操作系统(D)

第 5 次作业

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

Process	Burst Time	Priority
P_1	2	2
P_2	1	1
P_3	8	4
P_4	4	2
P_5	5	3

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 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)?

解.

a. 甘特图如下：

FCFS	P_1	P_2	P_3					P_4		P_5	
SJF	P_2	P_1	P_4			P_5			P_3		
Prority	P_3					P_5		P_1	P_4		P_2
RR	P_1	P_2	P_3	P_4	P_5	P_3	P_4	P_5	P_3	P_5	P_3

b. 周转时间表：

	FCFS	SJF	Priority	RR
P_1	2	3	15	2
P_2	3	1	20	3
P_3	11	7	8	20
P_4	15	12	19	13
P_5	20	20	13	18

c. 等待时间表：

	FCFS	SJF	Priority	RR
P_1	0	1	13	0
P_2	2	0	19	2
P_3	3	12	0	12
P_4	11	3	15	9
P_5	15	7	8	13

d. 等待平均时间：

	FCFS	SJF	Priority	RR
Waiting Avg	6.2	4.6	11	7.2

所以 SJF 拥有更短的平均等待时间。

5.5 The following processes are being scheduled using a preemptive, roundrobin scheduling algorithm.

Process	Priority	Burst	Arrival
P_1	40	20	0
P_2	30	25	25
P_3	30	25	30
P_4	35	15	60
P_5	5	10	100
P_6	10	10	105

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 P_{idle}). 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.

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?

解.

a. 甘特图如下：

RR	P_1	P_1	P_{idle}	P_2	P_3	P_2	P_4	P_3	P_2	P_4	P_{idle}	P_{idle}	P_6	P_5

b. 周转时间表：

	P_1	P_2	P_3	P_4	P_5	P_6
finish	20	60	75	85	125	115
turnaround	20	35	45	25	25	10

c. 等待时间：

	P_1	P_2	P_3	P_4	P_5	P_6
arrival	0	25	30	60	100	105
waiting	0	30	20	10	15	0

d. CPU 利用率：

$$\left(1 - \frac{30}{125}\right) \times 100\% = 76\%$$

5.10 The traditional UNIX scheduler enforces an inverse relationship between priority numbers and priorities: the higher the number, the lower the priority. The scheduler recalculates process priorities once per second using the following function:

$$\text{Priority} = (\text{recent CPU usage} / 2) + \text{base}$$

where base = 60 and *recent CPU usage* refers to a value indicating how often a process has used the CPU since priorities were last recalculated. Assume that recent CPU usage for process P_1 is 40, for process P_2 is 18, and for process P_3 is 10. What will be the new priorities for these three processes when priorities are recalculated? Based on this information, does the traditional UNIX scheduler raise or lower the relative priority of a CPU-bound process?

解.

	P_1	P_2	P_3
recent CPU Usage	40	18	10
priority	80	69	65

UNIX 降低了常用进程的优先级。

5.18 The following processes are being scheduled using a preemptive, priority-based, round-robin scheduling algorithm.

Process	Priority	Burst	Arrival
P_1	8	15	0
P_2	3	20	0
P_3	4	20	20
P_4	4	20	25
P_5	5	5	45
P_6	5	15	55

Each process is assigned a numerical priority, with a higher number indicating a higher relative priority. The scheduler will execute the highest priority process. For processes

with the same priority, a round-robin scheduler will be used with a time quantum of 10 units. If a process is preempted by a higher-priority process, the preempted process is placed at the end of the queue.

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?

解.

a. 甘特图如下：

P_1	P_2	P_1	P_3	P_4	P_5	P_2	P_6	P_3	P_4	P_6

b. 周转时间表：

	P_1	P_2	P_3	P_4	P_5	P_6
finish	25	60	80	90	50	95
turnaround	25	60	60	65	5	40

c. 等待时间表：

	P_1	P_2	P_3	P_4	P_5	P_6
arrival	0	0	20	25	45	55
waiting	10	40	40	45	0	25

5.20 Which of the following scheduling algorithms could result in starvation?

a. First-come, first-served

b. Shortest job first

c. Round robin

d. Priority

解. 最短作业优先调度(b.) 和优先级调度(d.)。因为前者可以作业时间很长的任务可能会永远得不到执行，后者优先级很低的任务可能永远得不到执行。