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SUGGESTED SOLUTION

FINAL MAY 2019 EXAM

SUBJECT- AMA

Test Code – FNJ 7083

BRANCH - () (Date :)

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Answer 1:

Statement Showing Standard Cost and Actual Cost of 320th Batch :

Standard Data			Actual Data			
Material						
SQ	**SP**	**SQ × SP**	**AQ**	**AP**	**AQ × AP**	**SP × AQ**
62.07 kgs.(Refer W.N. 1)	Rs. 55	Rs. 3,414	80 Kgs.	Rs. 50.00	Rs. 4,000	Rs. 4,400
Labour						
SH	**SR**	**SH × SR**	**AH**	**AR**	**AH × AR**	**SR × AH**
12.42 hours (Refer W.N.2)	Rs. 40	Rs. 497	20 hours	Rs. 50.00	Rs. 1,000	Rs. 800
Variable Overhead						
SH	**SR**	**SH × SR**	**AH**	**AR**	**AH × AR**	**SR × AH**
12.42 hours (Refer W.N.2)	Rs. 75	Rs. 932	20 hours	Rs. 90.00	Rs. 1,800	Rs. 1500

Computation of Variances : **(1 mark * 9 = 9 marks)**

Material Cost Variance = Standard Material Cost – Actual Material Cost

= SQ × SP – AQ × AP

= Rs. 3,414 – Rs. 4,000 = Rs. 586 (A)

Material Usage Variance = Standard Cost of Standard Quantity – Standard cost of Actual Quantity

= SQ × SP – AQ × SP

= Rs. 3,414 – Rs. 4,400 = Rs. 986 (A)

Material Price Variance = Standard Cost of Actual Quantity – Actual Material Cost

= AQ × SP – AQ × AP

= Rs. 4,400 – Rs. 4,000 = Rs. 400 (F)

Labour Cost Variance = Standard Cost of Labour – Actual Cost of Labour

= SH × SR – AH × AR

= Rs. 497 – Rs. 1,000 = Rs. 503 (A)

Labour Efficiency variance = Standard Cost of Standard Time – Standard Cost for Actual Time

= SH × SR – AH × SR

= Rs. 497 – Rs. 800 = Rs. 303 (A)

Labour Rate Variance = Standard Cost for Actual Time – Actual Cost of Labour

= AH × SR – AH × AR

= Rs. 800 – Rs. 1,000 = Rs. 200 (A)

Variable Overhead Cost Variance = Standard Variable Overheads for Production –

Actual Variable Overheads

= Rs. 932 – Rs. 1,800 = Rs. 868(A)

Variable Overhead Efficiency Variance

= Standard Variable Overheads for Production –

Budgeted Variable Overheads for Actual Hours

= Rs. 932 – 20 Hours × Rs. 75

= Rs. 568 (A)

Variable Overhead Expenditure Variance

= Budgeted Variable Overheads for Actual Hours –

Actual Variable Overheads

= 20 Hours × Rs. 75 – Rs. 1,800

= Rs. 300 (A)

Working Note :

(1) Working note showing Standard Quantity of Material for 320th Batch. (1.5 marks)

Cumulative Number of Batches = 320

Average Kgs. of Material per batch = $100 \times 320^{-0.074}$

$t = 100 \times 320^{-0.074}$

$\log t = \log 100 - 0.074 \times \log 320$

$\log t = \log 100 - 0.074 \times \log (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5)$

$\log t = \log 100 - 0.074 \times [\log 2^6 + \log 5]$

$\log t = \log 100 - 0.074 \times [6\log 2 + \log 5]$

$\log t = 2 - 0.074 \times [6 \times 0.30103 + 0.69897]$

$\log t = 1.81462$

$t = \text{Antilog } (1.81462)$

$t = 65.26$

Cumulative Number of Batches = 319

Average Kgs. of Material per batch = $100 \times 319^{-0.074}$

$t = 100 \times 319^{-0.074}$

$\log t = \log 100 - 0.074 \times \log 319$

$\log t = \log 100 - 0.074 \times \log 319$

$\log t = 2 - 0.074 \times 2.50379$

log t = 1.81472

t = Antilog (1.81472)

t = 65.27

Standard Quantity of Material for 320th Batch = 320 × 65.26 – 319 × 65.27 = 62.07 Kgs.

(2) Working note showing Standard Hours for 320th Batch. **(1.5 marks)**

Cumulative Number of Batches = 320

Average Labour Hours Per batch = $100 \times 320^{-0.322}$

$t = 100 \times 320^{-0.322}$

log t = log 100 – 0.322 × log 320

log t = log 100 – 0.322 × log (2 × 2 × 2 × 2 × 2 × 2 × 5)

log t = log 100 – 0.322 × [$\log 2^6$ + log 5]

log t = log 100 – 0.322 × [6 log 2 + log 5]

log t = 2 – 0.322 × [6 × 0.30103 + 0.69897]

log t = 1.19334

t = Antilog (1.19334)

t = 15.61

Cumulative Number of Batches = 319

Average Labour Hours per batch = $100 \times 319^{-0.322}$

$t = 100 \times 319^{-0.322}$

log t = log 100 – 0.322 × log 319

log t = 2 – 0.322 × 2.50379

log t = 1.19378

t = Antilog (1.19378)

t = 15.62

Standard Hours for 320th Batch = 320 × 15.61 – 319 × 15.62 = 12.42 hours

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.

