PRACTICE

Data Structure – Graph Theory

1. Given the adjacency matrix of an undirected graph. Draw two graphs corresponding to this matrix. **(10 points)**

0	1	0	0	1
1	0	1	1	1
0	1	1	1	0
0	1	1	0	1
1	1	0	1	0

2. Is it possible to create a simple graph with 5 nodes where the degree of each node is:
   a. 5, 2, 3, 2, 4
   b. 4, 4, 3, 2, 3
   c. 3, 3, 2, 3, 2
   d. 4, 4, 1, 3, 2

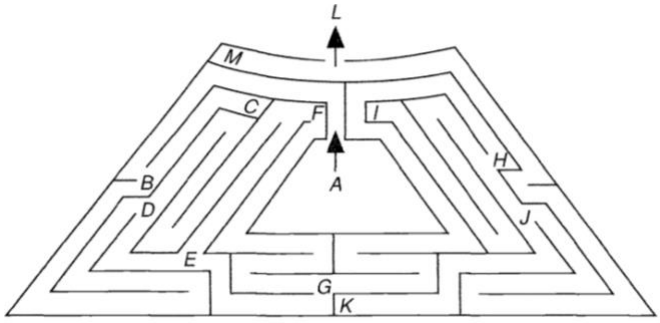
   If possible, provide one example; if not, give a brief reason. **(20 points)**

3. The following is the adjacency matrix for the directed graph. **(10 points)**

0	1	1	0	0	0	0
0	0	1	1	1	0	0
0	0	0	0	1	1	0
0	0	0	0	0	1	1
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	0	0	0	0	0	0

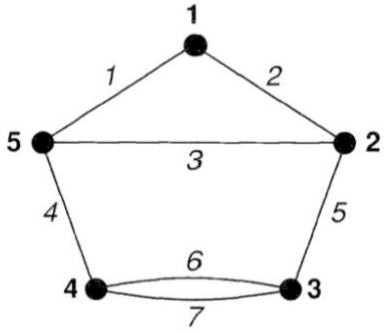
   (a) Draw a graph corresponding to the following matrix.
   (b) Create an adjacency list from the following matrix.

4. Draw a graph with vertices A, …, M that shows the various routes one can take when tracing the Hampton Court maze in the picture below. **(7,5 points)**



5. If G is a graph without loops, what can you say about the sum of the entries in **(15 points)**
   (i) any row or column of the adjacency matrix of G?
   (ii) any row of the incidence matrix of G?
   (iii) any column of the incidence matrix of G?

6. Write down the adjacency and incidence matrices of the graph below. **(15 points)**



7. Draw the graph whose incidence matrix is given below. **(7,5 points)**

$$\begin{pmatrix} 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

8. (i) Draw a graph on six vertices with degree sequence (3, 3, 5, 5, 5, 5); does there exist a simple graph with these degrees? **(7,5 points)**
   (ii) How are your answers to part (i) changed if the degree sequence is (2,3,3,4,5,5)? **(7,5 points)**