PAPER – 5 : ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Current Purchase System Vs Just in Time System

1. United Video International Company (UVIC) sells package of blank video tapes to its customer. It purchases video tapes from Indian Tape Company (ITC) @ ₹ 140 a package. ITC pays all freight to UVIC. No incoming inspection is necessary because ITC has a superb reputation for delivery of quality merchandise. Annual demand of UVIC is 13,000 packages. UVIC requires 15% annual return on investment. The purchase order lead time is two weeks. The purchase order is passed through Internet and it costs ₹ 2 per order. The relevant insurance, material handling etc ₹ 3.10 per package per year. UVIC has to decide whether or not to shift to JIT purchasing. ITC agrees to deliver 100 packages of video tapes 130 times per year (5 times every two weeks) instead of existing delivery system of 1,000 packages 13 times a year with additional amount of ₹ 0.02 per package. UVIC incurs no stock out under its current purchasing policy. It is estimated UVIC incurs stock out cost on 50 video tape packages under a JIT purchasing policy. In the event of a stock out, UVIC has to rush order tape packages which costs ₹ 4 per package. Comment whether UVIC should implement JIT purchasing system.

   Hindustan Tape Company (HTC) also supplies video tapes. It agrees to supply @ ₹ 136 per package under JIT delivery system. If video tape purchased from HTC, relevant carrying cost would be ₹ 3 per package against ₹ 3.10 in case of purchasing from ITC. However HTC. doesn't enjoy so sterling a reputation for quality. UVIC anticipates following negative aspects of purchasing tapes from HTC.

   - To incur additional inspection cost of 5 paisa per package.
   - Average stock out of 360 tapes packages per year would occur, largely resulting from late deliveries. HTC cannot rush order at short notice. UVIC anticipates lost contribution margin per package of ₹ 8 from stock out.
   - Customer would likely return 2% of all packages due to poor quality of the tape and to handle this return an additional cost of ₹ 25 per package.

   Comment whether UVIC places order to HTC.

Decision Making – Make or Buy

2. Aditya Ltd. manufactures four products A-1, B-2, C-3 and D-4 in Gurgaon and one product F-1 in Faridabad. Aditya Ltd. operates under Just-in-time (JIT) principle and does not hold any inventory of either finished goods or raw materials.

   Company has entered into an agreement with M Ltd. to supply 10,000 units per month of each product produced from Gurgaon unit at a contracted price. Aditya Ltd. is bound to supply these contracted units to M Ltd. without any fail. Following are the details related with non contracted units of Gurgaon unit.

(Amount in ₹)

	A-1	B-2	C-3	D-4
Selling Price *per unit*	360.00	285.00	290.00	210.00
Direct Labour @ ₹ 45 *per hour*	112.50	67.50	135.00	67.50
Direct Material M-1 @ ₹ 50 *per kg.*	50.00	100.00	---	75.00
Direct Material M-2 @ ₹ 30 *per litre.*	90.00	45.00	60.00	---
Variable Overhead (varies with labour hrs)	12.50	7.50	15.00	7.50
Variable Overhead (varies with machine hrs)	9.00	12.00	9.00	15.00
Total Variable Cost	274.00	232.00	219.00	165.00
Machine Hours *per unit*	3 hours	4 hours	3 hours	5 hours
Maximum Demand per month (units)	90,000	95,000	80,000	75,000

The products manufactured in Gurgaon unit use direct material M-1 and M-2 but product F-1 produced in Faridabad unit is made by a distinct raw material Z. Material Z is purchased from the outside market at ₹ 200.00 per unit. One unit of F-1 requires one unit of material Z.

Material Z can also be manufactured at Gurgaon unit but for this 2 hours of direct labour, 3 hours of machine time and 2.5 litres of material M-2 will be required.

The Purchase manager has reported to the production manager that material M-1 and M-2 are in short supply in the market and only 6,50,000 Kg. of M-1 and 6,00,000 litre of M-2 can be purchased in a month.

Required:

(i) Calculate whether Aditya Ltd. should manufacture material Z in Gurgoan unit or continue to purchase it from the market and manufacture it in Faridabad unit.

(ii) Calculate the optimum monthly usage of Gurgaon unit's available resources and make decision accordingly.

(iii) Calculate the purchase price of material Z at which your decision in (i) can be sustained.

Preparation of Flexible Budget

3. Satjuj Motors Ltd. had prepared fixed and flexible budget for the financial year 2013-14 as under:

	Fixed Budget *for full capacity* (₹)	Flexible Budget *for 75% level* (₹)
Sales	13,50,000	10,12,500
Direct Material	4,25,000	3,18,750
Direct Labour	1,85,000	1,38,750

Variable Overheads	2,15,000	1,61,250
Semi-Variable Overheads	3,65,000	3,23,750
Profit	1,60,000	70,000

After the closing of the financial year 2013-14, total actual sales stood at ₹ 11,07,000 and there was a favourable sales price variance of ₹ 17,000 (F).

Required:

Prepare a flexible budget for the actual level of sales.

Standard Costing – Required Information from Given Inputs and Variances

4. S. Ltd. operates a system of standard costing in respect of one of its products which is manufactured within a single cost centre, the following information is available:

For one unit of product the standard material input is 20 litres at a standard price of ₹2 per litre. The standard wage rate is ₹6 per hour and 5 hours are allowed to produce one unit. Fixed production overhead is absorbed at the rate of 100% of direct wages cost.

During the month just ended the following occurred -

	₹
Actual Price (paid for material purchased)	1.95 *per litre*
Total Direct Wages Cost	1,56,000
Fixed Production Overhead	1,58,000

Variance	Favourable (₹)	Adverse (₹)
Direct Material Price	8,000	-
Direct Material Usage	-	5,000
Direct Labour Rate	-	5,760
Direct Labour Efficiency	2,760	-
Fixed Production Overhead Expenditure	-	8,000

Calculate the following for the month-

(i) Budgeted output in units.

(ii) Number of litres purchased.

(iii) Number of litres used above standard allowed.

(iv) Actual units produced.

(v) Actual hours worked.

(vi) Average actual wage rate per hour.

Hotel Service – Calculation of Tariff & Break-even Analysis

5. A Hotel having 50 single rooms is having 80% occupancy in normal season (8 months) and 50% in off- season (4 months) in a year (take 30 days month).

Annual Fixed Expenses:	₹ Lakh
Salary of the Staff (excluding Room Attendant)	7.50
Repair & Maintenance	2.60
Depreciation on Building & Furniture	2.40
Other Fixed Expenses like Dusting, Sweeping etc.	3.25
Total	15.75

Variable Expenses (per Guest per Day):	₹
Linen, Laundry & Security Support	30.00
Electricity & Other Facilities	20.00
Misc Expenses like Attendant etc	25.00

Management wishes to make a Margin of 25% of Total Cost.

(i) Calculate the Tariff Rate per Room.

(ii) Calculate the Break Even Occupancy in Normal Season assuming 50% Occupancy is Off-Season.

(iii) Management is proposing 10% cut in Tariff to improve Occupancy at 100% and 70% in Normal Season and Off-Season respectively. Give your views on it.

(iv) What is the minimum rise in Occupancy % to take care of risk of fall in Profit due to Tariff-Cut?

