FINAL CA – NOV 2018

SUB: COSTING

Topics: Assignment, Transportation, LPP – Formulation, Graphic & Simplex, Marginal Costing, Pricing Policy, Learning Curve

Test Code – CF1

Branch (MULTIPLE) (Date : 27.05.2018)

(50 Marks)

*Note: **All** questions are compulsory.*

Question 1 (8 marks)

The initial solution is obtained below by Vogel's Approximation method (VAM).

Since demand 145 (75 + 20 + 50) is greater than supply 105 (10 + 80 + 15) by 40 units, the given problem is an unbalanced one. We introduce a dummy factory with a supply of 40 units. It is given that for the unsatisfied demands, the penalty cost is rupees 1, 2, and 3 for destinations (1), (2) and (3) respectively. Hence, the transportation problem becomes-

Factory	Destination			Supply to be Exhausted
	(1)	(2)	(3)	
A	5	1	7	10
B	6	4	6	80
C	3	2	5	15
Dummy	1	2	3	40
Demand	75	20	50	145

	1	2	3	Supply	Difference
A	5	1 $\boxed{10}$	7	10/0	4 - -
B	6 $\boxed{20}$	4 $\boxed{10}$	6 $\boxed{50}$	80/70/50/0	2 2 2
C	3 $\boxed{15}$	2	5	15/0	1 1 1
Dummy	1 $\boxed{40}$	2	3	40/0	1 1 -
Demand	75/35/20/0	20/10/0	50/0	145	
Difference	2	1	2		
	2	0	2		
	3	2	1		

The initial solution is given in the table below-

	1	2	3	Supply
A	5	1 10	7	10
B	6 20	4 10	6 50	80
C	3 15	2	5	15
Dummy	1 40	2	3	40
Demand	75	20	50	145

The number of allocations is 6 which is equal to the required m + n - 1 (= 6) allocations. Also, these allocations are in dependent. Hence, both the conditions are satisfied.

We now apply the optimality test to find whether the initial solution found above is optimal or not.

Let us now introduce ui [i = (1, 2, 3, 4)] and vj [j = (1, 2, 3)] such that Δij = Cij – (ui + vj) for allocated cells. We assume that u2 = 0 and remaining ui's, vj's and Δij's are calculated as below-

(ui + vj) Matrix for Allocated / Unallocated Cells

				ui
	3	1	3	-3
	6	4	6	0
	3	1	3	-3
	1	-1	1	-5
vj	6	4	6	

Now we calculate $\Delta_{ij} = C_{ij} - (u_i + v_j)$ for non basic cells which are given in the table belo

Δij Matrix

2		4
	1	2
	3	2

Since all Δ_{ij}'s for non basic cells are positive, therefore, the solution obtained above is an optimal one. The allocation of factories to destinations and their cost is given below-

Factory	Destination	Units	Cost	Total Cost	Type
A	(2)	10	1	10	Transportation Cost
B	(1)	20	6	120	
B	(2)	10	4	40	
B	(3)	50	6	300	
C	(1)	15	3	45	
Dummy	(1)	40	1	40	Penalty Cost
			Total	555	

Question 2

Let x and y denote the number of units produced for the product A & B respectively.

The linear programming model for the given problem is:

Maximize

$$Z = 80x + 100y$$

Subject to the Constraints:

