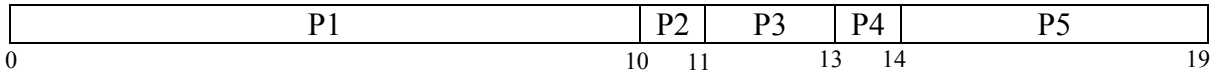
Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

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

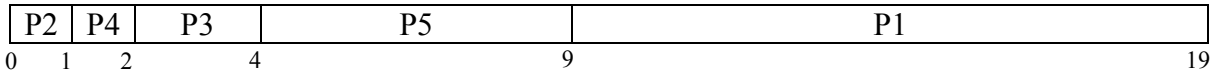
The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

a) Draw four Gantt charts illustrating the execution of these processes using **FCFS, SJF, a non-preemptive priority** (a smaller priority number implies a higher priority), and **RR** (quantum = 1) scheduling.

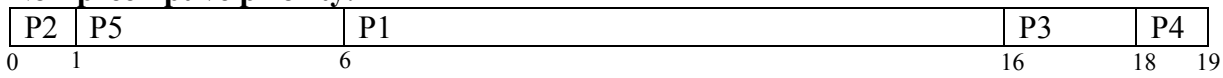
FCFS:



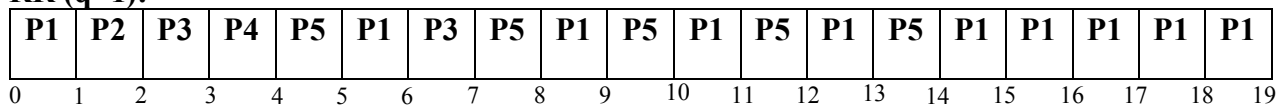
SJF:



Non-preemptive priority:



RR (q=1):



b) What is the turnaround time of each process for each of the scheduling algorithms in part (a)?

Process	FCFS	SJF	NP-P	RR
P1	10	19	16	19
P2	11	1	1	2
P3	13	4	18	7
P4	14	2	19	4
P5	19	9	6	14
Average	**13.4**	**7**	**12**	**9.2**

c) What is the waiting time of each process for each of the scheduling algorithms in part (a)?
Because there is no IO wait, Waiting Time = Turnaround Time – Burst Time

Process	FCFS	SJF	NP-P	RR
P1	0	9	6	9
P2	10	0	0	1
P3	11	2	16	5
P4	13	1	18	3
P5	14	4	1	9
Average	**9.6**	**3.2**	**8.2**	**5.4**

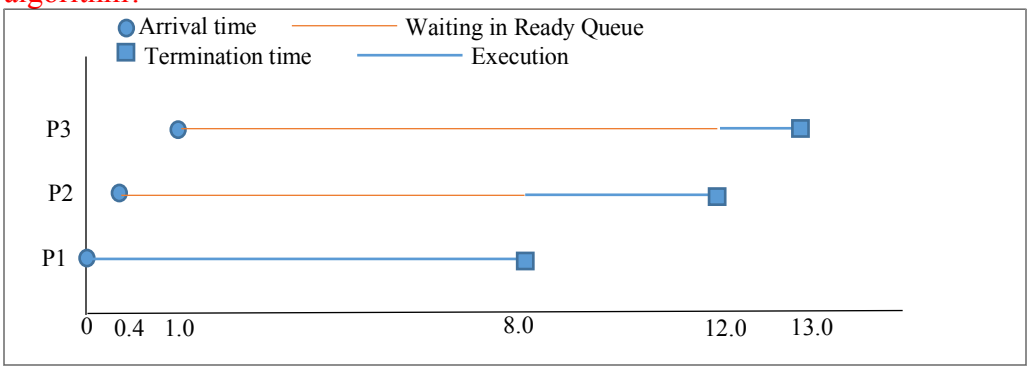
d) Which of the schedules in part (a) results in the minimal average waiting time (over all processes)?
SJF with average waiting time = 3.2ms.

Exercise 2

Suppose that the following processes arrive for execution at the times indicated. Each process will run the listed amount of time. In answering the questions, use **preemptive** scheduling and base all decisions on the information you have at the time the decision must be made.

