Sample Answers to In-Text Questions

# Module B: Transportation Models

## Discussion Questions

1. Why are transportation models treated as a special case of linear Programming models?

Answer: The transportation model is a special case of linear programming problems in which the objective is to minimize the total cost of transporting goods from the various supply origins to the different demand destinations. It is a pervasive problem that all companies have, and the implications of the decision are very important.

1. What are the three pieces of information required to formulate a transportation model?

Answer:   
1. All supply locations, and production capabilities per period;   
2. All demand locations and their requirements per period;   
3. The distribution or transportation cost of shipping one unit from each origin to each destination.

1. What are the five major assumptions required for transportation modeling?

Answer:

Capacity at each supply location or origin is limited.

* 1. The demand requirements at each destination are known.
  2. Regardless of their origin or destination, the items shipped are the same (homogeneous).
  3. Regardless of the number of units shipped, the shipping cost per unit remains the same.

1. Between each origin and destination, the mode of transportation being used does not change, and there is only one route used.
2. What is the difference between a balanced and an unbalanced transportation problem?

Answer: In a balanced problem, the total number of units demanded is equal to the number of units available. In an unbalanced problem, the number of units of supply and demand are different.

1. List the four “steps” of the northwest corner rule.
   1. Answer: Begin at the top left-hand or northwest corner of the transportation matrix and allocate as many units to this cell as possible until either the supply is exhausted or the demand requirements are met.
      1. Exhaust the capacity from each supply location (row) before moving down to the next supply location.
      2. Exhaust the requirements from each demand location (column) before moving right to the next demand location.
      3. Repeat steps 2 and 3 until all available supply capacity is exhausted and demand requirements are met.
2. List the four “steps” of the matrix least cost method.  
   Answer:
   1. Begin with the cell in the transportation matrix that has the lowest per unit cost. In case of any ties among cells for the lowest cost, break the ties arbitrarily.
   2. Allocate to this cost cell the maximum number of units allowable given available capacity or demand requirements. Eliminate the row or column that exhausts the supply or meets the demand requirements by this allocation from further consideration.
   3. From the remaining available cells in the matrix, choose the one that has the next lowest per unit cost and repeat step 2.
   4. Repeat step 3 until all units have been allocated.
3. Why does the matrix least cost method gives a better initial solution than the northwest corner rule does?

Answer: As the overall objective is to minimize total cost, this method is intuitively more appealing and has better rationale than the northwest corner rule. As a result, this method reduces the number of computations and the time required to determine the optimal solution.

1. What is the implication of getting a negative value of improvement index for a closed path?

Answer: You would need to select the cell with a minus sign that has the smallest shipment quantity, and then add that to all the cells with a + sign on the closed path.

1. For a balanced transportation problem, what are the two criteria for a nondegenerate optimum solution?

Answer:

1. All supply should be exhausted and all demand requirements must be met.
2. The number of cells with positive allocations should be equal to R + C – 1, where R is the number of rows and C is the number of columns in the transportation matrix.
3. What does the term *degeneracy* mean in the context of transportation modeling, and what problems does it create in applying the stepping stone method?  
   Answer: Degeneracy occurs when too few shipping routes are used, when one of the occupied routes (cells) fully exhausts the supply from a source and meets the demand requirements for a destination. When you apply the stepping stone method, it is impossible to trace a closed path for one or more of the unoccupied cells or routes. To overcome the problem of degeneracy, we need to create an artificially occupied cell.
4. Can the structure of transportation models be applied to other operations management situations? If the answer is “yes,” provide some examples.  
   Answer: Answers may vary.
5. In the stepping stone method, what is the rationale for placing alternate + and – signs around the closed path?  
   Answer: Because you will need to calculate an improvement index: a value obtained to see if there is an improvement in cost by choosing another route. This value is calculated by first summing up the unit costs in the cells with a plus sign, and then from the resulting total, subtract the sum obtained by adding the unit costs in cells containing a minus sign.
6. Why do we create dummy supply sources or dummy demand destinations in transportation modeling problems?  
   Answer: To model and solve an unbalanced transportation problem, we need to convert the unbalanced problem to a balanced one.