

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Implementation of Kaizen Costing System

1. M. India Ltd. (MIL) is an automobile manufacturer in India and a subsidiary of Japanese automobile and motorcycle manufacturer Leon. It manufactures and sells a complete range of cars from the entry level to the hatchback to sedans and has a present market share of 22% of the Indian passenger car markets. MIL uses a system of standard costing to set its budgets. Budgets are set semi-annually by the Finance department after the approval of the Board of Directors at MIL. The Finance department prepares variance reports each month for review in the Board of Directors meeting, where actual performance is compared with the budgeted figures. Mr. Suzuki, group CEO of the Leon is of the opinion that Kaizen costing method should be implemented as a system of planning and control in the MIL.

Required:

RECOMMEND key changes vital to MIL's planning and control system to support the adoption of KAIZEN COSTING CONCEPTS.

Kaizen Costing– Basic Concepts

2. ABC Ltd. is planning to introduce Kaizen Costing approach in its manufacturing plant. State whether and why the following are VALID OR NOT in respect of Kaizen Costing.
 - (i) VP (Finance) is of the view that company has to make a huge initial investment to bring a large scale modification in production process.
 - (ii) Head (Personnel) has made a point that introduction of Kaizen Costing does not eliminate the training requirement of employees.
 - (iii) General Manager (Manufacturing) firmly believes that only shop floor employees and workers' involvement is prerequisite of Kaizen Costing approach.
 - (iv) Manager (Operations) has concerns about creation of confusion among employees and workers regarding their roles and degradation in quality of production.

Life Cycle Costing – Optimal Plant Capacity

3. Y-Connections, China based firm, has just developed ultra-thintablet S-5 with few features like the ability to open two apps at the same time. This tablet cost ₹ 5,00,000 to develop; it has undergone extensive research and is ready for production. Currently, the firm is deciding on plant capacity, which could cost either ₹ 35,00,000 or ₹ 52,00,000. The additional outlay would allow the plant to increase capacity from 500 units to 750 units. The relevant data for the life cycle of the tablet at different capacity level are as under:

Expected Sales	500 units	750 units
Sale Price	₹79,600 per unit	₹69,600 per unit

Variable Selling Costs	10% of Selling Price	10% of Selling Price
Salvage Value - Plant	₹ 6,25,000	₹ 9,00,000
Profit Volume Ratio	40%	

Required:

ADVISE Y-Connections, regarding the OPTIMAL PLANT CAPACITY to install. The tablet's life cycle is two years.

Note: Ignore the time value of money.

Value Chain Analysis– Basic Concepts

4. EXAMINE the VALIDITY of following statements along with the reasons:
 - (i) The concepts, tools and techniques of value chain analysis apply only to all those organizations which produce and sell a product.
 - (ii) Procurement activities are included in the Primary activities as classified by Porter under value chain analysis concept.
 - (iii) Value chain analysis in the strategic framework consists of single cost driver concept.

Labour Related Decision – Strike

5. MFG Ltd. is producing a component called 'KDK'. Estimated costs are:

	Fixed Cost per year (₹ '000)	Variable Cost per 'KDK' (₹)
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 'KDK', 90 men work 8 hours per day for 300 days in a year. Each worker can machine and assemble 1 'KDK' 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.

MFG 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 'KDK'. 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 'KDK' would be lost. The balance that would ordinarily have been produced during the strike period could, however be sold, but these

'KDK' 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.

Pricing Strategy – Growth Stage (Antivirus Software)

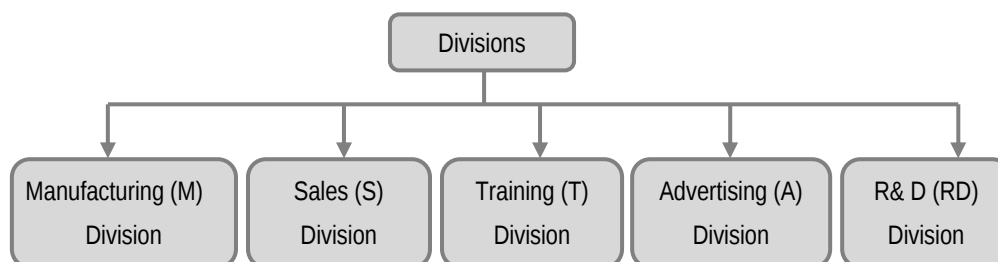
6. Rapid Heal Tech Ltd. (RHTL) is a leading IT security solutions and ISO 9001 certified company. The solutions are well integrated systems that simplify IT security management across the length and depth of devices and on multiple platforms. RHTL has recently developed an Antivirus Software and company expects to have life cycle of less than one year. It was decided that it would be appropriate to adopt a market skimming pricing policy for the launch of the product. This Software is currently in the Introduction stage of its life cycle and is generating significant unit profits.

EXPLAIN, with reasons, the changes, if any, to the unit selling price that could occur when the Software moves from the Introduction stage to Growth stage of its life cycle.

Also SUGGEST necessary STRATEGIES at this stage.

Zero Based Budgeting (Public Company – Telecommunications Sector)

7. Metro 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.

Standard Costing – Missing Figures

8. A company produces a product X, using raw materials A and B. The standard mix of A and B is 1: 1 and the standard loss is 10% of input. You are required to COMPUTE the MISSING INFORMATION indicated by "?" based on the data given below:

	A	B	Total
Standard price of raw material (₹ / kg.)	24	30	
Actual input (kg.)	?	70	
Actual output (kg.)			?
Actual price ₹ / kg.	30	?	
Standard input quantity (kg.)	?	?	
Yield variance (sub usage)			270(A)
Mix variance			?
Usage variance	?	?	?
Price variance	?	?	?
Cost variance	0	?	1,300(A)

Decision Making (Public Transport – Bus Service)

9. Expert Roadways Services Pvt. Ltd. is planning to run a fleet of 15 buses in Birpur City on a fixed route. Company has estimated a total of 2,51,85,000 passenger kilometers per annum. It is estimated buses to have 100% load factor. Buses are purchased at a price of ₹ 44,00,000 per unit whose scrape value at the end of 5 years life is ₹ 5,50,000. Seating capacity of a bus excluding a Driver's seat is 42. Each bus can give a mileage of 5 kmpl. Average cost of fuel is ₹ 66 per liter. Cost of Lubricants & Sundries per 1,000 km would be ₹ 3,300. Company will pay ₹ 27,500 per month to Driver and two attendants for each bus.

Other annual charges per bus: Insurance ₹ 55,000, Garage Charges ₹ 33,000, Repairs & Maintenance ₹ 55,000. Route Permit Charges upto 20,000 km is ₹ 5,500 and ₹ 2,200 for every additional 5,000 km or part thereof.

Required:

- CALCULATE a suggested fare per passenger/km taking into account markup on cost @20% to cover general overheads and sufficient profit.
- The Transport Sector of Birpur is highly regulated. The Government has fixed the fare @ ₹ 1.35 for next 2 years. COMMENT on the two year's profitability taking into consideration the inflation rate of 8%.

Note: Route permit charges is not subject to Inflation.

Multinational Transfer Pricing

10. Standard Corporation Inc. (SCI) is a US based multinational company engaged in manufacturing and marketing of Printers and Scanners. It has subsidiaries spreading across the world which either manufactures or sales Printers and Scanners using the brand name of SCI.

The Indian subsidiary of the SCI buys an important component for the Printers and Scanners from the Chinese subsidiary of the same MNC group. The Indian subsidiary buys 1,50,000 units of components per annum from the Chinese subsidiary at CNY (¥) 30 per unit and pays a total custom duty of 29.5% of value of the components purchased.

A Japanese MNC which manufactures the same component which is used in the Printer and Scanners of SCI, has a manufacturing unit in India and is ready to supply the same component to the Indian subsidiary of SCI at ₹ 320 per unit.

The SCI is examining the proposal of the Japanese manufacturer and asked its Chinese subsidiary to present its views on this issue. The Chinese subsidiary of the SCI has informed that it will be able to sell 1,20,000 units of the components to the local Chinese manufacturers at the same price i.e. ¥ 30 per unit but it will incur an excise duty @ 10% on sales value. Variable cost per unit of manufacturing the component is ¥ 20 per unit. The Fixed Costs of the subsidiaries will remain unchanged.

The Corporation tax rates and currency exchange rates are as follows:

Corporation Tax rates		Currency Exchange Rates
China	25%	1 US Dollar (\$) = ₹61.50
India	34%	1 US Dollar (\$) = ¥ 6.25
USA	40%	1 CNY (¥) = ₹ 9.80

Required:

- PREPARE a financial appraisal for the impact of the proposal by the Japanese manufacturer to supply components for Printers and Scanners to Indian subsidiary of SCI. [Present your solution in Indian Currency and its equivalent.]
- IDENTIFY other issues that would be considered by the SCI in relation to this proposal.

(Note: While doing this problem use the only information provided in the question itself and ignore the actual taxation rules or treaties prevail in the above mentioned countries)

Balance Score Card (Telecom Company)

- Standard Telecom Ltd. is a leading cellular service provider having a global presence. It aims to be the most innovative and trusted telecom company in the world. To achieve this aim, it is constantly working on its overall functioning. It is trying to adopt best management practices in the world. Following are some information related to the company's performance for a particular period:

Particulars	Current Year	Base Year	Target
Operating Ratio	60%	54%	Reduce it to 50%
Average Revenue per user	₹ 225	₹ 210	Increase it to ₹250

Unresolved Consumer Complaints	27,500	25,000	Reduce it by 20%
Customer Relationship Centres	280	200	Take the total to 250
Employee Coverage under Training Programme	10%	8%	At least 15%

EVALUATE the performance of the company using BALANCE SCORECARD approach.

Profitability Analysis (Manufacturing Company)

12. Aditya Decors Ltd. (ADL) is a leading manufacturer of luxury sanitary products and has divided its whole business into different product segments. At the Last year the management of ADL has decided to make some changes in its one of product-line 'AADee', the improved version was made available for sale from 1st of April 2014.

At the end of the financial year 2014-15, the finance and accounts department has extracted some relevant data for the product line 'AADee' to analyse the decision taken last year. The data related with AADee for the financial year 2013-14 and 2014-15 are as follows:

	2013-14	2014-15
No. of Units Sold	4,00,000	4,30,000
Selling Price <i>per unit</i>	₹4,175	₹ 4,325
Direct Materials Consumed	24,00,000 kg.	25,10,000 kg.
Cost <i>per kg.</i> of Direct Materials	₹470	₹485
Direct LabourUsed	32,00,000 hrs.	34,80,000 hrs.
Rate <i>per labour hour</i>	₹30	₹ 31
Fixed Costs	₹1,60,00,000	₹ 1,76,00,000

ADL has the capacity to produce 5,00,000 units of AADee a year.

