

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING
QUESTIONS

Activity Based Costing

1. Bank of NZ operated for years under the assumption that profitability can be increased by increasing Rupee volumes. But that has not been the case. Cost analysis has revealed the following:

Activity	Activity Cost (₹)	Activity Driver	Activity Capacity
Providing ATM Service	1,00,000	No. of Transactions	2,00,000
Computer Processing	10,00,000	No. of Transactions	25,00,000
Issuing Statements	8,00,000	No. of Statements	5,00,000
Customer Inquiries	3,60,000	Telephone Minutes	6,00,000

The following annual information on three products was also made available:

Activity Driver	Checking Accounts	Personal Loans	Gold Visa
Units of Product	30,000	5,000	10,000
ATM Transactions	1,80,000	0	20,000
Computer Transactions	20,00,000	2,00,000	3,00,000
Number of Statements	3,00,000	50,000	1,50,000
Telephone Minutes	3,50,000	90,000	1,60,000

Required

- (i) Calculate rates for each activity.
- (ii) Using the rates computed in requirement (i), calculate the cost of each product.

Value Added/ Non -Value Added Activities

2. Queensland Furniture (QF) manufactures high-quality wooden doors within the forests of Queensland since 1919. Management is having emphasize on creativity, engineering, innovation and experience to provide customers with the door they desire, whether it is a standard design or a one-of-a-kind custom door. The following information pertains to operations during Jan:

Processing time	9.0 hrs.*	Waiting time	6.0 hrs.*
Inspection time	1.5 hr.*	Move time	7.5 hrs.*
Units per batch	60 units		

(*) average time per batch

Required

Compute the following operational measures:

- (i) Average non-value-added time per batch
- (ii) Average value added time per batch
- (iii) Manufacturing cycle efficiency
- (iv) Manufacturing cycle time

Shut Down or Continue

3. If AICI Limited operates its plant at normal capacity it produces 2,00,000 units from the plant 'C'. The unit cost of manufacturing at normal capacity is as under:

	₹
Direct material.....	65
Direct labour.....	30
Variable overhead.....	33
Fixed overhead.....	<u>7</u>
	135

Direct labour cost represents the compensation to highly-skilled workers, who are permanent employees of the company. The company cannot afford to lose them. One labour hour is required to complete one unit of the product.

The company sells its product for ₹ 200 per unit with variable selling expenses of ₹ 16 per unit. The company estimates that due to economic down turn, it will not be able to operate the plant at the normal capacity, at least during the next year. It is evaluating the feasibility of shutting down the plant temporarily for one year.

If it shuts down the plant, the fixed manufacturing overhead will be reduced to ₹ 1,25,000. The overhead costs are incurred at a uniform rate throughout the year. It is also estimated that the additional cost of shutting down will be ₹ 50,000 and the cost of re-opening will be ₹ 1,00,000.

Requiredf

Calculate the minimum level of production at which it will be economically beneficial to continue to operate the plant next year if 50% of the labour hours can be utilized in another activity, which is expected to contribute at the rate of ₹ 40 per labour hour. The additional activity will relate to a job which will be off-loaded by a sister company only if the company decides to shut down the plant.

(Assume that the cost structure will remain unchanged next year. Ignore income tax and time value of money)

Labour Related Decision

4. If DBC Ltd. is producing a component called 'DBC'. Estimated costs are:

	Fixed Cost per year (₹ '000)	Variable Cost per 'DBC' (₹)
Production	32,000	3,600
Distribution	2,000	200

Direct labour costs are 40% of the variable production costs. In the production department machining and assembling of 'DBC', 90 men work 8 hours per day for 300 days in a year. Each worker can machine and assemble 1 'DBC' per uninterrupted 180 minutes time frame. In each 8 hours working day, 20 minutes are allowed for coffee-break, 30 minutes on an average for training and 22 minutes for supervisory instructions. Besides 10% of each day is booked as idle time to cover checking in and checking out changing operations, getting materials and other miscellaneous matters.

DBC Ltd. has been facing industrial relations problem as the workers of company have a very strong union. Company is faced with the possibility of a strike by direct production workers engaged on the assembly of 'DBC'. The trade union is demanding an increase of 15%, back-dated from the beginning of financial year, but the company expects that if a strike does take place, it will last 25 Days after which the union will settle for an increase of 10% similarly back-dated. The only product of the company is being sold at ₹ 6,000.

If the strike takes place, Sales of 1,300 'DBC' would be lost. The balance that would ordinarily have been produced during the strike period could, however be sold, but these 'DBC' would have to be made up in overtime working which would be at an efficiency rate of 90% of normal. This would entail additional fixed cost of ₹1,00,000 and wage payments at time and one-half.

Required

Give necessary advice to the management to allow the strike to go ahead or to accept the union's demand.

Sales or Further Processing Decision

5. If A process industry unit manufactures three joint products: L, B and G. G has no realisable value unless it undergoes further processing after the point of separation. The cost details of G are as follows:

	p.u.
	₹
Upto point of separation	
Marginal cost.....	30

Fixed Cost.....	20
After point of separation	
Marginal cost.....	15
Fixed cost.....	<u>5</u>
	70

G can be sold at ₹ 37 per unit and no more.

Required

- (i) Would you recommend production of G?
- (ii) Would your recommendation be different if L, B and G are not joint products?

CVP Analysis

6. The profit for the year of Garena Ltd. works out to 12.5% of the capital employed and the relevant figures are as under:

Sales.....	₹ 5,00,000
Direct Materials.....	₹ 2,50,000
Direct Labour.....	₹ 1,00,000
Variable Overheads.....	₹ 40,000
Capital Employed.....	₹ 4,00,000

The new Sales Manager who has joined the company recently estimates for next year a profit of about 23% on capital employed, provided the volume of sales is increased by 10% and simultaneously there is an increase in Selling Price of 4% and an overall cost reduction in all the elements of cost by 2%.

Required

Find out by computing in detail the cost and profit for next year, whether the proposal of Sales Manager can be adopted.

Cost Plus/ Mark-up Pricing

7. JTC Ltd. is specialists in the manufacture of sports goods. They manufacture croquet mallets but purchase the wooden balls, iron arches and stakes required to complete a croquet set.

Mallets consist of a head and handle. Handles use 2.5 board feet per handle at ₹ 50 per board foot. Spoilage loss is negligible for the manufacture of handles. Heads frequently split and create considerable scrap.