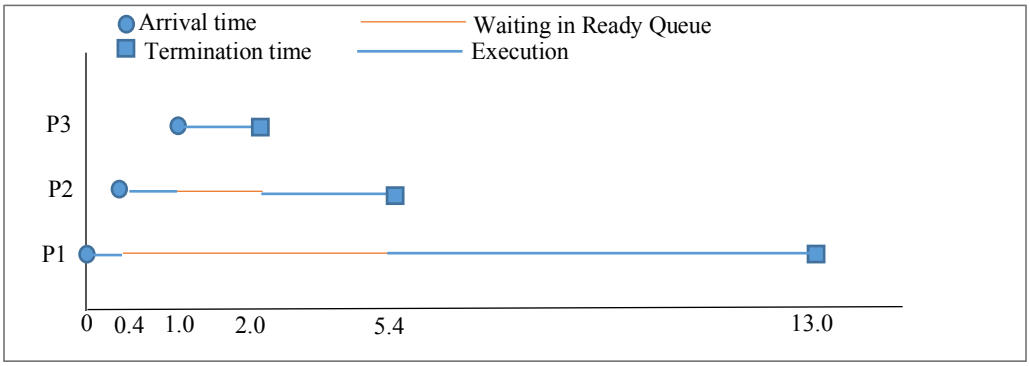
Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

a) What is the average turnaround time for these processes with the FCFS scheduling algorithm?



Average TT = [(8 – 0) + (12 – 0.4) + (13 – 1.0)] / 3 = 10.53

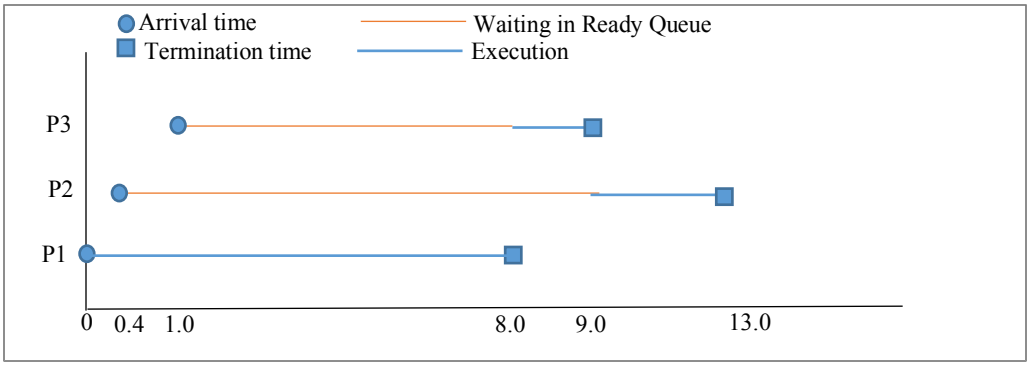
b) What is the average turnaround time and waiting time for these processes with the SJF scheduling algorithm?



Average TT = [(13 – 0) + (5.4 – 0.4) + (2 – 1)] / 3 = 6.33

Average WT = [(5.4 – 0.4) + (2 – 1) + 0] / 3 = 2

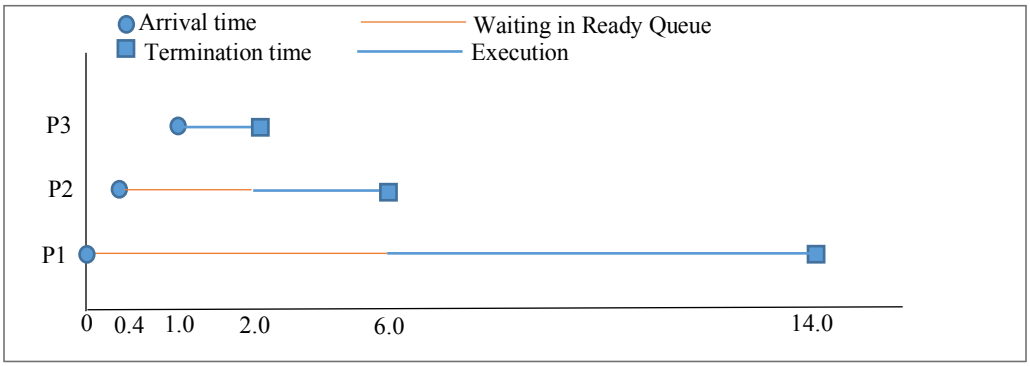
c) What is the average turnaround time and waiting time for these processes with the **non-preemptive** SJF scheduling algorithm?



Average TT = [(8 – 0) + (13 – 0.4) + (9 - 1)] / 3 = 9.53

Average WT = [0 + (9 – 0.4) + (8-1)] / 3 = 5.23

d) The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes P1 and P2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling.



Average TT = [(14 – 0) + (6 – 0.4) + (2 - 1)] / 3 = 6.87