Required:

- (i) ANALYSE the changes in the operating income from financial year 2013-14 to 2014-15 with respect to the following components:
 - (a) Growth, (b) Price- Recovery and (c) Productivity Components
- (ii) RECONCILIATION of Operating Profit from 2013-14 to 2014-15.

Linear Programming and Transportation

13. IDENTIFY three SIMILARITIES and three DIFFERENCES between Linear Programming Model and Transportation Model.

Assignment and Transportation

14. EXPLAIN following statement-

"Assignment problem is special case of transportation problem; it can also be solved by transportation methods"

Program Evaluation and Review Technique

15. The Chennai Construction Company is bidding on a contract to install a line of microwave towers. It has identified, the expected duration of the critical path is 18 weeks and the sum of the variances of the activities on the critical path is 9 weeks.

Required:

CALCULATE the PROBABILITY that the project may be completed not earlier than 15 weeks and not later than 21 weeks.

Simulation- Perishable Stock

16. A cake vendor buys pieces of cake every morning at ₹4.50 each by placing his order one day in advance (**at the time of receiving his previous order**) and sale them at ₹ 7.00 each. Unsold cake can be sold next day at ₹2.00 per piece and there after it should be treated as no value. The pattern for demand of cake is given below:

Fresh Cake:

Daily Sale	100	101	102	103	104	105	106	107	108	109	110
Probability	.01	.03	.04	.07	.09	.11	.15	.21	.18	.09	.02

One day old cake:

Daily Sale	0	1	2	3
Probability	.70	.20	.08	.02

Use the following set of random numbers:

Fresh Cake	37	73	14	17	24	35	29	37	33	68
One day old cake	17	28	69	38	50	57	82	44	89	60

The vendor adopts the following rule.

If there is no stock of cake with him at the end of previous day, he orders for 110pieces otherwise he orders 100 or 105 pieces whichever is nearest actual fresh cake sale on the previous day. Starting with zero stock and a pending order of 105 pieces, simulate for 10 days and CALCULATE vendor's profit.

Learning Curve – Sensitivity Analysis

17. B-Parts Inc., USA based firm, has just invented a new part 'B-20'. New part has a budgeted total profit of ₹75,000 from the first 256parts. 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.

SUGGESTED ANSWERS/HINTS

1. **Kaizen Costing** emphasizes on *small but continuous improvement*. Targets once set at the beginning of the year or activities are *updated continuously* to reflect the improvement that has already been achieved and that are yet to be achieved.

The suggestive changes which are required to be adopted Kaizen Costing concepts in MIL are as follows:

Standard Cost Control System to Cost Reduction System: Traditionally Standard Costing system assumes stability in the current manufacturing process and standards are set keeping the normal manufacturing process into account thus the whole effort is on to meet performance cost standard. On the other hand Kaizen Costing believes in continuous improvements in manufacturing processes and hence, the goal is to achieve cost reduction target. The first change required is the standard setting methodology i.e. from earlier Cost Control System to Cost Reduction System.

Reduction in the periodicity of setting Standards and Variance Analysis: Under the existing planning and control system followed by the MIL, standards are set semi-annually and based on these standards monthly variance reports are generated for analysis. But under Kaizen Costing system cost reduction targets are set for small periods say for a week or a month. So the period covered under a standard should be reduced from semi-annually to monthly and the current practice of generating variance reports may be continued or may be reduced to a week.

Participation of Executives or Workers in standard setting: Under the Kaizen Costing system participation of workers or executives who are actually involved in the manufacturing process are highly appreciated while setting standards. So the current system of setting budgets and standards by the Finance department with the mere consent of Board of Directors required to be changed.

2. (i) **Invalid:** Kaizen Costing is the system of cost reduction procedures which involves making small and continuous improvements to the production processes rather than innovations or large-scale investment.
- (ii) **Valid:** The training of employees is very much a long-term and ongoing process in the Kaizen costing approach. Training enhances the abilities of employees.
- (iii) **Invalid:** Kaizen costing approach involves everyone from top management level to the shop floor employees. Every employee's active participation is a must requirement.
- (iv) **Invalid:** Though the aim of Kaizen Costing is to reduce the cost but at the same time it also aims to maintain the quality. Kaizen costing also aims to bring the clarity in roles and responsibilities for all employees.

3. Workings

Statement Showing Variable Manufacturing Cost per unit

Particulars of Costs	₹ / unit
Sales	79,600
Less: Contribution (40%)	31,840
Variable Cost	47,760
Less: Variable Selling Costs ($₹79,600 \times 0.1$)	7,960
Variable Manufacturing Cost	39,800

Statement Showing Expected Profit

Particulars of Costs	('000) ₹ / unit	
	500 units	750 units
Sales	39,800 ($₹79,600 \times 500$)	52,200 ($₹69,600 \times 750$)
Less: Variable Mfg. Cost	19,900 ($₹39,800 \times 500$)	29,850 ($₹39,800 \times 750$)
Less: Variable Selling Cost	3,980 ($₹39,800 \times 0.1$)	5,220 ($₹52,200 \times 0.1$)
Add: Salvage Value	625	900
Less: Cost of Plant	3,500	5,200
Net Profit	13,045	12,830

Development cost is sunk and is not relevant.

Advice---

Based on the above 'Expected Profit' statement which is purely based on *financial considerations* firm may go for high price – low volume i.e. 500 units level. However, *non-financial considerations* are also given due importance as they account for actions that may not contribute directly to profits in the short run but may contribute significantly to profits in long run. Here, it is important to note that life cycle of product is two years and there is no significant difference between the profits at both levels. In this scenario firm may opt the plant having high capacity not only to increase its market share but also to establish a long term brand image.

4. (i) **Invalid:** The concepts, tools and techniques of value chain analysis apply to organizations which produce and sell a product and also to organizations which provide a service.
- (ii) **Invalid:** Procurement activities are included in the support activities rather than primary activities.
- (iii) **Invalid:** Value chain analysis in the strategic framework consists of multiple cost drivers concept. In value chain analysis, a set of unique cost drivers is identified for each value activity instead of single cost driver application at the overall firm level. Multiple cost drivers may be classified into Structural drivers and Executional drivers.

5. 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 units – (25 Days × 180 units per Day)] × ₹144.00]	71,28,000
Loss of Contribution <i>due to loss of sales</i> [1,300 units × ₹ 2,200]	28,60,000
Incremental Labour Cost for Balance 3,200 units [(25 Days × 180 units per Day) – 1,300 units] × ₹144.00]	4,60,800
Overtime Premium [3,200 units × 1,584 × 0.5]	25,34,400
Payment for Efficiency [3,200 units × 1/9 × 1,584 × 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 'KDK' ----**

	(₹)
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----

$$\text{Direct Labour (40\% of production costs of ₹3,600)} = ₹1,440 \text{ per unit}$$

$$\text{With 15\% Increase, Revised Labour Cost (₹1,440 + ₹216)} = ₹1,656$$

$$\text{With 10\% Increase, Revised Labour Cost (₹1,440 + ₹144)} = ₹1,584$$

(3) Statement Showing Budgeted Production----

Total Time in a Day: (8hrs. × 60 minutes)	= 480 minutes
Less: Idle Time	= 48 minutes
Coffee Break	= 20 minutes
Instructions	= 22 minutes
Training	= <u>30 minutes</u>
Productive Time <i>per day</i>	= 360 minutes

Therefore, 'KDK' to be produced per man per day: $(360/180 \times 1) = 2$ units

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



This question has been solved by comparing 'Existing Situation' with both 'Alternatives (Strike or Non-Strike)' *independently*. However this question can also be solved by comparing 'Alternatives (Strike or Non-Strike)' *only* and final answer would be the same.

Students may also solve this question by taking 'Total Approach' instead of 'Incremental Approach'.

6. Following acceptance by early innovators, conventional consumers start following their lead. New competitors are likely to now enter the market attracted by the opportunities for large scale production and profit. RHTL may wish to discourage competitors from entering the market by lowering the price and thereby lowering the unit profitability. The price needs to be lowered so that the product becomes attractive to different market segments thus increasing demand to achieve the growth in sales volume. Strategies at this stage may include the following
 - (i) Improving quality and adding new features such as Data Theft Protection, Parental Control, Web Protection, Improved Scan Engine, Anti Spyware, Anti Malware etc.
 - (ii) Sourcing new market segments/ distribution channels.
 - (iii) Changing marketing strategy to increase demand.
 - (iv) Lowering price to attract price-sensitive buyers.
7. 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 allows 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.

8. Working for Finding – Missing Figures

$$\begin{aligned}\text{Cost Variance}_A &= 0 \\ \text{Cost Variance}_{(A+B)} &= ₹ 1,300 (A) \\ \text{Yield Variance}_{(A+B)} &= ₹ 270 (A)\end{aligned}$$

Standard Cost and Actual Cost (Incomplete Information)

Raw Material	Standard Data			Actual Data		
	Qty. (Kg.) [SQ]	Price (₹) [SP]	Amount (₹) [SQ x SP]	Qty. (Kg.) [AQ]	Price (₹) [AP]	Amount (₹) [AQ x AP]
A	???	24	???	???	30	???
B	???	30	???	70	???	???
Total	???		???	???		???

$$\begin{aligned}\text{Material Cost Variance}_A &= \text{Standard Cost} - \text{Actual Cost} \\ \Rightarrow 0 &= (SQ_A \times ₹ 24 - AQ_A \times ₹ 30) \\ \Rightarrow SQ_A &= 1.25 AQ_A \\ \text{Material Yield Variance}_{(A+B)} &= \text{Average Standard Price per unit of Standard Mix} \times [\text{Total Standard Quantity (units)} - \text{Total Actual Quantity (units)}] \\ \Rightarrow ₹ 270 (A) &= \left(\frac{₹ 24 \times SQ_A + ₹ 30 \times SQ_B}{SQ_A + SQ_B} \right) \times [(SQ_A + SQ_B) - (AQ_A + 70)]\end{aligned}$$

