Summer exam - 2020

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Q1) Using Simplex method, solve the following linear programing problem

$$5x_1 + 4x_2 + 3x_3 = 8$$

$$2x_1 + 7x_2 + 5x_3 = 5$$

$$4x_1 + 4x_2 + 2x_3 = 4.$$

<u>Solution</u>

Q2: Use Vogels approximation method, to solve the following.

Origin	Destination			Supply
	1	2	3	
1	50	100	100	110
2	200	300	200	160
3	100	200	300	150
Demand	140	200	80	

Solution:

	1	2	3	Supply	Row Penalty
1	50	$\boxed{110}$ 100	100	~~110~~	(50, 0, 0)
2	200	$\boxed{80}$ 300	$\boxed{80}$ 200	~~160~~ 80	(0, 0, 0)
3	$\boxed{140}$ 100	200	300	~~150~~ 10	(10, 0, 0)
Demand	~~140~~ 0	~~200~~ 0	~~80~~ 0		

Column (50) (100) (100)

(100) (100)

(100) (200)

Initial Basic feasible solution of given T.P is

$x_{12} = 110$; $x_{24} = 8$; $x_{23} = 80$

$x_{31} = 140$; $x_{32} = 10$

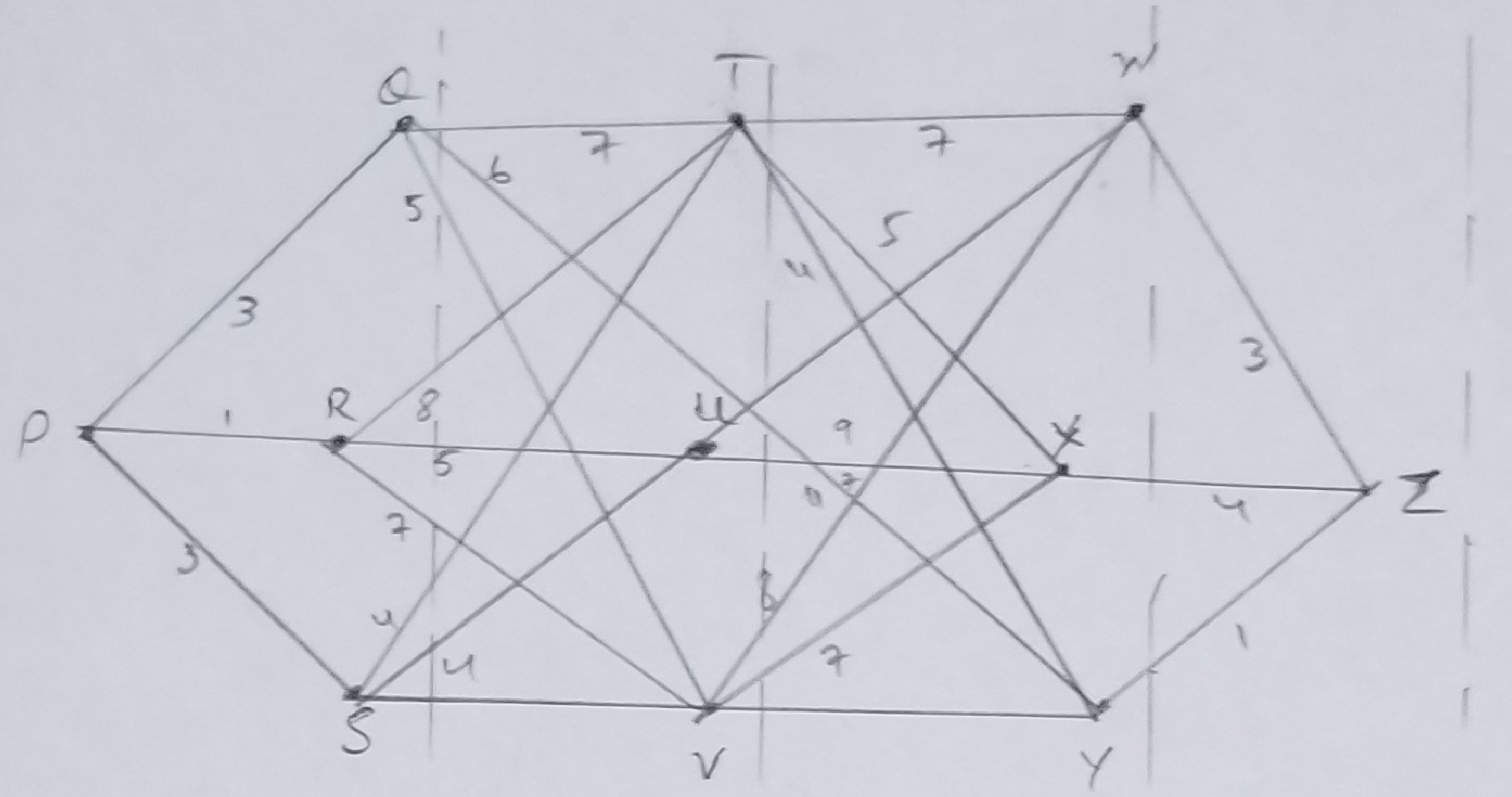
and minimum Transpotation Cost

$\Rightarrow (110 \times 100) + (80 + 300) + (80 \times 200) + (140 \times 100) + (10 \times 200)$

$\Rightarrow 11000 + 24000 + 16000 + 14000 + 2000$

$\Rightarrow 67000$ Rs. Solved

Q3 : For the figure given below, use dynamic Programming approach to find out the shortest possible path?



Solution:
There are four stage in this problem.

Stage 01:-

State variable x1	Alternative m1	F1(x1)*	M1*
	Z		
W	3	3	Z
X	4	4	Z
Y	1	1	Z

* The Possible alternative is only Z
* The Possible stat variable are w, x, y.

Stage#02

* The possible alternative are w, x, y
* The possible state variable are T, U, V

State variable	m_2 Alternative				
	w	x	y	$F_2(u_2)^*$	M_2^*
T	7+3=10	5+4=9	11+1=12	9	x
U	9+3=12	7+4=11	11+1=12	11	x
V	8+3=11	7+4=11	10+1=11	11	x

state variable	$F_2(u_2)^*$
T	9
U	11
V	11

Stage 03

* The Possiable alternative are T, U, V
* The Possiable state variable is Q, R, S.

State variable x_3	Alternative m_3			$F_3(x_3)^*$	M_3 *
	T	U	V		
Q	7+9=16	6+11=17	5+11=16	15	U
R	8+9=17	5+11=16	7+11=18	16	U
S	4+9=13	4+11=15	6+11=17	13	T

State variable	$F_3(x_3)^*$
Q	15
R	16
S	13

state # 04

* The possible alternative are Q, R, S
