

# 國立清華大學 103 學年度碩士班考試入學試題

系所班組別：服務科學研究所碩士班 乙組（服務系統組）

考試科目（代碼）：計算機概論（4801）

共 2 頁，第 1 頁

\*請在【答案卷、卡】作答

You can answer the questions in English or Chinese.

Write down all your assumptions when they are necessary in your answers.

1. A computer has a bus with a 25 nsec cycle time, during which it can read or write a 32-bit word from memory. The computer has a disk that uses the bus and runs at 40 Mbytes/sec. The CPU normally fetches and executes one 32-bit instruction every 25 nsec. How much does the disk slow down the CPU? (10%)
2. LRU (Least Recently Used) and FIFO (First-In First-Out) are two of the most popular page replacement policies. Please use one example to show when LRU is better than FIFO. And a second example to show that LRU performs worse than FIFO. You can decide the criteria to be used in judging "better performance." (10%)
3. In the operation of a computer's processing unit, it has been known that fetching of instructions from memory is a major bottleneck in instruction execution speed. Please describe how the concept of **Pipeline** help alleviate the problem. (15%)
4. Amazon.com announced that it will be able to do something like anticipatory shipping. That is, Amazon.com can anticipate what customers buy even before orders are placed to decrease shipping time. Can you make an assessment about how Amazon.com is able to do that? (15%)

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5. Please write a pseudo-code to calculate  $n!$ , where  $n! = n(n-1)!$  subject to the limiting condition that  $0! = 1$ .  
You will need to use “recursion” in your code.  
Please write down any assumption you have. (10%)
6. The e-Tag system is a system for charging highway fees to be based on distance travelled. In Taiwan, for the purpose of calculating the fees, there are 319 “frames” set up along the highway from north end to south end. Each frame is designed to be equipped with sensors for detecting the cars passing. Alternatively, instead of having the sensor frames all over the highway, we can set up monitoring “frames” only at all the entrances and exits to the highway. By calculating the distances between the entrance and exit, we will know the travelling distance.  
Now consider the situation when the e-Tag system tries to calculate the fee based on the distance a car travelled. Please make a comparison between these two approaches in obtaining data for calculating the highway fee. How are the two different ways of calculating the highway fee? What the strengths and weaknesses for each method? (20%)
7. Please use an example to explain what is a “race condition” when two processes are running independently and communicates via a shared channel. (10%)  
Please use one example to show how a semaphore can be used to resolve “race condition” issue. (10%)