$SQ_A = SQ_B$ as Standard Mix is in ratio 1:1

$$\begin{aligned}\Rightarrow ₹ 270 (A) &= \left(\frac{₹ 24 \times SQ_A + ₹ 30 \times SQ_A}{SQ_A + SQ_A} \right) \times [(SQ_A + SQ_A) - (AQ_A + 70)] \\ \Rightarrow ₹ 270 (A) &= 27 \times [2 \times SQ_A - (AQ_A + 70)] \\ \Rightarrow ₹ 270 (A) &= 27 \times [2 \times 1.25 AQ_A - (AQ_A + 70)] \\ \Rightarrow AQ_A &= 40 \text{ Kg.} \\ \text{As } SQ_A &= 1.25 AQ_A \\ &= 1.25 \times 40 \text{ Kg.} \\ &= 50 \text{ Kg.} \\ \text{As } SQ_B &= SQ_A \\ &= 50 \text{ Kg.}\end{aligned}$$

$$\begin{aligned}
 \text{Cost Variance}_{(A+B)} &= \text{Standard Cost} - \text{Actual Cost} \\
 \Rightarrow 1,300 \text{ (A)} &= (50 \text{ Kg.} \times ₹ 24 + 50 \text{ Kg.} \times ₹ 30) - (40 \text{ Kg.} \times ₹ 30 + 70 \text{ Kg.} \times AP_B) \\
 \Rightarrow AP_B &= ₹ 40
 \end{aligned}$$

Standard Cost and Actual Cost (Complete Information)

Raw Material	Standard Data			Actual Data			Std. Cost of Actual Qty. (₹) [AQ × SP]
	Qty. (Kg.) [SQ]	Price (₹) [SP]	Amount (₹) [SQ × SP]	Qty. (Kg.) [AQ]	Price (₹) [AP]	Amount (₹) [AQ × AP]	
A	50	24	1,200	40	30	1,200	960
B	50	30	1,500	70	40	2,800	2,100
Total	100		2,700	110		4,000	3,060

Computation of Variances

Material Cost Variance = Standard Cost – Actual Cost

$$= SQ \times SP - AQ \times AP$$

$$(A) = ₹1,200 - ₹1,200$$

$$= ₹0$$

$$(B) = ₹1,500 - ₹2,800$$

$$= ₹1,300 \text{ (A)}$$

$$\text{Total} = ₹0 + ₹1,300 \text{ (A)}$$

$$= ₹1,300 \text{ (A)}$$

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

$$= AQ \times SP - AQ \times AP$$

Or

$$= AQ \times (SP - AP)$$

$$(A) = 40 \text{ Kg.} \times (₹24.00 - ₹30.00)$$

$$= ₹240 \text{ (A)}$$

$$(B) = 70 \text{ Kg.} \times (₹30.00 - ₹40.00)$$

$$= ₹700 \text{ (A)}$$

$$\text{Total} = ₹240 \text{ (A)} + ₹700 \text{ (A)}$$

$$= ₹940 \text{ (A)}$$

Material Usage Variance = Standard Cost of Standard Quantity for Actual Output – Standard Cost of Actual Quantity

	=	SQ × SP – AQ × SP
		Or
	=	SP × (SQ – AQ)
(A)	=	₹24 × (50 Kg. – 40 Kg.)
	=	₹240 (F)
(B)	=	₹30 × (50 Kg. – 70 Kg.)
	=	₹600 (A)
Total	=	₹240 (F) + ₹600 (A)
	=	₹360 (A)
Material Mix Variance	=	Total Actual Quantity (units) × (Average Standard Price Per unit of Standard Mix – Average Standard Price per unit of Actual Mix)
	=	110 Kg. × $\left(\frac{₹ 2,700}{100 \text{ Kg.}} - \frac{₹ 3,060}{110 \text{ Kg.}} \right)$
	=	₹90 (A)
Material Yield Variance	=	Average Standard Price per unit of Standard Mix × [Total Standard Quantity (units) – Total Actual Quantity (units)]
	=	$\left(\frac{₹ 2,700}{100 \text{ Kg.}} \right) \times (100 \text{ Kg.} - 110 \text{ Kg.})$
	=	₹ 270 (A) (Given)
Standard Output	=	Standard Input – Standard Loss
	=	100 Kg. – 10 Kg.
	=	90Kg.
Actual Output	=	90 Kg.

(Actual Output and Standard Output are always equal numerically in any Material Variance Analysis)

9. (i) **Statement Suggesting Fare per passenger – km (Each Bus)**

Particulars	Cost per annum (₹)
Fixed Expenses:	
Insurance	55,000.00

Garage Charges	33,000.00
Depreciation	7,70,000.00
Running Expenses:	
Repair and Maintenance	55,000.00
Cost of Lubricants and Sundries	1,38,517.50
Fuel Cost	5,54,070.00
Salary of Driver and Two Attendants	3,30,000.00
Route Permit Charges	16,500.00
Total Cost <i>per annum</i>	19,52,087.50
Add: Markup @ 20% of Total Cost or 16.67% of Total Revenue	3,90,417.50
Total Revenue	23,42,505.00

Rate *per passenger-km* equals to ₹1.395

Workings

Total Passenger Kms	= 2,51,85,000
Total Buses	= 15
Passenger Kms <i>per bus</i>	= 16,79,000 (2,51,85,000 Kms / 15)
Total Passenger Capacity <i>per bus</i>	= 42 – 2
	= 40
Annual Distance Covered <i>by a bus</i>	= 41,975 Kms. (16,79,000 Kms/40)

(ii) Regulated Fare *per passenger km* is ₹1.35

Profitability Statement for Each Bus

Particulars	Year 1 (₹)	Year 2 (₹)
Fixed Expenses:		
Insurance	59,400.00	64,152.00
Garage Charges	35,640.00	38,491.20
Depreciation	7,70,000.00	7,70,000.00
Running Expenses:		
Repair and Maintenance	59,400.00	64,152.00
Cost of Lubricants and Sundries	1,49,598.90	1,61,566.81
Fuel Cost	5,98,395.60	6,46,267.25
Salary of Driver and Two Attendants	3,56,400.00	3,84,912.00

Route Permit Charges		16,500.00	16,500.00
Total Cost [A]		20,45,334.50	21,46,041.26
Total Revenue (Regulated) [B]		22,66,650.00	22,66,650.00
Profit [B] – [A]		2,21,315.50	1,20,608.74
Profit to Total Revenue		9.76%	5.32%

The gross margin is showing a downward trend because the cost components have taken into the effect of inflation hence increasing year by year but the total revenue has remained stagnant due to Government regulations which resulted in reduction in gross margin per bus.

The company's gross margin to total revenue ratio has come out to be 9.76% and 5.32% in first and second year respectively but initially the company's desired gross margin to total revenue ratio is 16.67% to cover general overheads and sufficient profit. Though the amount of general overheads is not given but we can safely assume that they may also subject to inflation i.e. increase year by year then in such case the company needs to maintain or increase its gross margin per bus to maintain its net profit after general overheads which is not possible in regulated environment. The information about regulated fare in the given case is regarding first two years only but if this regulated fare scenario persists for further years then the project may not be viable for the company.

10. (i) Impact of the Proposal by the Japanese Manufacturer to Supply Components for Printers and Scanners to the Indian Subsidiary of the SCI.

On Indian Subsidiary of SCI

Particulars	Amount (₹)
Cost of Purchase from the Chinese Manufacturer :	
Invoiced Amount $\{(1,50,000 \text{ units} \times \text{¥ } 30) \times \text{₹ } 9.80\}$	4,41,00,000
Add: Total Custom Duty $(\text{₹ } 4,41,00,000 \times 29.5\%)$	1,30,09,500
Total Cost of Purchase from the Chinese Manufacturer (A)	5,71,09,500
Cost of Purchase from Japanese Manufacturer in India:	
Invoice Amount $(1,50,000 \text{ units} \times \text{₹ } 320)$	4,80,00,000
Total Cost of Purchase from Japanese Manufacturer in India (B)	4,80,00,000
Savings on Purchase Cost Before Corporate Taxes (A) – (B)	91,09,500
Less: Corporate Tax @34%	30,97,230
Savings after Corporate Taxes	60,12,270

On Chinese Subsidiary of SCI

Particulars	Amount (₹)
Loss of Contribution [[$(1,50,000 - 1,20,000 \text{ units}) \times \text{¥ } (30 - 20)$] $\times \text{₹ } 9.80$]	29,40,000
Add: Excise Duty on Local Sale - Chinese Manufacturer [[$(1,20,000 \text{ units} \times \text{¥ } 30) \times 10\%$] $\times \text{₹ } 9.80$]	35,28,000
Total Loss Before Corporate Taxes	64,68,000
Less: Tax Savings on the Losses ($\text{₹ } 64,68,000 \times 25\%$)	16,17,000
Net Loss after Corporate taxes	48,51,000

On SCI Group

Particulars	Amount (₹)
Saving from Indian Subsidiary	60,12,270
Loss from Chinese Subsidiary	48,17,000
Net Benefit to SCI Group	11,61,270

From the above analysis it can be seen that the proposal from the Japanese manufacturer in India is beneficial for the SCI as it give a net benefit of ₹ 11,61,270.

- (ii) The SCI need to consider various other issues before reaching at a final decision of accepting the proposal of the Japanese manufacturer in India. The few suggestive issues that should be considered are as follows:

- *The longevity of the proposal of the Japanese manufacturer:* Whether Japanese manufacturer will supply the components in the future also. For this purpose a long term agreement between the Indian Subsidiary of SCI and Japanese manufacturer in India needs to be entered.
- *Certainty of the fiscal policy in India:* The Japanese manufacturer will not be able to supply the component at the present price if the fiscal policy of India will change in the future.
- *Repatriation of Profit earned in India:* Though the Indian subsidiary is making profit but it depends on the Government policy on the repatriation of profit from India to USA.
- *Operating Conditions in China:* The SCI has to make sure that the Chinese subsidiary is operating profitably and able to use the spare capacity in the future as well.
- *The fiscal policy in China:* If the Government of China liberalize its fiscal policies in China in future then the manufacturing cost will be cheaper than the today's cost.

Apart from above suggestive points the foreign relations and other tax treaties and accords should also be kept in consideration.

11. The balanced scorecard is a method which displays organisation's performance into four dimensions namely financial, customer, internal and innovation. The four dimensions acknowledge the interest of shareholders, customers and employees taking into account of both long-term and short-term goals. The detailed analysis of performance of the company using Balance Scorecard approach as follows:

- (i) **Financial Perspective:** Operating ratio and average revenue will be covered in this prospective.

Company is unable to achieve its target of reducing operating ratio to 50% instead it has increased to 60%. Company is required to take appropriate steps to control and manage its operating expenses. Average revenue per user has increased from ₹ 210 to ₹ 225 but remains short of targeted ₹ 250. This is also one of the reasons of swelled operating ratio. Company can boost up its average revenue per user either by increasing the price of its services or by providing more paid value added services.

- (ii) **Customer Perspective:** Service complaints will be covered under this perspective. The company had set a target of reducing unresolved complaints by 20% instead unresolved complaints have risen by 10% $[(27,500-25,000)/(25,000) \times 100]$. It shows dissatisfaction is increasing among the consumers which would adversely impact the consumer's general perception about the company and company may lose its consumers in long run.

