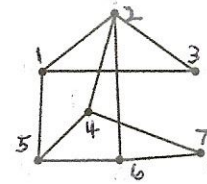
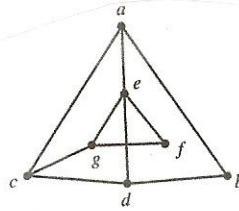


1. Are these 2 graphs isomorphic? Give the iso. or explain why none exists



2. Find a lower bound on the minimal-cost traveling salesperson tour for the table on the right (using the method in the text).

Suggest a good entry on which to branch. What is the new bound if you do not use this entry? or if you do use this entry?

	1	2	3	4
1	$\infty$	4	6	8
2	4	$\infty$	8	7
3	5	8	$\infty$	6
4	7	5	2	$\infty$

	a	b	c	d	e	f	g
a	0	0	1	0	0	1	0
b	0	0	0	0	0	0	1
c	1	0	0	1	1	0	0
d	0	0	1	0	0	1	0
e	0	0	1	0	0	0	0
f	1	0	0	1	0	0	0
g	0	1	0	0	0	0	0

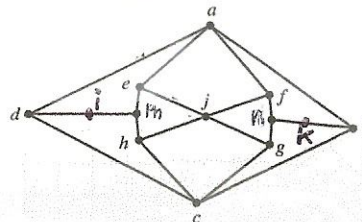
3. Is the graph with the adjacency matrix on the right connected? Test by trying to build a spanning tree found by a depth-first search starting at a.

4. There are 12 cruise ships scheduled to be in a port for various days during a given week. The ships must be assigned to one of 5 different piers (only one ship at a time can be docked at pier). The question is whether an assignment of ships to piers is possible, given ships' visiting plans. Describe how to make a graph coloring model of this assignment problem: what are the vertices, what are the edges, what are the colors? What is the maximum number of colors that can be used to color this graph?

5. Draw a planar graph (with no loops or multiple edges) for each of the following properties, if possible. If not possible, explain briefly why not.

- 13 edges and 9 regions (how many vertices must there be)
- 12 edges, all vertices of degree 3 (how many vertices and regions must there be).
- has at least 9 vertices, has an Euler cycle and requires exactly 2 colors to properly color.

6. Give a careful argument to show that this graph has no Hamilton circuit



7. An independent set  $I$  in a graph is a set of vertices with the property that each vertex is not adjacent to any other vertex in  $I$ .

- Explain why in a coloring of the vertices of a graph, all vertices of one given color form an independent set.
- What is the largest independent set in a circuit of length 7? Explain your answer briefly.

What is the largest independent set in a circuit of length  $n$  ( $n \geq 2$ )? Explain your answer briefly.

- What is the largest independent set possible in a connected graph with nine vertices. Draw the graph.