

Grup 6 – Bölüm 6 – Soru CD9

**Problem:**

Luxor motorhomes has two plants, one in Riverside, California and the other in Des Moines, Iowa. Each plant can produce three different models: the Grand Cruiser, the Traveler, and the Weekender. Labor time at the Riverside plant limits production to 600 models per month, while Des Moines plant can produce up to 1000 models per month. The manufacturing costs and monthly production capabilities for each model vary, depending on the plant. These costs are summarized in the following table:

	Riverside	Des Moines
Manufacturing Cost		
Grand Cruiser	53.000\$	50.000\$
Traveler	29.000\$	27.000\$
Weekender	18.000\$	17.000\$
Maximum Monthly Production		
Grand Cruiser	200	400
Traveler	500	500
Weekender	600	900

Once the units are manufactured, they are shipped to central distribution locations in Florida, Texas and California, where they are ultimately purchased by retailers. The demand for motorhomes at the distribution locations for this month's production is as follows.

	Florida	Texas	California
Grand Cruiser	100	50	150
Traveler	200	100	300
Weekender	225	175	250

The transportation cost for shipping a motorhome from a plant to a distribution center are independent of the model. These are given in the following table

	Florida	Texas	California
Des Moines	1.000\$	800\$	1.200\$
Riverside	2.000\$	700\$	300\$

Formulate this problem as a capacitated transshipment problem and solve for the optimal production and distribution of motorhomes during this month. Hint: Define a set of nodes for the plants, a set of nodes for the models, and a set for the models at the distribution locations.

**Solution:**

**a. Variables**

- $X_{11F}$  : Number of Grand Cruiser motors transported to Florida from Des Moines,
- $X_{12F}$  : Number of Traveler motors transported to Florida from Des Moines,
- $X_{13F}$  : Number of Weekender motors transported to Florida from Des Moines,
- $X_{21F}$  : Number of Grand Cruiser motors transported to Florida from Riverside,
- $X_{22F}$  : Number of Traveler motors transported to Florida from Riverside,
- $X_{23F}$  : Number of Weekender motors transported to Florida from Riverside,
- $X_{11T}$  : Number of Grand Cruiser motors transported to Texas from Des Moines,
- $X_{12T}$  : Number of Traveler motors transported to Texas from Des Moines,
- $X_{13T}$  : Number of Weekender motors transported to Texas from Des Moines,
- $X_{21T}$  : Number of Grand Cruiser motors transported to Texas from Riverside,
- $X_{22T}$  : Number of Traveler motors transported to Texas from Riverside,

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- $X_{23T}$  : Number of Weekender motors transported to Texas from Riverside,  
 $X_{11C}$  : Number of Grand Cruiser motors transported to California from Des Moines,  
 $X_{12C}$  : Number of Traveler motors transported to California from Des Moines,  
 $X_{13C}$  : Number of Weekender motors transported to California from Des Moines,  
 $X_{21C}$  : Number of Grand Cruiser motors transported to California from Riverside,  
 $X_{22C}$  : Number of Traveler motors transported to California from Riverside,  
 $X_{23C}$  : Number of Weekender motors transported to California from Riverside,

### b. Model

MIN:

$$\begin{aligned} & X_{11x} * 50.000 + X_{12x} * 27.000 + X_{13x} * 17.000 \text{ (Des Moines production cost)} \\ & + X_{21x} * 53.000 + X_{22x} * 29.000 + X_{23x} * 18.000 \text{ (Riverside Production cost)} \\ & + (X_{11F} + X_{12F} + X_{13F}) * 1.000 \text{ (Transportation cost from DM to Florida)} \\ & + (X_{21F} + X_{22F} + X_{23F}) * 2.000 \text{ (Transportation cost from Riverside to Florida)} \\ & + (X_{11T} + X_{12T} + X_{13T}) * 800 \text{ (Transportation cost from DM to Texas)} \\ & + (X_{21T} + X_{22T} + X_{23T}) * 700 \text{ (Transportation cost from Riverside to Texas)} \\ & + (X_{11C} + X_{12C} + X_{13C}) * 1.200 \text{ (Transportation cost from DM to California)} \\ & + (X_{21C} + X_{22C} + X_{23C}) * 300 \text{ (Transportation cost from Riverside to California)} \end{aligned}$$

$$\begin{aligned} X_{11x} + X_{12x} + X_{13x} &\leq 1.000 && \text{(DM production limit)} \\ X_{21x} + X_{22x} + X_{23x} &\leq 600 && \text{(Riverside production limit)} \\ X_{11x} &\leq 400 && \text{(DM Grand Cruiser Production limit)} \\ X_{12x} &\leq 500 && \text{(DM Traveller limit)} \\ X_{13x} &\leq 900 && \text{(DM Weekender limit)} \\ X_{21x} &\leq 200 && \text{(Riverside Grand Cruiser limit)} \\ X_{22x} &\leq 500 && \text{(Riverside Traveller limit)} \\ X_{23x} &\leq 600 && \text{(Riverside Weekender limit)} \\ X_{11F} + X_{21F} &\geq 100 && \text{(Florida request for Grand Cruiser)} \\ X_{12F} + X_{22F} &\geq 200 && \text{(Florida request for Traveller)} \\ X_{13F} + X_{23F} &\geq 225 && \text{(Florida request for Weekender)} \\ X_{11T} + X_{21T} &\geq 50 && \text{(Texas request for Grand Cruiser)} \\ X_{12T} + X_{22T} &\geq 100 && \text{(Texas request for Traveller)} \\ X_{13T} + X_{23T} &\geq 175 && \text{(Texas request for Weekender)} \\ X_{11C} + X_{21C} &\geq 150 && \text{(California request for Grand Cruiser)} \\ X_{12C} + X_{22C} &\geq 300 && \text{(California request for Traveller)} \\ X_{13C} + X_{23C} &\geq 250 && \text{(California request for Weekender)} \end{aligned}$$

**Note:** You can see the solution of the problem in the excel sheet [g6-s6-cd9.xls](#) with using solver.