- (iii) **Internal Business Perspective:** Establishing customer relationship centres will be covered under this perspective. Company has established 80 relationship centres in the current period exceeding its target of 50 (250-200) to cater to the needs of existing consumers as well as soliciting new consumers. This shows the seriousness of the company towards the consumer satisfaction and would help them in the long run.

- (iv) **Learning and Growth Perspective:** Employee training programmes are covered under this perspective.

Company had set a target to cover at least 15% employee under its training programmes but covered only 10%. This could hurt capabilities of the employees which are needed for long term growth of the organisation necessary to achieve the objectives set in the previous three perspectives. People or the human resource of the company is one of the three principle sources where organisational learning and growth comes.

12. Analysis of Changes in the Operating Income from Financial Year 2013-14 to 2014-15.**Growth Component**

Revenue Effect of Growth Component

$$\begin{aligned}
 &= \left(\frac{\text{Actual Units of Output Sold in 2014 - 15}}{\text{Actual Units of Output Sold in 2013 - 14}} - 1 \right) \times \text{Selling Price in 2013 - 14} \\
 &= (4,30,000 \text{ units} - 4,00,000 \text{ units}) \times ₹ 4,175 \\
 &= ₹ 12,52,50,000 \text{ (F)}
 \end{aligned}$$

Cost Effect of Growth Component (Variable Costs)*Direct Materials*

$$\begin{aligned}
 &= \left(\frac{\text{Direct Materials Required to Produce 4,30,000 Units in 2013 - 14}}{\text{Direct Materials Used to Produce 4,00,000 Units in 2013 - 14}} - 1 \right) \times \text{Cost per Kg. in 2013 - 14} \\
 &= \left(\frac{24,00,000 \text{ Kg.}}{4,00,000 \text{ units}} \times 4,30,000 \text{ units} - 24,00,000 \text{ Kg.} \right) \times ₹ 470 \\
 &= (25,80,000 \text{ Kg.} - 24,00,000 \text{ Kg.}) \times ₹ 470 \\
 &= ₹ 8,46,00,000 \text{ (A)}
 \end{aligned}$$

Direct Labour

$$\begin{aligned}
 &= \left(\frac{\text{Labour Hours Required to Produce 4,30,000 Units in 2013 - 14}}{\text{Labour Hours Used to Produce 4,00,000 Units in 2013 - 14}} - 1 \right) \times \text{Rate per hr. in 2013 - 14} \\
 &= \left(\frac{32,00,000 \text{ hrs.}}{4,00,000 \text{ units}} \times 4,30,000 \text{ units} - 32,00,000 \text{ hrs.} \right) \times ₹ 30 \\
 &= (34,40,000 \text{ hrs.} - 32,00,000 \text{ hrs.}) \times ₹ 30 \\
 &= ₹ 72,00,000 \text{ (A)}
 \end{aligned}$$

Price-Recovery ComponentRevenue Effect of Price-Recovery Component

$$\begin{aligned}
 &= \left(\frac{\text{Selling Price in 2014 - 15}}{\text{Selling Price in 2013 - 14}} - 1 \right) \times \text{Actual Units of Output Sold in 2014 - 15} \\
 &= (₹ 4,325 - ₹ 4,175) \times 4,30,000 \text{ units} \\
 &= ₹ 6,45,00,000 \text{ (F)}
 \end{aligned}$$

Cost Effect of Price-Recovery Component (Variable Costs)*Direct Material*

$$\begin{aligned}
 &= \left(\begin{array}{cc} \text{Direct Material} & \text{Direct Material} \\ \text{Price in} & - \text{Price in} \\ 2014 - 15 & 2013 - 14 \end{array} \right) \times \left(\begin{array}{c} \text{Direct Material Required to} \\ \text{Produce 4,30,000 Units in} \\ 2013 - 14 \end{array} \right) \\
 &= (\text{₹}485 - \text{₹}470) \times 25,80,000 \text{ kg.} \\
 &= \text{₹}3,87,00,000 \text{ (A)}
 \end{aligned}$$

Direct Labour

$$\begin{aligned}
 &= \left(\begin{array}{cc} \text{Labour Hour Rate in} & \text{Labour Hour Rate in} \\ 2014 - 15 & 2013 - 14 \end{array} \right) \times \begin{array}{c} \text{Labour Hours Required to Produce} \\ 4,30,000 \text{ units in } 2013 - 14 \end{array} \\
 &= (\text{₹} 31 - \text{₹} 30) \times 34,40,000 \text{ hrs.} \\
 &= \text{₹}34,40,000 \text{ (A)}
 \end{aligned}$$

Cost effect of Price-Recovery Component (Fixed Costs)

$$\begin{aligned}
 &= \left(\begin{array}{cc} \text{Rate per Unit} & \text{Rate per Unit} \\ \text{in } 2014 - 15 & - \text{in } 2013 - 14 \end{array} \right) \times \begin{array}{c} \text{Actual Units of Capacity in Last Year,} \\ \text{if Adequate to Produce Current Year's Output in Last Year} \end{array} \\
 &= \left(\frac{\text{₹}1,76,00,000}{5,00,000 \text{ units}} - \frac{\text{₹}1,60,00,000}{5,00,000 \text{ units}} \right) \times 5,00,000 \text{ units} \\
 &= (\text{₹}35.2 - \text{₹}32) \times 5,00,000 \text{ units} \\
 &= \text{₹}16,00,000 \text{ (A)}
 \end{aligned}$$

Productivity ComponentProductivity Component (for Variable Costs)*Direct Material*

$$\begin{aligned}
 &= \left(\begin{array}{cc} \text{Direct Materials Used} & \text{Direct Materials Required} \\ \text{to Produce 4,30,000} & - \text{to Produce 4,30,000} \\ \text{units in } 2014 - 15 & \text{units in } 2013 - 14 \end{array} \right) \times \text{Cost per Kg. in } 2014 - 15 \\
 &= (25,10,000 \text{ kg.} - 25,80,000 \text{ kg.}) \times \text{₹} 485 \\
 &= \text{₹}3,39,50,000 \text{ (F)}
 \end{aligned}$$

Direct Labour

$$= \left(\begin{array}{cc} \text{Labour Hours Used} & \text{Labour Hours Required} \\ \text{to Produce 4,30,000 Units} & - \text{to Produce 4,30,000 Units} \\ \text{in } 2014 - 15 & \text{in } 2013 - 14 \end{array} \right) \times \text{Rate per Hour in } 2014 - 15$$

$$= (34,80,000 \text{ hours} - 34,40,000 \text{ hours}) \times ₹ 31$$

$$= ₹12,40,000 \text{ (A)}$$

Reconciliation of Operating Profit from 2013-14 to 2014-15

	Amount (₹)	Amount (₹)
Operating Profit in 2013-14 (Refer to Working Note)		43,00,00,000
Add: Revenue effect of Growth Component	12,52,50,000	
Revenue effect of Price-Recovery	6,45,00,000	
Productivity Component (Direct Material)	3,39,50,000	22,37,00,000
Less: Cost effect of Growth Component (Direct Material)	8,46,00,000	
Cost effect of Growth Component (Direct Labour)	72,00,000	
Cost effect of Price-Recovery (Direct Material)	3,87,00,000	
Cost effect of Price-Recovery (Direct Labour)	34,40,000	
Cost effect of Price-Recovery (Fixed Cost)	16,00,000	
Productivity Component (Direct Labour)	12,40,000	13,67,80,000
		51,69,20,000

Working Note**Calculation of Operating Profit in 2013-14 and 2014-15**

	2013-14 (₹)	2014-15 (₹)
Sales (₹ 4,175 × 4,00,000 units; ₹ 4,325 × 4,30,000)	167,00,00,000	185,97,50,000
Less: Costs		
Direct Materials (₹470 × 24,00,000 Kg.; ₹485 × 25,10,000 Kg.)	112,80,00,000	121,73,50,000
Direct Labour (₹ 30 × 32,00,000 hrs.; ₹31 × 34,80,000 hrs.)	9,60,00,000	10,78,80,000
Fixed Cost	1,60,00,000	1,76,00,000
Operating Profit	43,00,00,000	51,69,20,000
Increase/ (Decrease) in Operating Profit	8,69,20,000	

13. Similarities

- (i) Both the models have an objective function.
- (ii) Both models' objective functions are linear.
- (iii) Both the models require non-negativity constraints.

Differences

- (i) The general linear programming problem may be of *maximization* or *minimization* type, whereas, transportation problem predominately deals with *minimization* problem.
 - (ii) A general linear programming problem is solved by using *simplex algorithm*; whereas transportation problem is solved by using *transportation algorithm* (as simplex method is less appropriate to solve).
 - (iii) The resources, for which the structural constraints are built up is *homogeneous* in transportation model; whereas in Linear Programming model they are *heterogeneous*.
14. The assignment problem is special case of transportation problem; it can also be solved by transportation method. But the solution obtained by applying this method would be severely degenerate. This is because the optimality test in the transportation method requires that there must be $m+n-1$ allocations/assignments. But due to the special structure of assignment problem of order $n \times n$, any solution cannot have more than n assignments. Thus, the assignment problem is naturally degenerate. In order to remove degeneracy, $n-1$ number of dummy allocations will be required in order to proceed with the transportation method. Thus, the problem of degeneracy at each solution makes the transportation method computationally inefficient for solving an assignment problem.



$$(*) \quad m+n-1 - n \Rightarrow n+n-1 - n \Rightarrow 2n-1 - n \Rightarrow n-1$$

15. Probability of Completing the Project by Schedule Time T_s is given by

$$Z = \frac{T_s - T_e}{\sigma_e}$$

Probability if the Project is required to be completed in 15 weeks:

Probability if the Project is required to be completed in 15 weeks is given by

$$Z = \frac{15 - 18}{3}$$

$$Z = -1$$

$$\text{Probability } (Z = -1) = 0.1587$$

Probability if the Project is required to be completed in 21 weeks:

Probability if the Project is required to be completed in 21 weeks is given by

$$Z = \frac{21 - 18}{3}$$

$$Z = +1$$

$$\text{Probability } (Z = +1) = 0.8413$$

Probability that the Project may be completed not earlier than 15 weeks and not later than 21 weeks

$$= 0.8413 - 0.1587$$

$$= 0.6826$$

$$\text{Or} = 68.26\%$$

16. Random No- Coding for Fresh Cake

No. of Cakes	Probability	Cumulative Probability	Random Numbers
100	0.01	0.01	00 – 00
101	0.03	0.04	01 – 03
102	0.04	0.08	04 – 07
103	0.07	0.15	08 – 14
104	0.09	0.24	15 – 23
105	0.11	0.35	24 – 34
106	0.15	0.50	35 – 49
107	0.21	0.71	50 – 70
108	0.18	0.89	71 – 88
109	0.09	0.98	89 – 97
110	0.02	1.00	98 – 99

Random No. Coding for One Day Old Cake

No. of Cakes	Probability	Cumulative Probability	Random Numbers
0	0.70	0.70	00 – 69
1	0.20	0.90	70 – 89
2	0.08	0.98	90 – 97
3	0.02	1.00	98 – 99

Let us simulate the sale of fresh and one day old cakes for the next ten days using the given random numbers / information.

