國立成功大學

113學年度碩士班招生考試試題

編　號：232

系　所：資訊管理研究所

科　目：資料結構

日　期：0202

節　次：第 3 節

備　註：不可使用計算機

國立成功大學113學年度碩士班招生考試試題

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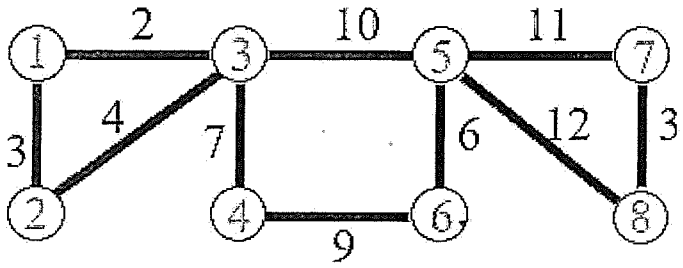
A1. (13%) The one-dimensional array int LinearProbingHash[19] is configured for hashing using the function f(Key) = Key % 19. To address overflow concerns, please insert pairs with keys "6, 12, 34, 29, 28, 11, 23, 7, 0, 33, 30, 49, 45" using linear probing. (7%) continue with this inquiry, if "12" is deleted, how does the content of LinerProbingHash[] change? (3%) If we found the average success search performance is about $\frac{1}{2}(1 + 1/(1-\alpha))$ and unsuccessful search is about $\frac{1}{2}(1 + 1/(1-\alpha)^2)$ where α is the loading density. Please clarify the average number of accesses required for a successful retrieval of a number. (3%)

A2. (11%) Please use the diagram below to answer the questions:

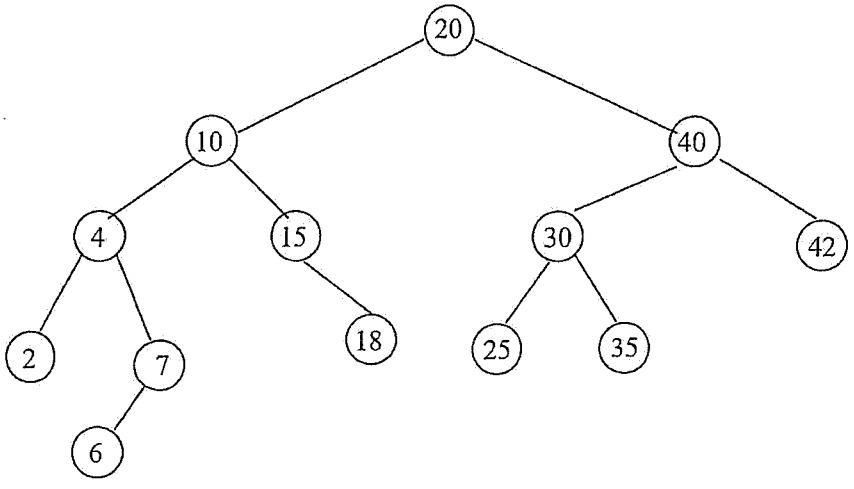
甲、Please explain what a "component" is in a graph? (3%)

乙、Please explain in detail how to use Sollin's Method to construct a Minimum-Cost Spanning Tree. (8%)



A3. (14%) If a number list {10, 15, 8, 3, 13, 6, 2, 14, 5, 9, 10, 1, 7, 12, 4] needed to be sorted in descending order, please explain step by step how to complete the process by heap sort (7%) and natural merge sort (7%) respectively.

A4. (12%) Please define **AVL search tree** and use the figure below to evaluate if it is fulfill the requirements of an AVL search tree. (5%) Please explain if a node "5" is added into this tree, how does it change in detail? (7%)



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B1. [8 points]

(a) [3%] Define the big-O notation: $f(n) = O(g(n))$

(b) [5%] Prove that $\sum_{i=0}^{n} i^3 = O(n^4)$ and $\sum_{i=0}^{n} i^3 \neq O(n^3)$

B2. [8 points]

A tridiagonal matrix is a kind of sparse matrix that arises often in numerical analysis. In a tridiagonal matrix $A = (a_{ij})_{1 \leq i,j \leq n}$ of size $n \times n$, the (i, j) component $a_{ij} = 0$ if the absolute value of $i - j$ is greater than 1. Answer the following questions:

(a) [3%] What is the maximum number of nonzero elements in A?

(b) [5%] Suppose that a array $B = (b_k)$ is used to store a_{ij} if the absolute value of $i - j$ is equal to or less than 1. Find a simple method to calculate the location of B storing a_{ij}.

B3. [11 points]

(a) [3%] Give a definition for Stack.

(b) [3%] Convert the following expression to postfix:

$$(b \times b - 4 \times a \times c)/(2 \times a)$$

(c) [5%] Describing the process of getting an infix expression from a postfix expression actually involves scanning the postfix expression and using Stack to keep track of the operands.

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B4. [10 points]

Try to use a generalized list to represent the following polynomial:

$$f(x, y, z) = 3x^8y^4x^2 + 5x^6y^4z^2 + 4x^6y^2z^2 + x^4y^2z$$

You need to point out the data structure of the data node and use it to represent the polynomial.

B5. [13 points]

(a) [3%] Give a definition for a binary search tree.

(b) [3%] Given the following two tree traversal sequences, determine the corresponding binary tree

preorder sequence: $17, 8, 4, 11, 26, 31, 27$

inorder sequence: $4, 8, 11, 17, 26, 27, 31$

(c) [7%] Design a new linked list to represent the binary tree in (b) and organize a pseudo code to search the binary search for the k_{th} smallest element.