* The Possible state variable is P

State variable x_4	Q	R	S	$f_4(x_4)^*$	x_4^*
P	3+15=18	1+16=17	3+13=16	16	S

The shortes path is

=> P → S → U → X → Z

Q4 = A Company makes two product (x & y) using two (A and B). Each unit of x

. . . . Linear Program.

Solution :- Let

- x be the number of unit of X product in the current week

- Y be the number of unit of Y product in the current week

than the constrait are

- $50x + 24y \leq 40(60)$ machine A time
- $30x \; 33y \leq 35(60)$ machine B time
- $x \geq 75 - 30$
- i.e $x \geq 45$ so production of $x \geq$ demand (75) - Initial stock (30), which ensure we meet demand
- $y \geq 95 - 90$
- i.e $y \geq 5$ so product of $y \geq$ demand (95) - initial stock (90), which ensure we meet dema

The object is : maximise

$$(x+30-75)+(y+90-95)=(x+y-50)$$

i.e to maximise the number of unit left in stock at the end of the week.

Solved

Question No- 05

(5.1)

Solution:-

Starting from the North west Corner, we allocate min(50,20) to P_1R_1, i.e. 20 units to cell P_1R_1. The demand for the First Column is Satisfied. The allocation is Shown in the following table.

Table 1

Company	Retail				Supply
	R_1	R_2	R_3	R_4	
P_1	3 [20]	5 [20]	7 [10]	6	50
P_2	2	5	8 [40]	2 [35]	75
P_3	3	6	9	2 [35]	25
Demand	20	20	50	60	

Now we move horizontally to the Second Column in the First row and allocate 20 units to cell P_1R_2. the demand for the Second Column is also Satisfied.

Proceeding in this way, we observe that $P_1R_3 = 10$, $P_2R_3 = 40$, $P_2R_4 = 35$, $P_3R_4 = 25$. The resulting feasible Solution is shown in the following table.

Here, number of retail Shops $(n) = 4$ and number of Plants $(m) = 3$.
number of basic variables
$= m + n - 1 = 3 + 4 - 1 = 6$.

initial basic feasible Solution
=

The initial basic feasible Solution is $X_{11} = 20$, $X_{12} = 5$, $X_{13} = 20$, $X_{23} = 40$, $X_{24} = 35$ and minimum Cost of transportation

$= 20 \times 30 + 20 \times 5 + 10 \times 7 + 40 \times 8 + 35 \times 2 +$
$25 \times 2 = 670$.

Solved.