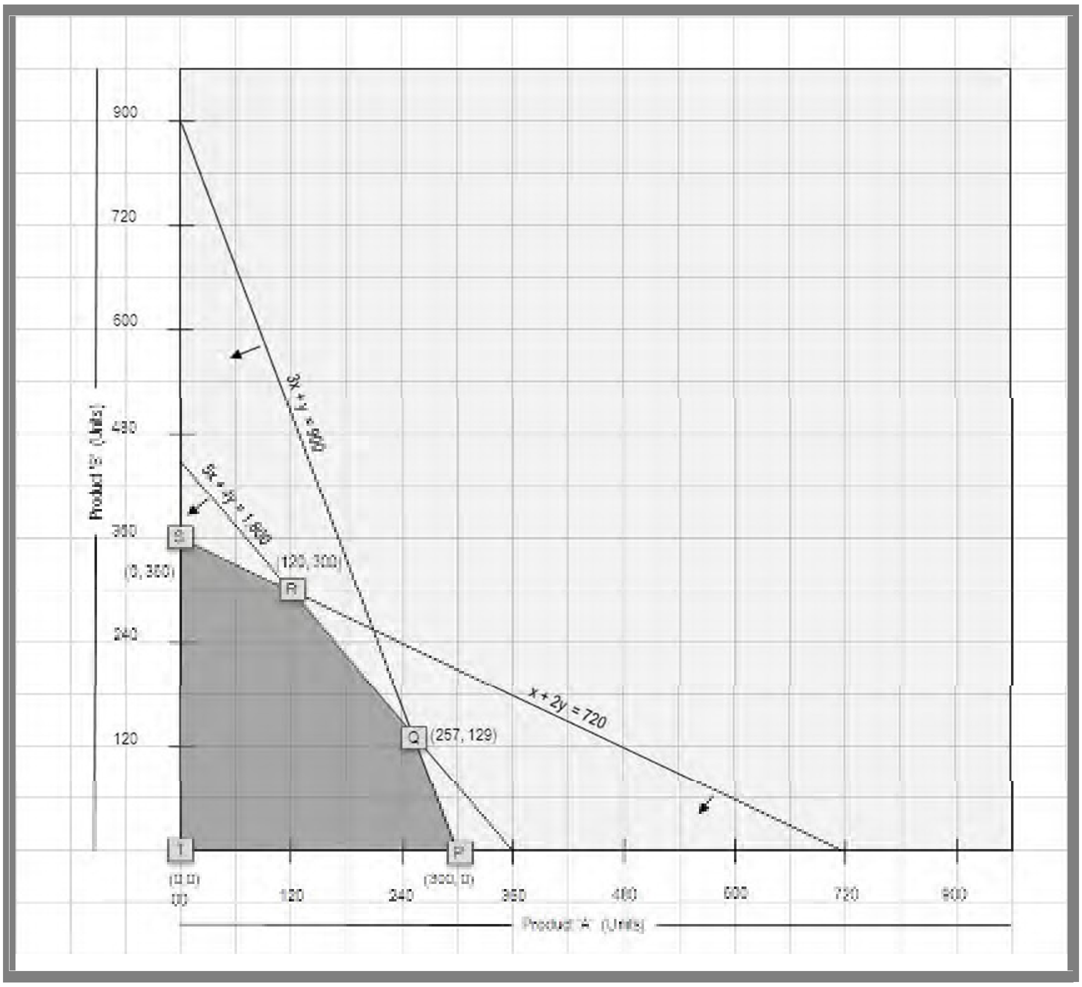
$$x + 2y \le 720 \quad \text{(Machining Time)}$$

$$5x + 4y \le 1{,}800 \quad \text{(Fabrication Time)}$$

$$3x + y \le 900 \quad \text{(Assembly Time)}$$

$$x, y \ge 0$$

The graphical solution for the problem is given below:



Working to find points to draw the lines and intersection points:

Points to draw $x + 2y = 720$

If $x = 0$

$2y = 720$

$y = 720/2$

$= 360$

If $y = 0$

$x = 720$

$(x, y) - (0, 360); (720, 0)$

Points to draw $5x + 4y = 1,800$

If $x = 0$

$4y = 1,800$

$y = 450$

If $y = 0$

$5x = 1,800$

$x = 360$

$(x, y) - (0, 450); (360, 0)$

Points to draw $3x + y = 900$

If $x = 0$

$y = 900$

If $y = 0$

$3x = 900$

$x = 300$

$(x, y) - (0, 900); (300, 0)$

Intersection Point (R)

$5x + 4y = 1,800$ (Equation1)

$x + 2y = 720$ (Equation2)

Or

$\cancel{5x} + 4y = 1,800$

$\cancel{5x} + 10y = 3,600$ [(Equation 2) × 5]

$-\quad -\quad -$

$-6y = -1,800$

$y = 300$

On putting value of y in any one of the above equation, the value of x = 120

Point R – (120, 300)

Intersection Point (Q)

$5x + 4y = 1,800$

(Equation1) $3x + y = 900$

(Equation 2)

Or

$5x + 4y = 1,800$

$12x + 4y = 3,600$ [(Equation 2) × 4]

$-\quad -\quad -$

$-7x = -1,800$

$X = 257$

On putting value of x in any one of the above equation, the value of y = 129

Point Q – (257, 129)

The shaded portion in the diagram represents the feasible region.

