CS2302 Operating System Exercises Spring 2022

Exercise 1: CPU Scheduling

Due date: Before Class, March 14, 2022

The following rules apply to the exercises:

* We assume that when a preempted process and new coming process need to be put in the ready queue at the same time, we prefer to put the new coming process in front of the preempted process in the ready queue.

* When processes are of same priority, use FCFS to determine the order.

1. Consider the following set of processes, with the arrival times and the length of the CPU-burst times given in milliseconds, and the priorities given so that smaller priority number means a higher priority.

Process	Arrival time	Burst time	Priority
P1	0	10	3
P2	2	1	1
P3	3	2	3
P4	4	1	4
P5	6	5	2

   a) Draw Gantt charts illustrating the execution of these processes using the following scheduling algorithm: (1) FCFS, (2) nonpreemptive SJF, (3) preemptive SJF, (4) nonpreemptive priority, (5) preemptive priority, (6) RR (quantum = 1), and (7) RR (quantum = 3). We specify that when a preempted process and new coming process need to be put in the ready queue at the same time, we prefer to put the new coming process in front of the preempted process in the ready queue. We also specify that when processes are of the same priority, use FCFS to determine the order.

   b) Calculate the average waiting time when using each of the above scheduling algorithms.

   c) Calculate the average turnaround time when using each of the above scheduling algorithms.

2. Consider the following set of processes, with the arrival times and the length of the CPU-burst times given in milliseconds.

Process	Arrival time	Burst time
P1	0	17
P2	12	25
P3	28	8
P4	36	32
P5	46	18

   a) Draw a Gantt chart illustrating the execution of these processes using a Multilevel Feedback Queue Scheduling. Use the same structure of the model as in the lectures: (queue 0: quantum 8), (queue 1: quantum 16), (queue 2: FCFS).

   b) Calculate the number of context switches for the processes.

   c) Calculate the average waiting time and the average turnaround time for the scheduling.

3. Which of the following scheduling algorithms could result in starvation, and why?
   a. First-come, first-served
   b. Shortest job first ✓
   c. Round robin
   d. Priority ✓

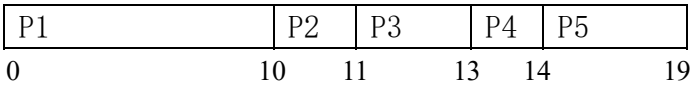
Because if there are process that have very long burst time or have very low priority, they must be starvation.

Exercise 1 Solution

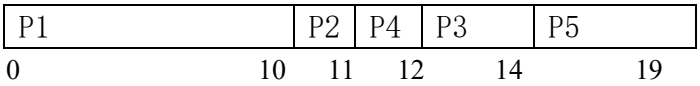
1.

a）

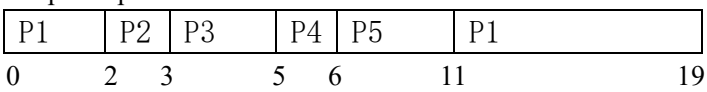
1）FCFS



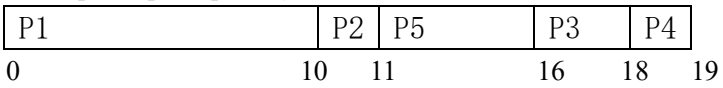
2）nonpreemptive SJF



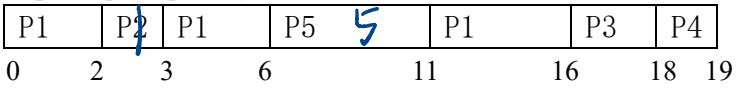
3）preemptive SJF



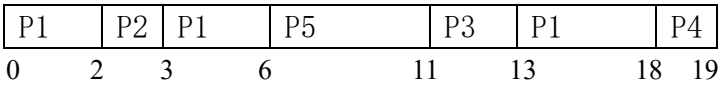
4) nonpreemptive priority



5) preemptive priority



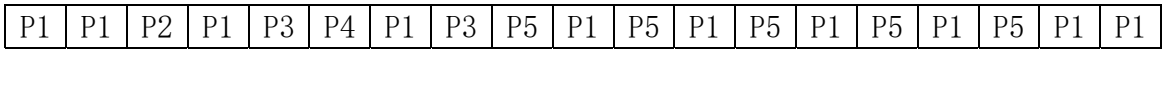
或



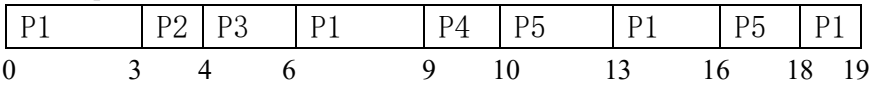
$P_1 \to 0$
$P_2 \to 2$
$P_3 \to 3$
$P_4 \to 4$
$P_5 \to 6$

6) RR (quantum = 1)

We assume that when a preempted process and new coming process need to be put in the ready queue at the same time, we prefer to put the new coming process in front of the preempted process in the ready queue.



7) RR (quantum = 3)



b）

1）[0+（10-2）+(11-3)+(13-4)+(14-6)]/5=6.6 ms

2) 6.4 ms

3) 2 ms

4) 8 ms

5) 6.6 ms / 6 ms

6) [(19-10)+0+(8-3-2)+(6-4-1)+(17-6-5)]/5 = 3.8 ms

7) [(19-10)+(4-2-1)+(6-3-2)+(10-4-1)+(18-6-5)]/5 = 4.6 ms

c)

1) [10+(11-2)+(13-3)+(14-4)+(19-6)]/5=10.4 ms

2) 10.2ms

3) 5.8 ms

4) 11.8 ms

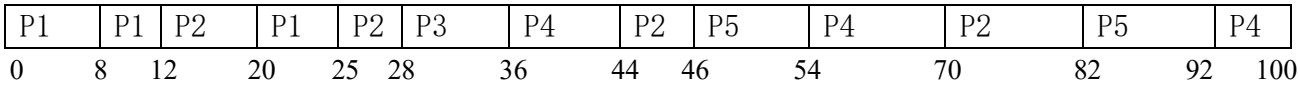
5) 10.4 ms / 9.8 ms

6) [(19-0)+(3-2)+(8-3)+(6-4)+(17-6)]/5 = 7.6 ms

7) [(19-0)+(4-2)+(6-3)+(10-4)+(18-6)]/5 = 8.4 ms

2.

a)



b) Context switch: The number of context switch is 8 (12 is also considered to be correct).

c) average waiting time:

[(25-17)+(82-12-25)+0+(100-36-32)+(92-46-18)]/5=22.6 ms

average turnaround time:

[(25-0)+(82-12)+(36-28)+(100-36)+(92-46)]/5=42.6 ms

3.

(b) SJF and (d) Priority can cause starvation!

Grading Policy:

Problem 1: (49+10): 3 * 7 + 2 * 7 + 2 * 7 + 10

3 for each gantt chart, 2 for each average waiting time/average turnaround time.

10 base score.

Problem 2: (16+10): 5 + 5 + 3 * 2 + 10

5 for a) and b), 3 for average waiting time/average turnaround time.

10 base score.

Problem 3: (5+5+5): 5 + 5 + 5

5 for choice b) and d) each.

5 base score.

100	[90,100)	[85,90)	[80,85)	[75,80)	[70,75)	[67,70)	[65,67)	[62,65)	[60,62)	[0,60)
A+	A	A-	B+	B	B-	C+	C	C-	D	F