TRANSPORTATION

A firm needs to plan for the distribution of their products to retailers in four different cities. These retailers would be served from any or all of three different warehouses. Transportation distances between each warehouse and destination city are given below, as well as city demands and warehouse capacities. Determine the overall shipment pattern for the situation which will minimize total miles traveled.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Destination | | | |
|  |  | City 1 | City 2 | City 3 | City 4 |
| Source | Whse A | 600 | 450 | 800 | 1450 |
| Whse B | 950 | 200 | 150 | 1000 |
| Whse C | 1200 | 1600 | 650 | 50 |

|  |  |
| --- | --- |
| City Demands | |
| City 1 | 10,000 |
| City 2 | 12,000 |
| City 3 | 9,000 |
| City 4 | 13,000 |

TRANSPORTATION/WAREHOUSE LOCATION -- CAPACITATED

A firm needs to plan for the distribution of their products to retailers in four different cities. These retailers would be served from any or all of three different warehouses. Transportation distances between each warehouse and destination city are given below, as well as city demands and warehouse capacities. Determine the overall shipment pattern for the situation which will minimize total miles traveled.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Destination | | | |
|  |  | City 1 | City 2 | City 3 | City 4 |
| Source | Whse A | 600 | 450 | 800 | 1450 |
| Whse B | 950 | 200 | 150 | 1000 |
| Whse C | 1200 | 1600 | 650 | 50 |

|  |  |
| --- | --- |
| City Demands | |
| City 1 | 10,000 |
| City 2 | 12,000 |
| City 3 | 9,000 |
| City 4 | 13,000 |

|  |  |
| --- | --- |
| Warehouse Capacities | |
| Whse A | 8,000 |
| Whse B | 11,000 |
| Whse C | 22,000 |

TRANSPORTATION/WAREHOUSE LOCATION --

CAPACITATED WITH FIXED & VARIABLE COSTS

A firm needs to plan for the distribution of their products to retailers in four different cities. These retailers would be served from any or all of three different warehouses. Transportation distances between each warehouse and destination city are given below, as well as city demands and warehouse capacities. Determine the overall shipment pattern for the situation which will minimize total miles traveled.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Destination | | | |
|  |  | City 1 | City 2 | City 3 | City 4 |
| Source | Whse A | 600 | 450 | 800 | 1450 |
| Whse B | 950 | 200 | 150 | 1000 |
| Whse C | 1200 | 1600 | 650 | 50 |

|  |  |
| --- | --- |
| City Demands | |
| City 1 | 10,000 |
| City 2 | 12,000 |
| City 3 | 9,000 |
| City 4 | 13,000 |

|  |  |
| --- | --- |
| Warehouse Capacities | |
| Whse A | 50,000 |
| Whse B | 50,000 |
| Whse C | 50,000 |

Transportation Cost: $2/unit/mile

Warehouse Fixed Cost: $10,000,000/year

TRANSPORTATION/WAREHOUSE LOCATION --

MULTIPLE WAREHOUSE CAPACITIES

A firm needs to plan for the distribution of their products to retailers in four different cities. These retailers would be served from any or all of three different warehouses. Transportation distances between each warehouse and destination city are given below, as well as city demands and warehouse capacities. Determine the overall shipment pattern for the situation which will minimize total miles traveled.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Destination | | | |
|  |  | City 1 | City 2 | City 3 | City 4 |
| Source | Whse A | 600 | 450 | 800 | 1450 |
| Whse B | 950 | 200 | 150 | 1000 |
| Whse C | 1200 | 1600 | 650 | 50 |

|  |  |
| --- | --- |
| City Demands | |
| City 1 | 10,000 |
| City 2 | 12,000 |
| City 3 | 9,000 |
| City 4 | 13,000 |

|  |  |  |
| --- | --- | --- |
| Warehouse Capacities | | |
|  | Small Whse | Large Whse |
| Whse A | 15,000 | 50,000 |
| Whse B | 15,000 | 50,000 |
| Whse C | 15,000 | 50,000 |

Transportation Cost: $2/unit/mile

Small Warehouse Fixed Cost: $5,000,000/year

Large Warehouse Fixed Cost: $10,000,000/year

SHORTEST PATH -- DISTANCE

Sorvada Park has recently been set aside for a limited amount of sightseeing and backpack hiking. Cars are not allowed into the park, but there is a narrow, winding road system for trams and for jeeps driven by the Park Rangers. This road system is shown (without the curves) in the network diagram below where location O is the entrance into the park; other letters designate the locations of ranger stations and other limited facilities. The numbers give the distances of these winding roads in miles. The park contains a scenic wonder at station T. A small number of trams are used to transport sightseers from the park entrance to station T and back. The park management would like to determine which route from the park entrance to station T as the *smallest total distance* for the operation of the trams. Formulate the mathematical optimization model which will determine the shortest route between the park entrance and the scenic wonder.

O

A

B

C

D

E

T

(2)

(5)

(4)

(1)

(2)

(7)

(4)

(3)

(4)

(1)

(5)

(7)

(distance in miles)

SHORTEST PATH -- COST

At a small but growing airport, the local airline is purchasing a new tractor for a tractor-trailer train to bring luggage to and from the airplanes. A new mechanized luggage system will be installed in three years, so the tractor will not be needed after that. However, because it will receive heavy use the operating and maintenance costs will increase rapidly as it ages. It may still be more economical to replace the tractor after one or two years. The following table gives the total net discounted costs associated with purchasing a tractor (purchase price minus trade-in allowance, plus operating and maintenance costs) at the end of year *i* and trading it in at the end of year *j*. Determine if and when the tractor should be replaced to minimize the total cost for the tractor over the three years.

|  |  |  |  |
| --- | --- | --- | --- |
|  | *j* | | |
| *i* | 1 | 2 | 3 |
| 0 | 8 | 18 | 31 |
| 1 |  | 10 | 21 |
| 2 |  |  | 12 |

TRAVELING SALESMAN

Philadelphia Paint Co. produces five colors of paint each month when switching from one color to the next, the blending machine must be cleaned and prepared for the next color. This setup time depends on what color was just produced in which color is to be produced next. This setup times when switching between all pairs of colors are given in the table below. As manager of the Production Department, you are to determine the sequence in which to produce the five colors so as to minimize the total setup time.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | To | | | | |
| From | White | Yellow | Orange | Red | Black |
| White |  | 150 | 120 | 100 | 110 |
| Yellow | 170 |  | 110 | 90 | 100 |
| Orange | 200 | 170 |  | 80 | 100 |
| Red | 220 | 190 | 100 |  | 90 |
| Black | 300 | 210 | 180 | 130 |  |