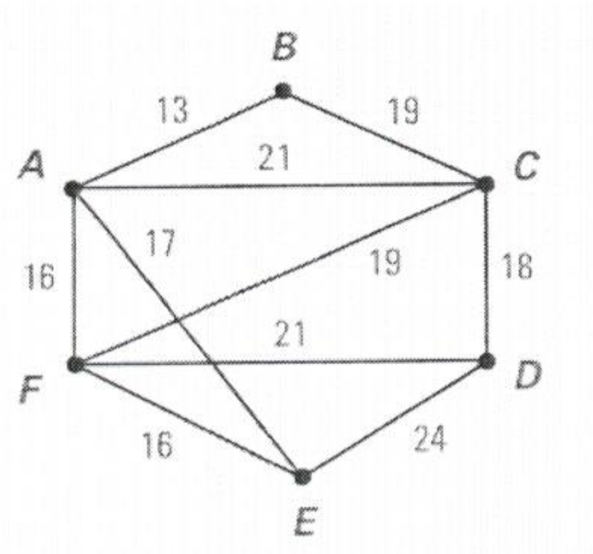
Assignment 7: Minimal Spanning Trees

1. The graph to the right shows a road network connecting six towns. The distances shown are in miles. The Highway Department wants to plow enough roads after a snowstorm so that people can travel from any town to any other town on plowed roads. However, because of the time and cost involved, they want to plow as few miles of road as possible.
   a. Find **all** the road networks that will work. Check to make sure the total length is the same for each network. Draw each network separately on a piece of paper.
   b. For each plowed-road network, which town is most centrally located? What **numerical** information did you base your decision on?

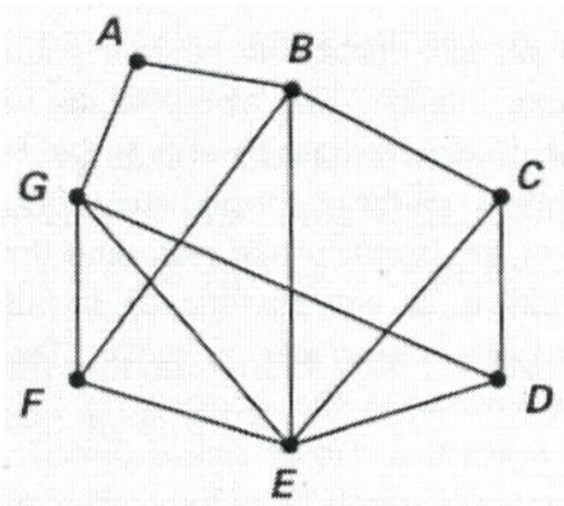


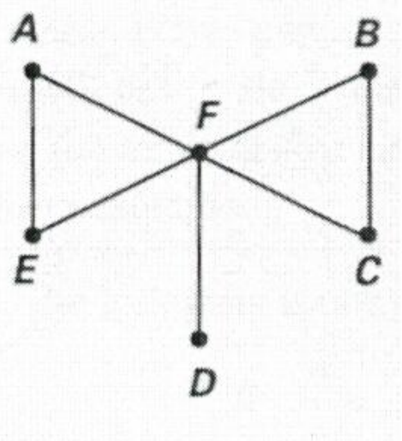
2. A restaurant has opened an outdoor patio for evening dining. The owner wants to hang nine decorative light fixtures at designated locations on the overhead latticework. Because of the layout of the patio and latticework, it is not possible to install wiring between every pair of lights. The matrix below shows the distances in feet between lights that can be linked directly. The main power supply from the restaurant is located at location X. The owner wants to use the minimum amount of wire to get all nine lights connected.

	X	A	B	C	D	E	F	G	H	I
X	-	18	-	-	11	-	-	13	17	-
A	18	-	16	-	-	15	15	-	-	-
B	-	16	-	16	12	-	-	-	-	-
C	-	-	16	-	-	-	-	12	-	-
D	11	-	12	-	-	-	-	10	-	-
E	-	15	-	-	-	-	7	-	-	-
F	-	15	-	-	-	7	-	-	-	-
G	13	-	-	12	10	-	-	-	18	-
H	17	-	-	-	-	-	-	18	-	8
I	-	-	-	-	-	-	-	-	8	-

Make a minimum spanning tree for the lighting plan. What is the minimum amount of wire needed?

3. A Spanning tree is a graph that connects all the vertices of a graph and uses the fewest number of edges.
   a. Draw the spanning tree for each graph below. Describe the method you used to find the spanning trees.





   b. Find all three different spanning tress for the following graph.
   c. Write a rule relating the number of vertices in a graph and the number of edges in a spanning tree for that graph.

4. Explain what the algorithm is for finding the minimum spanning tree.
5. How is the algorithm in 4 different from the algorithm for finding the *nearest-neighbor*?