**Integer Programming:** Whirlpool Corporation a major home appliance company is considering opening warehouses in four cities: New York, Los Angeles, Chicago, and Atlanta. Each warehouse can ship 15,000 units of refrigerators per week. The weekly fixed cost of keeping each warehouse open is $60,000 for New York, $50,000 for Los Angeles, $40,000 for Chicago, and $35,000 for Atlanta. The north-east region of the country requires 8000 units of refrigerators per week, the west region requires 9000 units per week, and the mid-west region requires 7000 units per week. The costs (including production and shipping costs) of sending one refrigerator from a warehouse to a region are shown in the table below. The company wants to meet weekly demands at minimum cost, subject to the preceding information and the following restrictions:

* If the New York warehouse is opened, then the Los Angeles warehouse must be opened.
* At most two warehouses can be opened.
* Either the Atlanta or the Los Angeles warehouse must be opened.

**Table:** Unit production and shipping costs



**Model**

**Decision Variables:**

: Units of refrigerators to be shipped from warehouse *i* to region *j*

{*i*: 1 = New York, 2 = Los Angeles, 3 = Chicago, 4 = Atlanta; *j*: 1 = North-East, 2 = West, 3 = Mid-West}

: equals 1 if warehouse *i* is opened and equals 0 otherwise.

**Input Parameters:**

: denotes requirement of refrigerators for region *j*.

: denotes fixed cost to open warehouse *i*

: Cost to ship one refrigerator from warehouse *i* to region *j*

L: Weekly limit of refrigerators that can be shipped by each warehouse

**Objective:**

Total shipping cost:

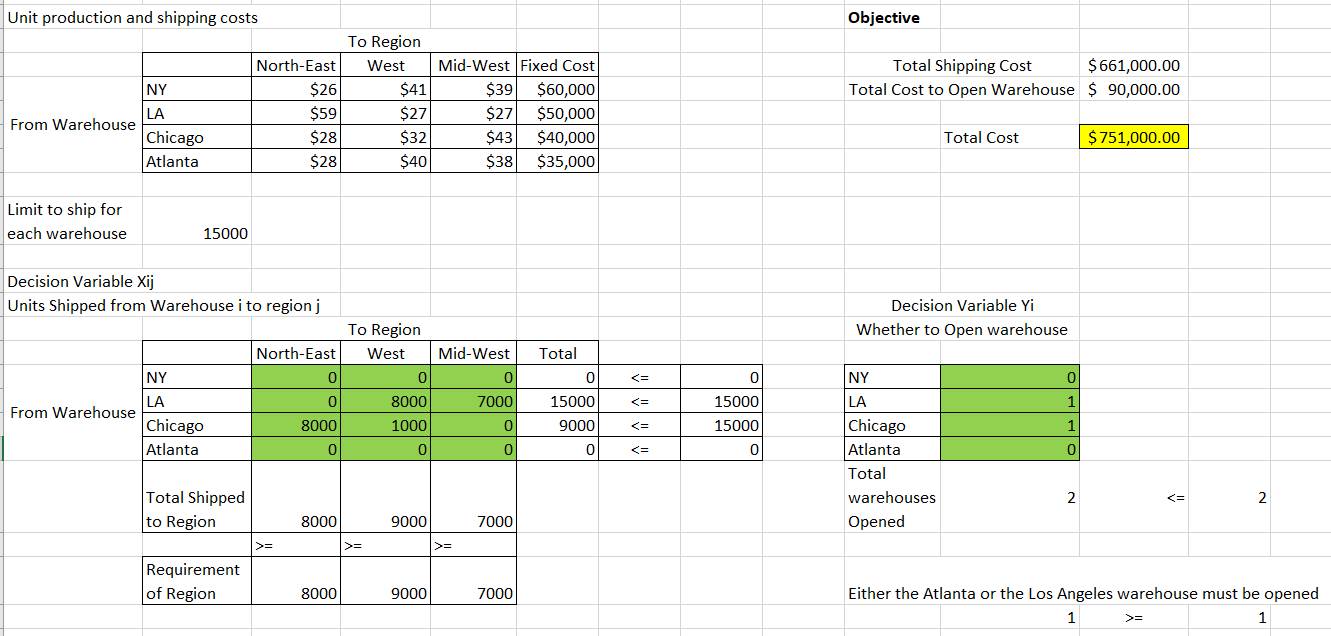
Total cost of opening the warehouses:

The objective of the company is to minimize the total shipping costs and the total cost of opening the warehouses. Thus, the objective function is as follows:

**Constraints:**

1. Limit of Shipping for each warehouse that is opened
2. Requirement of refrigerators for each region
3. At most two warehouses can be opened
4. If the New York warehouse is opened, then the Los Angeles warehouse must be opened.
5. Either the Atlanta or the Los Angeles warehouse must be opened.
6. Non-negativity and binary constraint

**Optimal Solution**



Whirlpool Corporation can satisfying the requirements of the 3 regions by opening warehouses in Los Angeles and Chicago with a total minimum cost of $751,000.