

國立臺灣科技大學

九十四學年度碩士班招生考試試題

系所組別：電機工程系碩士班丙一組

科目：資料結構

※ 總分為100分，所有答案務必寫於答案卷上。

1. Suppose a binary tree starts from level 1.
 - a) What is the maximum number of nodes on level i ($i \geq 1$) of a binary tree? (3%)
 - b) What is the maximum number of nodes in a binary tree of depth k ($k \geq 1$)? (3%)
 - c) How many nodes in a full binary tree of depth k ($k \geq 0$)? (3%)
 - d) How many nodes in a complete binary tree of depth k ($k \geq 0$)? (3%)
 - e) What is the relation between number of leaf nodes and nodes of degree 2 for any nonempty binary tree? (3%)

2. For priority queue representations, fill out the following table for their respective time complexities: (20%)

Representation	Insertion	Deletion
Unordered array		
Unordered linked list		
Sorted array		
Sorted linked list		
Max heap		

3. **Natural merge sort:** we can modify merge-sort to take into account the prevailing order within the input list. In this implementation we make an initial pass over the data to determine the sequences of records that are in order. The merge sort then uses these initially ordered sublists for the remainder of the passes.
 - a) How much time does this sorting algorithm take on an initially sorted list? Explain. (5%)
 - b) What is the worst computing time of the sorting algorithm? Give one example of the worst case. (5%)
 - c) What is the best computing time of the sorting algorithm? Give one example of the best case. (5%)

4. Read a serial of numbers of 71, 48, 33, 11, 78, 51, 63, 18, 25, and 9 in sequence to find:
 - (a) Max heap tree. (10%)
 - (b) Binary search tree. (10%)

5. Given an *prefix* as +A*-BC\$DE, Please find its binary tree and *postfix* by using *traversal*. (10%)



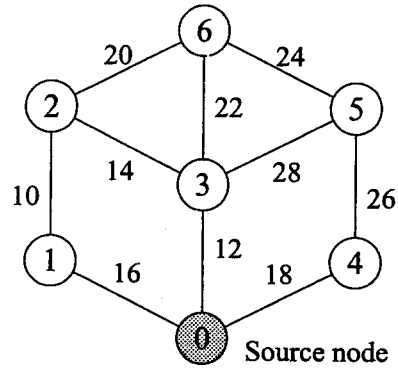
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6. Please construct a minimum cost spanning tree for the undirected connected graph with the cost beside each link shown below by
- (a) Prim's algorithm without any constrain. (10%)
- (b) Prim's algorithm with the constrain that a branch contains at most two links. (10%)



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