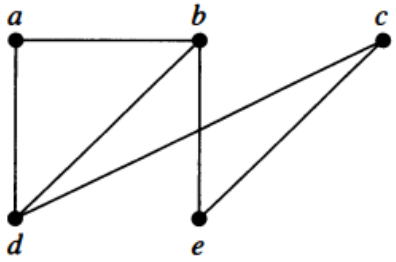
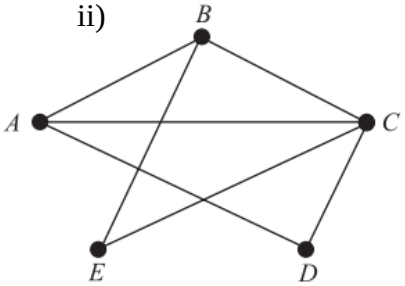
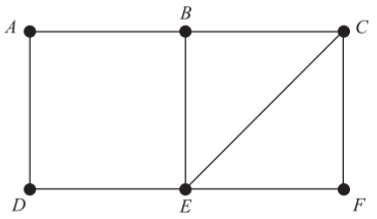
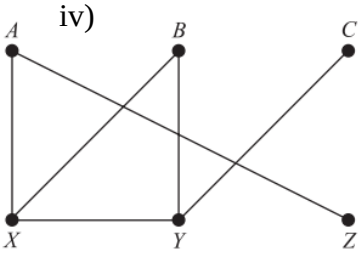
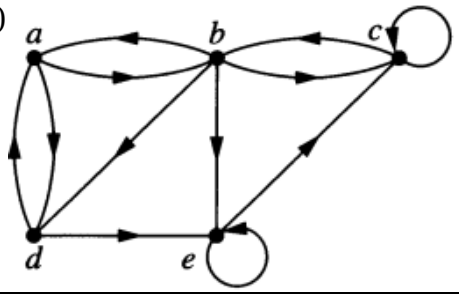
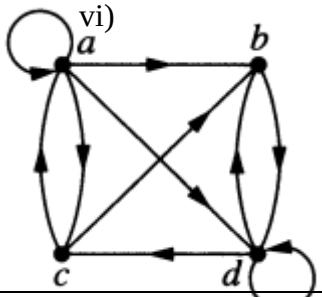
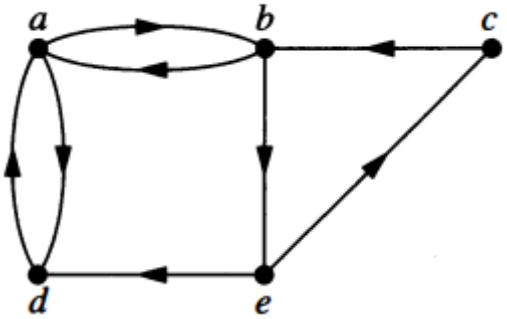
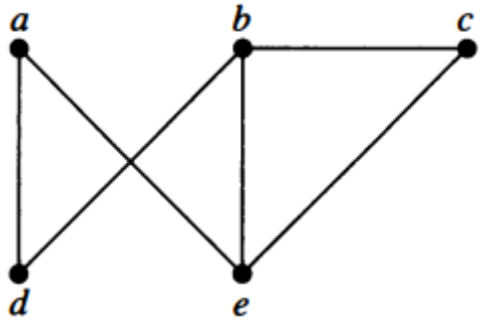
Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE –37
(An Autonomous Institute Affiliated to SPPU)
Discrete Mathematics (ES1030)
TUTORIAL 8 (Graph Theory)

Q. 1	**Attempt the following**
A)	Represent the following graph in with an adjacency list, adjacency matrix and incidence matrix. i)  ii)  iii)  iv)  v)  vi) 
B)	Determine whether each of these sequences is graphic. If graphic, how many edges are there in such graph. For those that are, draw a graph having the given degree sequence. a) 5, 4, 3, 2, 1 ,0 b) 2, 2, 2, 2, 2, 2 c) 3, 3, 2, 2, 2, 2 d) 5, 3, 3, 3, 3, 3 e) 6, 5, 4, 3, 2, 1 f) 3, 3, 3, 2, 2, 2 g) 1, 1 , 1 , 1 , 1 , 1 h) 5, 5, 4, 3, 2, 1
C)	i) How many vertices does a regular graph of degree four with 10 edges have? ii) How many edges does a graph have if its degree sequence is 5, 2, 2, 2, 2, I? Draw such a graph. iii) For which values of n are these graphs regular? a) K_n b) C_n c) W_n d) Q_n iv) For which values of m and n, $K_{m,\,n}$ is regular? v) If G is a simple graph with 15 edges and complement of G, $\overline{G}$ has 13 edges, how many vertices does G have? vi) If the degree sequence of the simple graph G is 4, 3, 3, 2, 2, what is the degree sequence of $\overline{G}$? vii) What is the sum of the entries in a column of the adjacency matrix for a simple graph? for a directed graph? viii) What is the sum of the entries in a row of the incidence matrix for a simple graph? ix) How many non isomorphic simple graphs are there with five vertices and three

