Assignment 4

1) **Solution for AED problem:**

Let K_{ij} = number of AEDs product in each plant sent to warehouses. Where I = plant 1, 2
And j = warehouse 1, 2, 3
$K_{11} + K_{12} + K_{13} + K_{21} + K_{22} + K_{23}$

Objective Function:
Min Z = $622K_{11} + 614K_{12} + 630K_{13} + 641K_{21} + 645K_{22} + 649K_{23}$

Subject to:

Demand in the three warehouses:
$K_{11} + K_{21} \geq 80$
$K_{12} + K_{22} \geq 60$
$K_{13} + K_{23} \geq 70$

Two plants monthly production capacities:
$K_{11} + K_{12} + K_{13} \leq 100$
$K_{21} + K_{22} + K_{23} \leq 120$

$K_{11} + K_{12} + K_{13} + K_{21} + K_{22} + K_{23} \geq 0$

- 100 AEDs should be produced in plant 1
- 110 AEDs should be produced in plant 2

To minimize the combined cost of production and shipping: $132,790

- 80 units of production should be sold to warehouse 1
- 60 units of production should be sold to warehouse 2
- 70 units of production should be sold to warehouse 3

2) **Solution for Oil Distribution in West Texas problem:**

Formulation of linear model.
Decision variables:

Let X_{wp} = amount of thousand barrels per day from well (w=1,2,3) to pump (p=1,2,3).
$X_{14}, X_{15}, X_{16}, X_{24}, X_{15}, X_{26}, X_{34}, X_{35}, X_{36}$
Y_{pr} = amount of thousand barrels per day move from pump (p=1,2,3) to Refinery (r=1,2,3,4,5)
$Y_{47}, Y_{48}, Y_{49}, Y_{410}, Y_{411}, Y_{57}, Y_{58}, Y_{59}, Y_{510}, Y_{511}, Y_{67}, Y_{68}, Y_{69}, Y_{610}, Y_{611}$

Objective Function:

C_{wp} = Cost of moving oil from well w to pump p . where w = 1,2,3 ; p = 1,2,3.
K_{pr} = Cost of moving oil from pump p to Refinery r; where p=1,2,3 ; r =1,2,3,4,5

Minimize total cost Z = $^{3}\sum_{w=1}\ ^{3}\sum_{p=1} X_{wp}\ C_{wp} +\ ^{3}\sum_{p=1}\ ^{5}\sum_{r=1}\ Y_{pr}\ K_{pr}$

$Z = 1.52X_{14} + 1.60X_{15} + 1.40X_{16} + 1.70X_{24} + 1.63X_{15} + 1.55X_{26} + 1.45X_{34} + 1.57\ X_{35} + 1.30X_{36} + 5.15Y_{47} + 5.69Y_{48} + 6.13Y_{49} + 5.63Y_{410} + 5.80Y_{411} + 5.12Y_{57} + 5.47Y_{58} + 6.05Y_{59} + 6.12Y_{510} + 5.71Y_{511} + 5.32Y_{67} + 6.16Y_{68} + 6.25Y_{69} + 6.17Y_{610} + 5.87Y_{611}$

Subject To

Constraints:

Supply at well 1 through well 3, and node 1 to 3

$X_{14}, X_{15}, X_{16} \leq 93$

$X_{24}, X_{15}, X_{26} \leq 88$

$X_{34}, X_{35}, X_{36} \leq 95$

Demand at refinery 1 through 5, and node 7 to 11

$Y_{47} + Y_{57} + Y_{67} = 30$
$Y_{48} + Y_{58} + Y_{68} = 57$
$Y_{49} + Y_{59} + Y_{69} = 48$
$Y_{410} + Y_{510} + Y_{610} = 91$
$Y_{411} + Y_{511} + Y_{611} = 48$

$Y_{14} + Y_{24} + Y_{34} = Y_{47} + Y_{48} + Y_{49} + Y_{410} + Y_{411}$ (Shipping through pump 1 (node 4)

