Math 140: Thursday, Sep 12, Day 8 Notes

Agenda for Thursday, Sep 12,2024	
Finish Section 1.4 Networks and Spanning Trees	**2**
Group Quiz 2	**2**

Reminders

- **Online Homework 3** due today by 11:59pm
- Office Hour **today 1-2:15pm** in C162
- **Second Group Quiz** today in class (you can use your handwritten notes)
- **Exam 1 next Thursday** - open guided notes allowed

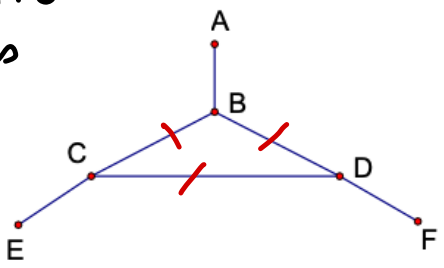
Recall Network

Tree

Spanning Tree

Example 4. Find how many spanning trees each graphs has (No need to draw them.)

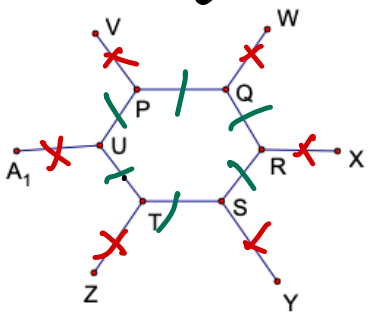
1.



6 Vertices → sp. trees need 5 edges
6 edges

3 sp. trees

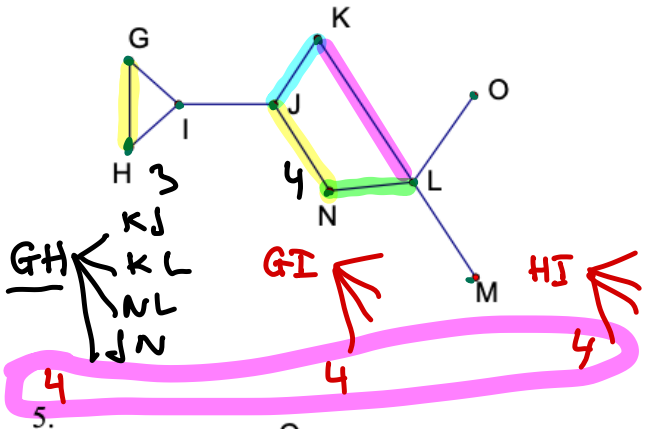
2.



12 V sp 11 edges
12 E

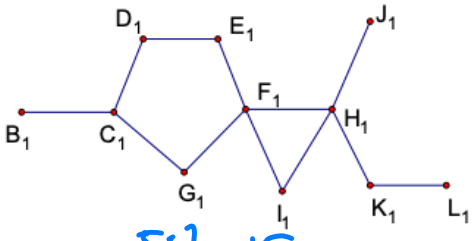
6 sp trees ?

3.



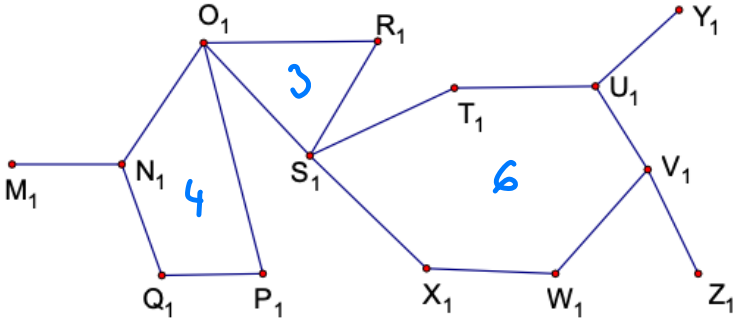
9 V, sp. tree 8 edges
10 edges

4.



5 · 3 = 15
sp trees

5.



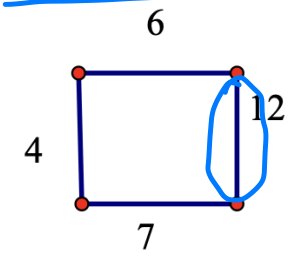
4 · 3 · 6 = 72 sp trees

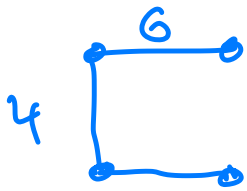
Networks and Spanning Trees-continued

Minimum Cost Spanning Tree(MCST) (MST)

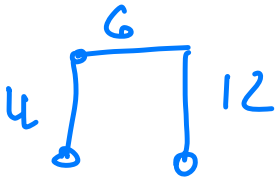
MST is the spanning tree with the least weight.

Example 1. Consider the following weighted graph. Find the minimum spanning tree.





weight = 17

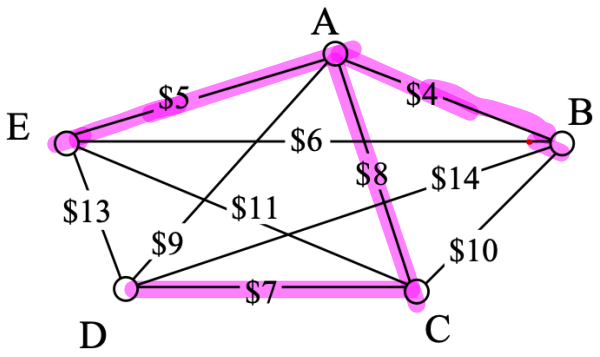


weight = 22

Kruskal's Algorithm for finding MST (Minimum spanning tree).

