CPU-scheduling Exercises

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

Exercises 2.

Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed. 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
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?

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 *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 called future-knowledge scheduling.

Exercises 3.

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

Process	Burst Time	Priority
P1	2	2
P2	1	1
P3	8	4
P4	4	2
P5	5	3

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

a. Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, nonpreemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2).

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

c. What is the waiting time of each process for each of these scheduling algorithms?

d. Which of the algorithms results in the minimum average waiting time (over all processes)?

Exercises 4.

The following processes are being scheduled using a preemptive, roundrobin scheduling algorithm. Each process is assigned a numerical priority, with a higher number indicating a higher relative priority. In addition to the processes listed below, the system also has an *idle task* (which consumes no CPU resources and is identified as *Pidle*). This task has priority 0 and is scheduled whenever the system has no other available processes to run. The length of a time quantum is 10 units. If a process is preempted by a higher-priority process, the preempted process is placed at the end of the queue.

Thread	Priority	Burst	Arrival
P1	40	20	0
P2	30	25	25
P3	30	25	30
P4	35	15	60
P5	5	10	100
P6	10	10	105

a. Show the scheduling order of the processes using a Gantt chart.

b. What is the turnaround time for each process?

c. What is the waiting time for each process?

d. What is the CPU utilization rate?