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Assignment 4: Transportation and Transshipment

Question #1:

Decision Variables:

X_{ij} – Where X represents the number of AEDs shipped from plant *i* to warehouse *j*
(i = A, B) (j = 1,2,3)

Objective Function:

Minimize the combined production and shipping costs, *Z*, for the company Heart Start.

$Z = 622*X_{A1} + 614*X_{A2} + 630*X_{A3} + 641*X_{B1} + 645*X_{B2} + 649*X_{B3}$

Subject to Constraints:

$X_{A1} + X_{A2} + X_{A3} \leq 100$
$X_{B1} + X_{B2} + X_{B3} \leq 120$
$X_{A1} + X_{B1} = 80$
$X_{A2} + X_{B2} = 60$
$X_{A3} + X_{B3} = 70$

And:

$X_{ij} \geq 0$

Solution from lpSolveAPI (see R Markdown file for code and output):

Plant A Units Shipped to Warehouse 1: 0 units
Plant A Units Shipped to Warehouse 2: 60 units
Plant A Units Shipped to Warehouse 3: 40 units
Plant B Units Shipped to Warehouse 1: 80 units
Plant B Units Shipped to Warehouse 2: 0 units
Plant B Units Shipped to Warehouse 3: 30 units

Question #2:

Part 1:

Decision Variables:

X_{ijk} – Where X represents the units of oil (in TBD) extracted from well *i* and moved to refinery *k* via pump station *j*. (*i* = 1,2,3) (*j* = A,B,C) (*k* = 1,2,3,4,5)

Objective Function:

Minimize the cost of providing oil to the refineries, Z, for Texxon:

$$Z = (1.52 + 5.15)*X_{1A1} + (1.52 + 5.69)*X_{1A2} + (1.52 + 6.13)*X_{1A3} + (1.52 + 5.63)*X_{1A4} + (1.52 + 5.80)*X_{1A5} + (1.60 + 5.12)*X_{1B1} + (1.60 + 5.47)*X_{1B2} + (1.60 + 6.05)*X_{1B3} + (1.60 + 6.12)*X_{1B4} + (1.60 + 5.71)*X_{1B5} + (1.40 + 5.32)*X_{1C1} + (1.40 + 6.16)*X_{1C2} + (1.40 + 6.25)*X_{1C3} + (1.40 + 6.17)*X_{1C4} + (1.40 + 5.87)*X_{1C5} + (1.70 + 5.15)*X_{2A1} + (1.70 + 5.69)*X_{2A2} + (1.70 + 6.13)*X_{2A3} + (1.70 + 5.63)*X_{2A4} + (1.70 + 5.80)*X_{2A5} + (1.63 + 5.12)*X_{2B1} + (1.63 + 5.47)*X_{2B2} + (1.63 + 6.05)*X_{2B3} + (1.63 + 6.12)*X_{2B4} + (1.63 + 5.71)*X_{2B5} + (1.55 + 5.32)*X_{2C1} + (1.55 + 6.16)*X_{2C2} + (1.55 + 6.25)*X_{2C3} + (1.55 + 6.17)*X_{2C4} + (1.55 + 5.87)*X_{2C5} + (1.45 + 5.15)*X_{3A1} + (1.45 + 5.69)*X_{3A2} + (1.45 + 6.13)*X_{3A3} + (1.45 + 5.63)*X_{3A4} + (1.45 + 5.80)*X_{3A5} + (1.57 + 5.12)*X_{3B1} + (1.57 + 5.47)*X_{3B2} + (1.57 + 6.05)*X_{3B3} + (1.57 + 6.12)*X_{3B4} + (1.57 + 5.71)*X_{3B5} + (1.30 + 5.32)*X_{3C1} + (1.30 + 6.16)*X_{3C2} + (1.30 + 6.25)*X_{3C3} + (1.30 + 6.17)*X_{3C4} + (1.30 + 5.87)*X_{3C5}$$

Subject to Constraints:

$$X_{1A1} + X_{1A2} + X_{1A3} + X_{1A4} + X_{1A5} + X_{1B1} + X_{1B2} + X_{1B3} + X_{1B4} + X_{1B5} + X_{1C1} + X_{1C2} + X_{1C3} + X_{1C4} + X_{1C5} \leq 93$$
$$X_{2A1} + X_{2A2} + X_{2A3} + X_{2A4} + X_{2A5} + X_{2B1} + X_{2B2} + X_{2B3} + X_{2B4} + X_{2B5} + X_{2C1} + X_{2C2} + X_{2C3} + X_{2C4} + X_{2C5} \leq 88$$
$$X_{3A1} + X_{3A2} + X_{3A3} + X_{3A4} + X_{3A5} + X_{3B1} + X_{3B2} + X_{3B3} + X_{3B4} + X_{3B5} + X_{3C1} + X_{3C2} + X_{3C3} + X_{3C4} + X_{3C5} \leq 95$$
$$X_{1A1} + X_{1B1} + X_{1C1} + X_{2A1} + X_{2B1} + X_{2C1} + X_{3A1} + X_{3B1} + X_{3C1} = 30$$
$$X_{1A2} + X_{1B2} + X_{1C2} + X_{2A2} + X_{2B2} + X_{2C2} + X_{3A2} + X_{3B2} + X_{3C2} = 57$$
$$X_{1A3} + X_{1B3} + X_{1C3} + X_{2A3} + X_{2B3} + X_{2C3} + X_{3A3} + X_{3B3} + X_{3C3} = 48$$
$$X_{1A4} + X_{1B4} + X_{1C4} + X_{2A4} + X_{2B4} + X_{2C4} + X_{3A4} + X_{3B4} + X_{3C4} = 91$$
$$X_{1A5} + X_{1B5} + X_{1C5} + X_{2A5} + X_{2B5} + X_{2C5} + X_{3A5} + X_{3B5} + X_{3C5} = 48$$

And:

$X_{ijk} \geq 0$ (*i* = 1,2,3) (*j* = A,B,C) (*k* = 1,2,3,4,5)

Part 2:

Network Diagram: