ASSIGNMENT 4

1) Formulate and solve this transportation problem using lpsolve, or any other equivalent library in R.

	Unit Shipping Cost			*Unit*	*Monthly*
	Warehouse 1	*Warehouse 2*	*Warehouse 3*	*Production Cost*	*Production Capacity*
Plant A	*$22*	*$14*	*$30*	*$600*	*100*
Plant B	*$16*	*$20*	*$24*	*$625*	*120*
Monthly Demand	*80*	*60*	*70*		

Formulation of the transportation Problem

Approach 1

Decision Variables:

Xij = No. of units shipped from Plant i to Warehouse j

XAW1 = No. of units shipped from Plant A to Warehouse 1

XAW2 = No. of units shipped from Plant A to Warehouse 2

XAW3 = No. of units shipped from Plant A to Warehouse 3

XBW1 = No. of units shipped from Plant B to Warehouse 1

XBW2 = No. of units shipped from Plant B to Warehouse 2

XBW3 = No. of units shipped from Plant B to Warehouse 3

Obj Function:

Min C = 22 XAW1 + 14 XAW2 + 30 XAW3 + 16 XBW1 + 20 XBW2 + 24 XBW3 + 600 XAW1 +600 XAW2 + 600 XAW3 + 625 XBW1+ 625 XBW2 + 625 XBW3

= 622 XAW1 + 614 XAW2 + 630 XAW3 + 641 XBW1 + 645 XBW2 + 649 XBW3

Constraints:

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Plant A Supply: XAW1 + XAW2 + XAW3 <= 100

Plant B Supply: XBW1 + XBW2 + XBW3 <= 120

Warehouse 1: XAW1 + XBW1 = 80

Warehouse 2: XAW2 + XBW2 =60

Warehouse 3: XAW3 + XBW3 = 70

All Xij >= 0

Approach 2

Using Dummy Model approach:

Now total Supply(220) > total demand(210) – Must add new dummy nodes(with difference of 10 units. New Constraints for this new node is :

Min C = 622 XAW1 + 614 XAW2 + 630 XAW3 + 641 XBW1 + 645 XBW2 + 649 XBW3

Constraints:

Supply Constraints:

Plant A Supply: XAW1 + XAW2 + XAW3 + XAD4 = 100

Plant B Supply: XBW1 + XBW2 + XBW3 + XBD4 = 120

Demand Constraints:

Warehouse 1: XAW1 + XBW1 = 80

Warehouse 2: XAW2 + XBW2 =60

Warehouse 3: XAW3 + XBW3 = 70

Warehouse 4: XAW4 + XBW4 = 10(Dummy)

Solution:

The problem is solved using R and the code is in

Assignment_Quant4.Rmd file (Rmd and LP files folder) and

The knitted file (Assignment_Quant4_Solutions_Knitted.pdf) is in pdf folder

2.A**)** **FORMULATION FOR TRANSSHIPMENT PROBLEM**

Objective Function:

Min C = 1.52 X1A + 1.60 X1B + 1.40 X1C + 1.70 X2A + 1.63 X2B + 1.55 X2C + 1.45 X3A + 1.57 X3B + 1.30 X3C + 5.15 XAR1 + 5.69 XAR2 + 6.13 XAR3 + 5.63 XAR4 + 5.80 XAR5 + 5.12 XBR1 + 5.47 XBR2 + 6.05 XBR3 + 6.12 XBR4 + 5.71 XBR5 + 5.32 XCR1 + 6.16 XCR2 + 6.25 XCR3 + 6.17 XCR4 + 5.87 XCR5;

Decision Variables: in (TBD= Thousand Barrels per Day)

Wells to Pump Stations:

X1A= No. of units of oil barrels moved from Well 1 to Pump station A in TBD

X1B= No. of units of oil barrels moved from Well 1 to Pump station B in TBD

X1C= No. of units of oil barrels moved from Well 1 to Pump station C in TBD

X2A= No. of units of oil barrels moved from Well 2 to Pump station A in TBD

X2B= No. of units of oil barrels moved from Well 2 to Pump station B in TBD

X2C= No. of units of oil barrels moved from Well 2 to Pump station C in TBD

X3A= No. of units of oil barrels moved from Well 3 to Pump station A in TBD

X3B= No. of units of oil barrels moved from Well 3 to Pump station B in TBD

X3C= No. of units of oil barrels moved from Well 3 to Pump station C in TBD

Pump Stations to Refineries:

XAR1= No. of units of oil barrels moved from Pump station A to Refinery 1 in TBD

XAR2= No. of units of oil barrels moved from Pump station A to Refinery 2 in TBD

XAR3= No. of units of oil barrels moved from Pump station A to Refinery 3 in TBD

XAR4= No. of units of oil barrels moved from Pump station A to Refinery 4 in TBD

XAR5= No. of units of oil barrels moved from Pump station A to Refinery 5 in TBD

XBR1= No. of units of oil barrels moved from Pump station B to Refinery 1 in TBD

XBR2= No. of units of oil barrels moved from Pump station B to Refinery 2 in TBD

XBR3= No. of units of oil barrels moved from Pump station B to Refinery 3 in TBD

XBR4= No. of units of oil barrels moved from Pump station B to Refinery 4 in TBD

XBR5= No. of units of oil barrels moved from Pump station B to Refinery 5 in TBD

XCR1= No. of units of oil barrels moved from Pump station C to Refinery 1 in TBD

XCR2= No. of units of oil barrels moved from Pump station C to Refinery 2 in TBD

XCR3= No. of units of oil barrels moved from Pump station C to Refinery 3 in TBD

XCR4= No. of units of oil barrels moved from Pump station C to Refinery 4 in TBD

XCR5= No. of units of oil barrels moved from Pump station C to Refinery 5 in TBD

Constraints:

