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SUGGESTED SOLUTION

FINAL MAY 2019 EXAM

SUBJECT- AMA

Test Code – FNJ 7084

BRANCH - () (Date :)

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Answer 1:

Customer Wise profitability Statement and Overall Profitability Statement

SN.	Particulars	PER	MGH	WLY	Total Rs.
A	Sales (net proceeds) – Table 1	241,288	237,500	272,812	751,600
B	Variable Cost of Goods sold	1,50,000	1,42,500	1,87,500	4,80,000
C	Assignable – Marketing and Administration Cost – Table 2				
	• Order Taking and Processing	1,200	600	4,500	6,300
	• Sale Return Processing	150	-	1,200	1,350
	• Billing Cost	200	100	750	1,050
	• Customer Visit	800	-	4,000	4,800
	Total Assignable Marketing and Administration Cost	2,350	700	10,450	13,500
D	Assignable – Distribution Cost – Table 2				
	Expedited / Rush Orders	250	-	1,250	1,500
	Delivery Costs	8,000	4,000	-	12,000
	Inventory Carrying Cost	10,000	9,500	12,500	32,000
	Total Assignable Distribution Cost	18,250	13,500	13,750	45,500
E	Non – Assignable Fixed Cost	-	-	-	1,00,000
F	Total Costs (B + C + D + E)	170,600	156,700	211,700	639,000
G	Net Profit (Step A – F)	70,688	80,800	61,112	112,600
H	Profit % of Sales (G/A)	29%	34%	22%	15%

(6 marks)

Workings

Table : 1 Customer sales Analysis – Revenue Analysis

All figures in Rs.

Particulars	PER	MGH	WLY	Total Rs.
Sales (Sales Units × Sale Price (gross))	2,50,000	2,37,500	3,12,500	8,00,000
Less : Sales Return (Step 1 × Return %)	1,250	-	31,250	32,500
Net Sales	2,48,750	2,37,500	2,81,250	7,67,500
Less : Cash Discount	7,462	-	8,438	15,900
Net Proceeds	2,41,288	2,37,500	2,72,812	7,51,600

(2 marks)

Table : 2 Assignable Marketing, Administrative and Distribution Costs

All figure in Rs.

Particulars	PER	MGH	WLY	Total
Order Taking and Processing (# of orders × cost per order)	1,200	600	4,500	6,300
Expedited / Rush Orders (# of orders × cost per order)	250	-	1,250	1,500
Delivery Costs (Distance in km. × cost per km)	8,000	4,000	-	12,000
Sales Return Processing (# of returns × cost per return)	150	-	1,200	1,350
Billing Cost (# of invoices × cost per invoice)	200	100	750	1,050

Customer Visit (# of customer visits × cost per visit)	800	-	4,000	4,800
Inventory Carrying Cost (# of units × inventory carrying cost p.u.)	10,000	9,500	12,500	32,000

(4 marks)

Answer 2:

Dummy machine (X_5) is inserted to make it a balanced cost matrix and assume its installation cost to be zero. Cost of install at cell X_3 (P) and X_2 (R) is very high marked as M.

	P	Q	R	S	T
X_1	18	22	30	20	22
X_2	24	18	M	20	18
X_3	M	22	28	22	14
X_4	28	16	24	14	16
X_5 (Dummy)	0	0	0	0	0

(1 mark)

Step 1

Subtract the minimum element of each row from each element of that row-

	P	Q	R	S	T
X_1	0	4	12	2	4
X_2	6	0	M	2	0
X_3	M	8	14	8	0
X_4	14	2	10	0	2
X_5 (Dummy)	0	0	0	0	0

(1 mark)

Step 2

Subtract the minimum element of each column from each element of that column-

	P	Q	R	S	T
X_1	0	4	12	2	4
X_2	6	0	M	2	0
X_3	M	8	14	8	0
X_4	14	2	10	0	2
X_5 (Dummy)	0	0	0	0	0

(1 mark)

Step 3

Draw lines to connect the zeros as under-

	P	Q	R	S	T
X_1	0	4	12	2	4
X_2	6	0	M	2	0
X_3	M	8	14	8	0
X_4	14	2	10	0	2
X_5 (Dummy)	0	0	0	0	0

There are five lines which are equal to the order of the matrix. Hence the solution is optimal. We may proceed to make the assignment as under-

	P	Q	R	S	T
X_1	0	4	12	2	4
X_2	6	0	M	2	0
X_3	M	8	14	8	0
X_4	14	2	10	0	2
X_5 (Dummy)	0	0	0	0	0

(1 mark)

The following is the assignment which keeps the total cost at minimum –

Machines	Location	Costs (Rs.)
X_1	P	18
X_2	Q	18
X_3	T	14
X_4	S	14
X_5 (Dummy)	R	0
	Total	64

(1 mark)

Answer 3:

Let x be the number of programmes of T.V. advertising and y denote the number of programmes of radio advertising.

