國立中正大學
114學年度碩士班招生考試
試 題

[第4節]

科目名稱	資料結構
系所組別	電機工程學系-計算機工程組

一作答注意事項一

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始40分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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科目名稱：資料結構　　本科目共 1 頁　第 1 頁

系所組別：電機工程學系-計算機工程組

1. Hashing

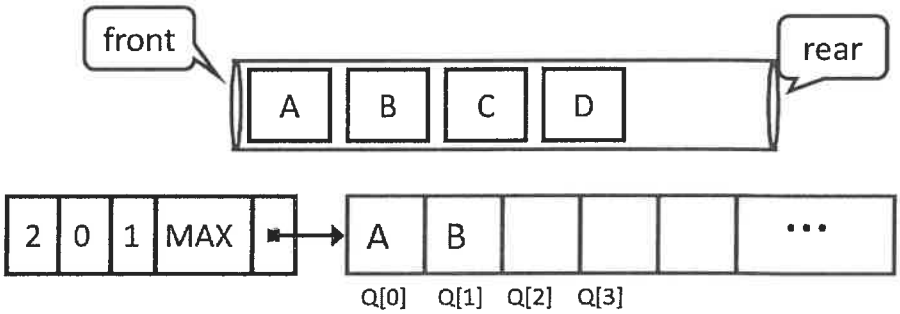
i. (10 points) Consider hashing IP addresses (IPv4 4-byte addresses). Design a hash table with a hash function and a storage. Explain what is a reasonable size of the table and also the effectiveness of the hash function which you propose. State your rationale with examples.

ii. (10 points) Define the hash function and the probing function for your proposal above. Be sure to define the function name, parameter list, return value, local variables, and calling method. Use C or pseudo code to complete your answer.

iii. (10 points) Analyze the time complexity of the hashing procedure above and show the result in the Big-O notation. Be sure to show the steps in analysis and the associated detail calculation. Explain what may be average complexity and what may be worst.

2. Queues

Consider the following concept of a priority queue where the elements, A, B, C, and D, are integers and the largest value is always at the front. An example of design using an array is given below. The queue head contains five fields, the element count, the index number of the front, the index number of the rear, the maximum size of the array storage, and the pointer to the array storage. Answer the following by writing C code or pseudo code.



i. (5 points) Define the data structures to the queue head and the queue storage shown above.

ii. (20 points) Construct the Enqueue function and the Dequeue function for this priority queue.

iii. (15 points) Analyze the time complexity of both the Enqueue procedure and the Dequeue procedure for time complexity and show the results in the Big-O notation. Be sure to show the steps in analysis and the associated detail calculation.

3. Sorting.

i. (15 points) Define a **merge sort** function which sorts the integer data in an ascending order. Use C or pseudo code to complete your answer. Be sure to define data structures, function headers, and local variables clearly.

ii. (15 points) Analyze the time complexity of the merge sort function above and show the result in the Big-O notation. Be sure to show the steps in analysis and the associated detail calculation along with your explanation.