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Supply = 276; Demand= 274

Supply > demand

Supply constraints :

X1A + X1B + X1C <= 93;

X2A + X2B + X2C <= 88;

X3A + X3B + X3C <= 95;

Transshipment Nodes:

X1A + X2A + X3A = XAR1 + XAR2 + XAR3 + XAR4 + XAR5;

X1B + X2B + X3B = XBR1 + XBR2 + XBR3 + XBR4 + XBR5;

X1C + X2C + X3C = XCR1 + XCR2 + XCR3 + XCR4 + XCR5;

Demand Constraints:

XAR1 + XBR1 + XCR1 = 30;

XAR2 + XBR2 + XCR2 = 57;

XAR3 + XBR3 + XCR3 = 48;

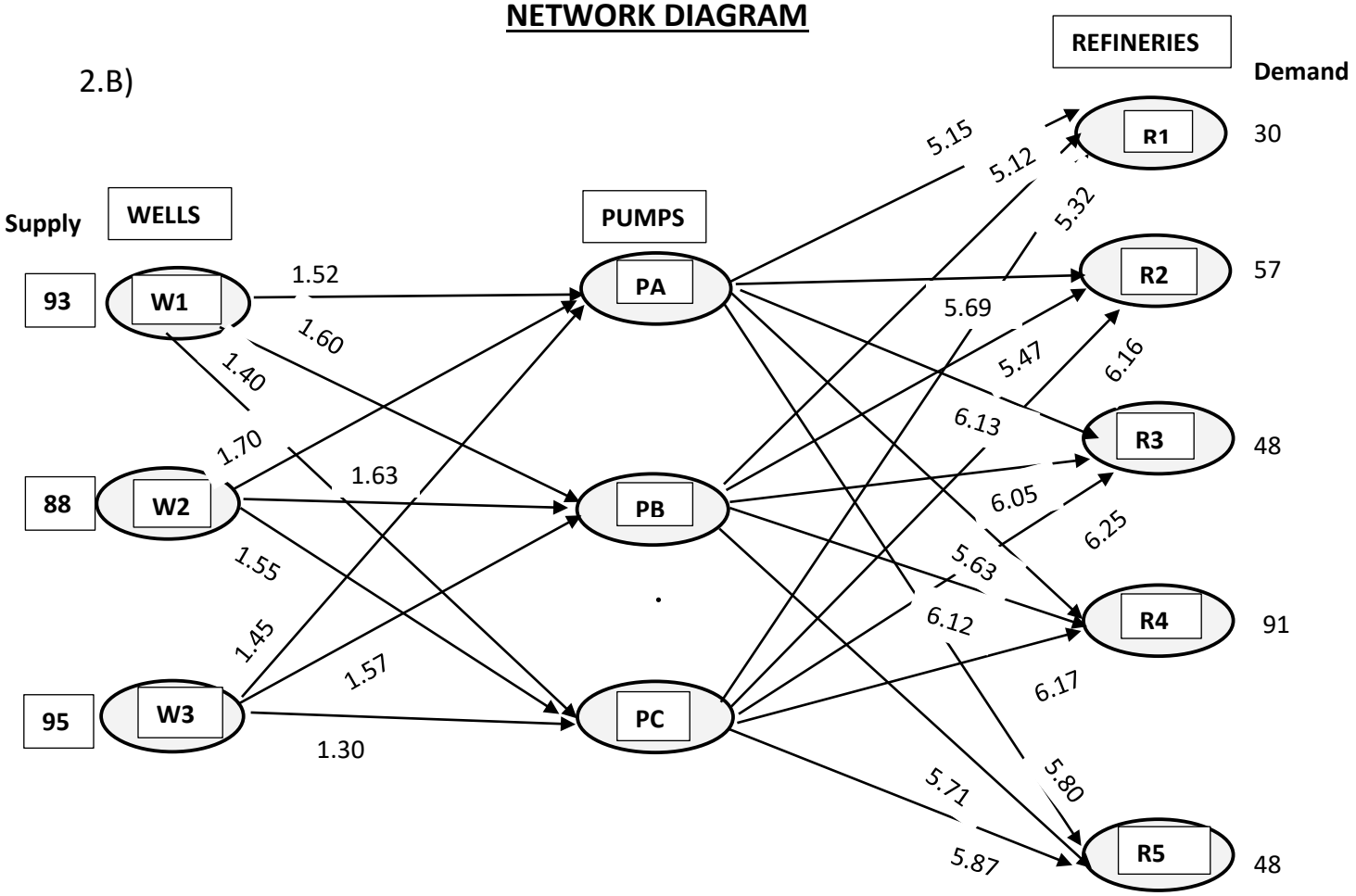
XAR4 + XBR4 + XCR4 = 91;

XAR5 + XBR5 + XCR5 = 48;

All Xij >=0

NETWORK DIAGRAM

2.B)



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