

Review for Midterm2

Problem 1: The ABC Boat Company manufactures three kinds of molded fiberglass recreational boats: **fishing boat, bass boat, and speed boat**. The profit for fishing boat is \$20,500, the profit for a bass boat is \$12,000, and the profit for a speed boat is \$22,300.

- The company believes it will sell more **fishing boats** than the other two boats combined **but no more** than twice as many.
- The **bass boat is its standard production model**, and fishing boats and speed boats are modifications. The company has **production capacity to manufacture 210 standard boats**; however, a fishing boat requires 1.3 times the bass boat production capacity, and a speed boat requires 1.5 times the bass boat production capacity.
- **In addition**, a fishing boat uses one high-powered engine and a speed boat uses two high-powered engine and only **160 high-powered engines** are available.

The company wants to know how many boats of each type to produce to maximize profit. **Formulate an integer programming model for this problem.**

Problem 2: The Bunker Manufacturing firm has **four employees** and **five machines** and wants to assign the employees to the machines to minimize cost. A cost table showing the cost incurred by each employee on each machine follows:

Because of union rules regarding departmental transfers, employee 3 cannot be assigned to machine E, and employee 4 cannot be assigned to machine B.

Formulate this problem as a linear programming model. Make sure each employee is assigned to only one machine

Machine					
Employee	A	B	C	D	E
1	\$12	\$7	\$20	\$14	\$8
2	10	14	13	20	9
3	5	3	6	9	X
4	9	X	7	16	9

Problem 3: ABC Company contracts with growers in Ohio, Pennsylvania, and New York to purchase grapes. The grapes are processed into juice at the farms and stored in refrigerated vats.

- Then the juice is shipped to two plants at Indiana and Georgia, where it is processed into bottled grape juice and frozen concentrate.
- The juice and concentrate are then transported to three food warehouses/distribution centers at Virginia, Kentucky & Louisiana.
- As a company policy, **there is no shipment from Ohio to Georgia and from Indiana to Kentucky.**
- The transportation costs per ton from the farms to the plants and from the plants to the distributors, and the supply at the farms and demand at the distribution centers are summarized in the following slides:

Formulate an LP model for this problem.

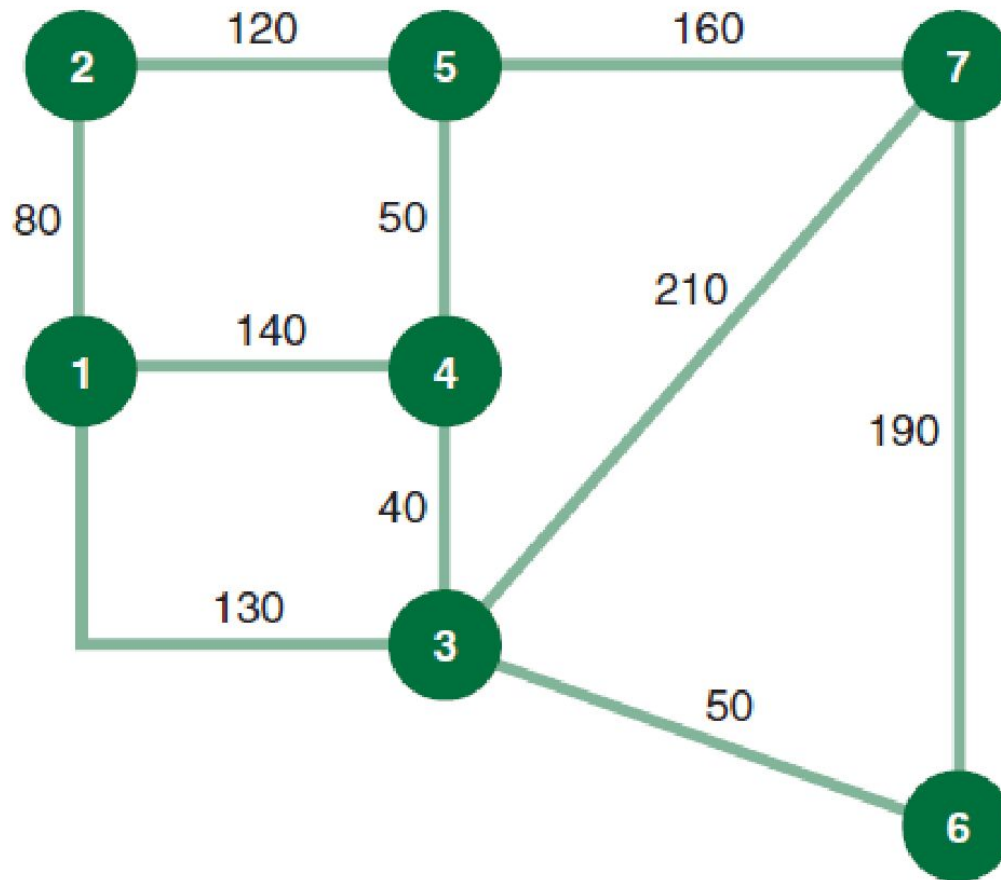
Farm	Plant		Supply (1,000 tons)
	Indiana	Georgia	
Ohio	\$16	X	72
Pennsylvania	18	16	105
New York	22	25	83