Value of the objective function at the feasible points is calculated below:

Point	**Co-Ordinates of the corner points of the feasible region (value of x and y)**	**Value of the objective function Z = 80x + 100y**
P	(300,0)	Rs.24,000
Q	(257,129)	Rs.33,460
R	(120,300)	Rs.39,600
S	(0,360)	Rs.36,000
T	(0,0)	Rs. 0

Since at Point R company makes *maximum profit* hence product mix at Point R i.e. 120 units of Product A and 300 units of product B should be produced.

Question 3

Limiting Factor

Case	**Basis for Selecting Priority of Product**
If maximum sales (in value) is a limiting factor	Profit Volume Ratio
If raw material is a limiting factor	Contribution per unit of raw material required to produce one unit of a product
If labour hour is a limiting factor	Contribution per unit of labour hour required to produce one unit of a product
If there is a heavy demand for the product	Profit Volume Ratio

Question 4 **Impact of Management Consultant's Plan on Profit of the IHCL**

Indraprastha Health Care Ltd.
Statement Showing Cost Benefit Analysis

Particulars	`
Cost:	
Incremental Cost *due to* Increased Readmission	25,00,000
Benefit:	
Saving in General Variable Cost *due to* Reduction in Patient Days [15,000 Patients × (2.5 Days – 2.0 Days) × `500)	37,50,000
Revenue from Increased Readmission (300 Patients × `4,500)	13,50,000
Incremental Benefit	26,00,000

(ii) Comment

Primary goal of investor-owned firms is shareholder wealth maximization, which translates to stock price maximization. Management consultant's plan is looking good for the IHCL as there is a positive impact on the profitability of the company (refer Cost Benefit Analysis).

Also IHCL operates in a competitive environment so for its survival, it has to work on plans like above.

But there is also the second side of a coin that cannot also be ignored i.e. Indraprasthaity values and business ethics. Discharging patients before their full recovery will add discomfort and disruption in their lives which cannot be quantified into money. There could be other severe consequences as well because of this practice. For gaining extra benefits, IHCL cannot play with the life of patients. It would put a question mark on the business ethics of the IHCL.

May be IHCL would able to earn incremental profit due to this practice in *short run* but It will tarnish the image of the IHCL which would hurt profitability in the *long run*.

So, before taking any decision on this plan, IHCL should analyze both *quantitative as well as qualitative factors*.

Question 5

JTC Ltd.
Cost Sheet of One Lot of 250 Croquet Mallets

Computation of Total Cost:	**(`)**
Direct Material	
Handles (2.5 feet × 250 units × `50)	31,250
Heads (1.20 × 250 × 0.40 × `60) [W.N.-1]	7,200
Less: Scrap Recovery (4% × 50 × `10)	(20)
Direct Labour (8Hrs × `6 × 250 / 120) [W.N.-2]	100
Prime Cost	38,530
Factory & Other Overheads	
Variable, Finishing & Painting (20,000 × 250 / 20,000) [W.N.-3]	250
Fixed (`72,000 × 250 / 18,000) [W.N.-4]	1,000
Total Cost	39,780
Price Quotation:	**(`)**
Cost *per mallet* (`39,780 / 250 Units)	159.12
Add: Profit (50% on Cost)	79.56
Selling Price	238.68

Working Notes

1. Since 20% of completed heads are spoiled, output of 1 unit requires input of 1.20 units (1 + 0.20); so, total heads processed, 300 (1.20 × 250), of which spoiled heads are 50.

2. Total Time *in a day* (8 × 60) 480 minutes

Less: Idle Time	48 minutes	
Coffee Break	15 minutes	
Instructions	9 minutes	
Training	8 minutes	80 minutes
Productive Time *per day*:		400 minutes

Therefore, mallets to be produced per man per day, 120 units (400/40 × 12).

Since mallets are produced at the rate of 120 mallets per man day, so total monthly production will be18,000 mallets (120 units × 6 men × 25 days).

3. Finishing and painting overheads are assumed to be variable for the production of 20,000 mallets.

4. All the other expenses are fixed and are to be absorbed by 18,000 (120 units × 6 men × 25 Days) mallets of monthly production.

6. Return of 12% Net (after tax of 40%) on Capital Employed is equivalent to 20% (Gross) [12% ÷ (1 – 0.4)] on Capital Employed.

