

國立成功大學

111學年度碩士班招生考試試題

編 號： 112

系 所： 工程科學系

科 目： 資料結構

日 期： 0220

節 次： 第 1 節

備 註： 不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1.(10%) Rank the following functions by order of growth; that is, give an ordered list of the functions g_1, g_2, \dots, g_8 satisfying $g_1 = \Omega(g_2)$, $g_2 = \Omega(g_3)$, and so on. Partition your list into equivalence classes using brackets, e.g. $[g_1, g_2]$, $[g_3, \dots, g_8]$, such that g_i and g_j are in the same class if and only if $g_i = O(g_j)$.

Please explain your answer.

$$n^2, (\lg n)!, (3/2)^n, \lg(n!), (\lg n)^{\lg n}, (n+1)!, n \lg n, 4^{\lg n}$$

2.(10%) Please derive the corresponding time complexity (Big - Oh) for each of the following program segments.

- (1) $k = 0;$
 for ($i = 0; i < N; i++$)
 for ($j = 0; j < N; j++$)
 $k++;$
- (2) $k = 0;$
 for ($i = 0; i < N; i++$)
 for ($j = 0; j < i * i; j++$)
 for ($z = 0; z < j; z++$)
 $k++;$

3. (10%) What is an optimal Huffman code for the following set of frequencies:

a:25, b:3, c:12, d:16, e:39, f:5, g:13.

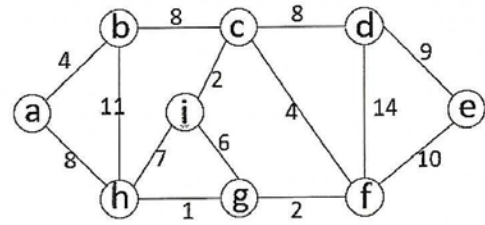
4. (10%) Consider inserting the keys 12,15,3,35,21,42 and 14 in order into each of the following data structures.

Initially the tree is empty. Draw the resulting tree.

- (1) Binary search Tree
 (2) Balanced Search Tree

5. (10%) Consider the following graph G:

- (a) Starting from node g , what is the depth-first traversal sequence of G?
 (b) Starting from node g , what is the breadth-first traversal sequence of G?



(Note: if there are several choices, choose the smallest one in lexicographic order)

6. (10%) Ackerman's function $A(m, n)$ is defined as below:

$$A(m, n) = \begin{cases} n + 1 & \text{if } m = 0 \\ A(m - 1, 1) & \text{if } n = 0 \\ A(m - 1, A(m, n - 1)) & \text{otherwise} \end{cases}$$

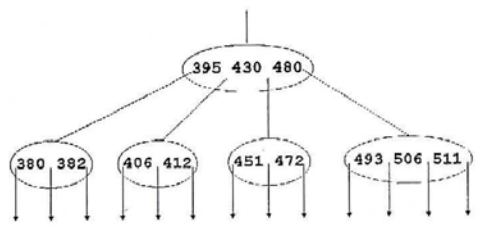
- (1) What is the value of $A(2, 1)$
- (2) Write a recursive program to calculate $A(m, n)$.

7. (10%)

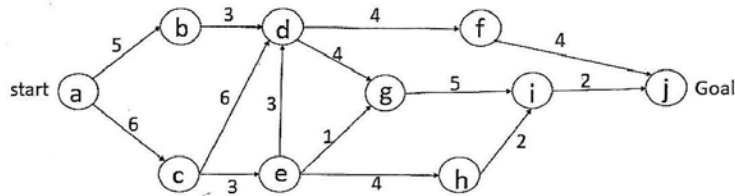
- (1) Explain what the best case situation is for Quicksort. What is the running time for this case and how do you arrive at this running time?
- (2) Explain what the worst case situation is for Quicksort. What is the running time for this case and how do you arrive at this running time?

8. (10%) Which data structure is most suitable for implementing a complete binary tree and why?

9. (10%) Please draw the tree after 507 and 520 are inserted into the following B-tree of order 5.



10. (10%) For the AOE(Activity On Edge) network given below:



- (a) Obtain the earliest starting time and latest starting time for each activity.
- (b) Determine the critical path of the project.
- (c) Is there any single activity whose speed up would result in reduction of the project length?