Plant	Distribution Center		
	Virginia	Kentucky	Louisiana
Indiana	\$23	X	\$29
Georgia	20	17	24
Demand (1,000 tons)	90	80	120

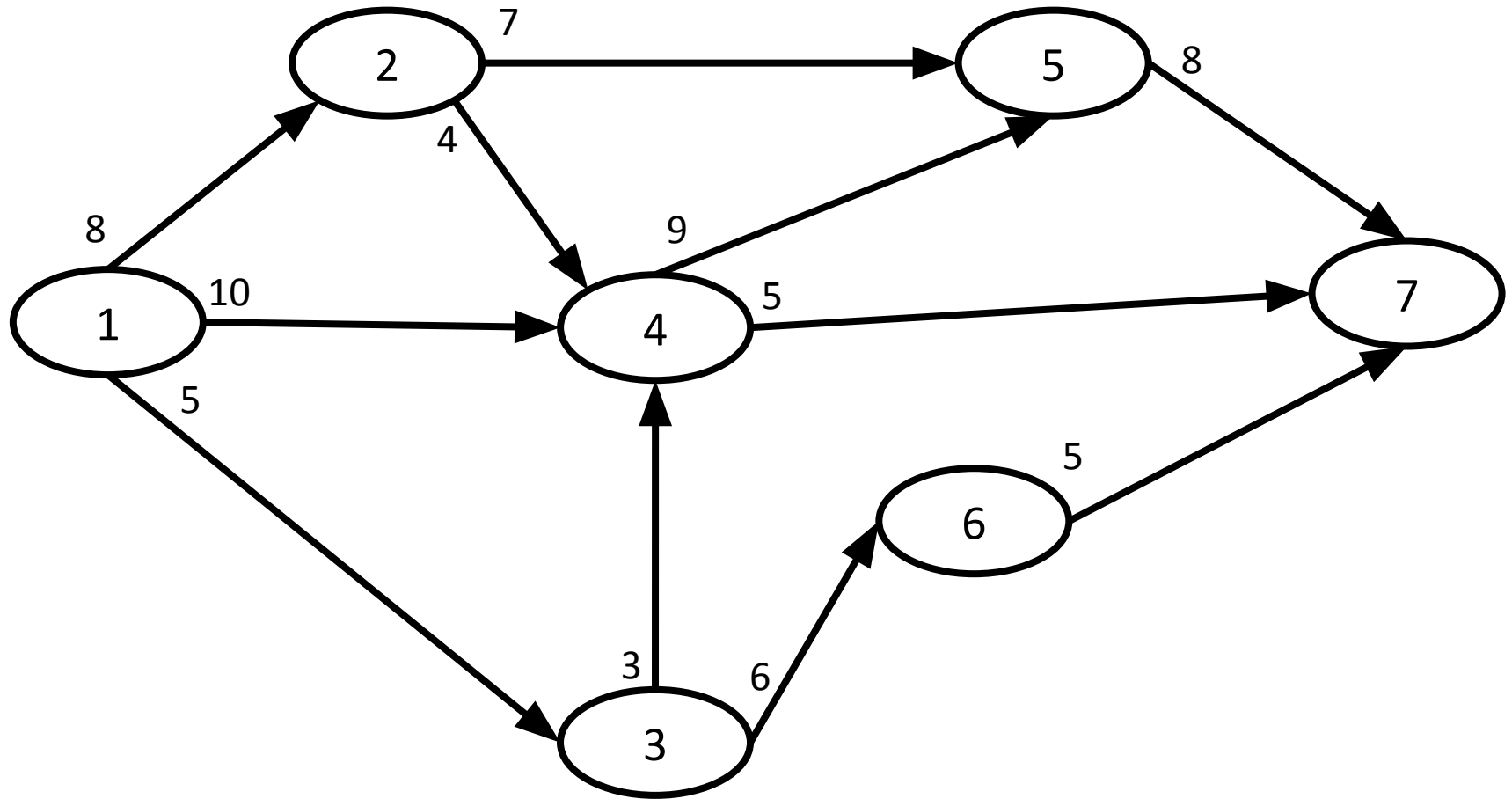
Problem 4: SHORTEST ROUTE PROBLEM

The plant engineer for the Bitco manufacturing plant is designing an overhead conveyor system that will connect the distribution/inventory center to all areas of the plant. The network of possible conveyor routes through the plant, with the length (in feet) along each branch, is available in the following slide:

- a) Determine the shortest conveyor route from the distribution/inventory center at node 1 to each of the other six areas of the plant.
