6.1 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 possible different schedules are there? Give a formula in terms of n.

Answer: $n!$ (n factorial $= n \times n-1 \times n-2 \times ... \times 2 \times 1$)

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

Process	Burst Time	Priority
P_1	10	3
P_2	1	1
P_3	2	3
P_4	1	4
P_5	5	2

The processes are assumed to have arrived in the order P_1, P_2, P_3, P_4, P_5, all at time 0.

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJI nonpreemptive priority (a smaller priority number implies a higher priority), and (quantum = 1) scheduling.

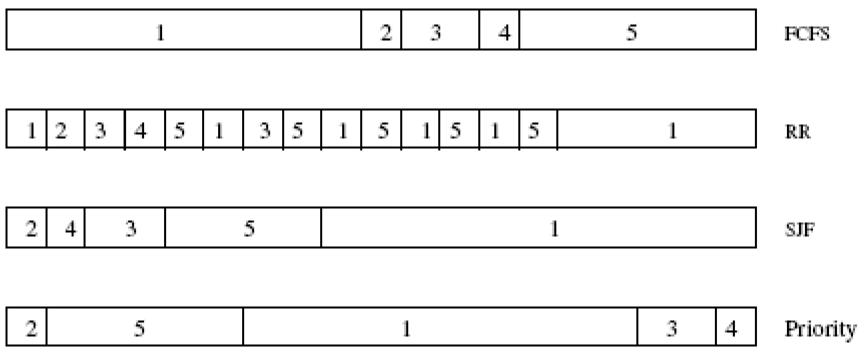
b. What is the turnaround time of each process for each of the scheduling algorithms part a?

c. What is the waiting time of each process for each of the scheduling algorithms in p a?

d. Which of the schedules in part a results in the minimal average waiting time (over processes)?

Answer:

a. The four Gantt charts are



b. Turnaround time

	FCFS	RR	SJF	Priority
P_1	10	19	19	16
P_2	11	2	1	1
P_3	13	7	4	18
P_4	14	4	2	19
P_5	19	14	9	6

c. Waiting time (turnaround time minus burst time)

	FCFS	RR	SJF	Priority
P_1	0	9	9	6
P_2	10	1	0	0
P_3	11	5	2	16
P_4	13	3	1	18
P_5	14	9	4	1

d. Shortest Job First

6.4 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 nonpreemptive scheduling and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
P_1	0.0	8
P_2	0.4	4
P_3	1.0	1

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

b. What is the average turnaround time for these processes with the SJF scheduling algorithm?

c. The SJF algorithm is supposed to improve performance, but notice that we chose to run process P_1 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 P_1 and P_2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling.

Answer:

a. 10.53

b. 9.53

c. 6.86

Remember that turnaround time is finishing time minus arrival time, so you have to subtract the arrival times to compute the turnaround times. FCFS is 11 if you forget to subtract arrival time.

6.5 Consider a variant of the RR scheduling algorithm where the entries in the ready queue are pointers to the PCBs.

a. What would be the effect of putting two pointers to the same process in the ready queue?

b. What would be the major advantages and disadvantages of this scheme?

c. How would you modify the basic RR algorithm to achieve the same effect without the duplicate pointers?

Answer:

a. In effect, that process will have increased its priority since by getting time more often it is receiving preferential treatment.

b. The advantage is that more important jobs could be given more time, in other words, higher priority in treatment. The consequence, of course, is that shorter jobs will suffer.

c. Allot a longer amount of time to processes deserving higher priority. In other words, have two or more quantums possible in the Round-Robin scheme.