

國立臺北大學 104 學年度碩士班一般入學考試試題

系(所)組別：資訊工程學系

科 目：資料結構與演算法

第 1 頁 共 2 頁

可 不可使用計算機

1. (13%)(a). Describe an $O(\log n)$ algorithm for searching the k^{th} smallest element in a binary search tree. (8%)(b). Using the following data 29, 12, 49, 8, 12, 31, 60, 5, 32 as an example. (5%)

2. (18%) (a) For the AOE (Activity on Edge) network as shown in Figure 1 obtain the earliest start time $e()$, and latest start time $l()$, for each activity. Which activities are critical? (12%)(b). What is the earliest time the project can finish? (3%) (c). In there any activity whose speed up would result in a reduction of the project length? (3%)

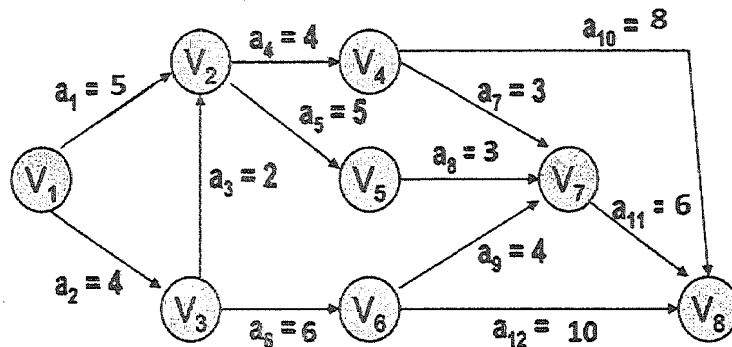


Figure 1

3. (19%) (a) Describe the property of B-tree of order m (3%) (b) What is the minimum number of nodes and keys for B-tree with order m and height h ? (5%) (c) Insert 3, 150 and 7 into B-tree of order 3 in Figure 2. (6%) (d) Delete 80, 10 and 50 from B-tree of order 3 in Figure 3 (5%).

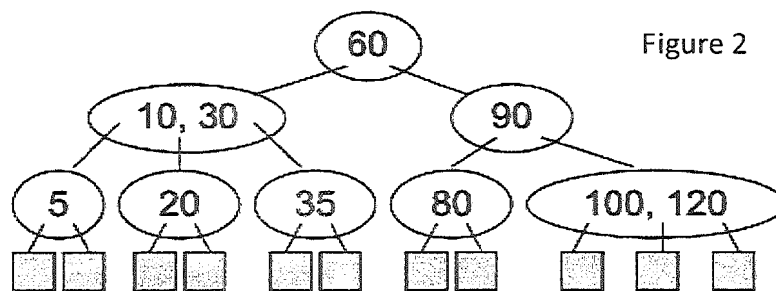


Figure 2

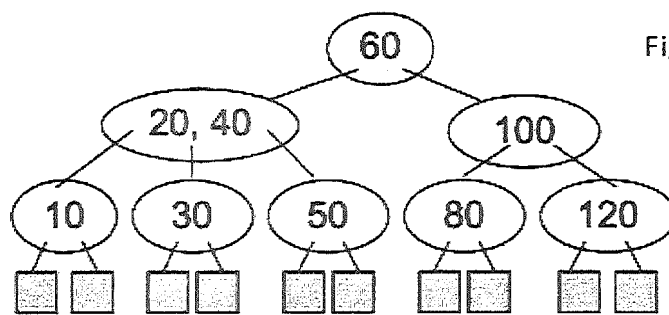


Figure 3

試題隨卷繳交

接背面

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4. (20%) Fill out the following table about time complexity of sorting n elements with various algorithms. Use Θ -notation.

	Average case	Worst case
Insertion sort		
Selection sort		
Merge sort		
Heap sort		
Quick sort		

5. (15%) Consider the following recursive function where $count$ is a global variable initialized to 0.

```
Rec-x( $n$ )
{
  if ( $n = 1$ ) or ( $n = 2$ ) then
     $count \leftarrow count + 1$ 
  else
  {
    Rec-x( $n - 1$ )
    Rec-x( $n - 2$ )
    Rec-x( $n - 2$ )
     $count \leftarrow count + 1$ 
  }
}
```

- Express the value of $count$, after the execution of $Rec-x(n)$ where $n > 0$, as a function of n . (5%)
- Find out the asymptotic time complexity in Θ -notation. (5%)
- Find out the asymptotic space complexity in Θ -notation. (5%)

6. (15%) Given 4 matrices A_1 (with dimension 30×35), A_2 (35×15), A_3 (15×5), A_4 (5×10), we want to compute the matrix-chain product $A_1A_2A_3A_4$. It is known that different ways to parenthesize the product may need different numbers of scalar multiplications.

- List all possible ways in which we can parenthesize the product $A_1A_2A_3A_4$. (5%)
- Find the optimal parenthesization to minimize the number of scalar multiplications. (5%)
- Find the minimal number of scalar multiplications needed to compute the product $A_1A_2A_3A_4$. (5%)

試題隨卷繳交