

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：電機工程系碩士班

組別：丙組

科目：資料結構

- 1) Let $D = \text{depth}$
 - a) A general tree contains 235 nodes. What can you determine about the depth of the tree. (5%)
 - b) A general tree of degree 4 contains 235 nodes. What can you say about the depth of the tree. (5%)
 - c) A binary tree contains 235 nodes. What can you determine about the depth of the tree. (5%)
 - d) A binary tree contains 235 nodes and 57 of them have degree 0. What can you say about the number of nodes of degree 1. (5%)

- 2) Determine the frequency counts for all statements AND time complexities for the following two programs:
 - a) (10%)

```
for i ← 1 to n
  for j ← 1 to i
    for k ← 1 to j
      x ← x + 1
    end
  end
end
```
 - b) (5%)

```
i ← 1
while i ≤ n do
  x ← x + 1
  i ← i + 1
end
```

- 3) QUICKSORT, HEAPSORT, and the 2-WAY MERGE SORT all have the same average time complexity of $O(n \log n)$. What arguments can you give (e.g., application conditions) for each of them that would lead you to make decision on the sorting method to use. (15%)

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- 4) Suppose that the binary tree in Fig. 1 is a splay tree.
- Draw the tree obtained after the key 5 is referenced and splayed. (5%)
 - Draw the tree obtained after the key 8 is inserted into the tree in Fig. 1 and the splaying operation is done. (5%)

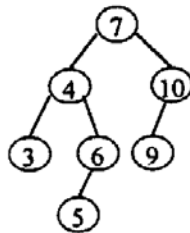


Fig. 1

- 5) Suppose that the binary tree in Fig. 1 is an ordinary search tree.
- Draw two possible result trees if the root node in Fig. 1 is deleted. Note that the trees you draw must be obtainable from a general deletion procedure. (5%)
 - List the keys in Fig. 1 with level-order and post-order tree traversal, respectively. (5%)
 - If recursive procedures are not allowed, what data structures should be used to implement level-order and post-order traversing, respectively? (5%)
- 6) The sequence of keys, 19, 31, 41, 9, 30, 21, 62, 17, is to be hashed into a hash table of size 11 by using the hashing function, $H(x) = x \% 11$.
- Show the content of the hash table obtained if quadratic probing is adopted to resolve collisions. (5%)
 - Show the content of the hash table obtained if double hashing is adopted and the increment is determined by the function, $Inc(x) = 9 - x \% 9$. (5%)
 - Suppose that random probing is adopted to resolve collisions and λ is the loading factor. Estimate the expected number of probing needed to insert a key into the hash table. (5%)
- 7) Write a recursive procedure, *int Height(tree T)*, to determine and return the height of the binary tree pointed by T. Note that a tree node has three fields which are named as LSP (pointing to its left son), RSP (pointing to its right son), and KEY. (10%)