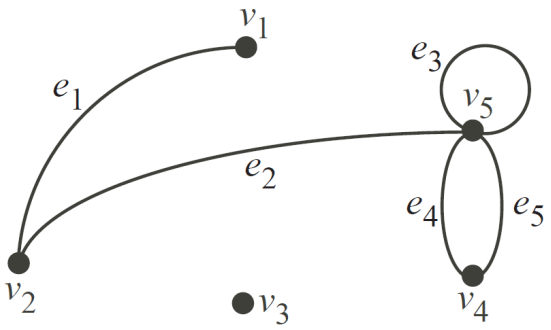
DAA-Exam#3-Prep-HW#3

Graph Theory Questions:



Q. What is the degree of vertex v4?

Q. (True or False) the degree of v5 is 4.
Q. (True or False) e4 and e5 are parallel.
Q. (True or False) e1 is a pendant vertex.
Q. (True or False) the graph is not simple.

Q. Which of the following statements is/are TRUE for <u>undirected graphs</u>?

P: Number of odd degree vertices is even.

Q: Sum of degrees of all vertices is even.

(A) P only
(B) Q only
(C) Both P and Q
(D) Neither P nor Q

Q. Maximum number of edges in an <u>n</u> vertex undirected graph without self loops is (complete graph)

(A) n^2
(B) $n(n-1)/2$
(C) $n-1$
(D) $(n+1)(n)/2$

Q. There are 25 telephones in a town. Is it possible to connect them with wires so that each telephone is connected with exactly 7 others?

Q. There are 9 line segments drawn in a plane. Is it possible that each line segment intersects exactly 3 others?

Q. What is the number of vertices in an undirected connected graph with 27 edges, 6 vertices of degree 2, 3 vertices of degree *4* and remaining of degree 3?

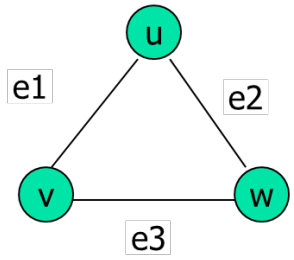
(A) 10
(B) 11
(C) 18
(D) 19

Q. The maximum number of edges in a bipartite graph on 12 vertices is _____.

(A) 36
(B) 48
(C) 12
(D) 24

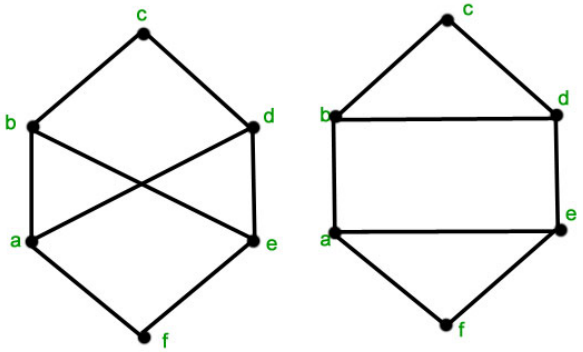
Q1. Represent the following graph in an Incidence Matrix.

Q2. Represent the following graph in an Adjacency Matrix.
(do the same thing for the directed graphs)



Graph – Isomorphism:

Q. Example – Are the two graphs shown below isomorphic?



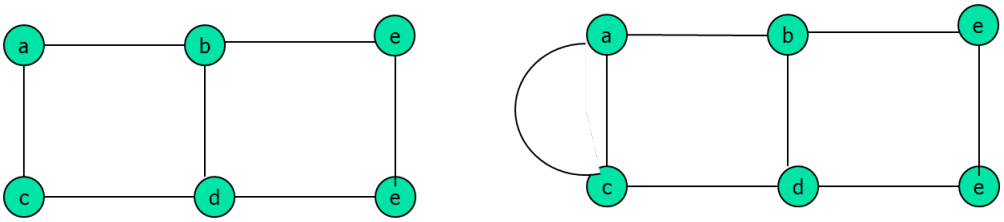
Q. Example – Are the two graphs shown below isomorphic?

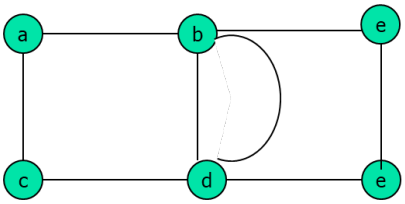
Q. What is the number of regions in a connected planar simple graph with 20 vertices each with a degree of 3?

