淡江大學 103 學年度碩士班招生考試試題

系別：資訊工程學系
　　　資訊工程學系資訊網路與通訊碩士班
科目：作業系統

考試日期：3月2日(星期日) 第2節　　　本試題共　6　大題，　2　頁

本試題雙面印刷

1. (a) List the three conditions that must be satisfied to solve the **critical-section problem**. (10%)

   (b) Show that which condition(s) cannot be satisfied by the following code segment in the concurrent programming environment,

   ```
   do {
       while (TestAndSet(&lock));
         // critical section
       lock = FALSE;
         // remainder section
   } while (TRUE);
   ```

   where `lock` is a shared boolean variable (initialized to `FALSE`) and `TestAndSet()` is an atomic hardware instruction (which will set the input parameter to `TRUE` and return the original value of the input parameter). (10%)

2. What will be the possible value of the variable `x` (shared by Threads 1 and 2) in the following code segment after the program is executed. (Assume that the initial value of `x` is 0.) Why? (10%)

   ```
   Thread 1: { for (i = 0; i < 15; i++) x = x + 1; }
   Thread 2: { for (i = 0; i < 15; i++) x = x - 1; }
   ```

3. What are the differences between **preemptive** and **non-preemptive** scheduling? (10%)

4. Suppose that a disk drive has 1,000 cylinders, numbered 0 to 999. The drive is currently serving a request at cylinder 593, and the previous request was at cylinder 425. The queue of pending requests, in FIFO order, is

   $$296, 470, 693, 774, 948, 509, 122, 750, 30$$

   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? (20%)

   (a) SSTF, (b) LOOK.

5. Consider a two-dimensional integer array `A` (where an integer is 4-byte long):

   ```
   int A[][] = new int[50][50];
   ```

   where `A[0][0]` is stored at location 1024, in a paged memory system with pages of size 1024 bytes. A small process resides in page 0 (locations 0 to 1023) for manipulating the matrix `A`. Thus, every instruction fetch will be from page 0. For a process with four page frames, how

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many page faults are generated by the following array- initialization loops, using the LRU (Least-Recently Used) replacement, and assuming page frame 1 has the process in it, and the other three are initially empty: (Note that the 2-dimensional array is in row-major order.) (20%)

```
for (int j = 0; j < 50; j++)
    for (int i = 0; i < 50; i++)
        A[i][j] = 0;
```

6. Assume that a Buddy system is used for allocating kernel memory. Initially, the contiguous memory is 1MB. For the following memory requests, draw the figures to show the result for each request. (20%)

(a) Process A requests 200K.

(b) Process B requests 70K.

(c) Process C requests 160K.

(d) Process A releases its memory.

(e) Process D requests 120K.

(f) Process B releases its memory.

(g) Process E requests 80K.

(h) Process C releases its memory.

(i) Process E releases its memory.

(j) Process D releases its memory.