Objective function:

One T.V. programme reaches 7,50,000 customers in target audience A and 1,50,000 customers in target audience B, whereas one radio programme reaches 40,000 customers in target audience A and 2,60,000 in target audience B. Since the advertising firm desires to determine the media mix to maximise the total reach, the objective function in given by

Maximise Z = (7,50,000 + 1,50,000) x + (40,000 + 2,60,000) y

Or Z = 9,00,000x + 3,00,000y

Condition-1:

One programme of T.V. advertising costs Rs. 50,000 and that of Radio advertising cots Rs. 20,000. The total advertising budget is Rs.

2,00,000. Hence, $50{,}000x + 20{,}000y \leq 2{,}00{,}000$

Or $5x + 2y \leq 20$

Condition-2:

Contract conditions require that there should be at least 3 programmes on T.V. and the number of programmes on Radio must not exceed 5.

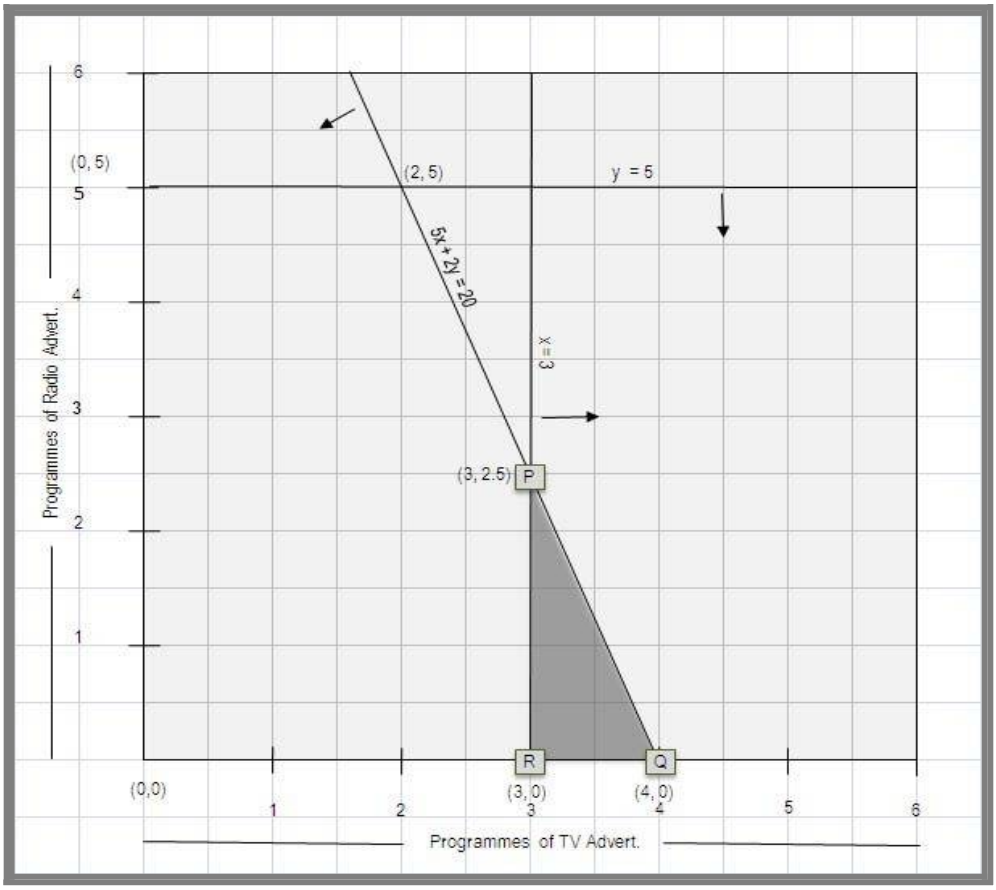
Therefore, $x \geq 3$

$y \leq 5$

The linear programming model for the given problem is:

Maximise
Z = 9,00,000x + 3,00,000y
Subject to the Constraints:
5x + 2y ≤ 20
X ≥ 3
Y ≤ 5

Where x, y ≥ 0 **(2.5 marks)**



(2.5 marks)

Answer 4:

(i) Cumulative Average Time for 256 parts = 48.43 hrs.*
[112.50 × (0.90^8)]

Total Time for 256 parts = 12,398.08 hrs.
[48.43 hrs.× 256 parts]

Total Labour Cost of 256 parts = ` 2,47,961.60
[12,398.08 hrs.× ` 20]

