

Modelling LP : A Transportation Problem



A Transportation Problem: Tropicsun



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Defining the Decision Variables

 $X_{ij} = #$ of bushels shipped from node *i* to node *j*

Specifically, the nine decision variables are:

 $X_{14} = #$ of bushels shipped from Mt. Dora (node 1) to Ocala (node 4) $X_{15} = \#$ of bushels shipped from Mt. Dora (node 1) to Orlando (node 5) $X_{16} = #$ of bushels shipped from Mt. Dora (node 1) to Leesburg (node 6) $X_{24} = #$ of bushels shipped from Eustis (node 2) to Ocala (node 4) $X_{25} = #$ of bushels shipped from Eustis (node 2) to Orlando (node 5) $X_{26} = #$ of bushels shipped from Eustis (node 2) to Leesburg (node 6) $X_{34} = #$ of bushels shipped from Clermont (node 3) to Ocala (node 4) $X_{35} = #$ of bushels shipped from Clermont (node 3) to Orlando (node 5) $X_{36} = #$ of bushels shipped from Clermont (node 3) to Leesburg (node 6)

Defining the Objective Function

Minimize the total number of bushel-miles. MIN: $21X_{14} + 50X_{15} + 40X_{16} + 35X_{24} + 30X_{25} + 22X_{26} + 55X_{34} + 20X_{35} + 25X_{36}$

Defining the Constraints

- Capacity constraints
- Supply constraints

 Nonnegativity conditions X_{ij} >= 0 for all i and j

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Implementing the Model

| | Tropicsun Distances From Groves to Plant at | | | | |
|-------------|---|--------------|------------|---------|-----------|
| | | | | | |
| | | | | | |
| Grove | Ocala | Orlando | Leesburg | | |
| Mt. Dora | 21 | 50 | 40 | | |
| Eustis | 35 | 30 | 22 | | |
| Clermont | 55 | 20 | 25 | | |
| | Busł | nels Shipped | From | | |
| | Groves to Plant at | | | Bushels | Bushels |
| Grove | Ocala | Orlando | Leesburg | Shipped | Available |
| Mt. Dora | 200,000 | 75,000 | 0 | 275,000 | 275,000 |
| Eustis | 0 | 175,000 | 225,000 | 400,000 | 400,000 |
| Clermont | 0 | 300,000 | 0 | 300,000 | 300,000 |
| Received | 200,000 | 550,000 | 225,000 | | |
| Capacity | 200,000 | 600,000 | 225,000 | | |
| Total Dista | nce (in bush | el-miles) | 24.150.000 | | <u>i</u> |

Implementing the Model

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|-------------|--------------|-------------------|------------|---------|-----------|---|
| | ۱ | Fropicsun | | | | |
| | |) istances Fro | om | | | |
| | Gr | roves to Plan | nt at | | | |
| Grove | Ocala | Orlando | Leesburg | | 1 | |
| Mt. Dora | 21 | 50 | 40 | | | |
| Eustis | 35 | 30 | 22 | | | |
| Clermont | 55 | 20 | 25 | | | |
| | Bush | nels Shipped | From | | | |
| | Gr | roves to Plan | ntat | Bushels | Bushels | |
| Grove | Ocala | Orlando | Leesburg | Shipped | Available | |
| Mt. Dora | 200,000 | 75,000 | 0 | 275,000 | 275,000 | |
| Eustis | 0 | 175,000 | 225,000 | 400,000 | 400,000 | |
| Clermont | 0 | 300,000 | 0 | 300,000 | 300,000 | |
| Received | 200,000 | 550,000 | 225,000 | | | |
| Capacity | 200,000 | 600,000 | 225,000 | | | _ |
| Total Dista | nce (in bush | el-miles) | 24,150,000 | 1 | | |
| | 5.00 MW | | | | 10 | - |

| | Tropicsun Distances From Groves to Plant at | | | | |
|--------------|---|--------------------|------------|---------|-----------|
| | | | | | |
| | | | | | |
| Grove | Ocala | Orlando | Leesburg | | |
| Mt. Dora | 21 | 50 | 40 | | |
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| Clermont | 55 | 20 | 25 | | |
| | | | | | |
| | Bus | hels Shipped | From | | |
| | G | Groves to Plant at | | | Bushels |
| Grove | Ocala | Orlando | Leesburg | Shipped | Available |
| Mt. Dora | 200.000 | 0 | 75.000 | 275.000 | 275.000 |
| Eustis | 0 | 250.000 | 150.000 | 400.000 | 400.000 |
| Clermont | 0 | 300.000 | 0 | 300.000 | 300.000 |
| Received | 200.000 | 550.000 | 225.000 | | |
| Capacity | 200.000 | 600.000 | 225.000 | | |
| | | | | | |
| Total Distan | ce (in bushel-m | iles) | 24.000.000 | | |
| | | | T | | |