

# 國立清華大學 100 學年度碩士班入學考試試題

系所班組別：服務科學研究所乙組（服務系統組）

考試科目（代碼）：5001 計算機概論

共 2 頁，第 1 頁 \*請在【答案卷、卡】作答

You can choose to answer the following questions in either English or Chinese.

If you find some necessary information is missing in answering a question, you may explain it and add the information in your answer.

Good luck!

1. (10%) A computer has a cache memory, a main memory, and a hard disk used as virtual memory. Assuming that it takes 20 ns to retrieve a word in the cache memory. And if it is in main memory but not in the cache memory, it will take 50 ns to access and store it in the cache memory. If it is not in main memory, it will take 12 ms to retrieve it from the hard disk and store it in the main memory, followed by another 60 ns to copy to the cache memory. Now assume that the Hit Ratio for the cache memory is 0.9 and the Hit Ratio for the main memory is 0.6. Please calculate the average time of retrieving a word in the system.

2.

```
Function foo8 (Type data[1..n])
  Int i, j, x;
  For i from 1 to n do
    x = i
    For j from (i + 1) to n do
      If data[j] > data[x] then
        x = j
    Swap data[i] and data[x]
  End foo8
```

- (a) (5%) Please briefly describe what does this function do.
- (b) (5%) What are the Worst case, Best case, and Average case Performance? Please use Big-O notation for the three situations.
- (c) (10%) Some computers use Flash memory, where every “write” (i.e. swap data) shortens the lifespan of the memory, thus it is costly for performing this function. Please provide a method that can produce the same results but use less “write” function. Please explain why your answer is correct.

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3. Standard hard disks spin the disk at a constant speed, which means that when the heads are on the outside of the disk they will traverse a much longer linear path than they do when on the inside.
- (a) (5%) For some disks having the same number of sectors for every track, what are the compensation mechanisms needed to let the magnetic head read every bit of the data with same speed.
- (b) (5%) If a design wants to make use of the disk capacity as much as possible, what changes need to be implemented to make it possible.
- (c) (5%) Consider a cluster of hard disks consists of 1000 hard disks. The Mean Time Between Failures (MTBF) of a hard disk is 750,000 hours. How long will the hard disk cluster encounters a failure?
4. (10%) The following excerpt involves two companies, Intel, the dominant CPU maker, and Nvidia, one of the two major Graphic processing unit (GPU) makers.

**Intel researchers have published the results of a performance comparison between their latest quad-core Core i7 processor and a two-year-old Nvidia graphics card, and found that the Intel processor can't match the graphics chip's parallel processing performance.**

**On average, the Nvidia GeForce GTX 280 -- released in June 2008 -- was 2.5 times faster than the Intel 3.2GHz Core i7 960 processor, and more than 14 times faster under certain circumstances.**

Based on this news, assuming it is true, considering the competition in the market and the different roles played by either CPU or GPU, What is the implication for a computer system using Intel + Nvidia? What is the implication for Intel? What is the implication for Nvidia?

In answering the question, you can make any assumption as needed. Please use a table to list the different factors you consider for making the comparison .

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5. (20%) One procedure in Taiwan's joint university entrance exam office is to assign students to a university department according to the sequence of the wish list of desired departments provided by each student. Assuming that there are 10,000 students, each student can provide no more than 10 choices of their desired department (from 1 to 10, 1 being the most desired), and each student will have one total score. There are a total of 100 departments from all universities participating in this entrance exam; each department can accommodate 60 students. Students will be assigned to one department, with the condition that students with a higher score will have higher priorities in getting assignment based on their individual wish lists. Assuming that no two students' score will be the same.
- Please use pseudo code for implementing this project so that every department can fill up their quota of students.
- You can give any additional information needed in answering this question.
6. For a peer-to-peer (p2p) system for file sharing, there are two types of architecture, with or without a centralized server that registers all the information within the peer network.
- (a) (10%) Please compare the two types of p2p systems in terms of indexing, resource discovery, vulnerability, and expandability.
- (b) (5%) Because p2p file sharing tends to have the characteristic of high-bandwidth usage, many Internet Service Providers or system managers would like to control the traffic. Please give one solution to bypass this control.
- (c) (10%) The concept of Net Neutrality becomes more important recently. In the US, they just granted federal government authority to regulate Internet traffic and prevent broadband providers from selectively blocking Web traffic. There are some people support Net Neutrality, and some oppose it. Can you provide the rationalization as to what the supporters and opponents are thinking?