1) What kind of graph (from Table 1) can be used to model a highway system between major cities where
a) there is an edge between the vertices representing cities if there is an interstate highway between them?
b) there is an edge between the vertices representing cities for each interstate highway between them?
c) there is an edge between the vertices representing cities for each interstate highway between them, and there is a loop at the vertex representing a city if there is an interstate highway that circles this city?

TABLE 1 Graph Terminology.

| Type	Edges	Multiple Edges Allowed?	Loops Allowed?
Simple graph	Undirected	No	No
Multigraph	Undirected	Yes	No
Pseudograph	Undirected	Yes	Yes
Simple directed graph	Directed	No	No
Directed multigraph	Directed	Yes	Yes
Mixed graph	Directed and undirected	Yes	Yes

2) Describe a graph model that represents the positive recommendations of movie critics, using vertices to represent both these critics and all movies that are currently being shown.

3) Describe a graph model that represents whether each person at a party knows the name of each other person at the party. Should the edges be directed or undirected? Should multiple edges be allowed? Should loops be allowed?

4) Determine whether each of these sequences is graphic or not.For those that are, draw a graph having the given degree sequence.

a) 5, 4, 3, 2, 1, 0 b) 6, 5, 4, 3, 2, 1 c) 2, 2, 2, 2, 2, 2
d) 3, 3, 3, 2, 2, 2 e) 3, 3, 2, 2, 2, 2 f) 1, 1, 1, 1, 1, 1

5) Show that if G is a bipartite simple graph with v vertices and e edges, then $e \leq v^2/4$.

6) Determine whether the given pair of graphs is isomorphic. Exhibit an isomorphism or provide a rigorous argument that none exists.
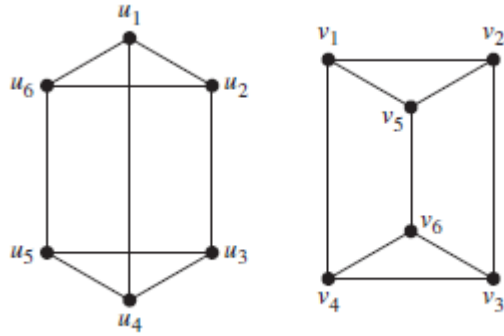
7) Does the graphs given below, have a Hamilton path? If so, find such a path. If it does not, give an argument to show why no such path exists.
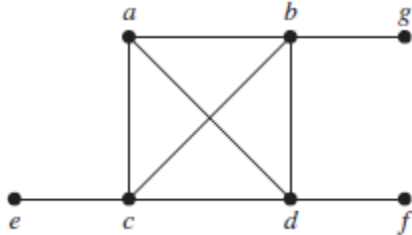
8) Solve the traveling salesperson problem for this graph by finding the total weight of all Hamilton circuits and determining a circuit with minimum total weight.
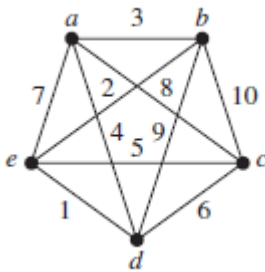
9) Construct the simple graph representing the n × n chessboard with edges representing the control of squares by queens for
a) n = 3. b) n = 4.

10) A tournament is a simple directed graph such that if u and v are distinct vertices in the graph, exactly one of (u, v) and (v, u) is an edge of the graph.
a) How many different tournaments are there with n vertices?
b) What is the sum of the in-degree and out-degree of a vertex in a tournament?
c) Show that every tournament has a Hamilton path.

11)A directed graph or digraph can have directed cycle in which _____
a)   starting   node   and   ending   node   are   different
b)   starting   node   and   ending   node   are   same
c)   minimum   four   vertices   can   be   there
d) ending node does not exist

12) What is a complete digraph?
a) connection of nodes without containing any cycle
b) connecting nodes to make at least three complete cycles
c) start node and end node in a graph are same having a cycle
d) connection of every node with every other node including itself in a digraph

13) An undirected graph has 8 vertices labelled 1, 2, ...,8 and 31 edges. Vertices 1, 3, 5, 7 have degree 8 and vertices 2, 4, 6, 8 have degree 7. What is the degree of vertex 8?
a)15
b)8
c) 5
d)23

14) G is an undirected graph with n vertices and 26 edges such that each vertex of G has a degree at least 4. Then the maximum possible value of n is _____
a)7
b)43
c)13
d)10