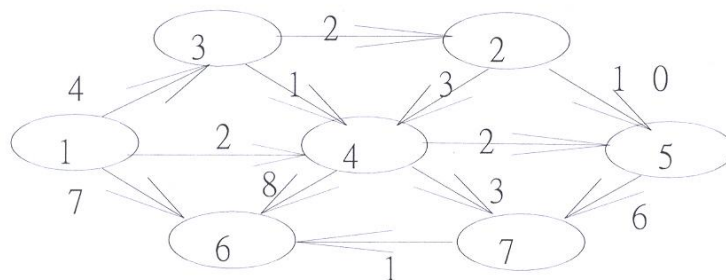


**94 Ph.D. Qualify Exam., Subject: Algorithms**

**Four hours, Closed book.**

1. Assume a data file of 100,000 characters contains only the characters a-g, with the frequencies (in thousands) indicated as the following: a (14), b (11), c (30), d (16), e (5), f (9), g (15).
  - a) Use the Huffman's algorithm to construct the optimal prefix Huffman code. (10%)
  - b) Please write the Huffman's algorithm. (10%)
2. What are binomial trees and their properties? What is a binomial heap and its properties? (10%)
3. Given two strings,  $X = \langle B, B, C, B, D, A, B \rangle$  and  $Y = \langle B, D, B, C, A, D, B, A \rangle$ ,
  - a) Use dynamic programming to find the LCS (longest common subsequence) of X and Y. (10%)
  - b) Please write the dynamic-programming based algorithm. (10%)
4. 請說明何謂tractable problem, intractable problem, halting problem? 這些問題在實際的問題領域裡，它分別代表的意義是什麼? 就我們從事資訊領域工作的人員而言，探討這些問題的意義是什麼? (8%) 請說明何謂P, NP, NPC, NP-hard? 並說明它們彼此之間的關係? (4%)
5. 請以 Dijkstra 的演算找出從點(1)到其餘各點的最短路徑，請仔細寫出每個步驟的結果 (12%)。



6. Construct the string-matching automation for the pattern  $P = \text{aabab}$  and illustrate its operation on the text string  $T = \text{aababaabaabab}$  (6%)
7. State the maximum-flow problem as a linear-programming problem (10%)
8. Solve the following linear program using SIMPLEX (10%)  
maximize  $-5X_1 - 3X_2$   
subject to  
 $X_1 - X_2 \leq 1$   
 $2X_1 + X_2 \leq 2$   
 $X_1, X_2 \geq 0$