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

2. 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?

3. 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.
   a) 7 vertices and 9 regions (how many edges must there be)
   b) 10 edges, all vertices of degree 4 (how many vertices and regions must there be).
   c) has exactly 8 vertices, has an Euler cycle and requires exactly 3 colors to properly color.

4. 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?  Show your work.

5. 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.

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

7. Consider a collection of circles (of varying sizes) in the plane. Make a 'circle graph' with a vertex for each circle and an edge between two vertices when they correspond to two circles that cross (if one circle properly contains another, there would be no edge).
   a) Draw a family of circles whose circle graph is 5-chromatic (requires 5 colors to properly color).
   b) Draw a family of circles whose circle graph has neither a Hamilton nor Euler circuit.
   c) Draw a family of circles whose circle graph is a $K_{3,3}$.