Simulation Sheet

Day	R. No. of Fresh Cake	Fresh Stock	Demand	Sales Pcs.	Cl. Stock	Order Initiated	One Day Old Stock	R.N. of Old Cake	Sale of Old Cake Pcs.	Loss Pcs.
1	37	105	106	105	0	110	0	17	0	0
2	73	110	108	108	2	110	0	28	0	0
3	14	110	103	103	7	105	2	69	0	2

Calculation of Vendor's Profit



(*)

On 7th Day Demand for 'One Day Old' cake is one piece (as per random no. 82). But there was nil stock at the end of the 6th Day. Accordingly, sale of one Day old cake is nil.

17. Cumulative Average Time for 256 parts	=	48.43 hrs.*
		[112.50 × (0.90 ⁸)]
Total Time for 256 parts	=	12,398.08 hrs.
		[48.43 hrs.× 256 parts]

Total Labour Cost of 256 parts	= ₹ 2,47,961.60
	[12,398.08 hrs. × ₹ 20]
Revised Labour Cost for <i>zero profit</i>	= ₹ 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

⇒	63.08	=	112.50 × (256) ^b
⇒	0.5607	=	2 ^{8b}
⇒	log 0.5607	=	log 2 ^{8b}
⇒	log 0.5607	=	8 × b × log 2
⇒	log 0.5607	=	8 × $\frac{\log r}{\log 2}$ × log 2
⇒	log 0.5607	=	8 log r
⇒	log 0.5607	=	log r ⁸
⇒	0.5607	=	r ⁸
⇒	r	=	$\sqrt[8]{0.5607}$
⇒	r	=	0.9302
	Learning Rate (r)	=	93.02%.

Therefore

Sensitivity	= 3.02/90
	= 3.36%



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

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING
QUESTIONS

Total Quality Management

1. KNM Road Carriers is a transporting company that transports goods from one place to another. It measures quality of service in terms of:

- (i) Time required to transport goods
- (ii) On-time delivery
- (iii) Number of lost or damaged cartons.

To improve its business prospects and performance the company is seriously considering to install a scheduling and tracking system, which involves an annual outlay of ₹1,25,000. The company furnishes the following information about its present and anticipated future performance:

	Current	Expected
On-time delivery	85%	95%
Variable costs per carton lost or damaged	₹ 55	₹ 55
Fixed costs per carton lost or damaged	₹ 45	₹ 45
Number of cartons lost or damaged	2,500	1,200

The company expects that each half per cent point increase in on-time performance will result in revenue increase of ₹9,000 per annum. Contribution margin of 45% is required.

Required

- (i) Should KNM Road Carriers acquire and install the new system?
- (ii) Also calculate additional amount of revenue required if benefits from new system is equal to cost & Contribution margin is 47.5%.

Kaizen Costing System

2. FZ India Ltd. (FZIL) is an automobile manufacturer in India and a subsidiary of Japanese automobile and motorcycle manufacturer Fuji. It manufactures and sells a complete range of cars from the entry level to the hatchback to sedans and has a present market share of 27% of the Indian passenger car markets. FZIL uses a system of standard costing to set its budgets. Budgets are set semi-annually by the Finance department after the approval of the Board of Directors at FZIL. The Finance department prepares variance reports each month for review in the Board of Directors meeting, where actual performance is compared with the budgeted figures. Ms. Kiyoshi, group CEO of the Fuji is of the opinion that Kaizen costing method should be implemented as a system of planning and control in the FZIL.

Required

Recommend key changes vital to FZIL's planning and control system to support the adoption of Kaizen Costing Concepts.

Activity Based Costing

3. A manufacturing company produces Ball Pens that are printed with the logos of various companies. Each Pen is priced at ₹5. Costs are as follows:

Cost Driver	Unit Variable Cost (₹)	Level of Cost Driver
Units Sold	2.5	-
Setups	225	40
Engineering hours	10	250

Other Data

Total Fixed Costs (conventional) ₹ 48,000

Total Fixed Costs (ABC) ₹ 36,500

Required

- Compute the break-even point in units using activity-based analysis.
- Suppose that company could reduce the setup cost by ₹ 75 per setup and could reduce the number of engineering hours needed to 215. How many units must be sold to break even in this case?

Just in Time

4. Haigh Ltd. is a leading manufacturing company. Under increasing pressure to reduce costs, to contain inventory and to improve service, Haigh's Costing Department has recently undertaken a decision to *implement a JIT System*.

The management of Haigh is convinced of the benefits of their changes. But Supplies Manager Mr. Smith 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!"

Required

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

Limiting Factor

5. List out the basis for deciding the priority of selecting the best product in the different circumstances stated below:
- When maximum sales (in value) is a limiting factor.
 - When raw-material is a limiting factor.

- (iii) When labour hour is a limiting factor.
- (iv) When there is a heavy demand for the product.

Break-even Point (Batches)

6. DRB 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:

	D ₁	D ₂	D ₃	D ₄	Total
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	
	(₹)	(₹)	(₹)	(₹)	(₹)
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:		
D ₁	10,00,000	
D ₂	1,00,000	
D ₃	2,00,000	
D ₄	<u>1,00,000</u>	14,00,000
General fixed overheads		<u>6,20,000</u>
		<u>31,00,000</u>

The other information is as follows:-

	D ₁	D ₂	D ₃	D ₄	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 DRB Ltd.
- Calculate the break-even volume in batches and also in approximate units for Product 'D₁'.

Flexible Budget

7. WDG Ltd. Had prepared fixed and flexible budget for the financial year 2015-16 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 2015-16, 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.

Pareto Analysis

8. Nine Plus Technology Ltd. develops cutting-edge innovations that are powering the next revolution in mobility and has nine tablet smart phone models currently in the market whose previous year financial data is given below:

Model	Sales (₹'000)	Profit-Volume (PV) Ratio
Tab - A001	5,100	3.53%
Tab - B002	3,000	23.00%
Tab - C003	2,100	14.29%
Tab - D004	1,800	14.17%
Tab - E005	1,050	41.43%

Tab - F006	750	26.00%
Tab - G007	450	26.67%
Tab - H008	225	6.67%
Tab - I009	75	60.00%

Required

Using the financial data, carry out a Pareto analysis (80/20 rule) of Sales and Contribution. Discuss your findings with appropriate recommendations.

Standard Costing

9. Sapporo Manufacturing Co. (SMC) is a leading consumer goods company. The budgeted and actual data of SMC for the year 2014-15 are as follows:-

Particulars	Budget	Actual	Variance
Sales / Production (units)	2,00,000	1,65,000	(35,000)
Sales (₹)	21,00,000	16,92,900	(4,07,100)
Less: Variable Costs (₹)	12,66,000	10,74,150	1,91,850
Less: Fixed Costs (₹)	3,15,000	3,30,000	(15,000)
Profit	5,19,000	2,88,750	(2,30,250)

The budgeted data shown in the table is based on the assumption that total market size would be 4,00,000 units but it turned out to be 3,75,000 units.

Required

Prepare a statement showing reconciliation of budget profit to actual profit through marginal costing approach for the year 2014-15 in as much detail as possible.

Decision Making

10. South Roadways Services Pvt. Ltd. is planning to run a fleet of 15 buses in Chittoor District on a fixed route. Company has estimated a total of 2,51,85,000 passenger kilometers per annum. It is estimated buses to have 100% load factor. Buses are purchased at a price of ₹ 44,00,000 per unit whose scrape value at the end of 5 years life is ₹ 5,50,000. Seating capacity of a bus excluding a Driver's seat is 42. Each bus can give a mileage of 5 kmpl. Average cost of fuel is ₹ 66 per liter. Cost of Lubricants & Sundries per 1,000 km would be ₹ 3,300. Company will pay ₹ 27,500 per month to Driver and two attendants for each bus.

Other annual charges per bus: Insurance ₹ 55,000, Garage Charges ₹ 33,000, Repairs & Maintenance ₹ 55,000. Route Permit Charges upto 20,000 km is ₹ 5,500 and ₹ 2,200 for every additional 5,000 km or part thereof.

Required

- (i) Calculate a suggested fare per passenger/km taking into account markup on cost @ 20% to cover general overheads and sufficient profit.
- (ii) The Transport Sector of Chittoor is highly regulated. The Government has fixed the fare @ ₹ 1.35 for next 2 years. Comment on the two year's profitability taking into consideration the inflation rate of 8%.

Note: Route permit charges is not subject to Inflation.

Transfer Pricing

11. AWB Ltd. has two divisions Division W and Division B. Division W produces product Z, which it sells to external market and also to Division B. Divisions in the AWB Ltd. are treated as profit centres and divisions are given autonomy to set transfer prices and to choose their supplier. Performance of each division measured on the basis of target profit given for each period.

Division W can produce 1,00,000 units of product Z at full capacity. Demand for product Z in the external market is for 70,000 units only at selling price of ₹ 2,500 per unit. To produce product Z Division W incurs ₹ 1,600 as variable cost per unit and total fixed overhead of ₹ 4,00,00,000. Division W has employed ₹ 12,00,00,000 as working capital, working capital is financed by cash credit facility provided by its lender bank @ 11.50% p.a. Division W has been given a profit target of ₹ 2,50,00,000 for the year.

Division B has found two other suppliers C Ltd and H Ltd. who are agreed to supply product Z.

Division B has requested a quotation for 40,000 units of product Z from Division W.

Required

- (i) Calculate the transfer price per unit of product Z that Division W should quote in order to meet target profit for the year.
- (ii) Calculate the two prices Division W would have to quote to Division B, if it became AWB Ltd. policy to quote transfer prices based on opportunity costs.

Linear Programming

12. The manufacturing company has 100 kg of A, 180 kg of B and 120 kg of C ingredients available per month. Company can use these materials to make three basic products namely 5-10-5, 5-5-10 and 20-5-10, where the numbers in each case represent the percentage of weight of A, B and C respectively in each of products. The cost of these raw materials are as follows:

Ingredient	Cost per Kg. (₹)
A	64
B	16
C	40
Inert Ingredients	16

Selling price of these products are ₹ 32.60, ₹ 34.80, and ₹ 36.00 per Kg, respectively. There is capacity restriction of the company product 5-10-5, so that company cannot produce more than 30 Kg per month.