- b) Formulate an LP model for this problem. Assume that there no flows from low valued nodes to high valued notes.



Problem 5: MAXIMAL FLOW EXAMPLE



a) Determine the maximum product flow that can be shipped from Node 1 to Node 7. b) Formulate an LP model for this problem.

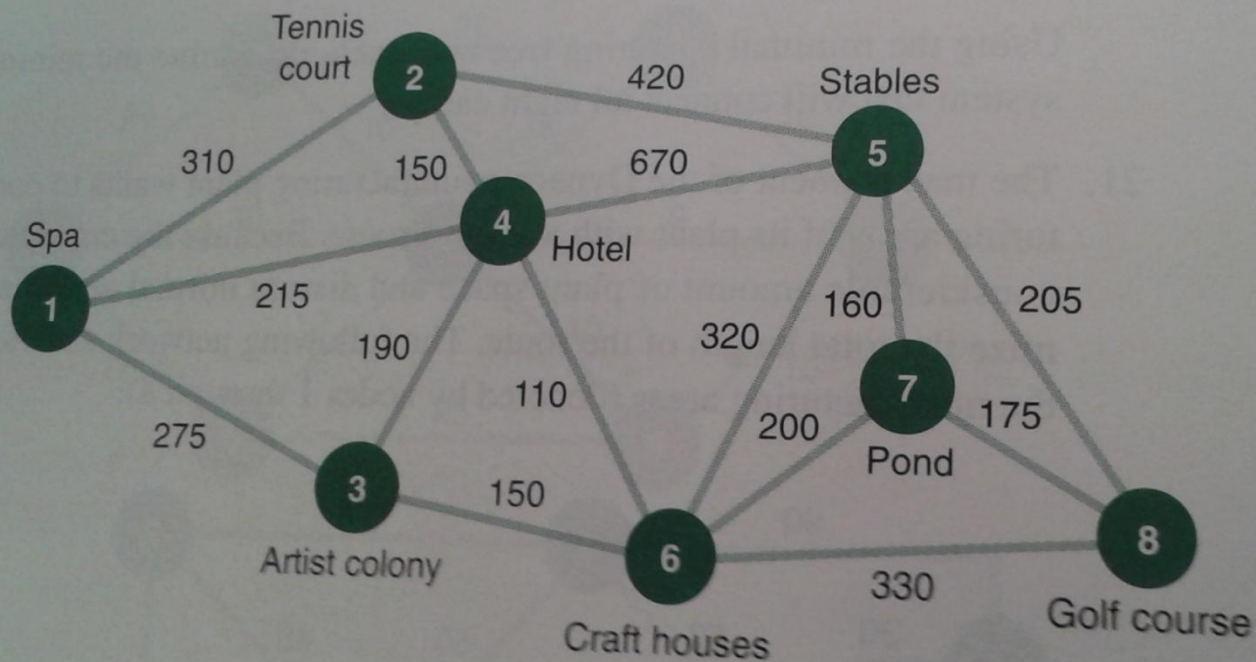
Problem 6: The Avalon Floor Cleaner Company is trying to determine the number of salespeople it should allocate to its **three regions**: the East, the Midwest, and the West. The company has 100 salespeople that it wants to assign all to the three regions. The annual average unit sales volume achieved by a salesperson in each region is as follows:

<u>Region</u>	<u>Units per Salesperson</u>
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☐ East	25000
☐ Midwest	18000
☐ West	31000

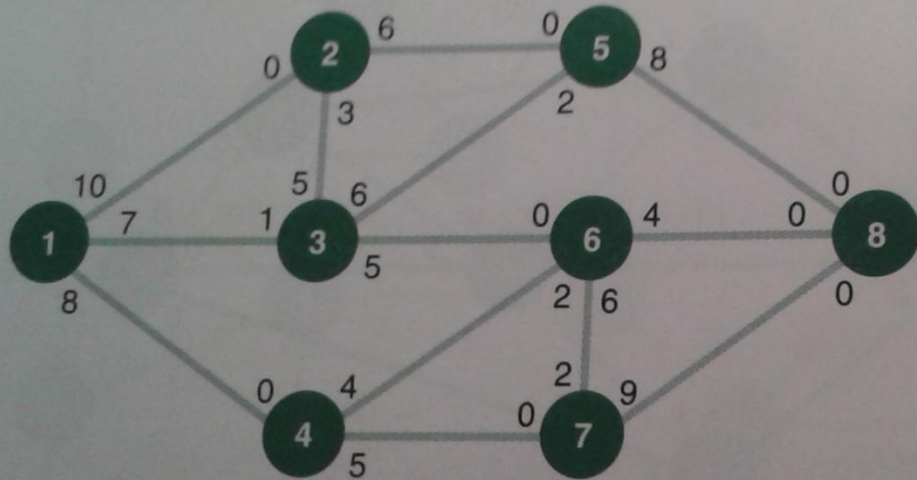
Because travel distances, costs of living, and other factors vary among the three regions, the annual cost of having a salesperson is **\$5,000** in the East, **\$11,000** in the Midwest, and **\$7,000** in the West. The company has **\$700,000** budgeted for expenses. To ensure nationwide exposure for its product, the company has decided that each region must have at least 10 salespeople.

- nect all 10 facilities, a 10-inch pipe will be used.
23. A major hotel chain is constructing a new resort hotel complex in Greenbranch Springs, West Virginia. The resort is in a heavily wooded area, and the developers want to preserve as much of the natural beauty as possible. To do so, the developers want to connect all the various facilities in the complex with a combination walking–riding path that will minimize the amount of pathway that will have to be cut through the woods. The following network shows possible connecting paths and corresponding distances (in yards) between the facilities:



Determine the path that will connect all the facilities with the minimum amount of construction and indicate the total length of the pathway.

32. A new stadium complex is being planned for Denver, and the Denver traffic engineer is attempting to determine whether the city streets between the stadium complex and the interstate highway can accommodate the expected flow of 21,000 cars after each game. The various traffic arteries between the stadium (node 1) and the interstate (node 8) are shown in the following network:



The flow capacities on each street are determined by the number of available lanes, the use of traffic police and lights, and whether any lanes can be opened or closed in either direction. The flow capacities are given in thousands of cars. Determine the maximum traffic flow the streets can accommodate and the amount of traffic along each street. Will the streets be able to handle the expected flow after a game?

33. The FAA has granted a license to a new airline, Omniair, and...