Let Selling Price per unit to be 'K'

Since Total Sales = Total Cost + Profit

80,000 K = 14,60,000 + 20% (12,00,000 + 0.5 × 80,000K)

Or, 80,000 K = 14,60,000 + 2,40,000 + 8,000K

Or, 72,000 K = 17,00,000

Or, 'K' = $\frac{17,00,000}{72,000}$

= `23.61

Hence Selling Price per unit will be `23.61.

Question 7

Primal

Minimize $Z = 2x1 - 3x2 + 4x3$

Subject to the constraints

$3x1 + 2x2 + 4x3 \geq 9$

$2x1 + 3x2 + 2x3 \geq 5$

$-7x1 + 2x2 + 4x3 \geq -10$

$6x1 - 3x2 + 4x3 \geq 4$

$2x1 + 5x2 - 3x3 \geq 3$

$-2x1 - 5x2 + 3x3 \geq -3$

$x1, x2, x3 \geq 0$

Dual

Maximize $Z = 9y_1 + 5y_2 - 10y_3 + 4y_4 + 3y_5 - 3y_6$

Subject to constraints

$$3y_1 + 2y_2 - 7y_3 + 6y_4 + 2y_5 - 2y_6 \le 2$$

$$2y_1 + 3y_2 + 2y_3 - 3y_4 + 5y_5 - 5y_6 \le -3$$

$$4y_1 + 2y_2 + 4y_3 + 4y_4 - 3y_5 + 3y_6 \le 4$$

$$y_1, y_2, y_3, y_4, y_5, y_6 \ge 0$$

By substituting $y_5 - y_6 = y_7$ the dual can alternatively be expressed as:

Maximize $Z = 9y_1 + 5y_2 - 10y_3 + 4y_4 + 3y_7$

Subject to constraints

$$3y_1 + 2y_2 - 7y_3 + 6y_4 + 2y_7 \le 2$$

$$-2y_1 - 3y_2 - 2y_3 + 3y_4 - 5y_7 \ge 3$$

$$4y_1 + 2y_2 + 4y_3 + 4y_4 - 3y_7 \le 4$$

$$y_1, y_2, y_3, y_4 \ge 0, \; y_7 \text{ unrestricted in sign.}$$

Question 8

(i) Under the Hungarian Assignment Method, the prerequisite to assign any job is that each row and column must have a zero value in its corresponding cells. If any row or column does not have any zero value then to obtain zero value, each cell values in the row or column is subtracted by the correspondingminimum cell value of respective rows or columns by performing row or column operation. This means*if any row or column have two or more cells having <u>same minimum value</u> then these row or column will have more than one zero.* However, having two zeros does not necessarily imply two equal values in the original assignment matrix just before row and column operations. *<u>Two zeroes in a same row can also be possible by two different operations</u> i.e. one zero from row operation and one zero from column operation*.

(ii) The order of matrix in the assignment problem is 4 × 4. The total assignment (allocations) will be four. In the assignment problem when any allocation is made in any cell then the corresponding row and column become unavailable for further allocation. Hence, these corresponding row and column are crossed mark to show unavailability. In the given assignment matrix two allocations have been made in A24 (2nd row and 4th column) and A32 (3rd row and 2nd column). This implies that <u>2nd and 3rd row</u> and <u>2nd and 4th column</u> are unavailable for further allocation.

Therefore, the other allocations are at either at **A11 and A43** or at **A13 and A41**.

Question 9

Penetration Pricing means a price suitable for penetrating mass market as quickly as possible through *lower price offers*. This method is also used for pricing a new product. In order to popularize a new product penetrating pricing policy is used initially. This pricing policy is in favour of using a low price as the principal instrument for penetrating mass markets early. It is opposite to skimming pricing. The low pricing policy is introduced for the sake of *long-term survival* and profitability and hence it has to receive careful consideration before implementation. It needs an analysis of the scope for market expansion and hence considerable amount of research and forecasting are necessary before determining the price.

Circumstances for Adoption

The three circumstances in which penetrating pricing policy can be adopted are as under:

(i) When demand of the product is*elastic to price*. In other words, the demand of the product increases when price is low.

(ii) When there are *substantial savings on large-scale production*, here increas in demand is sustained by the adoption of low pricing policy.

(iii) When there is *threat of competition*. The prices fixed at a low level act as an entry barrier to the prospective competitions.

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