I. How could we determine a graph is a tree based on its adjacency matrix. [30 pts] (You may assume that the graph is undirected, and only the upper right (as it is symmetric) of the matrix is used to denote the adjacency relation).

II. Give an algorithm to determine whether or not there is a path from vertex $u$ to vertex $v$ in graph $G$. The graph $G$ is represented as a matrix $m$, the label of $u$ is $n_u$ and the label of $v$ is $n_v$. The number of vertices in the graph is $n$. [30 pts]

III. For the following graph:

![Graph for Tree](image)

Figure 1: Graph for Tree

suppose we use
Draw the complete tree constructed by using Depth First Search algorithm. [30 pts]

IV. What is a Euler cycle, and what is a Hamiltonian cycle. Give an algorithm to construct the Euler cycle for a graph $G$ represented by a matrix $m$. If there is no Euler cycle, please state so in the algorithm also. [25 pts]

V. For the above algorithm, write a Java program to implement your algorithm. [25 pts]
VI. For the following graph

![Graph for Shortest Path](image)

Use Dijkstra’s algorithm to compute the shortest from $A$ to $Z$. You need to show the distance vector after each step. [30 pts]