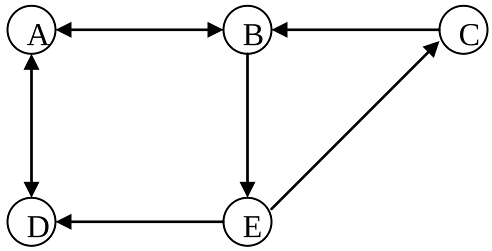
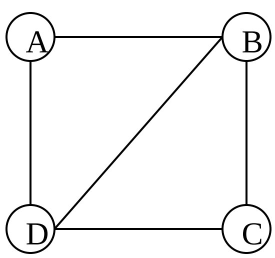
1. (a) Let a directed graph G_1 be given.



Does each of the following list of vertices form a path in G_1? If yes, determine (by circling) if the path is simple, if it is a circuit, and give its length.

a, b, e, c, b	Yes [simple circuit length ☐] No
a, d, a, d, a	Yes [simple circuit length ☐] No
a, d, e, b, a	Yes [simple circuit length ☐] No
a, b, e, c, b, a	Yes [simple circuit length ☐] No

(b) For the simple graph G_2



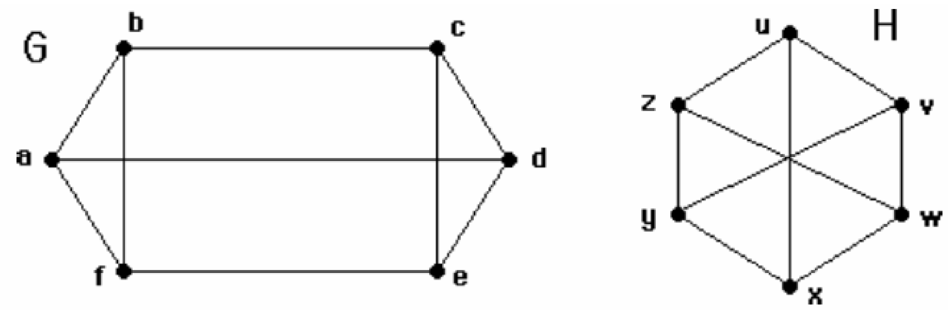
Find M^2, where M is the adjacency matrix of G_2

M^2 =

Find the number of paths from A to D in G_2 of length 2. ☐

2. List all the comparison steps used to search for 9 in the sequence 1, 3, 4, 5, 6, 8, 9, 11 using
a) a linear search.   b) a binary search.

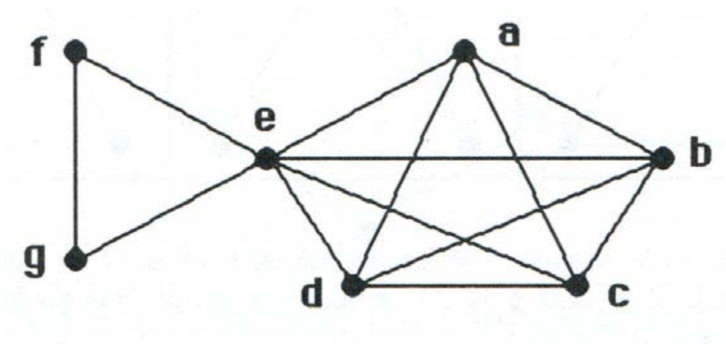
3. Determine whether the given pair of graphs is isomorphic. Exhibit an isomorphism or provide a rigorous argument that none exists.



4.

(a) Is there an Euler circuit in the following graph? If so, find such a circuit. If not, explain why no such circuit exists.

(b) Is there a Hamilton circuit in the following graph? If so, find such a circuit. If not, prove why no such circuit exists.



5. Let $f(n) = 3n^2 + 8n + 7$. Show that $f(n)$ is $O(n^2)$. Be sure to specify the values of the witnesses C and k.

6. How many vertices and how many edges does each of the following graphs have?
(a) K_5

(b) C_4

(c) W_5

(d) $K_{2,5}$

7. Describe an algorithm for finding the second largest integer in a sequence of distinct integers. Give a big-O estimate of the number of comparisons used by your algorithm.