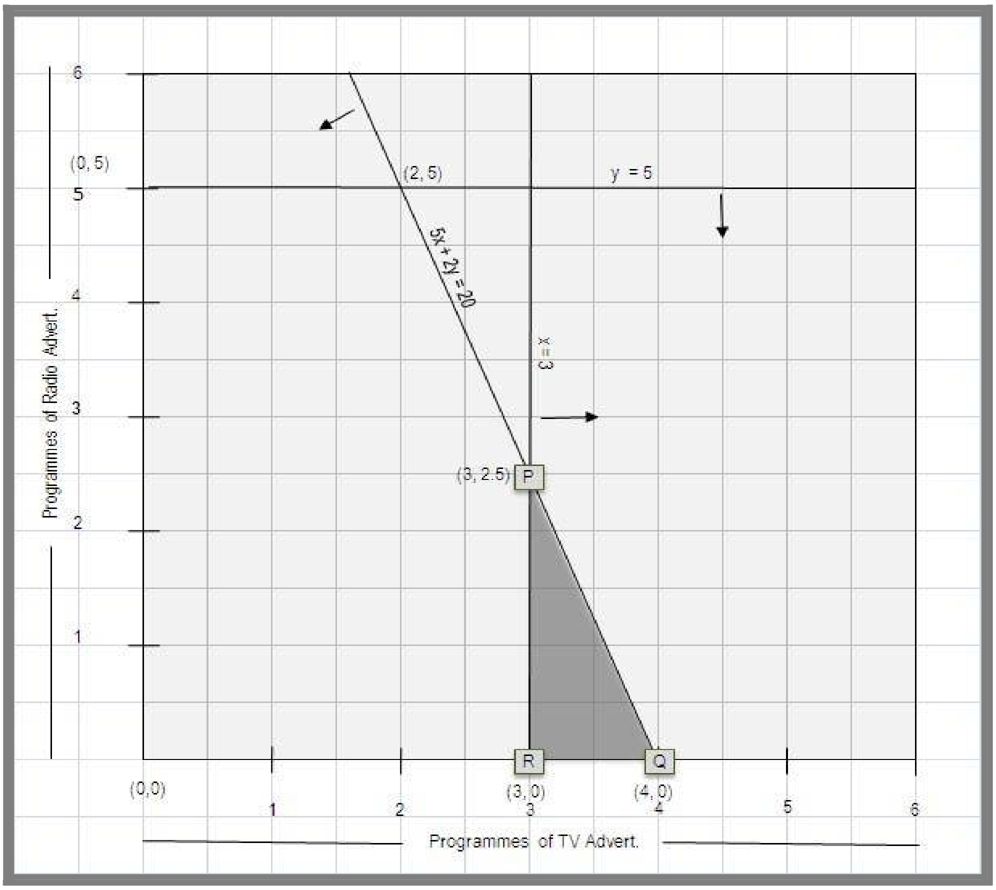
Therefore, $x \geq 3$

$y \leq 5$

The linear programming model for the given problem is:

Maximise
Z = 9,00,000x + 3,00,000y
Subject to the Constraints:
$5x + 2y \leq 20$
$X \geq 3$
$Y \leq 5$

Where $x, y \geq 0$ **(2.5 marks)**



(2.5 marks)

Answer 4:

Allocation of Random Numbers Demand (units) **(1 mark)**

Units	Probability	Cumulative Probability	Random Nos.
10,000	0.20	0.20	00 – 19
20,000	0.25	0.45	20 – 44
30,000	0.30	0.75	45 – 74
40,000	0.25	1.00	75 – 99

Contribution per unit **(1 mark)**

Rs.	Probability	Cumulative Probability	Random Nos.
25	0.25	0.25	00 – 24
35	0.30	0.55	25 – 54
45	0.35	0.90	55 – 89
55	0.10	1.00	90 – 99

Advertising Cost **(1 mark)**

Rs.	Probability	Cumulative Probability	Random Nos.
50,000	0.22	0.22	00 – 21
60,000	0.33	0.55	22 – 54
70,000	0.44	0.99	55 – 98

80,000	0.01	1.00	99 – 99

Investment **(1 mark)**

Rs.	**Probability**	**Cumulative Probability**	**Random Nos.**
50,00,000	0.10	0.10	00 – 09
55,00,000	0.30	0.40	10 – 39
60,00,000	0.45	0.85	40 – 84
65,00,000	0.15	1.00	85 – 99

Simulation Table **(3 marks)**

Random Number	**Demand Units**	**Contribution Per unit (Rs.)**	**Adv. Cost (Rs.)**	**Return (Rs.)**	**Investment (Rs.)**	**Return on Investment**
09, 24, 85, 07	10,000	25	70,000	1,80,000	50,00,000	3.60%
84, 38, 16, 48	40,000	35	50,000	13,50,000	60,00,000	22.50%
41, 73, 54, 57	20,000	45	60,000	8,40,000	60,00,000	14.00%
92, 07, 99, 64	40,000	25	80,000	9,20,000	60,00,000	15.33%
65, 04, 78, 72	30,000	25	70,000	6,80,000	60,00,000	11.33%

Highest Likely Return is 22.50% relating to trial 2. **(1 mark)**

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
D1	3 [35]	6 [25]	7	60/25/0
D2	8	5 [30]	7	30/0
D3	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 D_1F_2, *simultaneously vacates* the row and column totals. **(2 marks)**

(iii) If we consider $u_1 = 5$ instead of $u_1 = 0$ 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 C_{ij}. **(2 marks)**

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

	F_1	F_2	F_3	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