Required

Formulate this problem as an LP model to determine the productions (in Kg.) of each product which will maximise its monthly profit.

Note: Formulate Only

Transportation Problem

13. Coupers Partners a leading CA firm has three managers. Each manager can work up to 176 hours during the next month, during which time three assignments must be completed. Tax Accounting (TA) Assignment will take 143 hours, Tax Performance Advisory (TPA) will take 154 hours, and Global Compliance & Reporting (GCR) will take 176 hours. The amount per hour that can be billed for assigning each manager to each assignment is given below:

Manager	Assignment		
	TA (₹)	TPA (₹)	GCR (₹)
C ₁	1,800	2,250	2,850
C ₂	2,100	1,950	1,800
C ₃	2,400	2,100	2,250

Required

Formulate this as a transportation problem and find the optimal solution. Also find out the maximum total billings during the next month.

Note: A manager may be involved in more than one assignment.

PERT and CPM

14. State the Validity of following statements along with the reasons:
- Two activities have common predecessor and successor activities. So, they can have common initial and final nodes.
 - In respect of any activity whether real or dummy, the terminal node should bear a number higher than the initial node number.
 - The difference between the latest event time and the earliest event time is termed as free float.
 - For every critical activity in a network, the earliest start and the earliest finish time as well as the latest finish time and the latest start time are the same.
 - The optimal duration of a project is the minimum time in which it can be completed.

- (vi) Resource leveling aims at smoothening of the resource usage rate without changing the project duration.

Simulation

15. 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

16. Marketing manager of AV Ltd. has conducted a market research on the price-demand relationship for its consumer durable product 'K-2'. K-2 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

K-2 is produced in batches of 1,000 units. Production manager of AV 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 AV Ltd. should sell the K-2 in order to maximise its contribution.

Note

$$\log 0.93 = -0.0315, \log 2 = 0.3010, 2^{-0.1047} = 0.9299, 3^{-0.1047} = 0.8913, 4^{-0.1047} = 0.8649$$

SUGGESTED ANSWERS/ HINTS

1. (i) Should KNM Road Carriers acquire and install the new system?

	₹
Additional Costs of the new scheduling & tracking system p.a.	1,25,000
Additional Revenue from improvement in on-time performance (₹ 9,000 × 10%/0.5%)	1,80,000
Contribution from Additional Annual Revenue (45% × ₹ 1,80,000) (A)	81,000
Cost Saving in respect of Cartons [(2,500-1,200) × ₹ 55] ... (B)	71,500
Total Benefits ... (A+B)	1,52,500

As Expected Benefits are more than the cost. Accordingly company should install the new system.

Calculation of additional amount of revenue required if benefits from new system is equal to cost & Contribution margin is 47.5%:

	₹
Costs of the new scheduling & tracking system ... (A)	1,25,000
Cost Saving in respect of Cartons ... (B)	71,500
Contribution Margin ... (A – B)	53,500
Contribution Margin%	47.5
Corresponding Additional Revenue	1,12,632

2. **Kaizen Costing** emphasizes on *small but continuous improvement*. Targets once set at the beginning of the year or activities are *updated continuously* to reflect the improvement that has already been achieved and that are yet to be achieved.

The suggestive changes which are required to be adopted Kaizen Costing concepts in FZIL are as follows:

Standard Cost Control System to Cost Reduction System: Traditionally Standard Costing system assumes stability in the current manufacturing process and standards are set keeping the normal manufacturing process into account thus the whole effort is on to meet performance cost standard. On the other hand Kaizen Costing believes in continuous improvements in manufacturing processes and hence, the goal is to achieve cost reduction target. The first change required is the standard setting methodology i.e. from earlier Cost Control System to Cost Reduction System.

Reduction in the periodicity of setting Standards and Variance Analysis: Under the existing planning and control system followed by the FZIL, standards are set semi-annually and based on these standards monthly variance reports are generated for analysis. But under Kaizen Costing system cost reduction targets are set for small periods say for a week or a month. So the period covered under a standard should be reduced from semi-annually to monthly and the current practice of generating variance reports may be continued or may be reduced to a week.

Participation of Executives or Workers in standard setting: Under the Kaizen Costing system participation of workers or executives who are actually involved in the manufacturing process are highly appreciated while setting standards. So the current system of setting budgets and standards by the Finance department with the mere consent of Board of Directors required to be changed.

3. Break Even Units

1.
$$\frac{[\text{Fixed Costs} + (\text{Setup Cost} \times \text{Setups}) + (\text{Engineering Cost} \times \text{Engineering Hours})]}{(\text{Sale Price} - \text{Variable Cost})}$$

$$= \frac{[36,500 + (\text{₹ } 225 \times 40) + (\text{₹ } 10 \times 250)]}{(\text{₹ } 5 - \text{₹ } 2.5)}$$

$$= 19,200 \text{ units}$$
2.
$$\frac{[\text{Fixed Costs} + (\text{Setup Cost} \times \text{Setups}) + (\text{Engineering Cost} \times \text{Engineering Hours})]}{(\text{Sale Price} - \text{Variable Cost})}$$

$$= \frac{[36,500 + (\text{₹ } 150 \times 40) + (\text{₹ } 10 \times 215)]}{(\text{₹ } 5 - \text{₹ } 2.5)}$$

$$= 17,860 \text{ Units}$$

4. 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. Smith's doubt is correct on successful implementation of JIT System.

5. Limiting Factor

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

6. (i) Statement of Profitability of DRB Ltd

	Products (Amount in ₹)				
	D ₁	D ₂	D ₃	D ₄	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

$$\begin{aligned}
 \text{Total Sale Value of Product 'D}_1\text{' } &= ₹ 26,00,000 \\
 \text{Total Contribution of Product 'D}_1\text{' } &= ₹ 9,40,000 \\
 \text{Specific Fixed Overheads (Product D}_1\text{)} &= ₹ 10,00,000 \\
 \text{Break-even Sales (₹)} &= \frac{\text{Specific Fixed Cost}}{\text{Total Contribution}} \times \text{Total Sales Value} \\
 &= \frac{₹ 10,00,000}{₹ 9,40,000} \times ₹ 26,00,000 \\
 &= ₹ 27,65,957.45
 \end{aligned}$$

$$\text{Break-even Sales (units)} = \frac{\text{₹ } 27,65,957.45}{\text{₹ } 13.00} = 2,12,766 \text{ units}$$

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 $\left(\frac{\text{₹ } 282.20}{\text{₹ } 13.00}\right)$.

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

Break-even units of product 'D₁' 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	D ₁	D ₂	D ₃	D ₄
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)

7. 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

$$\begin{aligned}
 \text{Activity Level} &= \frac{\text{Actual Sales at Budgeted Prices}}{\text{Budgeted Sales at Full Capacity}} \times 100 \\
 &= \frac{₹10,90,000}{₹13,50,000} \times 100 \\
 &= 80.74\%
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Variable Overhead} &= \frac{\text{Overhead at Full Capacity} - \text{Overhead at 75\% Capacity}}{\text{Difference in Activity Level}} \\
 &= \frac{₹3,65,000 - ₹3,23,750}{25} \\
 &= ₹1,650 \\
 \text{Fixed Overhead} &= \text{Total SV Overheads at 100\% Level} - \text{Variable Overheads at 100\% level} \\
 &= ₹3,65,000 - (₹1,650 \times 100) \\
 &= ₹2,00,000
 \end{aligned}$$

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

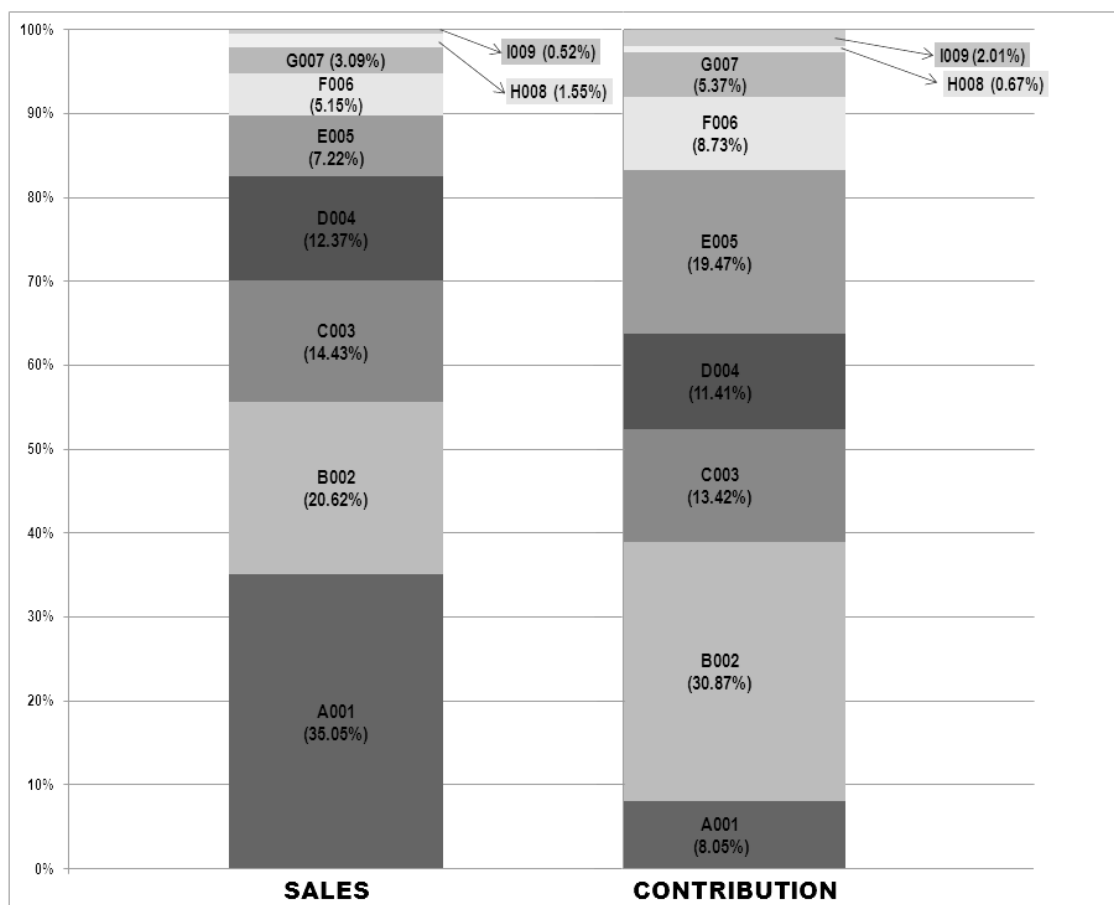
8. Statement Showing 'Pareto Analysis'

Model	Sales (₹'000)	% of Total Sales	Cumulative Total	Model	Cont. (₹'000)	% of Total Cont.	Cumulative Total %
Pareto Analysis Sales				Pareto Analysis Contribution			
A001	5,100	35.05%	35.05%	B002	690	30.87%	30.87%
B002	3,000	20.62%	55.67%	E005	435	19.47%*	50.34%
C003	2,100	14.43%	70.10%	C003	300	13.42%	63.76%

D004	1,800	12.37%	82.47%	D004	255	11.41%	75.17%
E005	1,050	7.22%	89.69%	F006	195	8.73%*	83.90%
F006	750	5.15%	94.84%	A001	180	8.05%	91.95%
G007	450	3.09%	97.93%	G007	120	5.37%	97.32%
H008	225	1.55%	99.48%	I009	45	2.01%	99.33%
I009	75	0.52%	100.00%	H008	15	0.67%	100.00%
	14,550	100.00%			2,235	100.00%	

(*) Rounding - off difference adjusted.

Diagram Showing 'Sales and Contribution' (NOT COMPULSORY)



This Diagram is shown for **better understanding** of the concept.

Recommendations

Pareto Analysis is a rule that recommends focus on most important aspects of the decision making in order to simplify the process of decision making. The very purpose of this analysis is to direct attention and efforts of management to the product or area where best returns can be achieved by taking appropriate actions.

Pareto Analysis is based on the 80/20 rule which implies that 20% of the products account for 80% of the revenue. But this is not the fixed percentage rule; in general business sense it means that a few of the products, goods or customers may make up most of the value for the firm.

In present case, five models namely A001, B002, C003, D004 account for 80% of total sales where as 80% of the company's contribution is derived from models B002, E005, C003, D004 and F006.

Models B002 and E005 together account for 50.34% of total contribution but having only 27.84% share in total sales. So, these two models are the key models and should be the top priority of management. Boths C003 and D004 are among the models giving 80% of total contribution as well as 80% of total sales so; they can also be clubbed with B002 and E005 as key models. Management of the company should allocate maximum resources to these four models.

Model F006 features among the models giving 80%of total contribution with relatively lower share in total sales. Management should focus on its promotional activities.

Model A001 accounts for 35.05% of total sales with only 8.05% share in total contribution. Company should review its pricing structure to enhance its contribution.

Models G007, H008 and I009 have lower share in both total sales as well as contribution. Company can delegate the pricing decision of these models to the lower levels of management, thus freeing themselves to focus on the pricing decisions for key models.

9. Statement of Reconciliation - Budgeted Vs Actual Profit

Particulars	₹
Budgeted Profit	5,19,000
Less:Sales Volume Contribution Planning Variance (Adverse)	52,125
Less:Sales Volume Contribution Operational Variance (Adverse)	93,825
Less:Sales Price Variance (Adverse)	39,600
Less:Variable Cost Variance (Adverse)	29,700
Less:Fixed Cost Variance (Adverse)	15,000
Actual Profit	2,88,750

Workings*Basic Workings*

$$\begin{aligned}
 \text{Budgeted Market Share (in \%)} &= \frac{2,00,000 \text{ units}}{4,00,000 \text{ units}} \\
 &= 50\% \\
 \text{Actual Market Share (in \%)} &= \frac{1,65,000 \text{ units}}{3,75,000 \text{ units}} \\
 &= 44\% \\
 \text{Budgeted Contribution} &= ₹ 21,00,000 - ₹ 12,66,000 \\
 &= ₹ 8,34,000 \\
 \text{Average Budgeted Contribution (per unit)} &= \frac{₹ 8,34,000}{₹ 2,00,000} \\
 &= ₹ 4.17 \\
 \text{Budgeted Sales Price per unit} &= \frac{₹ 21,00,000}{₹ 2,00,000} \\
 &= ₹ 10.50 \\
 \text{Actual Sales Price per unit} &= \frac{₹ 16,92,900}{₹ 1,65,000} \\
 &= ₹ 10.26 \\
 \text{Standard Variable Cost per unit} &= \frac{₹ 12,66,000}{₹ 2,00,000} \\
 &= ₹ 6.33 \\
 \text{Actual Variable Cost per unit} &= \frac{₹ 10,74,150}{₹ 1,65,000} \\
 &= ₹ 6.51
 \end{aligned}$$

Calculation of Variances

Sales Variances:.....

$$\begin{aligned}
 \text{Volume Contribution Planning*} &= \text{Budgeted Market Share \%} \times (\text{Actual Industry Sales Quantity in units} - \text{Budgeted Industry Sales Quantity in units}) \times (\text{Average Budgeted Contribution per unit}) \\
 &= 50\% \times (3,75,000 \text{ units} - 4,00,000 \text{ units}) \times ₹ 4.17 \\
 &= 52,125(A)
 \end{aligned}$$

(*)Market Size Variance

$$\begin{aligned}
 \text{Volume Contribution Operational}^{**} &= (\text{Actual Market Share \%} - \text{Budgeted Market Share \%}) \times (\text{Actual Industry Sales Quantity in units}) \times (\text{Average Budgeted Contribution per unit}) \\
 &= (44\% - 50\%) \times 3,75,000 \text{ units} \times ₹ 4.17 \\
 &= 93,825 \text{ (A)}
 \end{aligned}$$

(**)Market Share Variance

$$\begin{aligned}
 \text{Price} &= \text{Actual Sales} - \text{Standard Sales} \\
 &= \text{Actual Sales Quantity} \times (\text{Actual Price} - \text{Budgeted Price}) \\
 &= 1,65,000 \text{ units} \times (₹ 10.26 - ₹ 10.50) = 39,600 \text{ (A)}
 \end{aligned}$$

Variable Cost Variances:.....

$$\begin{aligned}
 \text{Cost} &= \text{Standard Cost for Production} - \text{Actual Cost} \\
 &= \text{Actual Production} \times (\text{Standard Cost per unit} - \text{Actual Cost per unit}) \\
 &= 1,65,000 \text{ units} \times (₹ 6.33 - ₹ 6.51) \\
 &= ₹ 29,700 \text{ (A)}
 \end{aligned}$$

Fixed Cost Variances:.....

$$\begin{aligned}
 \text{Expenditure} &= \text{Budgeted Fixed Cost} - \text{Actual Fixed Cost} \\
 &= ₹ 3,15,000 - ₹ 3,30,000 \\
 &= ₹ 15,000 \text{ (A)}
 \end{aligned}$$



Fixed Overhead Volume Variance does not arise in a Marginal Costing system.

10. (i) Statement Suggesting Fare per passenger – km (Each Bus)

Particulars	Cost per annum (₹)
Fixed Expenses:	
Insurance	55,000.00
Garage Charges	33,000.00
Depreciation	7,70,000.00
Running Expenses:	
Repair and Maintenance	55,000.00
Cost of Lubricants and Sundries	1,38,517.50

Fuel Cost	5,54,070.00
Salary of Driver and Two Attendants	3,30,000.00
Route Permit Charges	16,500.00
Total Cost <i>per annum</i>	19,52,087.50
Add: Markup @ 20% of Total Cost or 16.67% of Total Revenue	3,90,417.50
Total Revenue	23,42,505.00

Rate *per passenger- km* equals to ₹1.395

Workings

Total Passenger Kms	=	2,51,85,000
Total Buses	=	15
Passenger Kms <i>per bus</i>	=	16,79,000 (2,51,85,000 Kms / 15)
Total Passenger Capacity <i>per bus</i>	=	42 – 2
	=	40
Annual Distance Covered <i>by a bus</i>	=	41,975 Kms. (16,79,000 Kms/40)

(ii) Regulated Fare *per passenger km* is ₹1.35

Profitability Statement for *Each Bus*

Particulars	Year 1 (₹)	Year 2 (₹)
Fixed Expenses:		
Insurance	59,400.00	64,152.00
Garage Charges	35,640.00	38,491.20
Depreciation	7,70,000.00	7,70,000.00
Running Expenses:		
Repair and Maintenance	59,400.00	64,152.00
Cost of Lubricants and Sundries	1,49,598.90	1,61,566.81
Fuel Cost	5,98,395.60	6,46,267.25
Salary of Driver and Two Attendants	3,56,400.00	3,84,912.00
Route Permit Charges	16,500.00	16,500.00
Total Cost ...[A]	20,45,334.50	21,46,041.26
Total Revenue (Regulated) ...[B]	22,66,650.00	22,66,650.00
Gross Margin ...[B] – [A]	2,21,315.50	1,20,608.74
Gross Margin to Total Revenue	9.76%	5.32%

The gross margin is showing a downward trend because the cost components have taken into the effect of inflation hence increasing year by year but the total revenue has remained stagnant due to Government regulations which resulted in reduction in gross margin per bus.

The company's gross margin to total revenue ratio has come out to be 9.76% and 5.32% in first and second year respectively but initially the company's desired gross margin to total revenue ratio is 16.67% to cover general overheads and sufficient profit. Though the amount of general overheads is not given but we can safely assume that they may also subject to inflation i.e. increase year by year then in such case the company needs to maintain or increase its gross margin per bus to maintain its net profit after general overheads which is not possible in regulated environment. The information about regulated fare in the given case is regarding first two years only but if this regulated fare scenario persists for further years then the project may not be viable for the company.

11. (i) Transfer Price *per unit* of Product Z that Division W Should Quote *in order to meet Target Profit*

Quotation for the 40,000 units of product Z should be such that meet Division W's target profit and interest cost on working capital. Therefore the minimum quote for product Z will be calculated as follows:

Particulars	Amount (₹)
Target Profit (given for the year)	2,50,00,000
Add: Interest Cost on Working Capital (₹12,00,00,000 @11.5%)	1,38,00,000
Required Profit	3,88,00,000
Add: Fixed Overhead	4,00,00,000
Target Contribution	7,88,00,000
Less: Contribution Earned --- External Sales {60,000 units × (₹2,500 – ₹1,600)}	5,40,00,000
Contribution Required – Internal Sales	2,48,00,000
Contribution <i>per unit</i> of Product Z (₹2,48,00,000 ÷ 40,000 units)	620
Transfer Price of Product Z to Division B (Variable Cost <i>per unit</i> + Contribution <i>per unit</i>)	2,220

(ii) The Two Transfer Prices Based on Opportunity Costs

For the 30,000 units (i.e. maximum capacity – maximum external market demand) at variable cost of production i.e. ₹1,600 per unit.

For the next 10,000 units (i.e. external market demand – maximum possible sale) at market selling price i.e. ₹2,500 per unit.