Revised Labour Cost for *zero profit* = ` 3,22,961.60
[` 2,47,961.60 + ` 75,000]

Total Time for 256 parts (Revised) = 16,148.08 hrs.
[` 3,22,961.60/` 20]

Cumulative Average Time for 256 parts (Rev.)= 63.08 hrs.
[16,148.08/256] **(4 marks)**

The usual learning curve model is

$$y = ax^b$$

Where

y = Cumulative Average Time per part for x parts

a = Time required for first part

x = Cumulative number of parts

b = Learning coefficient (log r/log 2)

Accordingly

$63.08 = 112.50 \times (256)\, b$

$0.5607 = 28b$

$\log 0.5607 = \log 28b$

$\log 0.5607 = 8 \times b \times \log 2$

$\log 0.5607 = 8 \times (\log_r / \log_2) \times \log_2$

$\log 0.5607 = 8 \log r$

$\log 0.5607 = \log r^8$

$0.5607 = r^8$

$r = \sqrt[8]{0.5607}$

$r = 0.9302$

Learning Rate (r) = 93.02%.

Therefore

Sensitivity = 3.02/90

= 3.36%

Students may also take 48.38 hrs. (112.50 × 0.43)

(4 marks)

Answer 5:

(a) Workings

Activity	Duration	EST	EFT	LST	LFT	Total Float
	Dij	Ei	Ei+Dij	Lj–Dij	Lj	LST–EST
A	5	0	**5**	0	**5**	**0**
B	6	0	6	6	12	6
C	4	5	9	8	12	3
D	3	5	8	7	10	2
E	1	5	**6**	5	**6**	**0**
F	4	6	**10**	6	**10**	**0**
G	14	10	**24**	10	**24**	**0**
H	12	9	21	12	24	3
I	2	24	**26**	24	**26**	**0**

(3 marks)

(i) The critical path is the series of activities within the network with *zero total float*. Accordingly, Critical Path is A–E–F–G–I with duration of 26 Days. **(1 mark)**

(ii) Project Crashing:

Step1: Crash Activity A by 1 Day; Crashing Cost Rs. 1,000/- Step2: Crash Activity F by 1 Day; Crashing Cost Rs. 6,000/- Step3: Crash Activity G by 1 Day; Crashing Cost Rs. 7,000/-

Activity E can not be crashed since ZERO duration is not possible. **(1 mark)**

Requirement of Question **(5 marks)**

Sl. No.

(i) Duration= 26 Days

(ii) LFT:

C:	12
D:	10
H:	24
B:	12

(iii)

Step	Crash Activity	Days	Cost (Rs.)
I	A	1	1,000/-
II	F	1	6,000/-
III	G	1	7,000/-

(iv)

Activity	Increase duration by (days)
B	2 Days
C	0 Days

Concept: B had a total float of 6 days. Due to 3 days crashing, float reduces by 3. Since B is succeeded by H, and duration of H is increased by 1, the dependent 1 float is to be reduced. Hence, float reduces by 4 days. Therefore, duration of B can be prolonged by 2 days.

C had an original float of 3. It gained one more day due to crashing of A. It could start one day earlier. However, since it is succeeded by H, which had lost its 3 floats and increased 1 day duration, all the 4 days' float of C were consumed. Hence, no further increase in duration.

Answer 6:

(i) Initial Solution by the **Least Cost Method** **(3 marks)**

	F1	**F2**	**F3**	**Demand**
D 1	3 [35]	6 [25]	7	60/25/0
D 2	8	5 [30]	7	30/0
D 3	4	9	11 [30]	30/0
Supply	35/ 0	55/2 0 5/	30/0	120

Supply	35/ 0	55/2 0 5/	30/0	120

(ii) This solution is degenerate because number of occupied cells (=4) are *less than* required number (=3+3-1)

Degeneracy is certain when in any allocation (earlier than the last allocation), the row and column totals get simultaneously fulfilled.

In this problem, degeneracy arises as allocation at cell D1F2, *simultaneously vacates* the row and column totals. **(2 marks)**

(iii) If we consider u1= 5 instead of u1= 0 for $u_i + v_j$ matrix, Δ_{ij} matrix would remain **same**. Since for each *occupied cell* in the table, the row value (u_i) and column value (v_j) equals the cost element Cij. **(2 marks)**

(iv) Initial Solution by the **North- West Corner Rule** **(3 marks)**

	F1	F2	F3	Demand
D 1	3 [35]	6 [25]	7	60/25/0
D 2	8	5 [30]	7	30/0
D 3	4	9	11 [30]	30/0
Supply	35/ 0	55/3 0 0/	30/0	120