A head requires 0.40 board feet of high quality lumber costing ₹ 60 per board foot. Spoilage normally works out to 20% of the completed heads. 4% of the spoiled heads can be salvaged and sold as scrap at ₹ 10 per spoiled head.

In the department machining and assembling the mallets, 6 men work 8 hours per day for 25 days in a month. Each worker can machine and assemble 12 mallets per uninterrupted 40 minutes time frame. In each 8 hours working day, 15 minutes are allowed for coffee-break, 8 minutes on an average for training and 9 minutes for supervisory instructions. Besides 10% of each day is booked as idle time to cover checking in and checking out changing operations, getting materials and other miscellaneous matters. Workers are paid at a comprehensive rate of ₹ 6 per hour.

The department is geared to produce 20,000 mallets per month and the monthly expenses of the department are as under:

	(₹)
Finishing and painting of the mallets.....	20,000
Lubricating oil for cutting machines.....	600
Depreciation for cutting machine.....	1,400
Repairs and maintenance.....	200
Power to run the machines.....	400
Plant Manager's salary.....	9,400
Other overheads allocated to the department.....	60,000

Required

As the mallets are machined and assembled in lots of 250, prepare a total cost sheet for one lot and advise the management on the selling price to be fixed per mallet in order to ensure a minimum 33.33% margin on the selling price.

Return on Investment Pricing

8. The cost of production and sales of 80,000 units per annum of product 'I' are:

Material	₹ 4,80,000	Labour	₹ 1,60,000
Variable Overhead	₹ 3,20,000	Fixed overhead	₹ 5,00,000

The fixed portion of capital employed is ₹12 lacs and the varying portion is 50% of sales turnover.

Required

Determine the selling price per unit to earn a return of 12% net on capital employed (net of Tax @ 40%).

Profit Maximisation Model

9. APV Ltd. has developed a new product which is about to be launched into the market. The variable cost of selling the product is ₹ 17 per unit. The marketing department has

estimated that at a sale price of ₹ 25, annual demand would be 10,000 units. However, if the sale price is set above ₹ 25, sales demand would fall by 500 units for each ₹ 0.50 increase above ₹ 25. Similarly, if the price is below ₹ 25, demand would increase by 500 units for each ₹ 0.50 stepped reduction in price below ₹ 25.

Required

Determine the price which would maximise APV Ltd.'s profit in the next year.

Break Even Point (Batches)

10. BOSH India Ltd. is a leading Home Appliances manufacturer. The company uses just-in-time manufacturing process, thereby having no inventory. Manufacturing is done in batch size of 100 units which cannot be altered without significant cost implications. Although the products are manufactured in batches of 100 units, they are sold as single units at the market price. Due to fierce competition in the market, the company is forced to follow market price of each product. The following table provides the financial results of its four unique products:

	B	O	S	H	
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	Total
	(₹)	(₹)	(₹)	(₹)	(₹)
Revenue	26,00,000	45,20,000	42,40,000	32,00,000	145,60,000
Less: Material Cost	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Less: Labour Cost	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Less: Overheads	8,00,000	7,80,000	3,20,000	12,00,000	31,00,000
Profit / (Loss)	4,00,000	(1,60,000)	7,60,000	(2,00,000)	8,00,000

Since, company is concerned about loss in manufacturing and selling of two products so, it has approached you to clear picture on its products and costs. You have conducted a detailed investigation whose findings are below:

The overhead absorption rate of ₹ 2 per machine hour has been used to allocate overheads into the above product costs. Further analysis of the overhead cost shows that some of it is caused by the number of machine hours used, some is caused by the number of batches produced and some are product specific fixed overheads that would be avoided if the product were discontinued. Other general fixed overhead costs would be avoided only by the closure of the factory. Numeric details are summarized below:

	₹	₹
Machine hour related.....		6,20,000
Batch related		4,60,000

Product specific fixed overhead:

B.....	10,00,000	
O.....	1,00,000	
S.....	2,00,000	
H.....	<u>1,00,000</u>	14,00,000
General fixed overheads.....		<u>6,20,000</u>
		31,00,000

The other information is as follows:

	B	O	S	H	Total
Machine Hours	4,00,000	3,90,000	1,60,000	6,00,000	15,50,000
Labour Hours	1,00,000	2,60,000	1,60,000	1,50,000	6,70,000

Required

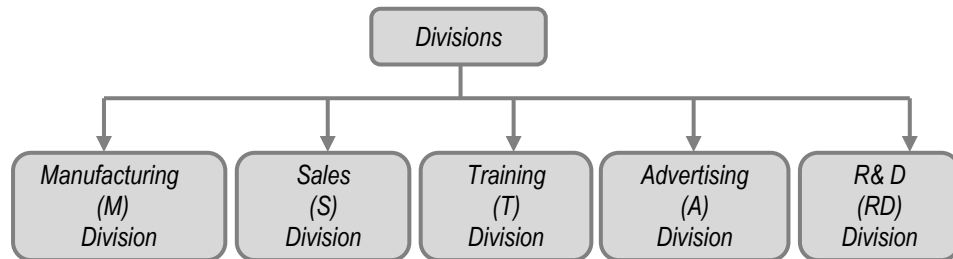
- Prepare a profitability statement that is more useful for decision making than the profit statement prepared by BOSH India Ltd.
- Calculate the break-even volume in batches and also in approximate units for Product 'B'.

Pricing Strategy

- State the appropriate pricing policy in each of the following independent situations:
 - 'W' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.
 - 'X' is a new product for the company, but not for the market. X's success is crucial for the company's survival in the long term.
 - 'Y' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the usual sources of capital have uncertainties blocking them.
 - 'Z' is a perishable item, with more than 80% of its shelf life over.

Budget – Zero Based Budgeting

- Air Communication Limited is a state-owned large public company in the telecommunications sector. One of its main planning and control tools is the preparation and use of traditional annual budgets. Its divisional structure is as under:



Division T, A and RD incur substantial amount on discretionary expenses.

Required

Identify the possibilities of introducing a Zero Based Budgeting system for Division T, A and RD.

Budget – Missing Figure

13. Following information are extracted from monthly budgets of JIT Ltd.

	November	December
Beginning WIP Inventory	36,000	???
Beginning Finished Goods Inventory	44,000	???
Variable Cost of Goods Sold	1,23,000	???
Direct Material Usage	50,000	56,000
Direct Labour	53,100	69,000
Variable Overhead	25,000	29,000
Variable Cost of Goods Manufactured	1,09,000	1,14,800
Ending WIP Inventory	???	???
Ending Finished Goods Inventory	???	45,000

Required

Find out missing figures.