	edges? x) Find the number of paths of length n between two different vertices in K4 if n is a) 2. b) 3. c) 4. d) 5.
D)	Does each of these lists of vertices form a path in the following graph? Which paths are simple? Which are circuits? What are the lengths of those that are paths? i) a, b, e, c, b ii) a, d, a , d, a iii) a, d, b, e, a iv) a , b, e, c, b, d, a 
E)	Does each of these lists of vertices form a path in the following graph? Which paths are simple? Which are circuits? What are the lengths of those that are paths? i) a, d, b, e, a ii) a , b, e, c, b, d, a c iii) a, e, b, c, b iv) a , e, a , d, b, c, a v) e, b, a , d, b, e vi) c, b, d, a, e, c 

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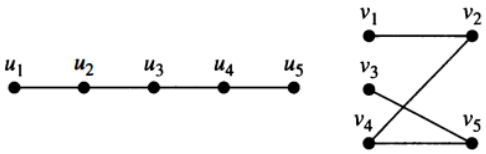
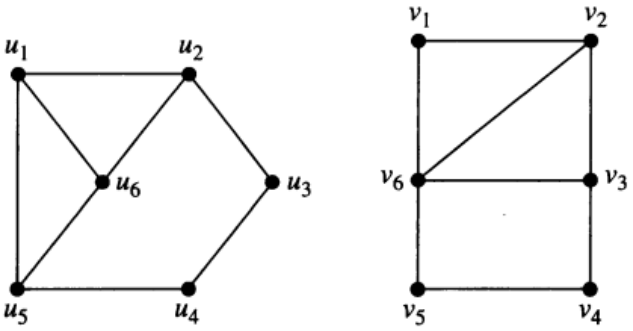
F) Determine whether the given pair of graphs is isomorphic. Exhibit an isomorphism or provide a rigorous argument that none exists.

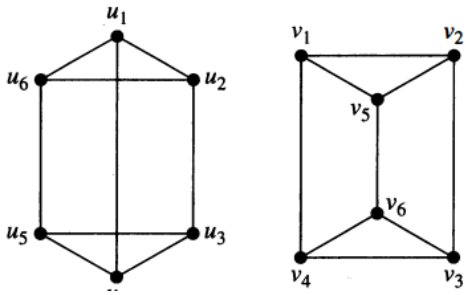
i)



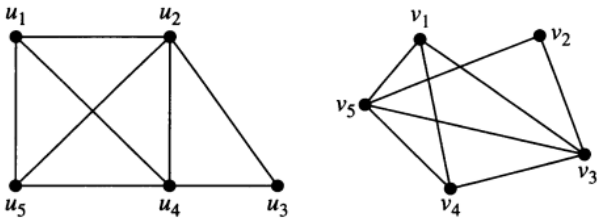
ii)



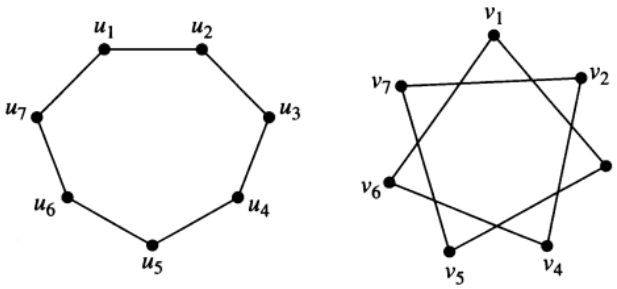
iii)



iv)



v)



G) Draw an undirected graph represented by the given adjacency matrix.

i) $\begin{bmatrix} 0 & 1 & 3 & 0 & 4 \\ 1 & 2 & 1 & 3 & 0 \\ 3 & 1 & 1 & 0 & 1 \\ 0 & 3 & 0 & 0 & 2 \\ 4 & 0 & 1 & 2 & 3 \end{bmatrix}$

ii) $\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$

iii) $\begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 0 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

