國立清華大學 101 學年度碩士班考試入學試題

系所班組別：服務科學研究所乙組

考試科目（代碼）：計算機概論（4701）

The total score is 100 points.

You may add any assumptions necessary in answering the questions. Good luck.

1. The popular Apple iPhone 4S has a new feature of voice activated assistant called *Siri,* which is a voice recognition system capable of responding to users' command and aware of the situation. Assuming a situation when you say "Should I bring an umbrella today?" And the *Siri* responds with "I recommend you to bring one for this evening." Please design a system so that it can function what the *Siri* can do. You can draw a graph of a system view that takes human voice commands as input and finally to produce *Siri* output (also in voice). Please show all the sub-systems that are needed in answering the question of "Should I bring an umbrella today?" Make sure to list clearly the necessary computational capability to make the whole system possible.
   Note: It is important to make your answer clear and you can write down any assumptions needed. You should list only what is necessary, but not some unrelated sub-systems. (20%)

2. (a) What is the maximum amount of time that it would take for a computer that can try 1 million RC2 keys (RC2 keys have 40 bits) every second to do a brute-force attack on a Microsoft Office document sealed with a cryptographic transformation that uses a 128-bit shared secret? (10%)
   (b) Computer hardware virtualization uses a layer of software that provides the illusion of a "real" machine to multiple instances of "virtual machines." Please list three benefits of using this kind of virtualization technique. (10%)

3. (a) Microsoft Windows 7 has a 32-bit version and a 64-bit version. What does the 32-bit and 64-bit mean for the operation of a computer system? (5%)
   (b) Why is the difference related to the RAM (Random Access Memory) usage? (5%)

4. Demand paging and Anticipatory paging are two applications of virtual memory. When the system attempts to access a page that is not in memory, it causes a page fault trap. The goal of the page replacement algorithm is to reduce the fault rate by selecting the best victim page to remove.
   Usually, when there are more memory pages, the page fault rate is less likely.

There is a situation when a system is given more memory, the fault rate might actually increase. Please describe why this is possible. You need to use an example to illustrate this. (10%)

5. When a database record is accessed by multiple users concurrently, it is likely to cause some problems when no protection mechanism is in place. Consider a bank account record is accessed by two different users at the same time.
(a) Please show a series of commands from the two different users, with no any protection mechanism for the system, in such a sequence that an addition to the bank account record is lost. (10%)
(b) Please introduce some mechanism to guard against such undesirable situation. (10%)

6. Consider the following "onesort" algorithm. Note: you can write down any assumption if you think some more information is needed.
(a)Given an array of number: { 31, 24, 8, 10, 9, 45, 17, 26, }
Please show during each run, how the list of number are sorted. You need to list the order of number in each pass. (10%)
(b) What is the worst, best, and average complexity of this algorithm? (10%)

```
function onesort(array, 'left', 'right')

   if 'left' < 'right'
      choose any 'pivotIndex' such that 'left' ≤ 'pivotIndex' ≤ 'right'
      'pivotNewIndex' := partition(array, 'left', 'right', 'pivotIndex')
      onesort(array, 'left', 'pivotNewIndex' - 1)
      onesort(array, 'pivotNewIndex' + 1, 'right')
```