Standard Costing – Profit Reconciliation

14. ANZ Ltd. has provided the following summarized results for two years:

	Year ended (₹ In lacs)	
	31-03-2016	31-3-2017
Sales	3,000	3,277.50
Material	2,000	2,357.50
Variable overheads	500	525.00

Fixed overheads	300	367.50
Profit	200	27.50

During the year ended 31-3-2017 sale price has increased by 15% whereas material and overhead prices have increased by 15% and 5% respectively.

Required

- Analyse the variances of revenue and each element of cost over the year in order to bring out the reasons for the change in profit.
- Present a profit reconciliation statement starting from profits in 2015-16 showing the factors responsible for the change in profits in 2016-17.

Note – Consider ‘Contribution Variances’ for solving this question.

Standard Costing

- Natural Spices manufactures and distributes high-quality spices to gourmet food shops and top quality restaurants. Gourmet and high-end restaurants pride themselves on using the freshest, highest-quality ingredients.

Natural Spices has set up five state of the art plants for meeting the ever growing demand. The firm procures raw material directly from the centers of produce to maintain uniform taste and quality. The raw material is first cleaned, dried and tested with the help of special machines. It is then carefully grounded into the finished product passing through various stages and packaged at the firm's ultraclean factory before being dispatched to customers.

The following variances pertain to last week of operations, arose as a consequence of management's decision to lower prices to increase volume.

Sales Volume Variance	18,000 (F)
Sales Price Variance	14,000 (A)
Purchase Price Variance	10,000 (F)
Labour Efficiency Variance	11,200 (F)
Fixed Cost Expenditure Variance	4,400 (F)

Required

- Identify the ‘Critical Success Factors’ for Natural Spices.
 - Evaluate the management's decision with the ‘Overall Corporate Strategy’ and ‘Critical Success Factors’.
- Great Southern 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 2017-18 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 Great Southern 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

- Calculate the unit quotation price of the Wagon that will maximise Great Southern Company Ltd.'s profit for the financial year 2017-18.
- 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 $MR = a - 2bQ$]

Balanced Scorecard

- Classify the following measures under appropriate categories in a Balanced Scorecard for a banking company which excels in its home loan products:
 - A new product related to life insurance is being considered for a tie up with the successful housing loan disbursements.
e.g. every housing loan applicant to be advised to take a life policy or compelled to take a fire insurance policy.
 - How different sectors of housing loans with different interest rates have been sanctioned, their volumes of growth in the past 4 quarters.
 - How many days are taken to service a loan, how many loans have taken longer, what additional loans are to be released soon, etc.

Linear Programming – Formulation

18. The owner of Fancy Goods Shop is interested to determine, how many advertisements to release in the selected three magazines M, N and O. His main purpose is to advertise in such a way that total exposure to principal buyers of his goods is maximized. Percentages of readers for each magazine are known. Exposure in any particular magazine is the number of advertisements released multiplied by the number of principal buyers. The following data are available:

Particulars	Magazines		
	M	N	O
Readers	1.0 Lakhs	0.6 Lakhs	0.4 Lakhs
Principal buyers	20%	15%	8%
Cost per advertisement	₹ 8,000	₹ 6,000	₹ 5,000

The budgeted amount is at the most ₹1.0 lakh for the advertisements. The owner has already decided that magazine M should have no more than 15 advertisements and that N and O each gets at least 8 advertisements.

Required

Formulate a Linear Programming model for this problem.

Assignment Problem – Minimisation

19. A factory is going to modify of a plant layout to install four new machines X_1 , X_2 , X_3 and X_4 . There are 5 vacant places P, Q, R, S and T available. Because of limited space machine X_2 cannot be placed at R and X_3 cannot be placed at P. The cost of locating machine to place in Rupees is shown below:

(₹)

	P	Q	R	S	T
X_1	18	22	30	20	22
X_2	24	18	--	20	18
X_3	--	22	28	22	14
X_4	28	16	24	14	16

Required

Determine the optimal assignment schedule in such a manner that the total costs are kept at a minimum.

Missing Figures & Network

20. The number of days of total float (TF), earliest start times (EST) and duration in days are given for some of the following activities.

Activity	TF	EST	Duration
1-2	0	0	???
1-3	2	???	???
1-4	5	???	???
2-4	0	4	???
2-5	1	???	5
3-6	2	12	???
4-6	0	12	???
5-7	1	???	???
6-7	???	23	???
6-8	2	???	???
7-8	0	23	???
8-9	???	30	6

Required

- Find the??? Figures.
 - Draw the network.
 - List the paths with their corresponding durations and state when the project can be completed.
21. Finance Controller of Dunk Limited has drawn the following projections with probability distribution:

Raw Material		Wages & Other Variable Overheads		Sales	
₹ in '000	Probability	₹ in 000	Probability	₹ in 000	Probability
08 – 10	0.2	11 – 13	0.3	34 – 38	0.1
10 – 12	0.3	13 – 15	0.5	38 – 42	0.3
12 – 14	0.3	15 – 17	0.2	42 – 46	0.4
14 – 16	0.2			46 – 50	0.2

Opening cash balance is ₹ 40,000 and fixed cost is estimated at ₹ 15,000 per month.

Required

Simulate cash flow projection and expected cash balance at the end of the sixth month. Use the following single digit random numbers.

Raw Material	4 3 1 0 4 6
Wages & Other Variable Overheads	2 7 9 1 8 9
Sales	0 6 6 0 2 8

Learning Curve

22. T Aviation Ltd, supplier of automation systems and equipment, has just invented a new part 'T'. New part has a budgeted total profit of ₹ 75,000 from the first 256 parts. The time taken to produce the first part was 112.50 hours. The labour rate is ₹ 20 per hour. A 90% learning curve is expected to apply indefinitely.

Required

Calculate the sensitivity of the budgeted total profit from the first 256 parts to changes in the learning rate.

Miscellaneous

23. Indicate 6 activity drivers in respect of each of the following activity cost pools:
- (i) Human Resources Cost
 - (ii) Accounting Costs
24. Which of the following statements are VALID in respect of flexible budgeting.
- (i) A flexible budget is one which changes from year to year.
 - (ii) It is a budget which departmental heads can change at will.
 - (iii) It is a system of budgeting which will recast the budgets because of a change in fixed expenses.
 - (iv) It is a system of budgeting under which budgets are recast quickly for changes in the volume of activity.
 - (v) It involves careful differentiation between fixed and variable expenses.
25. State whether the following statements are VALID or INVALID.
- (i) When price reductions are introduced to increase sales revenue, the revenue line will be a straight line.
 - (ii) In fixing selling prices, volume consideration should be taken into account so that fuller utilisation of plant capacity is achieved.
 - (iii) There is no price policy in perfect competition.
 - (iv) The rate of return to be earned by factory should cover the risk involved in business.
 - (v) Survival and progress of a firm depend on its ability to maintain and replace, whenever necessary, its fixed assets.