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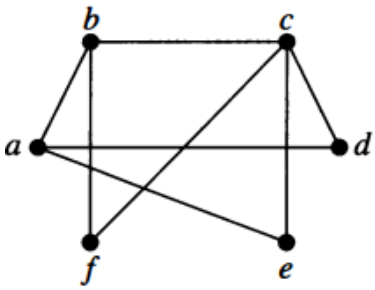
H) Determine whether the following graph is bipartite or not.

i)



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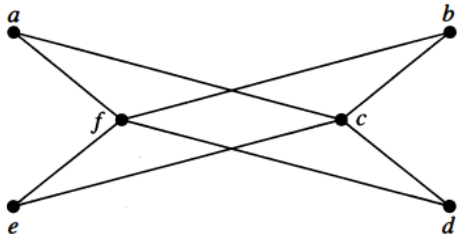

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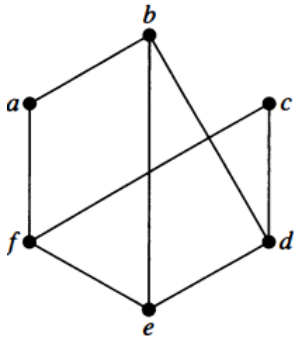
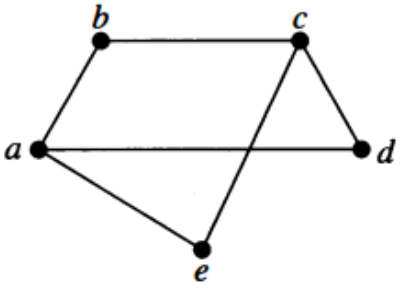


iv)



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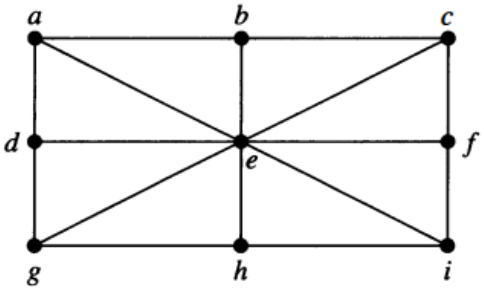
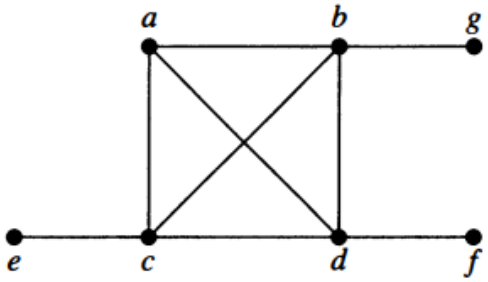
I) Determine whether the following graph is Eulerian / Hamiltonian / Planer
State the Eulerian path / Hamiltonian circuit. If not Hamiltonian circuit, is there a Hamiltonian path?

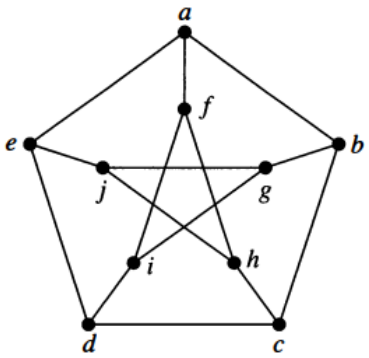
i)



ii)



iii)



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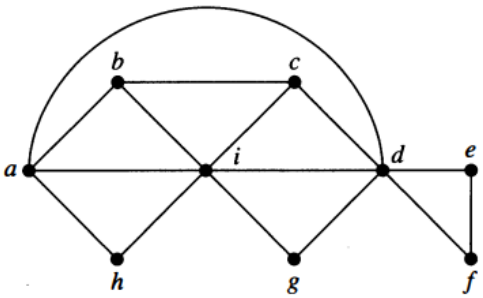
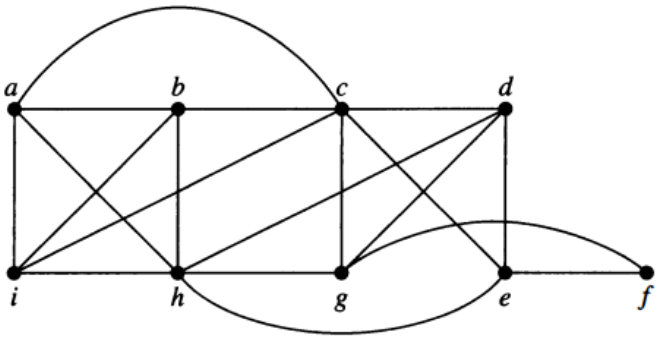


V)



vi)