Transfer Pricing

6. Eastern Company Ltd. has two Divisions namely Casnub Bogie Division (CBD) and Wagon Division (WD). CBD manufactures Casnub Bogies and WD manufactures BOBN type of Wagons. To manufacture a Wagon WD needs four Casnub Bogies. CBD is the only manufacturer of the Casnub Bogies and supplies both WD and outside customers. Details of CBD and WD for the coming financial year 2014-15 are as follows:

	CBD	WD
Fixed Costs (₹)	9,20,20,000	16,45,36,000
Variable Cost per unit (₹)	2,20,000	4,80,000*
Capacity per month (units)	320	12

** excluding transfer costs*

Market research has indicated that the demands in the market for Eastern Company Ltd.'s products at different quotations are as follows:

For Casnub Bogies: Quotation price of ₹3,20,000 no tender will be awarded, but demand will increase by 30 Casnub Bogies with every ₹10,000 reduction in the unit quotation price below ₹3,20,000.

For Wagons: Quotation price of ₹17,10,000 no tender will be awarded, but the demand for Wagons will be increased by two Wagons with every ₹50,000 reduction in the unit quotation price below ₹17,10,000.

Required:

(i) Calculate the unit quotation price of the Wagon that will maximise Eastern Company Ltd.'s profit for the financial year 2014-15.

(ii) Calculate the unit quotation price of the Wagon that is likely to emerge if the divisional managers of CBD and WD both set quotation prices calculated to maximise divisional profit from sales to outside customers and the transfer price is set at market selling (quotation) price.

[Note: If P = a – bQ then MR = a – 2bQ]

Direct Product Profitability (DPP)

7. Jigyasa India Ltd. (JIL) has 30 retail stores of uniform sizes 'Fruity & Sweety Retails' across the country. Mainly three products namely 'Butter Jelly', 'Fruits & Nuts' and 'Icy Cool' are sold through these retail stores. JIL maintains stocks for all retail stores in a centralised warehouse. Goods are released from the warehouse to the retail stores as per requisition raised by the stores. Goods are transported to the stores through two types of vans i.e. normal and refrigerated. These vans are to be hired by the JIL.

Costs per month of JIL are as follows:

	(₹)
Warehouse Costs:	
Labour & Staff Costs	27,000
Refrigeration Costs	1,52,000
Material Handling Costs	28,000
Total	2,07,000
Head Office Cost:	
Salary & Wages to Head Office Staff	50,000
Office Administration Costs	1,27,000
Total	1,77,000
Retail Stores Costs:	
Labour Related Costs	33,000
Refrigeration Costs	1,09,000
Other Costs	47,000
Total	1,89,000

Average transportation cost of JIL per trip to any retail stores are as follows:

Normal Van	₹3,200
Refrigerated Van	₹4,900

The Chief Financial Manager asked his Finance managers to calculate profitability based on three products sold through Fruity & Sweety retail stores rather than traditional method of calculating profitability.

The following information regarding retail stores are gathered:

	Butter Jelly	Fruits & Nuts	Icy Cool
No. of Cartons *per cubic metre* (m^3)	42	28	40
No. of Items *per cartons* (units)	300	144	72
Sales *per month* (units)	18,000	4,608	1,152
Time in Warehouse (in months)	1	1.5	0.5
Time in Retail Stores (in months)	1	2	1
Selling Price *per unit* (₹)	84	42	26
Purchase Price *per unit* (₹)	76	34	22

Butter Jelly and Icy-Cool are required to be kept under refrigerated conditions.

Additional information:

Total Volume of All Goods Sold *per month*	40,000 m^3
Total Volume of Refrigerated Goods Sold *per month*	25,000 m^3
Carrying Volume of *each van*	64 m^3

Required:

Calculate the Profit *per unit* using Direct Product Profitability (DPP) method.

Linear Programming – Graphic Method

8. Let us assume that you have inherited ₹1,00,000 from your father that can be invested in a combination of only two stock portfolios, with the maximum investment allowed in either portfolio set at ₹75,000. The first portfolio has an average rate of return of 10%, whereas the second has 20%. In terms of risk factors associated with these portfolios, the first has a risk rating of 4 (on a scale from 0 to 10), and the second has 9. Since you wish to maximize your return, you will not accept an average rate of return below 12% or a risk factor above 6. Hence, you then face the important question. How much should you invest in each portfolio?

   Formulate this as a Linear Programming Problem and solve it by Graphic Method.

Transportation Problem – Optimum Solutions and Minimum Cost

9. The following matrix is a minimization problem for transportation cost. The unit transportation costs are given at the right hand corners of the cells and the Δ_{ij} values are encircled.

	D_1	D_2	D_3	Supply
F_1	3	4	4	500
F_2	(8) 9	300 6	(8) 7	300
F_3	(0) 4	(8) 6	200 5	200
Demand	300	400	300	1,000

Find the optimum solution (s) and the minimum cost.

Assignment Problem – Cost Minimization

10. A BPO company is taking bids for 4 routes in the city to ply pick-up and drop cabs. Four companies have made bids as detailed below-

Bids for Routes (₹)

Company / Routes	R_1	R_2	R_3	R_4
C_1	4,000	5,000	–	–
C_2	–	4,000	–	4,000
C_3	3,000	–	2,000	–
C_4	–	–	4,000	5,000

Each bidder can be assigned only one route. Determine the minimum cost that the BPO should incur.

Critical Path Analysis – Preparation of Arrow Diagram & Analysis of Float

11. A project has the following time schedule:

Activity	Duration (in Weeks)	Activity	Duration (in Weeks)
1 – 2	4	5 – 7	8
1 – 3	1	6 – 8	1

2 – 4	1	7 – 8	2
3 – 4	1	8 – 9	1
3 – 5	6	8 – 10	8
4 – 9	5	9 – 10	7
5 – 6	4		

(i) Draw the arrow diagram.

(ii) Identify critical path and find the total project duration.

(iii) Determine total, free and independent floats.

Program Evaluation and Review Technique – Updating of Network Diagram

12. A company had planned its operations as follows:

Activity	Duration (Days)	Activity	Duration (Days)
1 – 2	7	4 – 7	19
2 – 4	8	3 – 6	24
1 – 3	8	5 – 7	9
3 – 4	6	6 – 8	7
1 – 4	6	7 – 8	8
2 – 5	16		

(i) Draw the network and find the critical paths.

(ii) After 15 days of working, the following progress is noted:

(a) Activities 1 – 2, 1 – 3 and 1 – 4 completed as per original schedule.

(b) Activity 2 – 4 is in progress and will be completed in 4 more days.

(c) Activity 3 – 6 is in progress and will need 17 more days to complete.

(d) The staff at activity 3 – 6 are specialised. They are directed to complete 3 – 6 and undertake an activity 6 – 7, which will require 7days. This rearrangement arose due to a modification in a specialisation.

(e) Activity 6 – 8 will be completed in 4 days instead of the originally planned 7 days.

(f) There is no change in the other activities.

Update the network diagram after 15 days of start of work based on the assumption given above. Indicate the revised critical paths along with their duration.

Simulation of a Cash Flow Problem

13. ABC Co-operative Bank receives and disburses different amount of cash in each month. The bank has an opening cash Balance of ₹15 crores in the first month. Pattern of receipts and disbursements from past data is as follows:

Monthly Cash Receipts		Monthly Cash Disbursements	
(₹ in Crores)	Probability	(₹ in Crores)	Probability
30	0.20	33	0.15
42	0.40	60	0.20
36	0.25	39	0.40
99	0.15	57	0.25

Simulate the cash position over a period of 12 months.