1) Find the cheapest edge and mark it.
2) Find the next cheapest unmarked edge, such that it does not produce a circuit.
3) Repeat until all vertices are linked in a tree. (Stop when you have N-1 edges).

Example 2. Find the Minimum Spanning Tree using Kruskal's Algorithm.

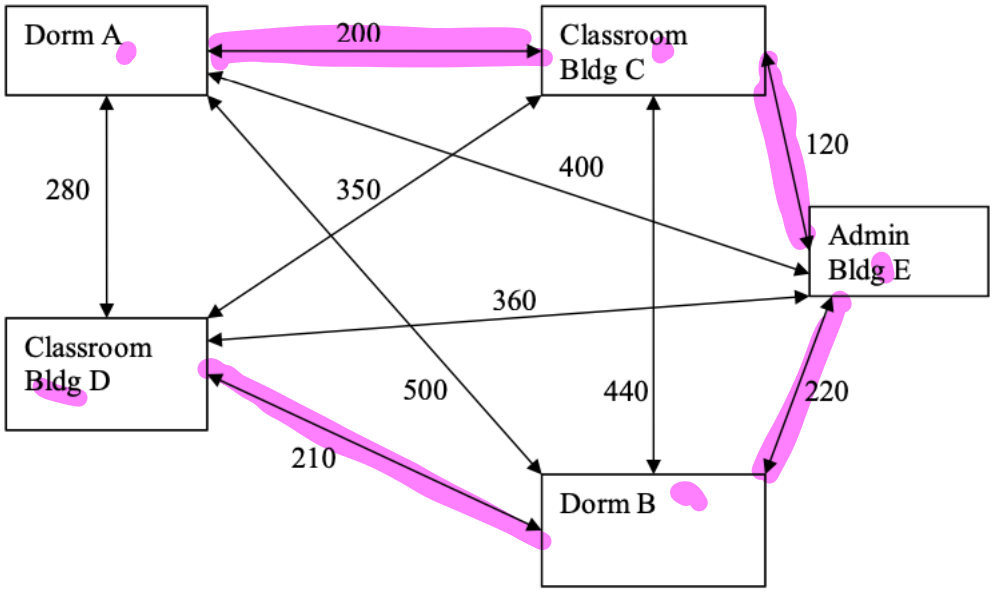


1) AB
2) AE
3) not ED
4) DC
5) AC

The weight of MST is: 4 + 5 + 7 + 8 = 24 $

Example 3. Find the Minimum Spanning Tree for the Cold Region problem.

5v
4 edges



Example 4. The Amazonian Cable Network The Amazonia Telephone Company is contracted to provide telephone, cable, and Internet service to the seven small mining towns shown in Fig. 7-15(a). These towns are located deep in the heart of the Amazon jungle, which makes the project particularly difficult and expensive. In this environment the most practical and environmentally friendly option is to create a network of underground fiber-optic cable lines connecting the towns. In addition, it makes sense to bury the underground cable lines along the already existing roads connecting the towns. The existing network of roads is shown in Fig. 7-15(a). Figure 7-15(b) is a network model of all the possible connections between the towns. The vertices of the network represent the towns, the edges represent the existing roads, and the weight of each edge represents the cost (in millions of dollars) of creating a fiber-optic cable connection along that particular edge. What is the optimal fiber optic cable network connecting the seven towns?

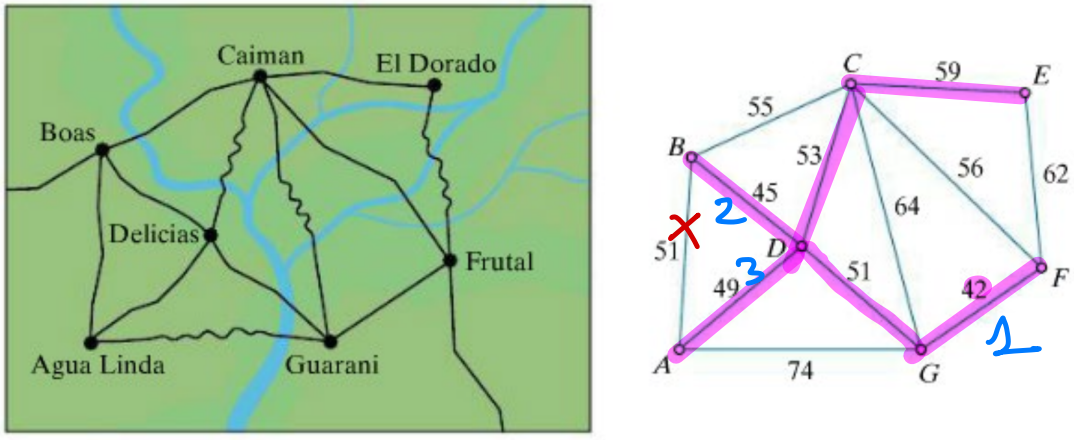


FIGURE 7-15 (a) Network of roads connecting seven towns. (b) Network model showing the cost (in millions) of each connection.

$42 + 45 + 49 + 51 + 53 + 59$

$87 + 100 + 112$

$299 millions