SUGGESTED ANSWERS/HINTS

1. Statement Showing "Activity Rate"

Activity	Activity Cost [a] (₹)	Activity Driver	No. of Units of Activity Driver [b]	Activity Rate [a] / [b] (₹)
Providing ATM Service	1,00,000	No. of ATM Transactions	2,00,000	0.50
Computer Processing	10,00,000	No. of Computer Transactions	25,00,000	0.40
Issuing Statements	8,00,000	No. of Statements	5,00,000	1.60
Customer Inquiries	3,60,000	Telephone Minutes	6,00,000	0.60

Statement Showing "Cost of Product"

Activity	Checking Accounts (₹)	Personal Loans (₹)	Gold Visa (₹)
Providing ATM Service	90,000 (1,80,000 tr. × ₹ 0.50)	---	10,000 (20,000 tr. × ₹ 0.50)
Computer Processing	8,00,000 (20,00,000 tr. × ₹ 0.40)	80,000 (2,00,000 tr. × ₹ 0.40)	1,20,000 (3,00,000 tr. × ₹ 0.40)
Issuing Statements	4,80,000 (3,00,000 st. × ₹ 1.60)	80,000 (50,000 st. × ₹ 1.60)	2,40,000 (1,50,000 st. × ₹ 1.60)
Customer Inquiries	2,10,000 (3,50,000 min. × ₹ 0.60)	54,000 (90,000 min. × ₹ 0.60)	96,000 (1,60,000 min. × ₹ 0.60)
Total Cost [a]	₹ 15,80,000	₹ 2,14,000	₹ 4,66,000
Units of Product [b]	30,000	5,000	10,000
Cost of each Product [a] / [b]	52.67	42.80	46.60

2. (i) Average Non Value Added Time *per batch*

$$\begin{aligned}
 &= \text{Inspection Time} + \text{Waiting Time} + \text{Move Time} \\
 &= 1.5 \text{ hr.} + 6.0 \text{ hrs.} + 7.5 \text{ hrs.} \\
 &= 15 \text{ hrs.}
 \end{aligned}$$

(ii) Average Value Added Time *per batch*

$$\begin{aligned}
 &= \text{Processing Time} \\
 &= 9 \text{ hrs.}
 \end{aligned}$$

(iii) Manufacturing Cycle Efficiency

$$= \frac{\text{Processing Time}}{\text{Processing Time} + \text{Inspection Time} + \text{Waiting Time} + \text{Move Time}}$$

$$= \frac{9.0 \text{ hrs.}}{9.0 \text{ hrs.} + 1.5 \text{ hr.} + 6.0 \text{ hrs.} + 7.5 \text{ hrs.}}$$

$$= 37.5\%$$

(iv) Manufacturing Cycle Time

$$= \frac{\text{Total Production Time}}{\text{Units per Batch}}$$

$$= \frac{24 \text{ hrs.}}{60 \text{ units}}$$

$$= 0.40 \text{ hrs. per unit}$$

3. Contribution per unit

Particulars	(₹)
Selling Price	200
Variable Cost (₹ 65 + ₹ 33 + ₹ 16)	114
Contribution per unit (Excluding direct labour, considered irrelevant and fixed)	86

Savings and Earnings if the Plant is Shut Down

Particulars	(₹)
Savings in Fixed Cost (₹ 14,00,000* – ₹ 1,25,000)	12,75,000
Contribution from Alternate Activity (₹ 40 × 50% of 2,00,000 hrs)	40,00,000
Shutting Down and Reopening Cost (₹ 50,000 + ₹ 100,000)	(1,50,000)
Total	51,25,000

* [2,00,000 units × ₹ 7]

Indifference Point: ₹ 51,25,000 / ₹ 86 = 59,593 units

Minimum level of production to justify continuation = 59,594 units

4. Alternative-1 with No Strike: (Refer W.N.-2, 3)

Cost of Settlement is 15% Increase i.e. ₹ 216 per unit

Annual Cost of Settlement

$$= 54,000 \text{ units} \times ₹ 216$$

$$= ₹ 1,16,64,000$$

Alternative 2 i.e. if Strike Goes Ahead: (Refer W.N.-1, 2, 3)

Extra Cost	(₹)
Annual Incremental Labour Cost (Ex. Strike Days Production) [$\{54,000 \text{ units} - (25 \text{ Days} \times 180 \text{ units per Day})\} \times ₹144.00$]	71,28,000
Loss of Contribution <i>due to loss of sales</i> [$1,300 \text{ units} \times ₹ 2,200$]	28,60,000
Incremental Labour Cost for Balance 3,200 units [$(25 \text{ Days} \times 180 \text{ units per Day}) - 1,300 \text{ units} \} \times ₹144.00$]	4,60,800
Overtime Premium [$3,200 \text{ units} \times 1,584 \times 0.5$]	25,34,400
Payment for Efficiency [$3,200 \text{ units} \times 1/9 \times 1,584 \times 1.5$]	8,44,800
Additional Fixed Cost	1,00,000
	1,39,28,000

If there is no strike, it will yield a financial benefit of ₹ 22,64,000 (₹ 1,39,28,000 – ₹ 1,16,64,000). Management should accept union's demand.

Working Note**(1) Statement Showing Contribution per unit of 'DBC'**

	(₹)
Selling Price	6,000
Less: Variable Costs:	
Labour Cost	1,440
Production Ex. Wages ($₹3,600 - ₹1,440$)	2,160
Distribution	200
Contribution	2,200

(2) Calculation of Labour Cost

Direct Labour (40% of production costs of ₹3,600)	= ₹1,440 per unit
With 15% Increase, Revised Labour Cost ($₹1,440 + ₹216$)	= ₹1,656
With 10% Increase, Revised Labour Cost ($₹1,440 + ₹144$)	= ₹1,584

(3) Statement Showing Budgeted Production

Total Time in a Day: (8hrs. \times 60 minutes)	= 480 minutes
Less: Idle Time	= 48 minutes
Coffee Break	= 20 minutes
Instructions	= 22 minutes

Training = 30 minutes
 Productive Time *per day* = 360 minutes
 Therefore, 'DBC' to be produced per man per day: $(360/180 \times 1) = 2$ units

Since 'DBC' are produced at the rate of 2 'DBC' per man day, so total yearly production will be 54,000 units (2 units \times 90 men \times 300 days) of 'DBC'



This problem has been solved by comparing 'Existing Situation' with both 'Alternatives (Strike or Non-Strike)' *independently*. However, this problem can also be solved by comparing 'Alternatives (Strike or Non-Strike)' *only* and final answer would be the same. Students may also solve this problem by taking 'Total Approach' instead of 'Incremental Approach'.