Required:

(i) Calculate probability that the ABC Cooperative Bank will fall short in payments.

(ii) Calculate average monthly shortfall.

(iii) If ABC bank can get an overdraft facility of ₹ 45 crores from other Nationalized banks. What is the probability that they will fall short in monthly payments?

Use the following sequence (row-wise) of paired random numbers.

1778 4316 7435 3123 7244 4692 5158 6808 9358 5478 9654 0977

Application of Learning Curve – Pricing of Product & Learning Curve Rate Not Given

14. Marketing manager of Arnav Ltd. has conducted a market research on the price-demand relationship for its consumer durable product 'Leo-9'. Leo-9 is a recently launched product. The price-demand pattern will be as follows:

Price per unit (₹)	Demand (units)
11,100	1,000
10,700	2,000
9,600	3,000
8,700	4,000

Leo-9 is produced in batches of 1,000 units. Production manager of Arnav Ltd. has also researched and studied the production pattern and has believe that 50% of the variable manufacturing cost would have learning and experience curve effect. This learning & experience curve effect will be continued upto 4,000 units of production at a constant rate. But after 4,000 units of production, unit variable manufacturing cost would be equal to the unit cost at the 4th batch. The manufacturing unit cost of the first batch will be ₹4,400 of which only 50% is subjected to learning and experience curve effect. The average unit variable cost of all 4 batches will be ₹4,120.

Required:

(i) Calculate the rate of learning that has been expected by the Production manager.

(ii) Calculate the price at which Arnav Ltd. should sell the Leo-9 in order to maximise its contribution.

Note:

log0.93 = -0.0315, log2 = 0.3010, $2^{-0.1047}$ = 0.9299, $3^{-0.1047}$ = 0.8913, $4^{-0.1047}$ = 0.8649

Balance Score Card – Identification of Scorecard Perspectives

15. Identify Balance Scorecard Perspectives from the following potential measures observed in different business sectors.

(i) Weekly Patient Complaints

(ii) Patient Satisfaction Survey

(iii) Flight Cancellation Rate

(iv) On-time Performance of an Airline

(v) Number of Grants Awarded to a Healthcare unit

(vi) Outstanding Loan Balances / Deposit Balances of a Banking Company

(vii) Employee Turnover Rate of a Healthcare unit

(viii) Patient Referral Rate

(ix) Non-interest Income of a Banking Company

(x) Lost of Bag Reports per 5,000 Passengers

Miscellaneous

16. Marine Diesel Ltd. (MDL) manufactures and sells Diesel Engine. Company appoints Mr. Philips to coordinate shipments of the Diesel Engine from the factory to distribution warehouses located in various parts of the India so that goods will be available as orders are received from customers. MDL is unsure how to classify his annual salary of ₹6,00,000 in its cost records. The company's cost analyst says that Mr. Philips's salary should be classified as manufacturing cost; the finance controllers says that it should be classified as selling cost; and the managing director says that it does not matter which way Mr. Philips's salary cost is classified. Which view point is correct and why?

17. Indian Petrons Ltd. (IPL) is a leading manufacturing company. Under increasing pressure to reduce costs, to contain inventory and to improve service, IPL's Costing Department has recently undertaken a decision to *implement a JIT System*.

The management of IPL is convinced of the benefits of their changes. But Supplies Manager Mr. Brian fears with the Costing Department's decision. He said:

"We've been driven by suppliers for years ... they would insist that we could only purchase in thousands, that we would have to wait weeks, or that they would only deliver on Mondays!"

Is Mr. Brian's view point correct and why?

18. *"Coefficients in the objective function and the constraint equations must be completely known and they should not change during the period of study."*

- Elucidate the above statement in respect of linear programming.

19. Write a short note on *alternate solution in "transportation problem"*.

20. Classify the following fixed cost as normally being either committed or discretionary.

(i) Depreciation on assets

(ii) Advertising

(iii) Research

(iv) Employees Training

SUGGESTED ANSWERS/HINTS

1. (i) Comparative 'Statement of Cost' for Purchasing from ITC under 'Current Policy' & 'JIT'

Particulars	Current Policy (₹)	JIT (₹)
Purchasing Cost	18,20,000 (13,000 Packages × ₹140)	18,20,260 (13,000 Packages × ₹140.02)
Ordering Cost	26.00 (₹2 × 13 Orders)	260.00 (₹2 ×130 Orders)
Opportunity/Carrying Cost	10,500.00 (1/2 × 1,000 Packages × ₹ 140 × 15%)	1,050 (1/2 × 100 Packages × ₹ 140.02 × 15%)
Other Carrying Cost (Insurance, Material Handling etc)	1,550.00 (1/2 × 1,000 Packages × ₹3.10)	155.00 (1/2 × 100 Packages × ₹3.10)
Stock Out Cost	---	200 (50 Packages × ₹4.00)
Total Relevant Cost	18,32,076	18,21,925

Comments: As may be seen from above, the relevant cost under the JIT purchasing policy is lower than the cost incurred under the existing system. Hence, a JIT purchasing policy should be adopted by the company.

(ii) 'Statement of Cost' for Purchasing from HTC under 'JIT'

Particulars	JIT (₹)
Purchasing Cost	17,68,000 (13,000 Packages × ₹136)
Ordering Cost	260.00 (₹2 ×130 Orders)
Opportunity / Carrying Cost	1,020 (1/2 × 100 Packages × ₹ 136 × 15%)
Other Carrying Cost (Insurance, Material Handling etc)	150.00 (1/2 × 100 Packages × ₹3.00)
Inspection Cost	650 (13,000 Packages × ₹0.05)
Stock Out Cost	2,880 (360Packages × ₹8.00)
Customer Return Cost	6,500 (13,000 Packages × 2% × ₹25.00)
Total Relevant Cost	17,79,460

Comments: The comparative costs are as follows:

Under Current Policy	₹18,32,076
Under Purchase under JIT from ITC	₹18,21,925
Under Purchase under JIT from HTC	₹17,79,460

Packages should be bought from HTC under JIT as it is the cheapest.

2. (i) Manufacturing Cost of Material Z, if Manufactured in Gurgaon unit

	Amount (₹)
Direct Labour (2 hours × ₹45)	90.00
Direct Material M-2 (2.5 litre × ₹30)	75.00
Variable Overhead, Varies with Labour Hours (2hours × ₹5)	10.00
Variable Overhead, Varies with Machine Hours (3hours × ₹3)	9.00
Total Variable Cost	184.00

The purchasing cost of material Z from the outside market is ₹200, which is more than the cost to manufacture it in Gurgaon unit. Hence, it will be beneficial for the Aditya Ltd. to manufacture material Z in Gurgaon unit itself.

(ii) Monthly Requirement of Direct Material M-1 & M-2

For Contracted units

	A-1	B-2	C-3	D-4	Total
Units to be Supplied to M Ltd. (units)	10,000	10,000	10,000	10,000	40,000
Direct Material M-1 (in Kg) [W.N.-1]	10,000	20,000	---	15,000	45,000
Direct Material M-2 (in Litre) [W.N.-2]	30,000	15,000	20,000	---	65,000

For Non-Contracted units

	A-1	B-2	C-3	D-4	Total
Demand in Outside Market (units)	90,000	95,000	80,000	75,000	3,40,000
Direct Material M-1 (in Kg) [W.N.-1]	90,000	1,90,000	---	1,12,500	3,92,500
Direct Material M-2 (in Litre) [W.N.-2]	2,70,000	1,42,500	1,60,000	---	5,72,500

Availability and Demand Comparison

	Direct Material M-1 (in Kg)	Direct Material M-2 (in Litre)
Availability in Market	6,50,000	6,00,000
Requirement	4,37,500 (45,000+3,92,500)	6,37,500 (65,000+5,72,500)

Material M-2 is a limiting factor as its availability is less than its requirement to produce contracted as well as for non-contracted units.

