Operating Systems: Homework #4

Due on March 1, 2016 at 11:59pm

Professor Qu
Monday & Wednesday 3:30pm — 5:17pm

Nicholas Land

Problem 1

Consider the following process arrival list:

Name	Arrival time	Service time
A	0	4
B	3	9
C	5	2
D	7	5
E	11	3
F	13	1
G	21	4

Consider the following scheduling methods:

(a) First-come first-served (FCFS)

(b) Shortest-job first (SJF)

(c) Shortest remaining time first (SRTF)

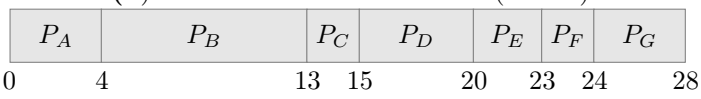
(d) Round-robin (RR), Quantum = 5

Draw a Gantt chart (time line) showing which process is executing over time and calculate the average waiting time and average completion time.

Notes : (1) In SRTF, if a process arrives with service time equal to the remaining service time of the process currently being served, the current process is not interrupted. (2) In RR, if a process arrives at the same time a quantum finishes, the running process is preempted and the new arrival executes. The preempted process goes to the end of the ready queue. (3) Waiting time and completion time is defined as in the slides.

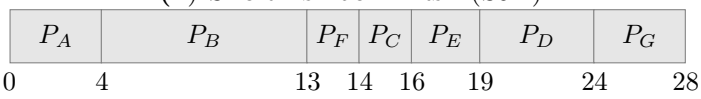
Solution

(a) First-come first-served (FCFS)



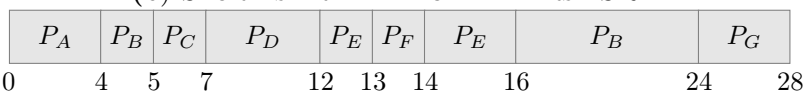
Average waiting time: $(0 + 1 + 8 + 8 + 9 + 10 + 3) \div 7 = 5.6$
Average completion time: $(4 + 8 + 10 + 13 + 12 + 11 + 7) \div 7 = 9.3$

(b) Shortest-job first (SJF)



Average waiting time: $(0 + 1 + 9 + 9 + 9 + 0 + 3) \div 7 = 4.4$
Average completion time: $(4 + 10 + 11 + 14 + 12 + 1 + 7) \div 7 = 8.4$

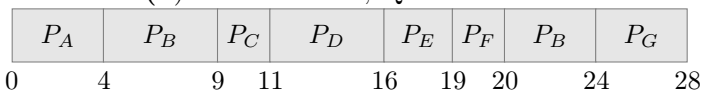
(c) Shortest remaining time first SRTF



Average waiting time: $(0 + 12 + 0 + 0 + 2 + 0 + 3) \div 7 = 5$
Average completion time: $(4 + 32 + 2 + 5 + 3 + 1 + 7) \div 7 = 14.1$

Problem 1 continued on next page...

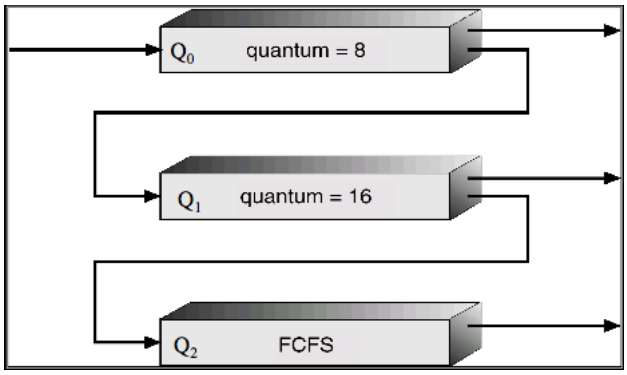
(d) Round-robin, Quantum = 5



Average waiting time: $(0 + 16 + 4 + 4 + 5 + 6 + 3) \div 7 = 5.4$
Average completion time: $(4 + 36 + 6 + 9 + 7 + 6 + 7) \div 7 = 10.7$

Problem 2

A Multilevel feedback queues are shown in the diagram below. The scheduler first executes all processes in Q0. Only when Q0 is empty will it execute processes in Q1, and only when Q0 and Q1 are empty will it execute processes in Q2. A process arriving for Q0 will preempt a process in Q1 or Q2, and a process arriving for Q1 will preempt a process in Q2; a process preempted in this case is put back to the head of the same queue; when this process is scheduled to run next time it will execute for the remaining of its allocated time quantum. A new process entering the system is put in Q0 and is given a time quantum of 8 milliseconds. If it does not finish within this time, it is preempted and moved to the tail of Q1. If Q0 is empty, the process at the head of Q1 is scheduled to run with a time quantum of 16 milliseconds. If it does not finish within this time, it is preempted and moved to the tail of Q2. Processes in Q2 are run on an FCFS basis.



Given the following arrival time and CPU burst of processes A, B, C, D, and E as shown in table below.

Task	Arrival Time	Service Time
A	0	25
B	5	28
C	19	11
D	25	19
E	36	33

a) Show the status of each queue along the time line during the running of the system. You only need to show the status of the system when either 1) a new process arrives, or 2) a process is preempted, or 3) a process terminates. The status includes time stamp, the name of the process and its remaining time in each queue. For example, at time 0, process A is in Q_0 and it has 25 time units toward finishing. Q_1 and Q_2 are empty. You are asked to complete the table with time moment and status of each queue. Moreover, B(x) A(y) shows A is at the head of the queue with x remaining time and B is at the tail of the queue with remaining time of y. You can add new rows to the table if you think the table is not enough to accommodate all the events.

Solution

Time	Q_0	Q_1	Q_2
0	A(25)		
5	B(28) A(20)		
8	B(25) A(17)		
13	B(20)	A(12)	
19	C(11)	B(14) A(6)	
24	C(6)	B(9) A(1)	
25	D(19) C(5)	B(8)	Process A terminates
28	D(16) C(3)	B(5)	
29	D(15)	C(2) B(4)	
31	D(13)	Process C terminates	B(2)
33	D(11)		Proces B Terminates
36	E(33)	D(8)	
44	E(25)	Process D terminates	
61		E(8)	
69			Process E terminates