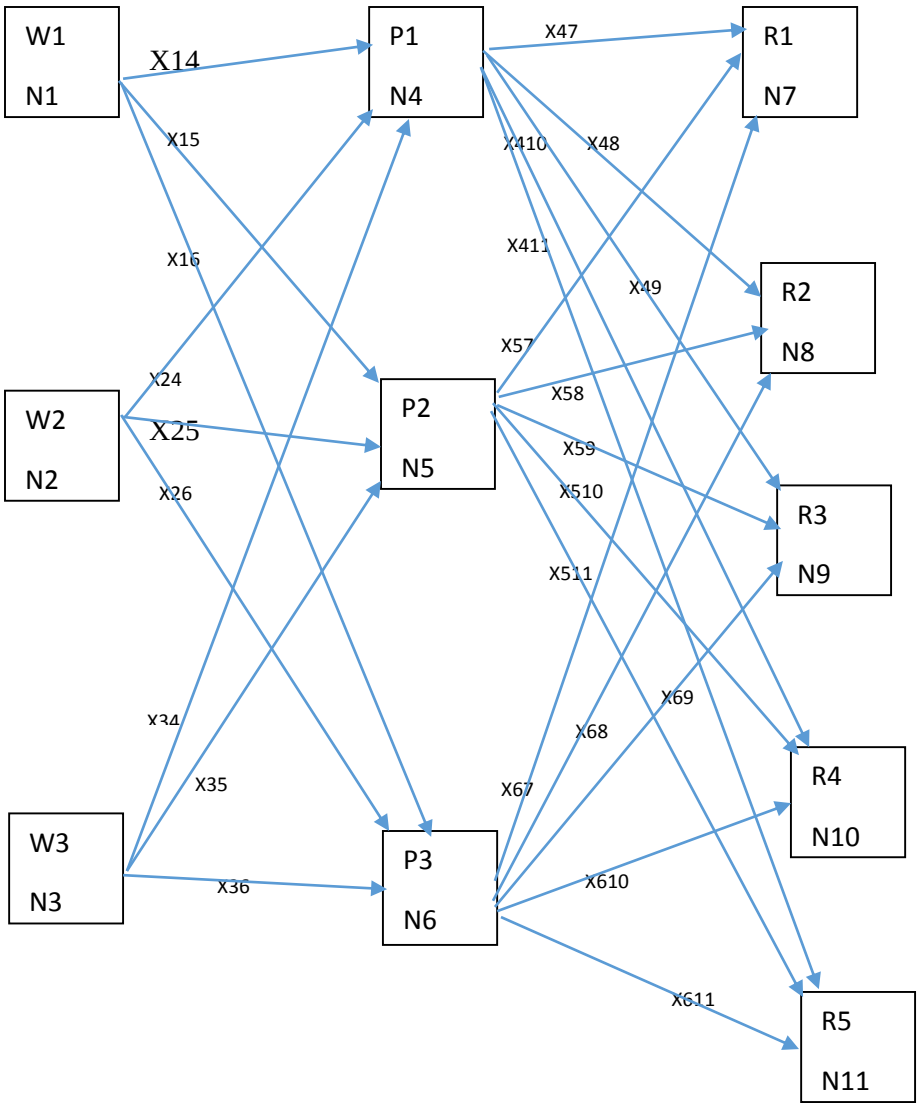
$Y_{14} + Y_{24} + Y_{34} = Y_{47} + Y_{48} + Y_{49} + Y_{410} + Y_{411}$ (Shipping through pump 2 (node 5)

$Y_{14} + Y_{24} + Y_{34} = Y_{47} + Y_{48} + Y_{49} + Y_{410} + Y_{411}$ (Shipping through pump 3 (node 6)

All $\mathbf{X_{wp}}$, $\mathbf{Y_{pr}} \geq 0$ for all w, p and r Non Negativity Constraints

1) See LP formulation above

2) Network diagram:


W1
N1
W2
N2
W3
N3
P1
N4
P2
N5
P3
N6
R1
N7
R2
N8
R3
N9
R4
N10
R5
N11
X14
X15
X16
X24
X25
X26
X34
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X47
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