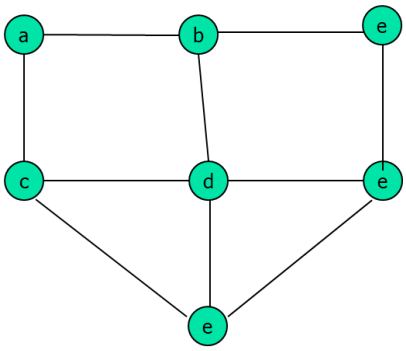
Q. Let G be a simple undirected planar graph on 10 vertices with 15 edges. If G is a connected graph, then the number of bounded faces in any embedding of G on the plane is equal to

(A) 3
(B) 4
(C) 5
(D) 6

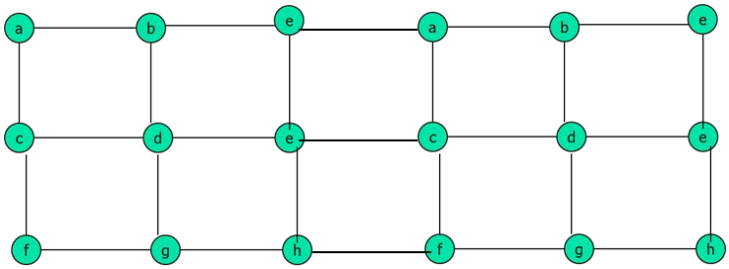
Q. Does the following graph has any Euler Path?
Q. Does the following graph has any Euler Cycle?

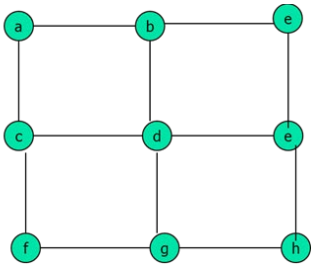


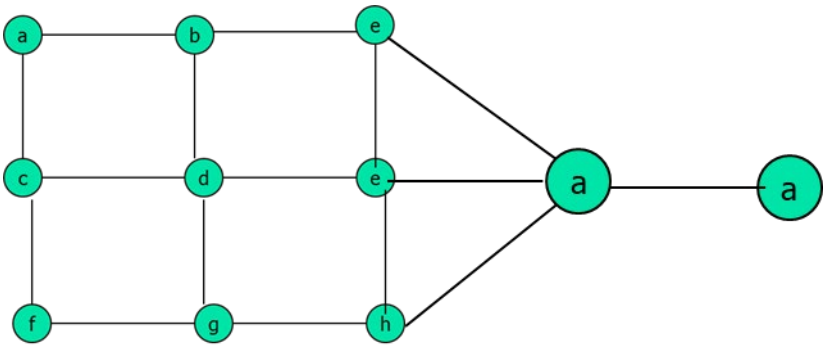




Q. Does a Hamiltonian path (*traceable path)* or circuit exist on the graph below?

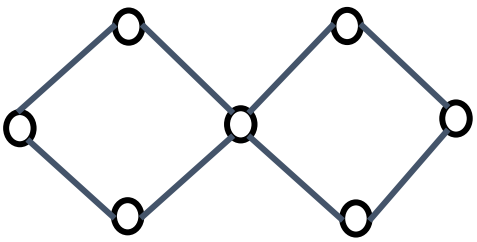




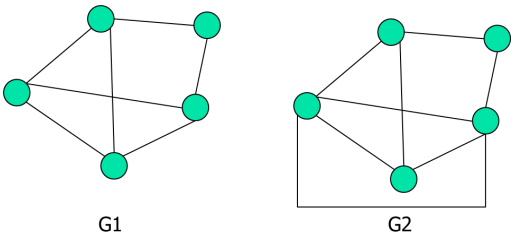


Q. For the following graph which one is not true?

a) This one has an Euler path
b) This one has an Euler cycle
c) This one has a traceable path
d) This one has an Hamiltonian cycle.



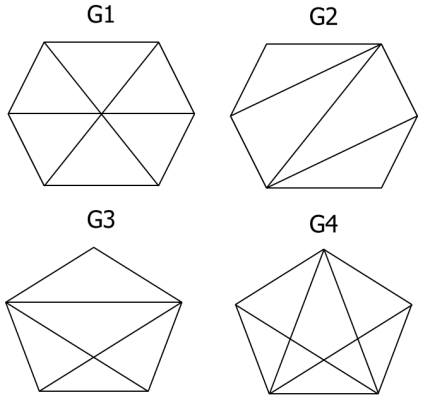
Q. Given the following graphs: Which of the following is correct?



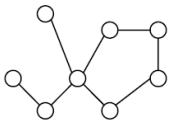
G1 G2

a) G1 contains Euler circuit and G2 does not contain Euler circuit.
b) G1 does not contain Euler circuit and G2 contains Euler circuit.
c) Both G1 and G2 do not contain Euler circuit.
d) Both G1 and G2 contain Euler circuit.

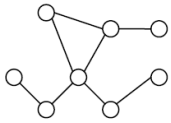
Q. Find Non planar from the following



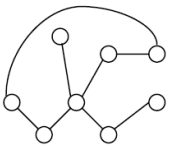
Q. Which of the following graphs is isomorphic to?



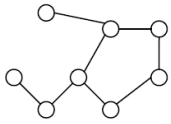
(A)



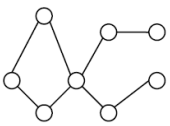
(B)



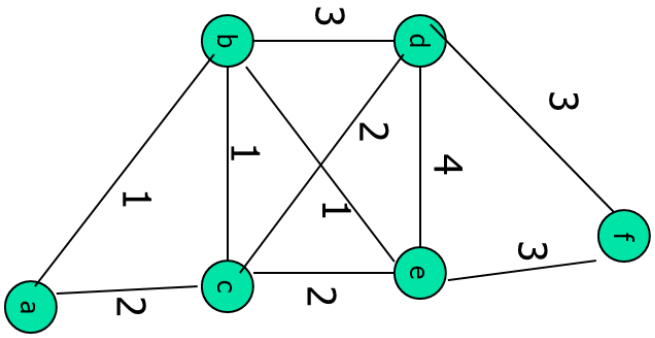
(C)



(D)

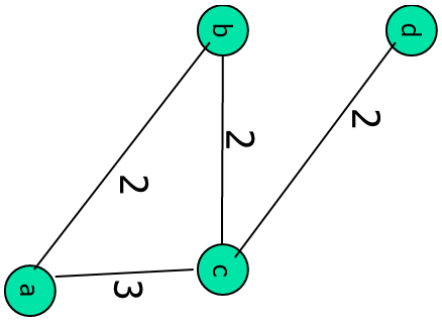


Q. Find the shortest path from a to f using Dijkstra's Algorithm. Show all your steps of using the algorithm.

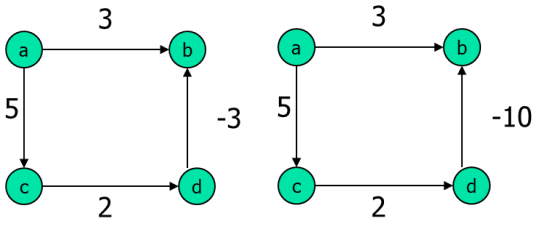


Q. Find the shortest path from a to d using Prim's minimum spanning tree algorithm.

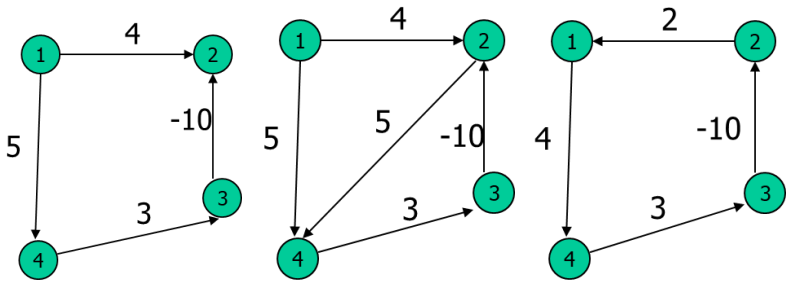
Q. Find the shortest path from a to d using Dijkstra's Algorithm.



Q. Find the shortest path from a to b using Dijkstra's Algorithm.



Q. Find the shortest path from 1 to 2 using Bellman-Ford Algorithm.

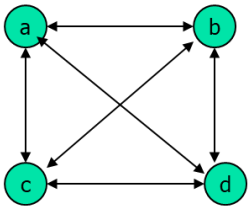


Q. Solve the following Traveling Salesman Problem using dynamic programming method. Show all the detail steps of your work.

