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STUDY BUDDIES

Assignment -3

Q:-1

(a) Given,

Hence plant with cost \$1000 & not connected to city.

So, the model is →

City

	1	2	3	
Plant 1	600	700	400 25	25
Plant 2	320 23	300 17	350	40
Plant 3	500	480 25	450	30
Excess Plant 4	1000 13	1000		
	36	42	30	

(b) Optimal Soln above cost = \$ 49,710.

(c) Only city 1 uses excess electricity. So, excess cost for City 1 ⇒ \$13 × 1000 = \$13,000.

(d) For 10% power loss, assume units in lakhs.

So, 36 million KWh → 360 lakh KWh.

For 10% loss → Supply capcity will be = 225, 360, 270 & 225.

$$\text{Cost} = \frac{225 \times 40 + 135 \times 32 + 225 \times 30 + 145 \times 48 + 75 \times 45 + 100 \times 225}{10}$$

$= \$\ 55,305$.

Plant				
1	60	70	40 / 225	225
2	32 / 135	30 / 225	35	360
3	50	48 / 195	45 / 75	270
Excess	100 / 225	100	∞	225
	360	420	300	

→ Reduced Supply.

Q:-2.

Total Supply = 150+200+250 = 600 Crates
Total demand = 150+150+400+100 = 800 Crates.

[Potential overtime supply by each of orchard 1 & 2] = 800 − 600 = 200 crates.

Using Excel Solver for LPP Simplex.

Cost = \$1150.

Hence,
Orchard 1 used 200 crates for overtime & Orchard 2 produced None.

Q:-3.

Hence, supply & demand are expected in truck loads.
So, converting supply/demand into truckload $= \frac{\text{Demand/supply}}{18}$

$= \frac{400}{18} = 22.2$ or 23 truck loads.

Cost = $25 × (100×6 + 140×9 + 35×8 + 70×3 + 60×9 + 90×9)

= $ 92,500

Then optimal schedule being →

(1) 6 truckloads , 9 & 8 truckloads from center 1 to dealer 1, 4, 5

(2) 3, 9 truckloads from center 2 to dealer 2 & 3.

(3) 9 truckloads to dealer 2 from center 3.

Q:- 4.

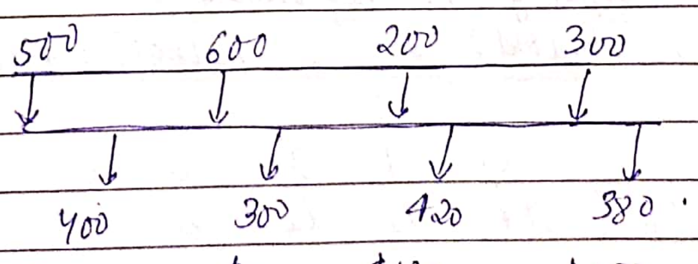
In the given problem, cost increase by $3 per month & supply > demand for 4 months.

So, there will be surplus.

So, the formulated Transportation problem is done by LPP solver.

Total cost = $ 190,040.

Period	Capacity	Produced Amount	Delivery.
1	500	500	400 for (period) 1 & 100 for 2
2	600	600	200 for 2, 220 for 3, 180 for 4
3	200	200	200 for 3
4	300	200	200 for 4.



c: $100 $140 $120 $150

h: $3 $3 $3 $3

Solving using LPP solver →

Cost = $ 190,090

Q:5 Max $Z = x_1 + 3x_2$

subject to

$-x_1 + 3x_2 \le 6$

$2x_1 + x_2 \le 12$

& $x_1, x_2 \ge 0$; x_1, x_2 non-negative integers.

The problem is converted to canonical form by adding slack, surplus & artifical variables as appropiate.

Iteration 1

B	C_B	X_B	x_1	x_2	S_1	S_2	Min Ratio $\frac{X_B}{x_2}$
		C_j	1	3	0	0	
S_1	0	6	-1	(3)	1	0	$\frac{6}{3} = 2 \rightarrow$
S_2	0	12	2	1	0	1	$\frac{12}{1} = 12$
$Z = 0$		Z_j	0	0	0	0	
		$Z_j - C_j$	-1	-3 ↑	0	0	

Minimum ratio is 2 & its row index is 1.

So, the leaving basis variable is S_1.

∴ The pivot element is 3.

Entering $= x_2$, Departing $= S_1$, Key Element $= 3$.

$R_1 (new) = R_1 (old) \div 3$; $R_2 (new) = R_2 (old) - R_1 (new)$.

