

國立清華大學 102 學年度碩士班考試入學試題

系所班組別：服務科學研究所

考試科目（代碼）：計算機概論（4701）

共 2 頁，第 1 頁 *請在【答案卷、卡】作答

- You can answer in English or Chinese. 可以用中文或英文回答。
 - 回答時請將各題答案內容以條列式，明白標示第一點，第二點等方式寫出。
 - 若有何資訊為答題所需要，而題目沒有寫明的，請說明，並自行加入。
1. Please describe one sorting algorithm that has the following characteristics:
Worst case performance: $O(n^2)$ comparisons, swaps
Best case performance: $O(n)$ comparisons, $O(1)$ swaps
Average case performance: $O(n^2)$ comparisons, swaps
 - (a) What is the name of this sorting? (5%)
 - (b) Write a pseudo-code for this sorting algorithm. (5%)
 - (c) Also use this mechanism to sort the following series of numbers. You need to show every step of the number changes in the sorting process. (10%)
31, 57, 48, 81, 52, 24, 54, 10
 2. A group of $2^n - 1$ routers are interconnected in a centralized binary tree, with a router at each tree node. Router i communicates with router j by sending a message to the root of the tree. The root then sends the message back down to j . Derive an approximate expression for the mean number of hops per message for large n , assuming that all router pairs are equally likely. (20%)
 3. A video server can be considered as a massive real time I/O device. As data showed, not all movies are equally popular. Some find Zipf's law can be used to describe the dispersion in movie popularity.
 - (a) What is Zipf's law? Name ONE other situation in which the Zipf's Law can be observed. (10%)
 - (b) There are two possible ways of organizing disk storage of videos: disk farm and disk array. For Disk Farm, each drive holds a few entire movies. For Disk Array, each movie is spread out over multiple drives, for example, block 0 on drive 0, block 1 on drive 1. Please compare the advantages and disadvantages of these two ways of disk storage in the situation of video server. (10%)

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4. Consider Linked lists vs. Dynamic Arrays, two data structures related to allocating memory space.
 - (a) In insertion or deletion of an element in a Dynamic Array, there may be problems causing fragmentation. Please describe when this will happen? (10%)
 - (b) Linked list is suitable for what kind of access? In what situation do the Dynamic Arrays more efficient? (5%)
 - (c) When will a Circularly linked list be necessary, compared to a linearly linked list? (5%)

5. 在討論行動上網費率時，關於上網吃到飽的問題，有人提到『有線無限，無線有限』。也就是說有線的頻寬可以藉由線路的增加來確保，無線的頻寬卻不能。
 - (a) 請對『有線無限，無線有限』這句話的意義，深入說明為何如此？(10%)
 - (b) 當有大型活動時，例如跨年倒數，大量的人數聚集在一個小區域，上網品質受到嚴重影響。請問有何方法解決這種在大型活動有臨時性的大量人數，同一時間需要頻寬的問題？(10%)