Q. Solve the following Traveling Salesman Problem using branch and bound method. Show all the detail steps of your work.

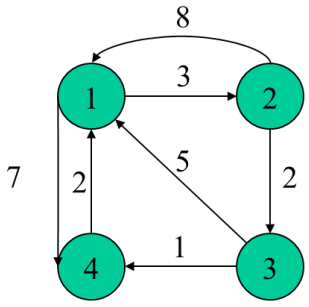
Adjacency Matrix

	a	b	c	d
a	0	10	15	20
b	5	0	9	10
c	6	13	0	12
d	8	8	9	0



Q. all pairs shortest path problem:

a) For the given directed graph, find all pairs shortest path by using dynamic programming.



P, NP Complexity Issues

Q. True or False Questions

1. (True or False) Assuming P != NP, NP-complete = NP

2. (True or False) Assuming P != NP, NP-complete ∩ P is empty

3. (True or False) Assuming P != NP, NP-hard = NP

4. (True or False) Assuming P != NP, NP-complete = P

Q. Let S be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to S and <u>S is polynomial-time reducible to R</u>. Which one of the following statements is true?

a) R is NP-complete

b) R is NP-hard
c) Q is NP-complete
d) Q is NP-hard

Q. Let X be a problem that belongs to the class NP. Then which one of the following is TRUE?

a) There is no polynomial time algorithm for X.
b) If X can be solved deterministically in polynomial time, then P = NP.
c) If X is NP-hard, then it is NP-complete.
d) X may be undecidable.

Q. (True or False) The problem 3-SAT is NP-complete

Q. (True or False) The problem 2-SAT is P

(1) (True or False) The problem of determining whether there exists a cycle in an undirected graph is in P.

(2) (True or False) The problem of determining whether there exists a cycle in an undirected graph is in NP.

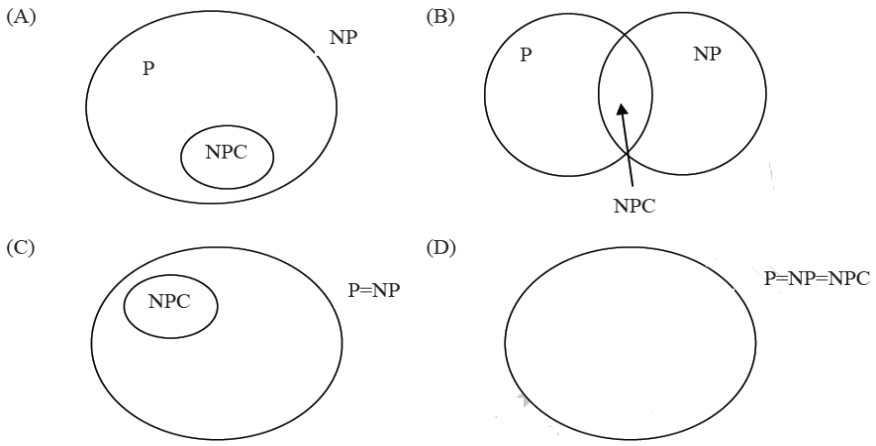
(3) (True or False) If a problem A is NP-Complete, there exists a non-deterministic polynomial time algorithm to solve A.

(1) (True or False) If we want to prove that a problem X is NP-Hard, we take a known NP-Hard problem Y and reduce Y to X.

(2) (True or False) The first problem that was proved as NP-complete was the circuit satisfiability problem.

(3) (True or False) NP-complete is a subset of NP Hard.

Q. Suppose a polynomial time algorithm is discovered that correctly computes the largest clique in a given graph. In this scenario, which one of the following represents the correct Venn diagram of the complexity classes P, NP and NP Complete (NPC)?



Q. Ram and Shyam have been asked to show that a certain problem Π is NP-complete. Ram shows a polynomial time reduction from the 3-SAT problem to Π, and Shyam shows a polynomial time reduction from Π to 3-SAT. Which of the following can be inferred from these reductions?

a) Π is NP-hard but not NP-complete
b) Π is in NP, but is not NP-complete
c) Π is NP-complete
d) Π is neither NP-hard, nor in NP

1) (True or False) Given a graph, find if the graph has a cycle that visits every vertex exactly once except the first visited vertex which must be visited again to complete the cycle. It belongs NP Complete.

2) (True or False) Given a graph, find if the graph has a cycle that visits every edge exactly once. It belongs P.

Q. Consider two decision problems Q1, Q2 such that Q1 reduces in polynomial time to 3-SAT and 3-SAT reduces in polynomial time to Q2. Then which one of the following is consistent with the above statement?

a) Q1 is in NP, Q2 is NP hard
b) Q2 is in NP, Q1 is NP hard
c) Both Q1 and Q2 are in NP
d) Both Q1 and Q2 are in NP hard