Design and Analysis of Algorithms (COMP3001)

Tutorial 5 - Graphs

Question 1.

The incidence matrix of a directed graph $G = (V, E)$ is a $|V| \times |E|$ matrix M such that

$$M[i][j] = \begin{cases} -1 & \text{if edge } j \text{ leaves vertex } i \\ +1 & \text{if edge } j \text{ enters vertex } i \\ 0 & \text{otherwise} \end{cases}$$

Describe what the entries in the matrix product MM^T represent, where M^T is the transpose of M.

Question 2.

Show that a *depth first search* of an undirected graph G can be used to identify the connected components of G. Devise an algorithm that will label each vertex with an integer that is the label of the connected component to which it belongs. That is, u and v will have the same label if they are in the same connected component.

Question 3.

a) Use procedure DFS_Tree to find the depth first search tree of the following graph. Let node s be the root.

b) Use procedure BFS_Tree to find the breadth first search tree of the following graph. Let node s be the root.