5. (i) Cost incurred on Product 'G' *upto point of separation* is irrelevant for decision making as Product 'G' is a Joint Product. Joint Products are the result of same raw material & same process Operations.

Cost incurred *after point of separation* will be considered for decision making as *specifically* incurred for Product 'G'.

After further processing Product 'G' will *contribute* ₹17 per unit toward 'Joint Production Cost'.

Calculation is as follows

Particulars	Amount (₹)
Selling Price <i>per unit</i>	37.00
Less: Cost after separation:	
Marginal Cost <i>per unit</i>	15.00
Fixed Cost <i>per unit</i>	5.00
Contribution toward 'Joint Production Cost'	

Hence, *further processing* of Product 'G' is recommended.

- (ii) If Product 'G' is not a joint product with same cost structure. In this case there will be *negative contribution* on production of Product 'G'. The calculation is as follows—→

Particulars	Amount (₹)
Selling Price <i>per unit</i>	37.00
Less: Marginal Cost (₹ 30 + ₹ 15)	45.00
Contribution	(8.00)

Hence, production of Product 'G' will not be recommended.

6. Statement Showing "Cost and Profit for the Next Year"

Particulars	Existing Volume, etc.	Volume, Costs, etc. after 10% Increase	Estimated Sale, Cost, Profit, etc.*
	(₹)	(₹)	(₹)
Sale	5,00,000	5,50,000	5,72,000
Less: Direct Materials	2,50,000	2,75,000	2,69,500
Direct Labour	1,00,000	1,10,000	1,07,800
Variable Overheads	40,000	44,000	43,120
Contribution	1,10,000	1,21,000	1,51,580
Less: Fixed Cost [#]	60,000	60,000	58,800
Profit	50,000	61,000	92,780

(*) for the next year after increase in selling price @ 4% and overall cost reduction by 2%.

(#) Fixed Cost = Existing Sales – Existing Marginal Cost – 12.5% on ₹ 4,00,000
 = ₹ 5,00,000 – ₹ 3,90,000 – ₹ 50,000
 = ₹ 60,000

Percentage Profit on Capital Employed equals to 23.19% $\left(\frac{₹92,780}{₹4,00,000} \times 100 \right)$

Since the Profit of ₹ 92,780 is more than 23% of capital employed, the proposal of the Sales Manager can be adopted.

7. 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 (8 Hrs × ₹ 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

- 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.
- | | | |
|--------------------------|------------|--------------------|
| Total Time in a day | (8 × 60) | 480 minutes |
| Less: Idle Time | 48 minutes | |
| Coffee Break | 15 minutes | |
| Instructions | 9 minutes | |
| Training | 8 minutes | <u>80 minutes</u> |
| Productive Time per day: | | <u>400 minutes</u> |

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 be 18,000 mallets (120 units × 6 men × 25 days).
- Finishing and painting overheads are assumed to be variable for the production of 20,000 mallets.
- All the other expenses are fixed and are to be absorbed by 18,000 (120 units × 6 men × 25 Days) mallets of monthly production.
- 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'

$$\begin{aligned}
 \text{Since Total Sales} &= \text{Total Cost} + \text{Profit} \\
 80,000 K &= 14,60,000 + 20\% (12,00,000 + 0.5 \times 80,000K) \\
 \text{Or, } 80,000 K &= 14,60,000 + 2,40,000 + 8,000K \\
 \text{Or, } 72,000 K &= 17,00,000 \\
 \text{Or, 'K'} &= \frac{17,00,000}{72,000} \\
 &= ₹ 23.61
 \end{aligned}$$

Hence Selling Price per unit will be ₹ 23.61.

9. **Statement of Total Contribution**

Sales Price p.u. (₹)	Variable Cost p.u. (₹)	Contribution p.u. (₹)	Sales Volume (units) (₹)	Total Contribution (₹)
(1)	(2)	(3) = (1) - (2)	(4)	(5) = (3) × (4)
25.00	17.00	8.00	10,000	80,000
24.50	17.00	7.50	10,500	78,750
24.00	17.00	7.00	11,000	77,000
25.50	17.00	8.50	9,500	80,750
26.00	17.00	9.00	9,000	81,000
27.00	17.00	10.00	8,000	80,000
27.50	17.00	10.50	7,500	78,750

From the above statement it is quite apparent that the contribution would be maximum at a sale price of ₹ 26 per unit and sales demand of 9,000 units.



This problem can also be solve by using 'Profit Maximisation' model formula.

10. (i) **Statement Showing "Profitability of BOSH India Ltd"**

	Products (Amount in ₹)				
	B	O	S	H	Total
Sales	26,00,000	45,20,000	42,40,000	32,00,000	1,45,60,000
Direct Materials	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Direct Wages	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Overheads (W.N.2):					
Machine Related	1,60,000	1,56,000	64,000	2,40,000	6,20,000
Batch Related	1,00,000	1,30,000	80,000	1,50,000	4,60,000
Contribution	9,40,000	3,34,000	9,36,000	6,10,000	28,20,000
Product Specific Fixed Overheads	10,00,000	1,00,000	2,00,000	1,00,000	14,00,000
Gross Profit	(60,000)	2,34,000	7,36,000	5,10,000	14,20,000
General Fixed Overheads					6,20,000
Profit					8,00,000

(ii) Break-even Point

$$\begin{aligned}
 \text{Total Sale Value of Product 'B'} &= ₹ 26,00,000 \\
 \text{Total Contribution of Product 'B'} &= ₹ 9,40,000 \\
 \text{Specific Fixed Overheads (Product 'B')} &= ₹ 10,00,000 \\
 \text{Break-even Sales (₹)} &= \frac{\text{Specific Fixed Cost}}{\text{Total Contribution}} \times \text{Total Sales Value} \\
 &= \frac{₹ 10,00,000}{₹ 9,40,000} \times ₹ 26,00,000 \\
 &= ₹ 27,65,957.45 \\
 \text{Break-even Sales (units)} &= \frac{₹ 27,65,957.45}{₹ 13.00} \\
 &= 2,12,766 \text{ units}
 \end{aligned}$$

