國立中正大學
109學年度碩士班招生考試
試 題

[第3節]

科目名稱	線性代數與資料結構
系所組別	通訊工程學系-通訊乙組

Linear Algebra

1. $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \\ 1 & 3 & 5 & 7 \\ 7 & 5 & 3 & 1 \end{bmatrix}$

   a. (10 pts.) Use Gaussian-Jordan elimination to find the reduced row echelon form of A.

   b. (10 pts.) Find the basis C of column space of A.

   c. (10 pts.) Express the vector $v = (0, -5, 1, 9)$ as a linear combination of the row vectors in A, and find the coordinate vector $(v)_C$ with the basis C.

2. $B = \begin{bmatrix} 1 & 0 & 3 \\ 0 & 5 & 0 \\ 7 & 0 & 9 \end{bmatrix}$

   a. (10 pts.) Find the null space of B and determine the dimension of this null space.

   b. (10 pts.) Find the eigenvalues and eigenvectors of B.

Data Structure

3. Consider a Binary Search Tree (BST) and answer the following questions.

   a. (5 pts.) Whether Fig. 1 is a BST or not? If not, explain why it is not a BST.

   b. (5 pts.) Define a data structure for a node in a BST.

   c. (10 pts.) Using C or pseudocode to write a function to perform in-order traversal. Your function takes a BST with node structure defined in (b).

   d. (10 pts.) Using C or pseudocode to write a function to insert a node to a BST. The input parameters of your function include the given BST and the given node for insertion.
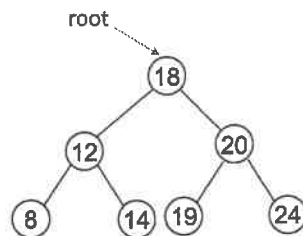

Fig. 1

4. Consider an undirected graph and answer the following questions.

   a. (5 pts.) Find and draw a minimum spanning tree for the graph shown in Fig. 2.

   b. (5 pts.) Define an adjacency matrix using C or pseudocode. Show the content of your matrix using the graph shown in Fig. 2.

c.　(10 pts.) Using C or pseudocode to implement a function that takes an adjacency matrix defined in (b) to obtain a minimum spanning tree. You can also use more parameters for your function, such as the number of nodes in the graph. You can also limit the maximum number of nodes in the graph.
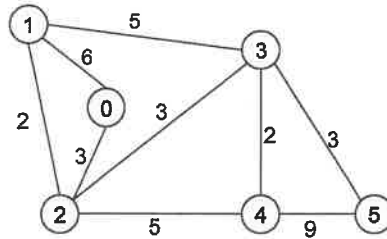
Fig. 2