國立台灣科技大學九十八學年度碩博士在職專班招生試題

系所組別： 資訊工程系碩士在職專班

科　　目： 資訊工程概論

（總分爲 100 分）

1. True or False. **You MUST justify your answer to receive full credit.** (15%)
   (a) A process is in thrashing state if it is spending more time executing than paging.
   (b) A user application only runs in user mode and the kernel only runs in kernel mode.
   (c) The Multi-Level-Feedback-Queue (MLFQ) scheduling is an approximation to the Shortest-Job-First (SJF) scheduling.
   (d) The four necessary conditions for a deadlock are: mutual exclusion, preemptive, hold and wait, and circular wait.
   (e) A Translation Lookaside (or Lookahead) Buffer (TLB) has a fixed number of page table entries, which map physical memory addresses onto disk addresses.

2. Consider the following snapshot of the resources in a system: (10%)

Resource / Process ID	Allocated				Max Required			
	A	B	C	D	A	B	C	D
1	1	1	2	1	5	3	3	3
2	2	3	0	1	5	4	3	2
3	1	2	2	0	3	4	3	2
4	2	0	1	2	3	5	3	6

Currently available resource `[A, B, C, D] = [2, 2, 2, 2]`. Will the system be in a safe state if Process 1's request of `[1, 0, 1, 0]` is granted at this moment? **You must show step-by-step how you arrive at your answer to receive full credit.**

3. Assume that there are three page frames (initially empty). Consider the references strings: (15%)

   1 2 3 2 1 4 1 2 3 4 1 2 1 3 2 4

   How many page faults will occur for the following replacement algorithms?
   (a) FIFO
   (b) LRU
   (c) Optimal

   You must show step-by-step how you arrive at your answer to receive full credit.

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4. Devise algorithms for the following problems. (20%)

   a、 Given an array of N elements of two different types, Green and Yellow, design an O(N) in-place algorithm to put all the Green elements on the left, followed by all the Yellow elements.

   b、 Extend your algorithm to the case where there are three different types of elements, Green, Yellow, and Red.

5. Consider the function defined recursively for all positive integers n by $f(1) = 1$ and $f(n) = f(n-1) + 2n - 1$, for $n > 1$. (15%)

   a、 Give an explicit formula for $f(n)$.(Hint: Try a few simple formulas.)

   b、 Prove that the formula is correct.

6. What is the computational complexity of the following code fragment? (10%)

```
for(i=n/2; i<n; i++)
    for(j=1; j<n; j+=n/2)
        for(k=1; k<n; k=2*k)
            x=x+1;
```

7. What is the probability of getting one pair in a five-card poker hand? That is two cards of one rank, and three cards that don't match the rank of the pair or each other. (15%)