FCS152 Tutorial 11
**Paths, Circuits & Trees**

1.   (i)   Give an example of a graph that has an Euler Circuit but not a Hamilton Circuit.
     (ii)   Give an example of a graph that has a Hamilton Circuit but not an Euler Circuit.
     (iii)   Give an example of a graph that has a circuit which is both an Euler Circuit and a Hamilton Circuit.
     (iv)   Give an example of a graph that has a Hamilton Circuit and an Euler Circuit but they are not the same.

2.   Determine whether each of the following graphs has.
     (i)   An Euler Circuit. Construct such a circuit when one exists.
     (ii)   An Euler path but not an Euler Circuit. Construct such a path when one exists.
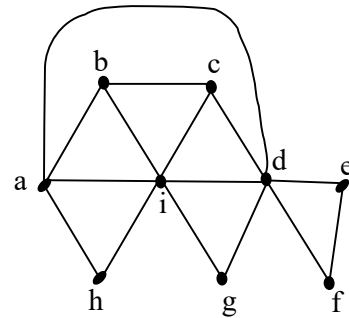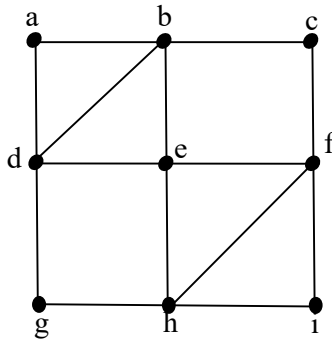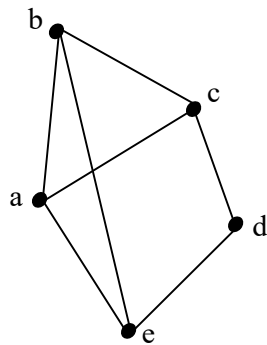
3.   Determine whether the following graphs given by their adjacency matrices have a Hamilton circuit. If so find such a circuit. If it does not, give an argument to show why no such circuit exists. Do the graphs have a Hamilton path. If so, find such a path. If not, give the reason.
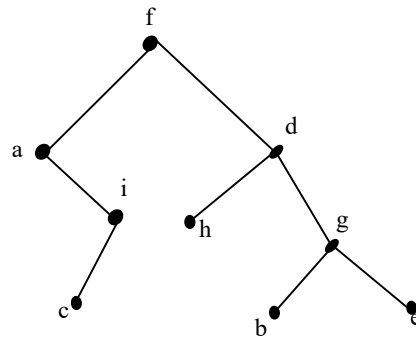
$$A1 = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$A2 = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$A3 = \begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 \end{bmatrix} \qquad A4 = \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

4. Consider the following binary tree T.

(i)   Find the depth of T.
(ii) Traverse T using the preorder algorithm.
(iii) Traverse T using the inorder algorithm.
(iv) Traverse T using the postorder algorithm.