However, production must be done in batches of 100 units. Therefore, **2,128 batches** are required for break even. Due to the production in batches, 34 units (2,128 batches × 100 units – 2,12,766 units) would be produced extra. These 34 units would add extra cost ₹ 282.20 (34 units × ₹ 8.3*). Accordingly, break-even units as calculated above will increase by 22 units $\left(\frac{₹ 282.20}{₹ 13.00} \right)$.

$$(*) \left(\frac{₹ 6,00,000 + ₹ 8,00,000 + ₹ 1,60,000 + ₹ 1,00,000}{2,00,000 \text{ units}} \right)$$

Break-even units of product 'B' is 2,12,788 units (2,12,766 units + 22 units).

Workings**W.N. 1****Calculation Showing Overhead Rates**

Overhead's Related Factors	Overhead Cost (₹) [a]	Total No. of Units of Factors [b]	Overhead Rate (₹) [a] / [b]
Machining Hours	6,20,000	15,50,000 hrs.	0.40
Batch Production	4,60,000	9,200 batches	50.00

W.N.-2

Statement Showing - Overhead Costs Related to Product

Particulars	B	O	S	H
Machining hrs. related overheads	₹ 1,60,000 (4,00,000 hrs × ₹0.40)	₹ 1,56,000 (3,90,000 hrs × ₹0.40)	₹ 64,000 (1,60,000 hrs × ₹0.40)	₹ 2,40,000 (6,00,000 hrs × ₹0.40)
Batch related overheads	₹1,00,000 2,000 batches × ₹ 50)	₹1,30,000 (2,600 batches × ₹50)	₹80,000 (1,600 batches × ₹50)	₹1,50,000 (3,000 batches × ₹50)

11.

Situation		Appropriate Pricing Policy
(i)	'W' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.	Penetration Pricing
(ii)	'X' is a new product for the company, but not for the market. X's success is crucial for the company's survival in the long term.	Market Price or Price Just Below Market Price
(iii)	'Y' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the unusual sources of capital have uncertainties blocking them.	Skimming Pricing
(iv)	'Z' is a perishable item, with more than 80% of its shelf life over.	Any Cash Realizable Value*

(*) *this amount decreases every passing day.*

12. Discretionary costs are those that are incurred, typically each year, in an amount that is approved as part of the normal budget process. However, there is no clear relationship between the volume of services and the amount of cost that must be incurred. Manager must decide and justify the level that is deemed to be appropriate. This justification is to be made a fresh without making reference to previous level of spending in his/her department.

Zero based budgeting is undoubtedly most effective in terms of discretionary costs. The bottom line of a zero based budgeting is that it is important to understand what types of objectives are being accomplished by discretionary cost centers and what resources being devoted to accomplishing various objectives. This will allow a prioritization, so

that organization can evaluate the likely impact of substantial increase or decrease in the resources allocated to the discretionary center.

Accordingly, ZBB has extensive potential application to the division T, A and RD.

13. Analysis of WIP Account

	November	December
Opening WIP	36,000	55,100
Add: Direct Materials Usage	50,000	56,000
Add: Direct Labor	53,100	69,000
Add: Variable Overhead	25,000	29,000
Total Inflow into WIP	1,64,100	2,09,100
Less: Variable Cost of Goods Manufactured	1,09,000	1,14,800
Ending WIP	55,100	94,300

Analysis of Finished Goods Inventory Account

	November	December
Opening Finished Goods	44,000	30,000
Add: Cost of Goods Manufactured	1,09,000	1,14,800
Cost of Goods Available for Sale	1,53,000	1,44,800
Less: Cost of Goods Sold	1,23,000	99,800
Ending Finished Goods Inventory	30,000	45,000

14. Statement Showing Reconciliation Between Budgeted [F.Y. 2015-16] & Actual Profit [F.Y. 2016-17]

Particulars	(₹ in lacs)	(₹ in lacs)
Budgeted Profit		200.00
Sales Contribution Variances:		
Price	427.50 (F)	
Volume	25 (A)	402.50 (F)
Direct Material Variances:		
Price	307.50 (A)	
Usage	150.00 (A)	457.50 (A)
Variable Overheads Variances:		
Expenditure	25.00 (A)	
Efficiency	25.00 (A)	50.00 (A)

Fixed Overheads Variances:		
Expenditure	67.50 (A)	
Volume	N.A.	67.50 (A)
Actual Profit		27.50

Computation of Variances (₹ In Lacs)**Sales Variances (W.N.1)**

$$\begin{aligned}
 \text{Price Variance} &= \text{Actual Sales} - \text{Standard Sales} \\
 &= ₹ 3,277.50 - ₹ 2,850.00 \\
 &= ₹ 427.50 (F)
 \end{aligned}$$

$$\begin{aligned}
 \text{Volume Variance} &= \text{Standard Sales} - \text{Budgeted Sales} \\
 &= ₹ 2,850.00 - ₹ 3,000.00 \\
 &= ₹ 150 (A)
 \end{aligned}$$

Sales Contribution Variances

$$\text{Sales Contribution} = \text{Sales Price Variance}$$

Price Variance

$$= ₹ 427.50 (F)$$

$$\text{Sales Contribution} = \text{Sales Volume Variance} \times \text{Budgeted PV Ratio}$$

Volume Variance

$$\begin{aligned}
 &= ₹ 150 (A) \times \left(\frac{₹ 200 + ₹ 300}{₹ 3,000} \right) \\
 &= ₹ 25 (A)
 \end{aligned}$$

Material Variances (W.N.2)**Material Price Variance**

$$\begin{aligned}
 &= \text{Standard Cost of Actual Quantity} - \text{Actual Cost} \\
 &= ₹ 2,050.00 - ₹ 2,357.50 \\
 &= ₹ 307.50 (A)
 \end{aligned}$$

Material Usage Variance

$$\begin{aligned}
 &= \text{Standard Cost of Standard Quantity for Actual Output} - \\
 &\quad \text{Standard Cost of Actual Quantity} \\
 &= ₹ 1,900 - ₹ 2,050 \\
 &= ₹ 150 (A)
 \end{aligned}$$

Variable Overhead Variances (W.N.3)**Expenditure Variance**

$$= \text{Budgeted Variable Overheads for Actual Hours} - \text{Actual Variable Overheads}$$

Or

$$= \text{Std. Rate per unit} \times \text{Expected Output for Actual Hours Worked} - \text{Actual Variable Overheads}$$

$$= ₹ 500 - ₹ 525$$

$$= ₹ 25 \text{ (A)}$$

$$\text{Efficiency Variances} = \text{Standard Variable Overheads for Production} - \text{Budgeted Variable Overheads for Actual Hours}$$

Or

$$= \text{Std. Rate per unit} \times \text{Actual Output} - \text{Std. Rate per unit} \times \text{Expected Output for Actual Hours Worked}$$

$$= ₹ 475 - ₹ 500$$

$$= ₹ 25 \text{ (A)}$$

Fixed Overhead Variances (W.N.4)**Expenditure Variance**

$$= \text{Budgeted Fixed Overheads} - \text{Actual Fixed Overheads.}$$

$$= ₹ 300.00 - ₹ 367.50$$

$$= ₹ 67.50 \text{ (A)}$$

Working Notes (₹ in lacs)**Note-1:**

Sales in F.Y. 2016-2017	3,277.50
Less: Increase due to <i>price rise</i> [₹ 3,277.50 lacs x 15/115]	427.50
Sales in F.Y. 2016-2017 at F.Y. 2015-2016 Prices [Standard Sales]	2,850.00
Sales in F.Y. 2015-2016	3,000.00
Fall in Sales in F.Y. 2016-2017 [₹ 3,000 lacs - ₹ 2,850 lacs]	150.00
Percentage fall	5%

Note-2:

Material Cost in F.Y. 2015-2016	2,000.00
Less: 5% for Decrease in Volume	100.00
'Standard Material Usage' at F.Y. 2015-16 Prices (Standard Cost of Standard Quantity for Actual output)	1,900.00
Actual Material Cost F.Y. 2016-2017	2,357.50
Less: 15% Increase in Prices [₹ 2,357.50 lakhs x 15/115]	307.50
Actual Materials Used, at F.Y. 2015-2016 Prices (Standard Cost of Actual Quantity)	2,050.00

Note-3:

Variable Overheads Cost in F.Y. 2015-16	500.00
Less: 5% due to fall in Volume of Sales in F.Y. 2016-17	25.00
"Standard Overheads for Production" in F.Y. 2016-17	475.00
Actual Variable Overheads Incurred in F.Y. 2016-17	525.00
Less: 5% for Increase in Price [₹ 525 lacs x 5 / 105]	25.00
Amount Spent in F.Y. 2016 -17 at F.Y. 2015-16 Prices (Budgeted Variable Overheads for Actual Hours)	500.00

15. (i) Gourmet and high-end restaurants recognises Natural Spices on the basis of its *high quality* of spices. Therefore, quality is most critical success factor of Natural Spices. There are other factors which cannot be ignore such as price, delivery options, attractive packing etc. But all are secondary to the quality.
- (ii) Deliberate action of cutting price to increase sales volume indicates that firm is intending to expand its market to retail market and street shops which is price sensitive.

Purchase Price Variance is clearly indicating that firm has purchased raw material at lower price which may be due to buying of lower quality of material. Similarly positive *Efficiency Variance* is indicating cost cutting and stretching resources.

It appears that firm is intending to expand its market to retail market and street shops by not only reducing the price but also compromising its quality which is opposing its current strategy of *high quality*.

Management should monitor the trends of variances on regular basis and take appropriate action in case of evidence of permanent decline in quality. Here, customer feedback is also very important.

16. (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'

$$P = ₹ 17,10,000 - (₹50,000 / 2) \times Q$$

$$\text{Revenue (R)} = Q \times [17,10,000 - 25,000 \times Q]$$

$$= 17,10,000 Q - 25,000 Q^2$$

$$\text{Marginal Revenue (MR)} = 17,10,000 - 50,000 Q$$

$$\text{Marginal Cost (MC)} = 13,60,000$$

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

$$17,10,000 - 50,000 Q = 13,60,000$$

$$Q = 7.00 \text{ units}$$

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

$$P = 17,10,000 - (50,000 / 2) \times Q$$

$$= 17,10,000 - 25,000 \times 7.00$$

$$= ₹ 15,35,000$$

At ₹15,35,000 unit Quotation Price of a Wagon the Great Southern 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.

$$\text{MR of a Casnub Bogies} = \text{MC of Manufacturing a Casnub Bogies}$$

$$3,20,000 - 2(10,000 / 30) \times Q = 2,20,000$$

$$Q = 150 \text{ units}$$

Selling Price of a Casnub Bogie 'P' is

$$P = 3,20,000 - (10,000 / 30) \times 150$$

$$= ₹ 2,70,000$$

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.

$$\text{MR of a Wagon} = \text{MC of Manufacturing a Wagon}$$

$$17,10,000 - 50,000 \times Q = (\text{₹ } 2,70,000 \times 4 \text{ Casnub Bogies}) + \text{₹ } 4,80,000$$

$$Q = 3.00 \text{ units}$$

Quotation Price of a Wagon 'P' should be:

$$P = \text{₹ } 17,10,000 - 25,000 \times 3.00$$

$$= \text{₹ } 16,35,000$$

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

17. (i) New Product *tie up* --- Innovation / Learning Perspective
 (ii) Growth of Volume --- Financial Perspective
 (iii) Time for Loan / Fresh Products --- Customer Perspective
18. Let x_1 , x_2 and x_3 denote the number of advertisements to be released in three magazines M, N and O respectively. Let Z denote the total exposure to the principal buyers of the goods.