To optimum usage of resources available in Gurgaon unit, prioritisation of production of products is necessary. The following is the comparison table of product A-1, B-2, C-3 and Z. Product D-4 is not taken into comparison as material M-2 is not required to produce product D-4.

Calculation of Contribution per litre of M-2

	A-1	B-2	C-3	Z
Contribution *per unit* (W.N-3 & 4)	₹ 86.00	₹ 53.00	₹ 71.00	₹ 16.00
Quantity of Material M-2 *per unit*	3 litre	1.5 litre	2 litre	2.5 litre
Contribution *per litre* of M-2	₹ 28.67	₹ 35.33	₹ 35.50	₹ 6.40
Rank	III	II	I	IV

Since, contribution per unit of material Z is lowest as compared to other products consuming material M-2. *Material –Z cannot be manufactured under the given resource constraint. Hence only existing products of Gurgaon units should be manufactured.*

Optimum Production Plan

Product	No. of Units	Quantity of M-2 Required (in Litre)	Balance Availability of M-2 (in Litre)
C-3	90,000	1,80,000 (90,000 units × 2 litre)	4,20,000 (6,00,000 – 1,80,000)
B-2	1,05,000	1,57,500 (1,05,000 units × 1.5 litre)	2,62,500 (4,20,000 – 1,57,500)
A-1	87,500*	2,62,500 (87,500 units × 3 litre)	0 (2,62,500 – 2,62,500)

(*) Units that can be produced with the help of available quantity of M-2 i.e. 2,62,500 litre.

(iii) Decision in requirement (i) will be changed as material Z cannot be manufactured in Gurgaon unit as noted in requirement (ii). *The minimum purchase price of material Z at which decision taken in (i) above can be sustained* is calculated as below:

	Amount (₹)
Existing Purchase Price	200.00
Add: Market Price *to be increased by* [W.N.-5]	55.68
Total	255.68

Working Notes

(1) Quantity of M-1 *required per unit of production*

	A-1	B-2	D-4
Cost *per unit*	₹50	₹100	₹75
Rate *per Kg.*	₹50	₹50	₹50
Quantity *per unit* of Production	1Kg.	2Kg.	1.5Kg.

(2) Quantity of M-2 *required per unit of production*

	A-1	B-2	C-3
Cost of *per unit*	₹90	₹45	₹60
Rate *per Kg.*	₹30	₹30	₹30
Quantity *per unit* of Production	3 litre	1.5 litre	2 litre

(3) Contribution *per unit* (₹)

	A-1	B-2	C-3	D-4
Selling Price *per unit*	360	285	290	210
Less: Variable Cost *per unit*	274	232	219	165
Contribution *per unit*	86	53	71	45

(4) Contribution (Benefit) *per unit* of Material Z

	(₹)
Purchasing Cost *per unit*	200
Less: Cost of Manufacture	184
Contribution *per unit*	16

(5) The next best product to material Z is A-1 {as calculated in (ii) above} which has a contribution of ₹28.67 per litre of M-2 which is ₹22.27 (₹28.67 – ₹6.40) higher than the contribution per litre of M-2 for material Z. Material Z required 2.5 litre of M-2, therefore, purchase price of material Z would have to ₹55.68 (2.5 litre × ₹22.27) higher than the existing market price.

3. Working Notes

(1) Calculation of Actual Sales at Budgeted Prices

	(₹)
Actual Sales at Actual Price	11,07,000
Less: Sales Price Variance (F)	17,000
Actual Sales at Budgeted Prices	10,90,000

$$\text{Activity Level} = \frac{\text{Actual Sales at Budgeted Prices}}{\text{Budgeted Sales at Full Capacity}} \times 100$$

$$= \frac{₹10,90,000}{₹13,50,000} \times 100$$

$$= 80.74\ldots\%$$

(2) Segregation of Fixed & Variable Cost Element from Semi-Variable Overheads

$$\text{Variable Overhead} = \frac{\text{Overhead at Full Capacity - Overhead at 75\% Capacity}}{\text{Difference in Activity Level}}$$

$$= \frac{₹3,65,000 - ₹3,23,750}{25}$$

$$= ₹1,650$$

Fixed Overhead = Total Other Overheads at 100% Level – Variable Overheads at 100% level

= ₹3,65,000 – (₹1,650 × 100)

= ₹2,00,000

Flexible Budget at 80.74..% Activity Level

	(Amount in ₹)
Sales	10,90,000
Less:	
Direct Material (₹4,25,000 × 80.74..%)	3,43,148
Direct Labour (₹1,85,000 × 80.74..%)	1,49,370
Variable Overheads (₹ 2,15,000 × 80.74..%)	1,73,593
Semi-Variable Overheads	
Variable Cost (₹1,650 × 80.74..) [W.N.-2]	1,33,222
Fixed Cost [W.N.-2]	2,00,000
Profit	90,667

4. Computation of Requirements of Question

Budgeted output in units

Fixed Overhead Expenditure Variance

= Budgeted Fixed Overheads – Actual Fixed Overheads

⇒ ₹8,000 (A) = Budgeted Output × (₹6 × 5 hrs.) – ₹1,58,000

⇒ Budgeted Output = 5,000 units

Number of litres purchased

Material Price Variance = Actual Quantity × (Std. Price – Actual Price)

⇒ ₹8,000 (F) = No. of litres purchased × (₹2 – ₹1.95)

⇒ No. of litres purchased

= 1,60,000 litres

Number of litres used above standard allowed

Material Usage Variance = Standard Price × (Standard Quantity – Actual Quantity)

⇒ ₹5,000 (A) = ₹2 × (Standard Quantity – 1,60,000 litres)

⇒ Standard Quantity = 1,57,500 litres

No. of litres above Standard = 1,60,000 litres – 1,57,500 litres

= 2,500 litres

Actual units produced

Labour Cost Variance = Rate Variance + Efficiency Variance

= ₹5,760 (A) + ₹2,760 (F)

= ₹3,000 (A)

Labour Cost Variance = Standard Cost – Actual Cost

⇒ ₹3,000 (A) = Actual Output × (₹ 6 × 5 hrs.) – ₹1,56,000

⇒ Actual Output = 5,100 units

Actual hours worked

Labour Efficiency Variance = Standard Rate × (Standard Hours – Actual Hours)

⇒ ₹2,760 (F) = ₹6 × (5,100 units × 5 hrs. – Actual Hours)

⇒ Actual Hours = 25,040 hours

Average actual wage rate per hour

Labour Rate Variance = Actual Hours × (Standard Rate – Actual Rate)

⇒ ₹5,760 (A) = 25,040 hours × (₹6 – Actual Rate)

⇒ Actual Rate = ₹6.23...*per hour*

5. (a) Variable Cost *per Room-Day* = ₹75
(₹30 + ₹20 + ₹25)

Total Occupancy = 12,600 Room-Days
(50 × 30 × 8 × 0.8 + 50 × 30 × 4 × 0.5)

Total Variable Cost = ₹9.45 lakhs
(12,600 Room-Days × ₹75)