Iteration 2

B	C_B	X_B	x_1	x_2	S_1	S_2	Min Ratio $\frac{X_B}{x_1}$
		C_j	1	3	0	0	
x_2	3	2	-0.3333	1	0.3333	0	---
S_2	0	10	(2.333)	0	-0.3333	1	$\frac{10}{2.3333} = 4.2857 \rightarrow$
$Z = 6$		Z_j	-1	3	1	0	
		$Z_j - C_j$	-2 ↑	0	1	0	

Negative minimum $Z_j - C_j$ is -2 & its column index is 1.
So, the entering variable is x_1.
Min ratio is 4.2857 & the row index is 2.
Pivot element = 2.3333.
Entering = x_1, Departing = S_2, Key Element = 2.3333.
$R_2(\text{new}) = R_2(\text{old}) \div 2.3333$.
$R_1(\text{new}) = R_1(\text{old}) \div 0.3333 R_2(\text{new})$.

Iteration - 3

		C_j	1	3	0	0	
B	C_B	X_B	x_1	x_2	S_1	S_2	Min ratio
x_2	3	3.4286	0	1	0.2857	0.1429	
x_1	1	4.2857	1	0	-0.1429	0.4286	
$Z = 14.5714$		Z_j	1	3	0.7143	0.8571	
		$Z_j - C_j$	0	0	0.7143	0.8571	

Since all $Z_j - C_j \geq 0$.

Q:-6.
= The given problem is a dynamic scheduling problem & it can be converted to a transportation problem.

→ It is assumed that periods come in order 1, 2, 3, 4 & we cannot go back in periods as time moves forward.
→ Supply > demand, So surplus is sold at a profit of \$5 unit & \$8 unit for plant 1 & 2.
→ The converted transportation problem would be.

Using Simplex LP solver in Excel, we get that units should be shipped in the below manner to minimize cost.

		Outlet 1			Outlet 2			Outlet 3			Surplus	Output (Supply)
	Periods →	1	2	3	1	2	3	1	2	3		
Plant 1	P_1	7	10	13	9	12	15	12	15	18	-5	15
	P_2	∞	7	10	∞	9	12	∞	12	15	-5	15
	P_3	∞	∞	7	∞	∞	9	∞	∞	12	-5	10
Plant 2	P_1	10	12	14	11	13	15	16	18	20	-8	25
	P_2	∞	10	12	∞	11	13	∞	16	18	-8	25
	P_3	∞	∞	10	∞	∞	11	∞	∞	16	-8	20
Demand		10	10	10	5	10	15	20	10	10	10	

(Demand - Supply)
[110 - 100 = 10].

→ Cost of surplus is -ve because it is profit & we have to lower the cost.

→ The problem becomes transportation problem with producer & consumer.

Outlet 1 → Outlet 1 gets 10 units in period one from plant 2
" " 5 " from both plant 1 & 2 during period 2
Outlet 1 gets 10 units in Period 3 from Plant 2.

Outlet 2 → Gets 5 units from plant 2 in period 1.
Gets 10 units from plant 2 " 2
" 10 " " " 3 —— 3 &
5 unit from plant 3 in Period 3 that were produced & stored in Period 2.

Outlet 3 → Gets 15 units from plant 1 & 5 units from plant 2 in Period 1.
→ Gets 10 units from plant 1 in period 2.
→ " 10 " " " 1 " 3

Surplus used → 5 units surplus produced from plant 2 at period 1 Sold for $8 profit per unit.
→ 5 units surplus produced from plant 2 at period 2 sold for $8 profit per unit.

∴ Total cost = $1095.

Q:- 7.

We are given Standard Transportation Problem with 2 plant & 4 outlets.
Here also, supply < Demand.
& it is given supply can be Ted if plants work overtime at cost of $5 unit for plant 1 & 7 per unit for plant 2.
The problem can be converted to transportation problem with modified costs & added plants are plant regular & plant overtime.

	Outlet 1	Outlet 2	Outlet 3	Outlet 4	Supply
Plant 1	53	50	43	44	200
Plant 2	50	47	42	44	400
(5 per unit) Plant 1 Overtime	58	55	48	49	40
(7 per unit) Plant 2 Overtime	57	54	49	51	80
Demand	250	200	150	75	

The minimum cost product & delivery Schedule are calculated using Excel LP Simplex Solver.
Then,
Outlet 1 → gets 200 unit from plant 2 & 50 from plant 2 at overtime.

Outlet 2 → gets 200 unit from plant 2.

Outlet 3 → Gets 125 unit from plant 1 & 25 unit from plant 1 at overtime.

Outlet 4 → gets 75 units from plant 1.

The total comes out to be $ 32125.