Objective function:

Since the exposure in any magazine is the number of advertisements multiplied by the number of principal buyers, therefore, the value of Z is given by:

$$\begin{aligned} Z &= (0.20 \times 1,00,000) x_1 + (0.15 \times 60,000) x_2 + (0.08 \times 40,000) x_3 \\ &= 20,000x_1 + 9,000x_2 + 3,200x_3 \end{aligned}$$

Constraints:

The budgeted amount for the advertisements is at the most ₹1,00,000

$$\text{Hence, } 8,000x_1 + 6,000x_2 + 5,000x_3 \leq 1,00,000$$

Also, the magazine M should have no more than 15 advertisements, N and O each should get at least 8 advertisements.

$$\begin{aligned} \text{Hence, } x_1 &\leq 15, \\ x_2 &\geq 8 \text{ and} \\ x_3 &\geq 8 \end{aligned}$$

The linear programming model for the problem:

Maximise

$$Z = 20,000x_1 + 9,000x_2 + 3,200x_3$$

Subject to the Constraints:

$$8,000x_1 + 6,000x_2 + 5,000x_3 \leq 1,00,000$$

	$x_1 \leq 15$
	$x_2 \geq 8$
	$x_3 \geq 8$
Where	$x_1, x_2 \text{ and } x_3 \geq 0$

19. 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

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

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

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

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

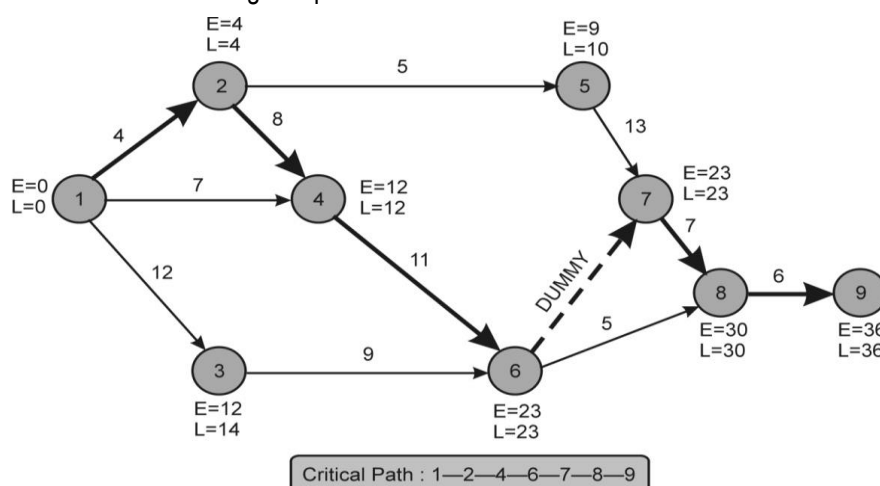
Machines	Location	Costs (₹)
X ₁	P	18
X ₂	Q	18
X ₃	T	14
X ₄	S	14
X ₅ (Dummy)	R	0
Total		64

20. (i) Calculation of Missing Figures:

Activity	Duration	EST	EFT	LST	LFT	Total Float
	D _{ij}	E _i	E _i + D _{ij}	L _j - D _{ij}	L _j	LST - EST
1-2	4	0	4	0	4	0

1-3	12	0	12	2	14	2
1-4	7	0	7	5	12	5
2-4	8	4	12	4	12	0
2-5	5	4	9	5	10	1
3-6	9	12	21	14	23	2
4-6	11	12	23	12	23	0
5-7	13	9	22	10	23	1
6-7	0	23	23	23	23	0
6-8	5	23	28	25	30	2
7-8	7	23	30	23	30	0
8-9	6	30	36	30	36	0

(ii) The **Network** for the given problem:



(iii) The **Various Paths** in the Network are:

- 1-2-4-6-7-8-9 with Duration 36 Days
- 1-2-5-7-8-9 with Duration 35 Days
- 1-3-6-7-8-9 with Duration 34 Days
- 1-2-4-6-8-9 with Duration 34 Days
- 1-3-6-8-9 with Duration 32 Days
- 1-4-6-7-8-9 with Duration 31 Days
- 1-4-6-8-9 with Duration 29 Days

(iv) The **Critical Path** is 1-2-4-6-7-8-9 with Duration 36 Days.

21. Allocation of Random Numbers

Raw Material			Wages & Other Variable Overheads			Sales		
Mid Point	Cum. Prob.	Random Nos.	Mid Point	Cum. Prob.	Random Nos.	Mid Point	Cum. Prob.	Random Nos.
9	0.2	0 – 1	12	0.3	0 – 2	36	0.1	0
11	0.5	2 – 4	14	0.8	3 – 7	40	0.4	1 – 3
13	0.8	5 – 7	16	1.0	8 – 9	44	0.8	4 – 7
15	1.0	8 – 9				48	1.0	8 – 9

Simulation Table

(₹ in 000)

Month	Raw Material	Wages & Other V.O	Sales	Fixed Cost	Net Cash Flow	Cash Balancing (Opening ₹40 thousand)
1	11	12	36	15	-2	38
2	11	14	44	15	+4	42
3	9	16	44	15	+4	46
4	9	12	36	15	0	46
5	11	16	40	15	-2	44
6	13	16	48	15	+4	48

22. (i) Cumulative Average Time for 256 parts = 48.43 hrs.*
 $[112.50 \times (0.90^8)]$
- Total Time for 256 parts = 12,398.08 hrs.
 $[48.43 \text{ hrs.} \times 256 \text{ parts}]$
- Total Labour Cost of 256 parts = ₹ 2,47,961.60
 $[12,398.08 \text{ hrs.} \times ₹ 20]$
- 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.
 $[16,148.08 / 256]$
- 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

$$\begin{aligned}
 \Rightarrow 63.08 &= 112.50 \times (256)^b \\
 \Rightarrow 0.5607 &= 2^{8b} \\
 \Rightarrow \log 0.5607 &= \log 2^{8b} \\
 \Rightarrow \log 0.5607 &= 8 \times b \times \log 2 \\
 \Rightarrow \log 0.5607 &= 8 \times \frac{\log r}{\log 2} \times \log 2 \\
 \Rightarrow \log 0.5607 &= 8 \log r \\
 \Rightarrow \log 0.5607 &= \log r^8 \\
 \Rightarrow 0.5607 &= r^8 \\
 \Rightarrow r &= \sqrt[8]{0.5607} \\
 \Rightarrow r &= 0.9302 \\
 \text{Learning Rate (r)} &= 93.02\%.
 \end{aligned}$$

Therefore

$$\begin{aligned}
 \text{Sensitivity} &= 3.02/90 \\
 &= 3.36\%
 \end{aligned}$$



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

23. (i)

Human Resource Cost	1. Number of employee
	2. Number of training Hours
	3. Number of benefit changes
	4. Number of insurance claims
	5. Number of pension changes
	6. Number of recruiting contacts

(ii)

Accounting Cost	1. Number of billings
	2. Number of cash receipts
	3. Number of check payments
	4. Number of general ledger entries
	5. Number of reports issued
	6. Number of responsibility centre

24. (i) Invalid

(ii) Invalid

(iii) Invalid

(iv) Valid

(v) Valid

25. (i) Invalid

(ii) Valid

(iii) Valid

(iv) Valid

(v) Valid