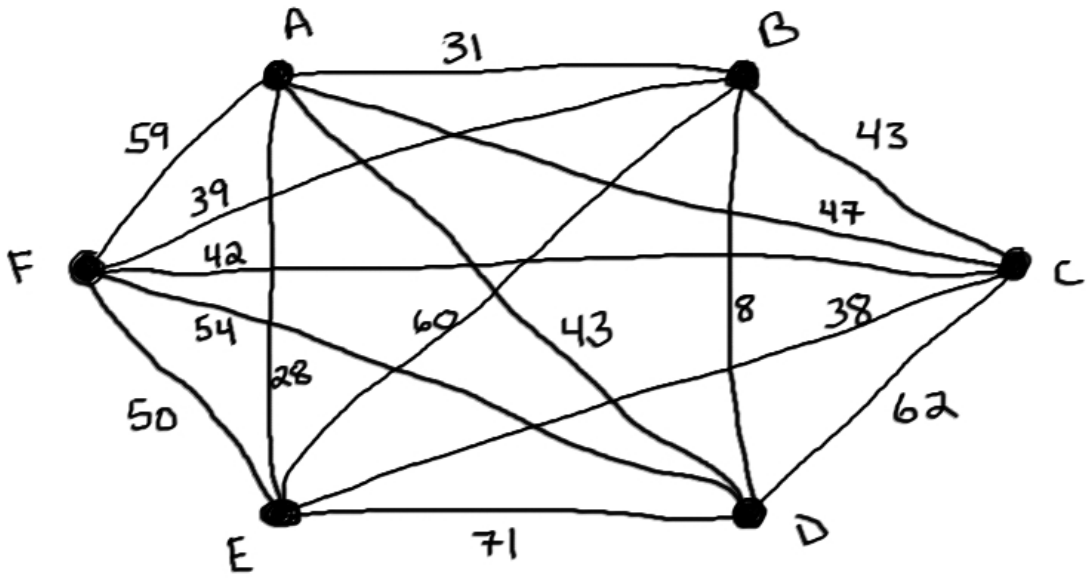
Instructions

- Complete solutions will include well labeled graphs, good explanation of the process used to implement any algorithms, and complete sentences for any discussion of the answer. Where appropriate, you can draw circuits or number edges directly on the graphs provided.
- You may talk about the assignment with other students in the class, but the work you submit must be your own independent creation. If you have questions talk with me before or after class or during office hours.

Questions

1. (20 marks) For the graph below,

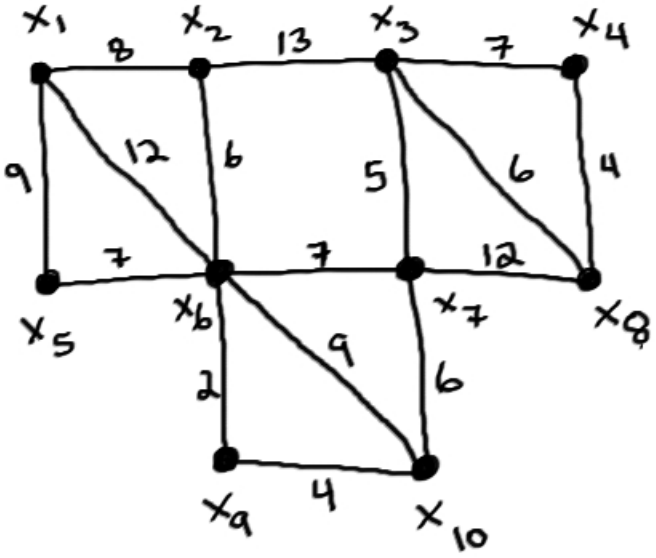


a) Find the cost of the Hamiltonian circuit generated from the sorted edges algorithm.

b) Find the cost of the nearest neighbour tour starting at vertex F.

c) How many distinct Hamiltonian circuits does this graph have? Are you guaranteed to find the minimum-cost Hamiltonian circuit? Explain why or why not.

2. (20 marks) A large company wishes to to install a pneumatic tube system that would enable small items to be sent between any of 10 locales, possibly by using relay. If the nonprohibitive costs (in \$100) is shown in the graph model below, between which sites should the tube be installed to minimize cost?



If the cost of each edge is increased by 3 (ie. cost between x_1 and x_5 becomes 12) will the tree that achieves minimum cost for the new collection of weights be the same as the one that achieves minimum cost for the original set of weights? Explain why this is so if the answer is yes. If the answer is no, find the minimum cost tree for this situation.

If the cost of each edge is increased by factor of 3 (ie. cost between x_1 and x_5 becomes 27) will the tree that achieves minimum cost for the new collection of weights be the same as the one that achieves minimum cost for the original set of weights? Explain why this is so if the answer is yes. If the answer is no, find the minimum cost tree for this situation.

3. (20 marks)

a) Give an example of a job that is made up of at least 8 tasks, and for which at least 2 of the tasks depend on other tasks. Determine your best estimate of the time necessary to complete each task. Finally, construct an order requirement digraph for the job.

b) For the order requirement digraph you created in Part a), identify the earliest completion time of the job from your order requirement digraph. Then, schedule the tasks on three processors using critical path scheduling.

Answers will vary, but each answer should include:

- a) will include:
  - list of tasks and times
  - order requirement digraph, which shows the dependencies between the tasks
- b) will include:
  - earliest completion time (by identifying critical path in your order requirement digraph)
  - priority list created using critical path scheduling
  - a schedule on three processors, created using the list processing algorithm.

In this problem, you are trying to come up with your own example of a good order requirement digraph that you could potentially use to explain the concept to other people, so try to think of a job that can be done by more than one person. For example, doing laundry is not a good example because the order requirement digraph is too "linear"–each task in the job leads directly to the next task, and other than folding laundry their really isn't much for a second person to do. Laundry is also confusing because the processors are humans and machines–and having two different types of processors could lead to confusion. A good example would be a job that has many small tasks that can be worked on concurrently by more than one person, and then some tasks that depend on a few of the small tasks to be completed before they can be started. All the tasks should be things that a person could do, so your processors are all people.