Chapter 9
Transportation and Assignment Models - Dr. Samir Safi

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

1) Transportation and assignment problems are really linear programming techniques called network flow problems. 1)

2) Transportation models may be used when a firm is trying to decide where to locate a new facility. 2)

3) The objective of a transportation problem solution is to schedule shipments from sources to destinations while minimizing total transportation and production costs. 3)

4) The transportation algorithm can be used to solve both minimization problems and maximization problems. 4)

5) The objective of an assignment problem solution most often is to minimize the total costs or time of performing the assigned tasks. 5)

6) In the assignment problem, the costs for a dummy row will be equal to the lowest cost of the column for each respective cell in that row. 6)

7) The Hungarian method is designed to solve transportation problems efficiently. 7)

8) In a transportation problem, each destination must be supplied by one and only one source. 8)

9) Maximization assignment problems can easily be converted to minimization problems by subtracting each rating from the largest rating in the table. 9)

10) In a transportation problem, a dummy source is given a zero cost, while in an assignment problem, a dummy source is given a very high cost. 10)

11) In a transportation problem, a single source may supply something to all destinations. 11)

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which of the following accurately describes steps of the northwest corner rule, after making the initial allocation of units in the northwest cell? 1)
   A) Move right first, and then move down.
   B) Move right or down first, depending on whether the demand requirement or the supply capacity, respectively, is exhausted first.
   C) Move right or down first, depending on whether the supply capacity or the demand requirement, respectively, is exhausted first.
   D) Move down first, and then move right.
   E) Move diagonally first.
2) What is the overall objective in applying the transportation method to the facility location problem?
   A) minimize the distance traveled
   B) maximize the value of items shipped
   C) minimize the cost of the distribution system
   D) minimize the number of items shipped
   E) None of the above

3) An artificial source added to a transportation table when total demand is greater than total supply is called ________.
   A) filler source
   B) excess source
   C) dummy source
   D) supply source
   E) demand source

4) If we want to quickly arrive at a "feasible," but not necessarily "optimal" solution to the transportation problem, we will use the
   A) Vogel's approximation method.
   B) stepping-stone method.
   C) northwest corner rule.
   D) MODI method.
   E) Any of the above

5) Practically speaking, multiple optimal solutions ________.
   A) are degenerate
   B) are infeasible
   C) are unbalanced
   D) are unbounded
   E) provide management with greater flexibility in selecting and using resources

6) Which of the following is not a step in the Hungarian method of assignment?
   A) enumerate all possible solutions
   B) revise the opportunity-cost table
   C) find the opportunity-cost table
   D) test for an optimal assignment
   E) None of the above

7) In an assignment problem
   A) the number of rows and columns must be equal.
   B) the number of rows must equal or exceed the number of columns.
   C) the number of columns must equal or exceed the number of rows.
   D) the number of rows must exceed the number of columns.
   E) None of the above

8) Which of the following methods is used only with the assignment problem?
   A) the Hungarian method
   B) the simplex method
   C) Vogel's approximation method
   D) stepping-stone method
   E) MODI method
ESSAY. Write your answer in the space provided or on a separate sheet of paper.

1) A certain firm has four different operations that must be assigned to four locations. The profit (in thousands of dollars) associated with each operation at each location is presented below. The firm's vice president would like to assign the various operations so that the total profit is maximized. Find the appropriate assignments.

<table>
<thead>
<tr>
<th>Operations</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>W</td>
<td>9</td>
</tr>
<tr>
<td>X</td>
<td>10</td>
</tr>
<tr>
<td>Y</td>
<td>8</td>
</tr>
<tr>
<td>Z</td>
<td>12</td>
</tr>
</tbody>
</table>

2) Four projects must be completed, and each of four employees will be assigned to work on exactly one of the four projects. The table below presents an estimate of the cost that each employee would incur if working on the respective projects. What is the minimum-cost assignment of workers to projects?

<table>
<thead>
<tr>
<th>EMPLOYEE</th>
<th>PROJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Mary</td>
<td>$45</td>
</tr>
<tr>
<td>Elizabeth</td>
<td>$50</td>
</tr>
<tr>
<td>Steven</td>
<td>$52</td>
</tr>
<tr>
<td>Joshua</td>
<td>$60</td>
</tr>
</tbody>
</table>

3) Table 9–19 describes a transportation problem:

Table 9–19

<table>
<thead>
<tr>
<th>To⇒⇒</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Demand</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

(a) Use the northwest corner method to get an initial solution.
(b) What is the cost of the initial solution?
(c) Use the stepping-stone method to find the optimal solution.
(d) What is the cost of the optimal solution?
(e) Is there an alternate optimal solution?
1) TRUE
2) TRUE
3) TRUE
4) TRUE
5) TRUE
6) FALSE
7) FALSE
8) FALSE
9) TRUE
10) FALSE
11) TRUE

1) Assign W to 2, X to 4, Y to 3, and Z to 1. Total profit = $48 (thousand)
2) MaryProject 2, ElizabethProject 4, StevenProject 1, JoshuaProject 3
3) (a)

<table>
<thead>
<tr>
<th></th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20</td>
<td>20</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>30</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

(b) Cost = 280

(c) Optimal solution:

<table>
<thead>
<tr>
<th></th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
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<td>20</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

(d) Cost = 210
(e) no