Fixed Cost = ₹15.75 lakhs

Total Cost = ₹25.20 lakhs
(₹9.45 lakhs + ₹15.75 lakhs)

Profit (25% of Total Cost) = ₹6.30 lakhs
(25% of ₹25.20 lakhs)

Tariff *per Day* = ₹250.00
[(₹25,20,000 + ₹6,30,000) / 12,600 Room-Days]

(b) Contribution *per Day* = ₹175.00
(₹250 − ₹75)

BEP (Room–Day) = 9,000 Room-Days
(₹15,75,000 / ₹175)

During Off Season *for 4 months*

Rooms Occupied = 3,000 Days
(50 × 30 × 4 × 0.5)

For BEP,

Occupancy During Normal Period	=	6,000 Days i.e. (50% of Total Capacity in Normal Season)

(c) If 10% Discount is allowed,

Tariff	=	₹225 *per Room-Day*
Contribution per Room-Day (with tariff cut)	=	₹150 (₹225 − ₹75)
Total Occupancy	=	16,200 Room-Days (50 × 30 × 8) + (50 × 30 × 4 × 0.7)
Total Contribution *for the year*	=	₹24.30 lakhs (16,200 Room-Days × ₹150)
Fixed Cost (unchanged)	=	₹15.75 lakhs
Profit	=	₹8.55 lakhs

As the Proposal increases the Profit, it may be accepted.

(d) To maintain the Same Profit,

Contribution Required	=	₹22.05 lakhs
With New Tariff,		
Contribution *per day*	=	₹150
Number of Room-Days Occupied	=	14,700 Room-Days (₹22,05,000 / 150)
Increase % in Occ. Required	=	16.67 % [(14,700 – 12,600) / 12,600]

6. (i) Assumed Quotation Price 'P', Quantity 'Q'

The Marginal Cost of a 'Wagon' is ₹13,60,000

(₹2,20,000 × 4 Casnub Bogies + ₹4,80,000)

Demand Function for a 'Wagon'

P	=	₹17,10,000 – (₹50,000 / 2) × Q
Revenue (R)	=	Q x [17,10,000 – 25,000 × Q]
	=	17,10,000 Q – 25,000 Q^2
Marginal Revenue (MR)	=	17,10,000 – 50,000 Q
Marginal Cost (MC)	=	13,60,000

Profit is Maximum where Marginal Revenue (MR) equals to Marginal Cost (MC)

17,10,000 – 50,000 Q = 13,60,000

Q = 7.00 units

By putting the value of 'Q' in *Demand Function*, value of 'P' is obtained.

P = 17,10,000 – (50,000/ 2) × Q

= 17,10,000 – 25,000 × 7.00

= ₹15,35,000

At ₹15,35,000 unit Quotation Price of a Wagon the Eastern Company Ltd.'s Profit will be Maximum.

(ii) At CBD the Divisional Manager would ensure that Divisional Marginal Revenue should be ***equal to*** Division's Marginal Cost so that Profit can be Maximum.

MR of a Casnub Bogies = MC of Manufacturing a Casnub Bogies

3,20,000 – 2(10,000/ 30) × Q = 2,20,000

Q = 150 units

Selling Price of a Casnub Bogie 'P' is

P = 3,20,000 – (10,000/ 30) × 150

= ₹2,70,000

CBD will earn Maximum Profit when it will Quote ₹2,70,000 to the Outside Market. Since, Outside Market Quotation is *Transfer Price* as well, so Transfer Price to WD will be ₹2,70,000 and it forms part of WD's Marginal Cost.

At WD, Division Manager would ensure that Divisional Marginal Revenue should be ***equal to*** Division's Marginal Cost so that Profit can be Maximum.

MR of a Wagon = MC of Manufacturing a Wagon

17,10,000 – 50,000 × Q = (₹2,70,000 × 4 Casnub Bogies) + ₹4,80,000

Q = 3.00 units

Quotation Price of a Wagon 'P' should be:

P = ₹17,10,000 – 25,000 × 3.00

= ₹16,35,000

The unit Quotation Price of Wagon that emerges as a result of Market Based Transfer Pricing is ₹16,35,000.

7. Direct Product Profitability (DPP) Statement

(Amount in ₹)

	Butter Jelly	Fruits & Nuts	Icy Cool
Selling Price *per unit*	84.00	42.00	26.00
Less: Purchase Price *per unit*	76.00	34.00	22.00
Gross Profit ...(A)	8.00	8.00	4.00
Direct Product Costs:			
Warehouse Costs *per* m^3 [W.N.-1]	7.46	2.07	3.73
Retail Stores Costs *per* m^3 [W.N.-2]	6.36	4.00	6.36
Transportation Costs [W.N.-3]	76.56	50.00	76.56
Total DPP costs *per* m^3	90.38	56.07	86.65
Items *per* m^3 [W.N.-4]	12,600	4,032	2,880
Cost *per item* ...(B)	0.007	0.014	0.030
Direct Product Profit ...(A) - (B)	7.993	7.986	3.97

Working Notes

(1) Warehouse Related Costs

	General Costs (₹)	Cost Related with Refrigerated Goods (₹)
Labour & Staff Costs	27,000	---
Refrigeration Costs	---	1,52,000
Material Handling Costs	28,000	---
Total	55,000	1,52,000
Volume of Goods Sold	40,000 m^3	25,000 m^3
Cost *per* m^3 *per month*	1.38	6.08

Products	Time in Warehouse	Cost *per* m^3 *per month* (₹)	Total Cost (₹)
Butter Jelly	1 Month	7.46 (1.38 + 6.08)	7.46
Fruits & Nuts	1.5 Months	1.38	2.07
Icy-cool	0.5 Months	7.46 (1.38 + 6.08)	3.73

(2) Retail Stores Related Costs

	General Costs (₹)	Cost Related with Refrigerated Goods (₹)
Labour Related Costs	33,000	---
Refrigeration Costs	---	1,09,000
Other Costs	47,000	---
Total	80,000	1,09,000
Volume of Goods Sold	40,000 m^3	25,000 m^3
Cost *per* m^3 *per month*	2.00	4.36

Products	Time in Retail Stores	Cost *per* m^3 *per month*	Total Cost
Butter Jelly	1 Month	₹6.36 (₹2.00 + ₹4.36)	₹6.36
Fruits & Nuts	2 Months	₹2.00	₹4.00
Icy-Cool	1 Month	₹6.36 (₹2.00 + ₹4.36)	₹6.36

(3) Transportation Costs

	Normal Van Costs	Refrigerated Van Costs
Cost *per trip*	₹3,200	₹4,900
Volume of Van	64 m^3	64 m^3
Cost *per* m^3 *per trip*	₹50.00	₹76.56

(4) No. of Items *per* m^3

Products	No. of Cartons (m^3)	No. of Items *per Cartons* (units)	No. of Items *per* m^3
Butter Jelly	42	300	12,600 (42 × 300)
Fruits & Nuts	28	144	4,032 (28 × 144)
Icy - Cool	40	72	2,880 (40 × 72)

8. Let x and y be the amount to be invested in first and second stock portfolio respectively.

Objective function:

The average rate of return for first portfolio is 10% and for second portfolio, it is 20%. Since the company wishes to maximize the return from investment, the objective function is as given below:

Maximise $Z = 0.10x + 0.20y$

Condition-1:

The maximum amount available for investment is ₹ 1,00,000.

