

**Problem 1**

The Wirehouse Lumber Company will soon begin logging eight groves of trees in the same general area. Therefore, it must develop a system of dirt roads that makes each grove accessible from every other grove. The distance (in miles) between every pair of groves is as follows:

**Distance Between Pairs of Groves**

	1	2	3	4	5	6	7	8
Grove 1	-	1.3	2.1	0.9	0.7	1.8	2.0	1.5
Grove 2	1.3	-	0.9	1.8	1.2	2.6	2.3	1.1
Grove 3	2.1	0.9	-	2.6	1.7	2.5	1.9	1.0
Grove 4	0.9	1.8	2.6	-	0.7	1.6	1.5	0.9
Grove 5	0.7	1.2	1.7	0.7	-	0.9	1.1	0.8
Grove 6	1.8	2.6	2.5	1.6	0.9	-	0.6	1.0
Grove 7	2.0	2.3	1.9	1.5	1.1	0.6	-	0.5
Grove 8	1.5	1.1	1.0	0.9	0.8	1.0	0.5	-

Management now wishes to determine between which pairs of groves the roads should be constructed to connect all groves with a minimum total length of road. Solve, give the minimum spanning tree, and the final distance.

Source: Hillier & Lieberman 9.4.2

**Problem 2**

The Texago Corporation has four oil fields, four refineries, and four distribution centers. A major strike involving the transportation industries now has sharply curtailed Texago's capacity to ship oil from the oil fields to the refineries and to ship petroleum products from the refineries to the distribution centers. Using units of thousands of barrels of crude oil (and its equivalent in refined products), the following tables show the maximum number of units that can be shipped per day from each oil field to each refinery, and from each refinery to each distribution center.

**Oil Field to Refinery**

Oil Field	New Orleans	Charleston	Seattle	St. Louis
Texas	11	7	2	8
California	5	4	8	7
Alaska	7	3	12	6
Middle East	8	9	4	15

**Refinery to Distribution Center**

Refinery	Pittsburgh	Atlanta	Kansas City	San Francisco
New Orleans	5	9	6	4
Charleston	8	7	9	5
Seattle	4	6	7	8
St. Louis	12	11	9	7

The Texago management now wants to determine a plan for how many units to ship from each oil field to each refinery and from each refinery to each distribution center that will maximize the total number of units reaching the distribution centers.

As a hint, you'll want to create a graph for this solution with an extra source node and an extra sink node. Solve, provide an allocation for each arc, and provide the final number of thousands of barrels that will be sent out from the distribution centers.

Source: Hillier & Lieberman 9.5.4

**Problem 3**

Two ducks (Jimbo and Donny) waddle in to a cantina. Which one shoots first and why?

Source; All day Star Wars marathon yesterday.