

Transshipment and Assignment Models

Management 560: Management Science

March 31, 2009

Learning Objective	Active Learning Activity
Learn how to deal with intermediate stops	Lecture / Worksheet
Learn how handle assignments with a transportation model.	Worksheet problem.
Learn about shortest-route problems and how to solve them.	Excel problem.
Build our expertise	Quiz

Goals of this class meeting

- Learn how to formulate transportation models with intermediate points.
- Learn how to use the transportation model framework for finding optimal assignments.
- Continue to perfect our linear programming skills!

Transshipment Models

- A **transshipment model** is a transportation model with intermediate destinations between the sources and the destinations.
- Example: Goods are often transported from manufacturing plants to distribution centers or warehouses, then finally to stores.
- Constraints involving sources and destinations are similar:
 - Everything leaving sources must not exceed supplies.
 - Everything entering destinations must not exceed demand.
- New constraint: everything entering an intermediate point *must equal* everything leaving.

Worksheet questions

Walsh's Fruit Company buys grapes and produces 100% grape juice, not from concentrate. The grapes are purchased from growers in Ohio, Pennsylvania, and New York and processed into juice at plants in Indiana and Georgia. Once the juice is made, it is sent to distribution centers in Virginia, Kentucky, and Louisiana, then eventually sold to stores. The supply of grapes at each grower and the transportation costs to get the grapes to the processing plants are given by,

From Farm:	To Processing Plant:		Supply (1000 tons)
	(4) Indiana	(5) Georgia	
(1) Ohio	\$16	\$21	72
(2) Pennsylvania	\$18	\$16	105
(3) New York	\$22	\$25	83

The demand and the transportation costs to get the juice from the processing plants to the distribution centers are given by,

From Processing Plant:	To Distribution Center		
	(6) Virginia	(7) Kentucky	(8) Louisiana
(4) Indiana	\$23	\$15	\$29
(5) Georgia	\$20	\$17	\$24
Demand (1000 tons)	90	80	120

1. Draw a map of what is happening (do not try to make an accurate U.S. map)
2. How many variables are there? What are they?
3. What is the objective function?
4. Is this a balanced model? What does that imply about your source constraints and your destination constraints?

5. Write down the source constraints. How many are there?

6. Write down the demand constraints. How many are there?

7. Write down the intermediate constraints. How many are there?

8. Solve this problem with Excel. What is the minimum transportation cost?

Assignment Models

- **Assignment models** are like transportation models, except you decide whether or to assign a source to a destination (or employee to a task).
- Decision variables are **binary**.
- Suppose you have 3 employees and 3 tasks. How many different possible assignments are there?
- Constraints:
 - Each assignment must get at most 1 assignee.
 - Each assignee must get at most 1 assignment.
 - Non-negativity constraints.
 - Integer constraints (use Integer Programming).

3. There are two sources for constraints. What are the constraints for the faculty? How many are there? Keep in mind whether this is a balanced or unbalanced model.

4. What are the constraints for the courses? How many are there?

5. Solve the problem using Excel. Who is going to teach what?

Homework!

- Case problem, “Burlingham Textile Company”, page 267
- Case problem, “The Graphic Palette”, page 268.
- Do not do these problems by hand! Figure out the problems using Excel, and type up your conclusions, along with an explanation. Print out your Excel sheet and answers.
- Read for next time: Network flow models, Chapter 7.

Quiz!

Fancy Pants Department Store has four salespeople with a great deal of experience throughout the store, and is ready to give three promotions to department supervisor. The three departments that need supervisors are Women's clothing, Men's Clothing, and Jewelry. Each employee has worked previously in all these departments, and the store keeps data on sales for each employee for each department. The employees' average monthly sales numbers are,

Salesperson	Department		
	Men	Women	Jewelry
Abby	\$340	\$160	\$610
Beth	\$560	\$370	\$520
Carla	\$270	\$540	\$350
Deborah	\$360	\$220	\$630

The store manager thinks it is reasonable to promote the employees to supervise departments in such a way that maximizes the expected sales of the department. What assignments should be made to achieve the managers objective? Does everyone get promoted? What are the total expected sales for the supervisors? Type up your answers on the Excel sheet and print out your quiz to turn in.