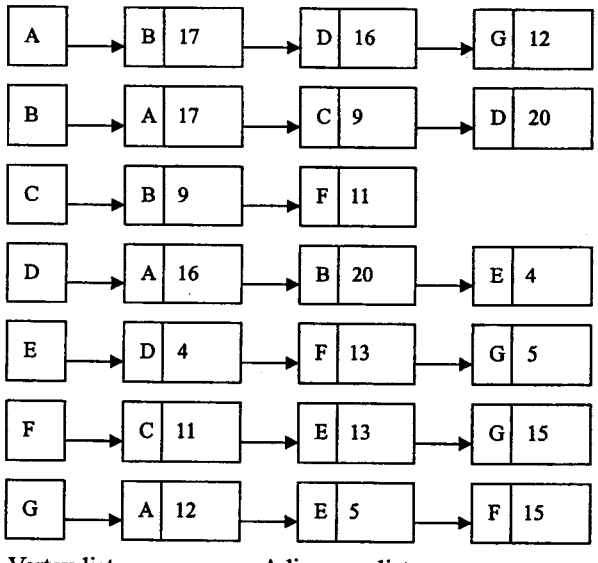
國立臺灣科技大學
九十四學年度碩士班招生考試試題
系所組別：資訊管理系碩士班甲組
科　　目：資料結構

共 6 題，總分 100 分

1. (a) Give the definition of complete binary tree. (5%)
(b) Give the definition of nearly complete binary tree. (5%)
(c) Give the definition of min heap. (5%)
(d) A min-max heap is a complete binary tree such that if it is not empty, each element has a field called *key*. Alternating levels of this tree are min levels and max levels, respectively. The root is on a min level. Let x be any node in a min-max heap. If x is on a min level then the element in x has the minimum key from among all elements in the subtree with root x. Similarly, if x is on a max level then the element in x has the maximum key from among all elements in the subtree with root x. Please draw the final min-max heap after inserting the following numbers (keys) sequentially into an empty min-max heap: 45, 20, 30, 51, 18, 33, 12, 17, 66, 27, 35, 14, 6, 54, 7. (10%)

2. Based on the adjacency list shown below, answer following questions. The value field in element of the adjacency list contains edge weight of the graph.
(a) Draw the graph diagram. (5%)
(b) Draw the minimum cost spanning tree of this graph. (5%)



184

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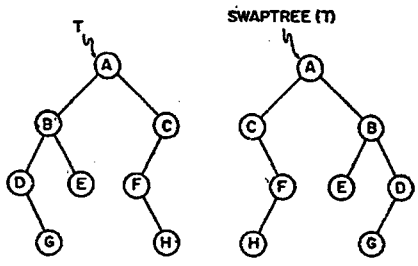
3. Use (x mod 17) as the hash function to insert the following keys into an empty hash table: 18, 36, 19, 52, 24, 20, 40, 35. Since collision may occur during the insertion operation, three collision methods listed below may be used to handle the collision problem. Please draw the final hash table after applying each one of these collision methods. If information is not sufficient to you, make your own assumption and write it down with your answer.
   (a) Linear probe (one slot per bucket) (5%)
   (b) Bucket hashing (two slot per bucket) (5%)
   (c) Chaining (linked list resolution) (5%)
4. Answer the following questions.
   (a) Give an algorithm to evaluate a postfix expression. Use the following expression as an example to illustrate your algorithm: (10%)
   AB+CD-*
   (b) Write a SWAPTREE(T) algorithm which takes a binary tree and swaps the left and right children of every node (Assume that each node has a LEFT and a RIGHT fields pointing to its left child and right child respectively). An example of tree swapping is shown in the following: (10%)



5. Answer the following questions.
   (a) Give the definition of an AVL tree. (5%)
   (b) Show the result of inserting 2, 1, 4, 5, 9, 3, 6, 7 into an initially empty AVL tree.(10%)
6. Compute the Big Ohs of the following functions and list them in ascending order of their growth rates. (15%)

$$T_1(n) = T_1(n-1) + \frac{1}{n} \quad , T_1(1) = 1$$

$$T_2(n) = T_2(n-1) + n \quad , T_2(1) = 1$$

$$T_3(n) = 2T_3(\frac{n}{2}) + 1, \quad T_3(1) = 1$$

$$T_4(n) = 8T_4(\frac{n}{2}) + 6n \quad , T_4(1) = 6$$

185