Hence, $x + y \leq 1,00,000$

Condition-2:

Further, the maximum investment allowed in either portfolio set is ₹ 75,000.

Therefore, $x \leq 75,000$ and

$y \leq 75,000$

Condition-3:

The first portfolio has a risk rating of 4 (on a scale from 0 to 10) and the second has 9. The company will not accept a risk factor above 6.

Therefore, $4x + 9y \leq 6(x + y)$

Or $-2x + 3y \leq 0$

Condition-4:

Further, the company will not accept an average rate of return below 12%.

Hence, $0.10x + 0.20y \geq 0.12(x + y)$

Or $-0.02x + 0.08y \geq 0$

Condition-5:

Also, $x, y \geq 0$

The linear programming model for the given problem can now be formulated as follows:

Maximise

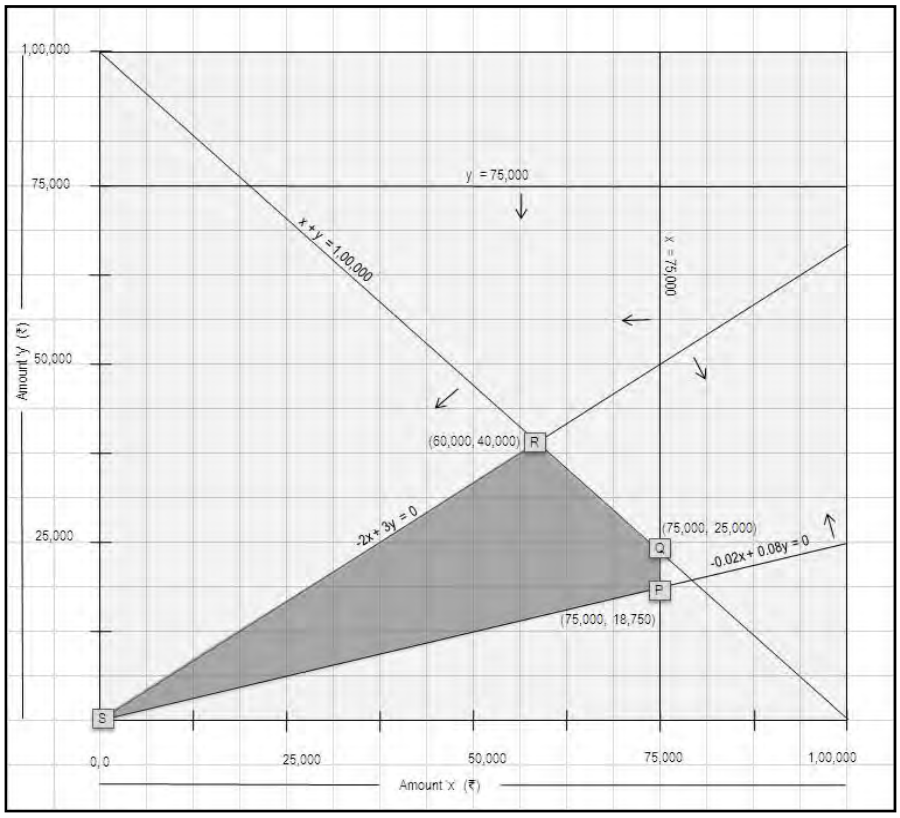
$$Z = 0.10x + 0.20y$$

Subject to the Constraints:

$$x + y \leq 1,00,000$$
$$x \leq 75,000$$
$$y \leq 75,000$$
$$-2x + 3y \leq 0$$
$$-0.02x + 0.08y \geq 0$$

Where $x, y \geq 0$

The problem is solved graphically below:



Intersection Points:

The point of intersection for the lines		
− 2x + 3y	=	0 and
x + y	=	1,00,000 is given by Intersection Point R (60,000, 40,000)
The point of intersection for the lines		
x	=	75,000 and
x + y	=	1,00,000 is given by Intersection Point Q (75,000, 25,000)
Similarly, the lines		
x	=	75,000 and
− 0.02x + 0.08y	=	0 Intersect at Point P (75,000, 18,750)

Thus, the feasible region is bounded by SRQP and feasible points are S (0, 0); R (60,000, 40,000); Q (75,000, 25,000) and P (75,000, 18,750).

Value of the objective function at the above mentioned 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 = 0.10 x + 0.20 y
S	(0, 0)	₹ NIL
R	(60,000, 40,000)	₹ 14,000
Q	(75,000, 25,000)	₹ 12,500
P	(75,000, 18,750)	₹ 11,250

We find that the value of the objective function is maximum ₹14,000 at point R (60,000, 40,000).

Hence, there should be investment of ₹ 60,000 in first portfolio and investment of ₹ 40,000 in second portfolio to achieve the maximum return of ₹14,000.

9. As we know Δ_{ij} values are given for unallocated cells. Hence, the remaining cells represent the allocated cells which is 5 and equal to m + n -1 (no. of columns + no of rows – 1).

Now we fill up the allocated cells with allocated units.

Allocation, other than Δ_{ij} cells

Cell	Demand in Corresponding Column	Supply in Corresponding Row	Maximum Possible Allocation (Minimum of Demand and Supply)	Allocation
R_1C_1	300	500	300	300
R_1C_2	100 (400 – 300 in R_2C_2)	200 (500 – 300 in R_1C_1)	100	100
R_1C_3	100 (300 – 200 in R_3C_3)	100 (200 – 100 in R_1C_2)	100	100

	D_1	D_2	D_3	Supply
F_1	300 (3)	100 (4)	100 (4)	500
F_2	(8) (9)	300 (6)	(8) (7)	300
F_3	(0) (4)	(8) (6)	200 (5)	200
Demand	300	400	300	1,000

This solution is optimal since all Δ_{ij} values are either zero or positive. However alternative solution exists as at R_3C_1 the Δ_{ij} value is zero. For the other optimal solution, a loop is created as follows-

	D_1	D_2	D_3
F_1	300 -200	100	100 +200
F_2		300	
F_3	 +200		200 -200

Re-allocation table is as below-

	D_1	D_2	D_3
F_1	100	100	300
F_2		300	
F_3	200		

Minimum Cost-

Allocation	Alternative-I	Alternative-II
R_1C_1	900 (3 × 300)	300 (3 × 100)
R_1C_2	400 (4 × 100)	400 (4 × 100)
R_1C_3	400 (4 × 100)	1,200 (4 × 300)
R_2C_2	1,800 (6 × 300)	1,800 (6 × 300)
R_3C_3	1,000 (5 × 200)	---
R_3C_1	---	800 (4 × 200)
Total	4,500	4,500

10. Step 1

Reducing minimum from each column element (figure in '000s)-

	R_1	R_2	R_3	R_4
C_1	1	1	–	–
C_2	–	0	–	0
C_3	0	–	0	–
C_4	–	–	2	1

Step 2

Reducing minimum from each row element (figure in '000s)-

	R_1	R_2	R_3	R_4
C_1	0	0	–	–
C_2	–	0	–	0
C_3	0	–	0	–
C_4	–	–	1	0

Step 3

Draw the minimum number of lines to cover all zeros.

