國立中山大學資訊工程學系

93 學年度第 2 學期博士班資格考試　作業系統

1. **Process** [A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts*, John Wiley & Sons, Inc., 6th Ed., Chapter 5, Exercises 5.3]

   What are the differences between user-level threads and kernel-supported threads? Under what circumstances is one type "better" than the other? **(**15%**)**

2. **Process Synchronization** [A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts*, John Wiley & Sons, Inc., 6th Ed., Chapter 7, Exercises7.17]

   Write a monitor that implements an alarm clock that enables a calling program to delay itself for a specified number of time units (ticks). You may assume the existence of a real hardware clock, which invokes a procedure tick in your monitor at regular intervals. **(20%)**

3. **Deadlocks** [A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts*, John Wiley & Sons, Inc., 6th Ed., Chapter 8, Exercises 8.13]

   Consider the following snapshot of a system:

	Allocation	Max	Available
	A B C D	A B C D	A B C D
P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

   Answer the following questions using the banker's algorithm:

   a). What is the content of the matrix **Need**? **(5%)**

   b). Is the system in a safe state? **(5%)**

   c). If a request from process P1 arrives for (0,4,2,0), can the request be granted immediately? **(5%)**

4. **Virtual Memory** [A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts*, John Wiley & Sons, Inc., 6th Ed., Chapter 10, Exercises 10.10]

Consider the two-dimensional array A:

```
var A: array[1..100] of array of [1..100] of integer;
```

where A[1][1] is at location 200, in a paged memory system with pages of size 200. A small process is in page 0 (locations 0 to 199) for manipulating the matrix; thus, every instruction fetch will be from page 0. For three page frames, how many page faults are generated by the following array-initialization loops, using LRU replacement, and assuming page frame 1 has the process in it, and the other two are initially empty: (20%)

(a)
```
for j :=   1 to 100 do
        for i := 1 to 100 do
            A[i][j] := 0;
```

(b)
```
for i :=   1 to 100 do
        for j := 1 to 100 do
            A[i][j] := 0;
```

5. CPU Scheduling [A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts*, John Wiley & Sons, Inc., 6th Ed., Chapter 6, Exercises 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
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? **(5%)**

b. What is the average turnaround time for these processes with the SJF scheduling algorithm? **(5%)**

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 known as future-knowledge scheduling. **(5%)**

6. **Mass Storage** [A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts*, John Wiley & Sons, Inc., 6th Ed., Chapter 14, Exercises 14.2]

   Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130
   Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms?

   A. FCFS **(3%)**
   B. SSTF **(3%)**
   C. SCAN **(3%)**
   D. LOOK **(3%)**
   E. C-SCAN **(3%)**