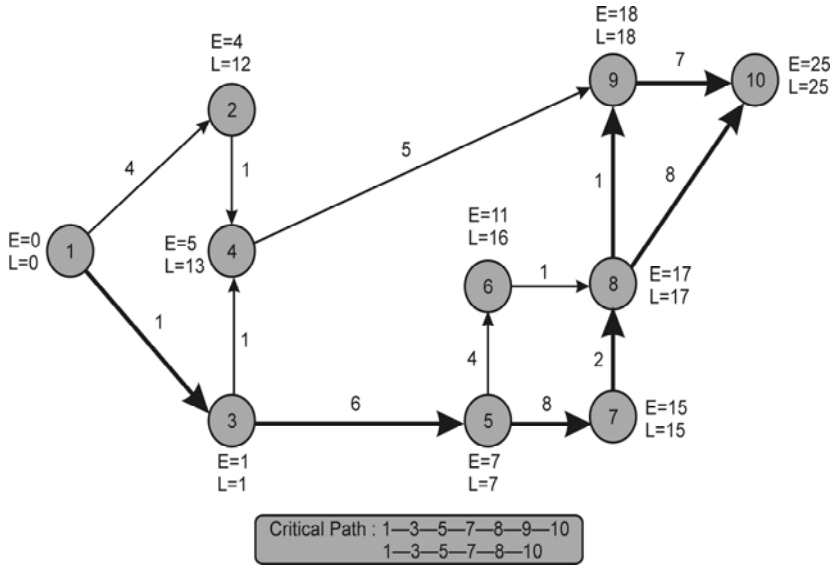
	R_1	R_2	R_3	R_4
C_1	0	0	–	–
C_2	–	0	–	0
C_3	0	–	0	–
C_4	–	–	1	0

The minimum number of lines covering all zeroes is 4 which is equal to the order of the matrix, hence, the above matrix will give the optimal solution. Specific assignments in this case are as shown below:

Company	Route	(₹)
C_1	R_1	4,000
C_2	R_2	4,000
C_3	R_3	2,000
C_4	R_4	5,000
	Total	15,000

The minimum cost is ₹ 15,000.

11. (i) The Arrow Diagram for the given data:



(ii) The Critical Paths are 1 – 3 – 5 – 7 – 8 – 9 – 10 and 1 – 3 – 5 – 7 – 8 – 10.

Total Project Duration is 25 Weeks.

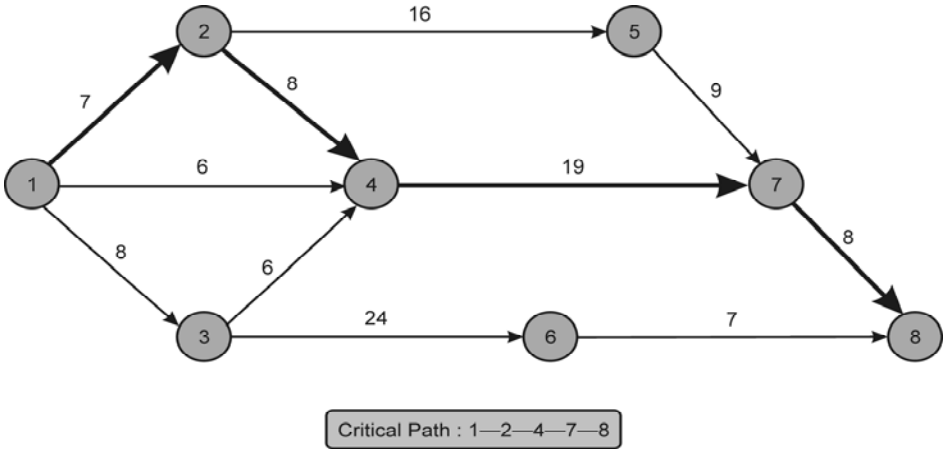
(iii) The Total, Free and Independent Floats are computed in the following table:

Activity	Duration	EST	EFT	LST	LFT	Slack of Tail Event	Slack of Head Event	Total Float	Free Float	Ind. Float
	D_{ij}	E_i	$E_i + D_{ij}$	$L_j - D_{ij}$	L_j	$L_i - E_i$	$L_j - E_j$	LST – EST	Total Float – Slack of Head Event	Free Float – Slack of Tail Event
1 – 2	4	0	4	8	12	0	8	8	0	0
1 – 3	1	0	1	0	1	0	0	0	0	0
2 – 4	1	4	5	12	13	8	8	8	0	0*
3 – 4	1	1	2	12	13	0	8	11	3	3
3 – 5	6	1	7	1	7	0	0	0	0	0
4 – 9	5	5	10	13	18	8	0	8	8	0
5 – 6	4	7	11	12	16	0	5	5	0	0
5 – 7	8	7	15	7	15	0	0	0	0	0

6 – 8	1	11	12	16	17	5	0	5	5	0
7 – 8	2	15	17	15	17	0	0	0	0	0
8 – 9	1	17	18	17	18	0	0	0	0	0
8 – 10	8	17	25	17	25	0	0	0	0	0
9 – 10	7	18	25	18	25	0	0	0	0	0

(*) Being negative, the independent float is taken to be equal to zero.

12. The *network* for the given problem:



Various Paths of the network are as follows:

Path	Duration (Days)
1 – 2 – 5 – 7 – 8	40 (7 + 16 + 9 + 8)
1 – 2 – 4 – 7 – 8	42 (7 + 8 + 19 + 8)
1 – 4 – 7 – 8	33 (6 + 19 + 8)
1 – 3 – 4 – 7 – 8	41 (8 + 6 + 19 + 8)
1 – 3 – 6 – 8	39 (8 + 24 + 7)

Critical Path is 1 – 2 – 4 – 7 – 8 with duration of 42 days.

The new formulation of the problem is as follows:

(i) Activities 1 – 2, 1 – 3 and 1 – 4 need 7 Days, 8 Days and 6 Days respectively as per Original Programme.

(ii) Activity 2 – 4 needs 12 Days (15 + 4 − 7) instead of Original Programme of 8 Days.

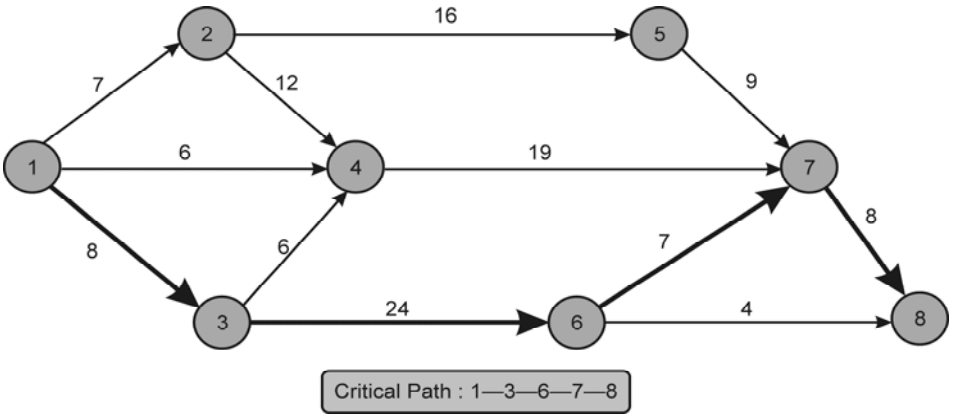
(iii) Activity 3 – 6 needs 24 Days (15 + 17 − 8) as per Original Schedule.

(iv) New Activity 6 – 7 needs 7 Days.

(v) Activity 6 – 8 needs lesser duration of 4 Days instead of Original Planned 7 Days.

(vi) Activities 2 – 5, 3 – 4, 4 – 7, 5 – 7, 7 – 8 need 16 Days, 6 Days, 19 Days, 9 Days, 8 Days respectively as per Original Schedule.

The *new network* based on the above listed activities will be as follows:



Various Paths of revised network are as follows:

Path	Duration (Days)
1 – 2 – 5 – 7 – 8	40 (7 + 16 + 9 + 8)
1 – 2 – 4 – 7 – 8	46 (7 + 12 + 19 + 8)
1 – 4 – 7 – 8	33 (6 + 19 + 8)
1 – 3 – 4 – 7 – 8	41 (8 + 6 + 19 + 8)
1 – 3 – 6 – 7 – 8	47 (8 + 24 + 7 + 8)
1 – 3 – 6 – 8	36 (8 + 24 + 4)

Critical Path is 1 – 3 – 6 – 7 – 8 with duration of 47 Days.

13. Random No. Coding

Monthly Cash Receipts (₹Crores)				Monthly Cash Disbursements (₹Crores)			
Cash	Probability	Cumulative	R.N.	Cash	Probability	Cumulat.	R.N.
30	0.20	0.20	00 – 19	33	0.15	0.15	00 – 14
42	0.40	0.60	20 – 59	60	0.20	0.35	15 – 34
36	0.25	0.85	60 – 84	39	0.40	0.75	35 – 74
99	0.15	1.00	85 – 99	57	0.25	1.00	75 – 99

Simulation Sheet

Month	Opening	Receipt		Total	Payment		Closing
	(₹ in Crores)	Random Numbers	(₹ in Crores)	(₹ in Crores)	Random Numbers	(₹ in Crores)	(₹ in Crores)
1	15	17	30	45	78	57	(12)
2	(12)	43	42	30	16	60	(30)
3	(30)	74	36	06	35	39	(33)
4	(33)	31	42	09	23	60	(51)
5	(51)	72	36	(15)	44	39	(54)
6	(54)	46	42	(12)	92	57	(69)
7	(69)	51	42	(27)	58	39	(66)
8	(66)	68	36	(30)	08	33	(63)
9	(63)	93	99	36	58	39	(3)
10	(3)	54	42	39	78	57	(18)
11	(18)	96	99	81	54	39	42
12	42	09	30	72	77	57	15

(i) In 12 months, the bank falls Short of Cash in 10 months to meet payment.

Thus, Probability of Shortfall is 0.83 (10/12).

(ii) Total Shortfall of ₹ 399 Crores over 10 months.

Average monthly Shortfall during 10 months is ₹39.9 Crores.

(iii) With an Overdraft Facility of ₹45 Crores, there will be a Shortfall in 5 months (4,5,6,7,8). Therefore, Probability will be 0.42 (5/12).

14. (i) Variable cost per unit that will be effected by learning and experience curve is ₹2,200 (₹4,400 – 50% of ₹ 4,400).

Let, 'r' be the learning curve rate.

No. of Batch (x)	Cumulative Average Cost *per unit* (y)
1	2,200
2	2,200 r
4	2,200 r^2

If 2,200 r^2 = ₹1,920 (₹4,120 – 50% of ₹ 4,400)

r^2 = 0.8727

r = 0.934

Therefore, Learning Curve Effect = 93% (rounded off)

(ii) Calculation of Optimum Price

Price *per unit* (₹)	Demand (units)	Variable Cost *per unit* * [W.N.] (₹)	Variable Cost *per unit* ** (₹)	Total Variable Cost *per unit* (₹)	Contribution *per unit* (₹)	Total Contribution (₹)
11,100.00	1,000	2,200.00	2,200.00	4,400.00	6,700.00	67,00,000
10,700.00	2,000	2,046.00	2,200.00	4,246.00	6,454.00	1,29,08,000
9,600.00	3,000	1960.86	2,200.00	4,160.86	5,439.14	1,63,17,420
8,700.00	4,000	1,902.78	2,200.00	4,102.78	4,597.22	1,83,88,880

(*) This represents variable cost part which is affected by the learning and experience curve effect.

(**) This represents variable cost part which is not affected by the learning and experience curve effect.

Working Note [W.N.]

Variable Cost *per unit*

Output in Batches (x)	Average Cost of the First Unit (a)	$x^{-0.1047}$	Cumulative Average Cost *per unit* (y)
1	2,200	1.0000	2,200.00
2	2,200	0.9299	2,046.00
3	2,200	0.8913	1,960.86
4	2,200	0.8649	1,902.78

$y = ax^b$

Where,

y = Cumulative average unit costs

a = Average cost of the first unit

x = Cumulative number of batches

b = Log of learning ratio ÷ Log of 2

= log 0.93 ÷ log 2

= −0.0315 ÷ 0.3010

= −0.1047

15. Statement Showing Balance Scorecard Perspectives for Different Business Sectors

	Health Care	Airlines	Banking
Weekly Patient Complaints	Internal Operating Efficiency	---	---
Patient Satisfaction Survey	Customer Service & Satisfaction	---	---
Flight Cancellation Rate	---	Customer Service & Satisfaction	---
On-time Performance of an Airline	---	Internal Operating Efficiency	---
Number of Grants Awarded to a Healthcare unit	Learning and Growth	---	---
Outstanding Loan Balances / Deposit Balances of a Banking Company	---	---	Financial Strength
Employee Turnover Rate of a Healthcare unit	Learning and Growth	---	---
Patient Referral Rate	Customer Service & Satisfaction	---	---
Non-interest Income of a Banking Company	---	---	Financial Strength
Lost of Bag Reports per 5,000 Passengers	---	Customer Service & Satisfaction	---

16. Selling Costs would include *all costs necessary to secure customer orders and get the finished product into the hands of customers*.

The responsibility of Mr. Philips as described in the problem is coordination of shipments of Diesel Engines from the factory to distribution warehouses and same would appear to fall in this class. Accordingly, the finance controller is correct in his view point that the salary cost should be classified as selling cost.

17. JIT Inventory System

"For successful operation of JIT inventory system, the suppliers chosen must be willing to make frequent deliveries in small lots. Rather than deliver a week's or a month's material at one time, suppliers must be willing to make deliveries several times a day and in the exact quantities specified by the buyer."

It is described in the problem that suppliers are not willing to

- make frequent deliveries and
- make supplies in the exact quantities as required

Accordingly Mr. Brian's doubt is correct on successful implementation of JIT System.

18. In linear programming problem, *coefficients in the objective function and the constraint equations must be completely known* and they should not change during the period of study. They should be known constraints. In practical situation, it may not be possible to state all coefficients in the objective function and constraints with certainty. Furthermore, these coefficients may actually be random variables, each with an underlying probability distribution for the values. Such problems cannot be solved using linear programming.

19. Alternate Solution in 'Transportation Problem'

The Δ_{ij} matrix or $C_{ij} - (u_i + v_j)$ matrix, where C_{ij} is the cost matrix and $(u_i + v_j)$ is the cell evaluation matrix for unallocated cell. The Δ_{ij} matrix has one or more 'Zero' elements, indicating that, if that cell is brought into the solution, the optimum cost will not change though the allocation changes.

Thus, a 'Zero' element in the Δ_{ij} matrix reveals the possibility of an alternative solution.

20. Committed Cost / Discretionary Cost

S. No.	Fixed Costs	Committed / Discretionary
(i)	Depreciation on assets	Committed Cost
(ii)	Advertising	Discretionary Cost
(iii)	Research	Discretionary Cost
(iv)	Employees Training	Discretionary Cost