12. Let the P_1 , P_2 and P_3 be the three products to be manufactured. Then the data are as follows:

Products	Product ingredients			
	A	B	C	Inert Ingredients
P_1	5 %	10%	5%	80%
P_2	5%	5%	10%	80%
P_3	20%	5%	10%	65%
Cost per kg (₹)	64	16	40	16

Cost of Product P_1

$$= 5\% \times ₹ 64 + 10\% \times ₹ 16 + 5\% \times ₹ 40 + 80\% \times ₹ 16$$

$$= ₹ 19.60 \text{ per kg}$$

Cost of Product P_2

$$= 5\% \times ₹ 64 + 5\% \times ₹ 16 + 10\% \times ₹ 40 + 80\% \times ₹ 16$$

$$= ₹ 20.80 \text{ per kg.}$$

Cost of Product P_3

$$= 20\% \times ₹ 64 + 5\% \times ₹ 16 + 10\% \times ₹ 40 + 65\% \times ₹ 16$$

$$= ₹ 28.00 \text{ per kg.}$$

Let x_1 , x_2 , and x_3 be the quantity (in kg) of P_1 , P_2 , and P_3 respectively to be manufactured. The LP problem can be formulated:

Objective function:

$$\begin{aligned} \text{Maximise } Z &= (\text{Selling Price} - \text{Cost Price}) \times \text{Quantity of Product} \\ &= (₹ 32.60 - ₹ 19.60) x_1 + (₹ 34.80 - ₹ 20.80) x_2 + (₹ 36.00 - ₹ 28) x_3 \\ &= 13x_1 + 14x_2 + 8x_3 \end{aligned}$$

Subject to Constraints:

$$1/20 x_1 + 1/20 x_2 + 1/5 x_3 \leq 100$$

$$\text{Or } x_1 + x_2 + 4x_3 \leq 2,000$$

$$1/10 x_1 + 1/20 x_2 + 1/20 x_3 \leq 180$$

$$\text{Or } 2x_1 + x_2 + x_3 \leq 3,600$$

$$1/20 x_1 + 1/10 x_2 + 1/10 x_3 \leq 120$$

$$\text{Or } x_1 + 2x_2 + 2x_3 \leq 2,400$$

$$x_1 \leq 30$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

13. The given information can be tabulated in following transportation problem-

Manager	Assignment			Time Available (Hours)
	TA (₹)	TPA (₹)	GCR (₹)	
C ₁	1,800	2,250	2,850	176
C ₂	2,100	1,950	1,800	176
C ₃	2,400	2,100	2,250	176
Time Required (Hours)	143	154	176	

The given problem is an unbalanced transportation problem. Introducing a dummy assignment to balance it, we get-

Manager	Assignment				Time Available (Hours)
	TA (₹)	TPA (₹)	GCR (₹)	Dummy (₹)	
C ₁	1,800	2,250	2,850	0	176
C ₂	2,100	1,950	1,800	0	176
C ₃	2,400	2,100	2,250	0	176
Time Required (Hours)	143	154	176	55	528

The objective here is to maximize total billing amount of the auditors. For achieving this objective, let us convert this maximization problem into a minimization problem by subtracting all the elements of the above payoff matrix from the highest payoff i.e. ₹2,850.

Manager	Assignment				Time Available (Hours)
	TA (₹)	TPA (₹)	GCR (₹)	Dummy (₹)	
C ₁	1,050	600	0	2,850	176
C ₂	750	900	1,050	2,850	176
C ₃	450	750	600	2,850	176
Time Required (Hours)	143	154	176	55	528

Now, let us apply VAM method to the above matrix for finding the initial feasible solution.

Manager	Assignment				Time Avail. (Hours)	Difference
	TA (₹)	TPA (₹)	GCR (₹)	Dummy (₹)		
C ₁	1,050	600	0 176	2,850	176/0	600 - -
C ₂	750	900 121	1,050	2,850 55	176/55/0	150, 150 1,950
C ₃	450 143	750 33	600	2,850	176/33/0	150, 300, 2,100
Time Required	143/0	154/121/0	176/0	55/0	528	
Difference	300	150	600	0		
	300	150	-	0		
	-	150	-	0		

The initial solution is given below. It can be seen that it is a degenerate solution since the number of allocation is 5. In order to apply optimality test, the total number of allocations should be 6 ($m + n - 1$). To make the initial solution a non-degenerate, we introduce a very small quantity in the least cost independent cell which is cell of C₃, GCR.

Manager	Assignment			
	TA (₹)	TPA (₹)	GCR (₹)	Dummy (₹)
C ₁	1,050	600	0 176	2,850
C ₂	750	900 121	1,050	2,850 55
C ₃	450 143	750 33	600 e	2,850

Let us test the above solution for optimality-

$(u_i + v_j)$ Matrix for **Allocated / Unallocated Cells**

					U_i
V_j	-150	150	0	2,100	-600
	600	900	750	2,850	150
	450	750	600	2,700	0
	450	750	600	2,700	

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

 Δ_{ij} Matrix

1,200	450		750
150		300	
			150

Since, all allocations in $\Delta_{ij} = C_{ij} - (u_i + v_j)$ are non negative, the allocation is optimal. The allocation of assignments to managers and their billing amount is given below:

Manager	Assignment	Billing Amount
C ₁	Global Compliance & Reporting (GCR)	₹5,01,600 (176 hrs. × ₹2,850)
C ₂	Tax Performance Advisory (TPA)	₹2,35,950 (121 hrs. × ₹1,950)
C ₃	Tax Accounting (TA)	₹3,43,200 (143 hrs. × ₹2,400)
C ₃	Tax Performance Advisory (TPA)	₹69,300 (33 hrs. × ₹2,100)
Total Billing		₹11,50,050

14. (i) Invalid

Reason: As per the rules of network construction, parallel activities between two events, without intervening events, are prohibited. Dummy activities are needed when two or more activities have same initial and terminal events. Dummy activities do not consume time or resources.

(ii) Valid

Reason: As per the conventions adopted in drawing networks, the head event or terminal node always has a number higher than that of initial node or tail event.

(iii) Invalid

Reason: The difference between the latest event time and the earliest event time is termed as slack of an event. Free float is determined by subtracting head event slack from the total float of an activity.

(iv) Invalid

Reason: For every critical activity in a network, the earliest start time and the latest start time is same and also the earliest finish time and the latest finish time is same.

(v) Invalid

Reason: The optimum duration is the time period in which the total cost of the project is minimum.

(vi) Valid

Reason: Resource leveling is a network technique used for reducing the requirement of a particular resource due to its paucity or insufficiency within a constraint on the project duration. The process of resource leveling utilize the large floats available on non-critical activities of the project and cuts down the demand of the resource.

15. 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

- 16. (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

$$\begin{aligned}
 \text{If } 2,200 r^2 &= ₹1,920 \text{ (₹4,120 – 50\% of ₹ 4,400)} \\
 r^2 &= 0.8727 \\
 r &= 0.934 \\
 \text{Therefore, Learning Curve Effect} &= 93\% \text{ (rounded off)}
 \end{aligned}$$

(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,

$$\begin{aligned}
 y &= \text{Cumulative average unit costs} \\
 a &= \text{Average cost of the first unit} \\
 x &= \text{Cumulative number of batches} \\
 b &= \text{Log of learning ratio} \div \text{Log of 2} \\
 &= \log 0.93 \div \log 2 \\
 &= -0.0315 \div 0.3010 = -0.1047
 \end{aligned}$$

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING
QUESTIONS

Shut Down or Continue

1. 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.

Required

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

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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.

Pricing Strategy

8. State the appropriate pricing policy in each of the following independent situations:
 - (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.
 - (ii) 'X' is a new product for the company, but not for the market. B's success is crucial for the company's survival in the long term.
 - (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 usual sources of capital have uncertainties blocking them.
 - (iv) 'Z' is a perishable item, with more than 80% of its shelf life over.

Budget – Ratio

9. Calculate from the following figures:
 - (i) Efficiency ratio,
 - (ii) Activity, Ratio and
 - (iii) Capacity Ratio:

Budgeted Production..... 528 units
 Standard Hours per unit.....10
 Actual Production.....450 units
 Actual Working Hours..... 6,000

Budget – Missing Figure

10. 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	1,07,500	1,15,900
Ending WIP Inventory	???	???
Ending Finished Goods Inventory	???	45,000

Required

Find out missing figures.

Standard Costing – Profit Reconciliation

11. HKT Ltd. has provided the following summarized results for two years:

	Year ended (₹ In lacs)	
	31-03-2015	31-3-2016
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 31-3-2016 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 2014-15 showing the factors responsible for the change in profits in 2015-16.

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

Balanced Scorecard

12. 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.

- (ii) How different sectors of housing loans with different interest rates have been sanctioned, their volumes of growth in the past 4 quarters.
- (iii) 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

13. The owner of Fancy Goods Shop is interested to determine, how many advertisements to release in the selected three magazines A, B and C. 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		
	A	B	C
Readers	50,000	30,000	20,000
Principal buyers	40%	30%	16%
Cost per advertisement	₹12,000	₹9,000	₹7,500

The budgeted amount is at the most ₹ 1.5 lakh for the advertisements. The owner has already decided that magazine A should have no more than 8 advertisements and that B and C each gets at least 4 advertisements.

Required

Formulate a Linear Programming model for this problem.

Assignment Problem – Minimisation

14. 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	9	11	15	10	11
X_2	12	9	--	10	9
X_3	--	11	14	11	7
X_4	14	8	12	7	8

Required

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

PERT/ CPM

15. The following table gives the activities in a construction project and the time duration of each activity:

Activity	Predecessors	Normal Time (Days)
A	---	16
B	---	20
C	A	8
D	A	10
E	B,C	6
F	D,E	12

Required

- Draw the activity network of the project.
- Find critical path.
- Find the total float and free-float for each activity.

Learning Curve

16. The Crocodile Ltd. makes mementos for offering chief guests and other dignitaries at functions. A customer wants 4 identical pieces of hand-crafted gifts for 4 dignitaries invited to its function.

For this product, Company estimates the following costs for the 1st unit of the product.

Particulars of Costs	₹ / unit
Direct Variable Costs (excluding labour)	1,000
Direct Labour (20 hours @ ₹ 25 hour)	500

90 % learning curve ratio is applicable and one labourer works for one customer's order.

Required

- What is the price per piece to be quoted for this customer if the targeted contribution is ₹ 750 per unit?
- If 4 different labourers made the 4 products simultaneously to ensure faster delivery to the customer, can the price at (i) above be quoted? Why?

Miscellaneous

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

SUGGESTED ANSWERS**1. 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

2. 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 units – (25Days × 180 units per Day)] × ₹144.00]	71,28,000
Loss of Contribution <i>due to loss of sales</i> [1,300 units × ₹ 2,200]	28,60,000
Incremental Labour Cost for Balance 3,200 units [(25 Days × 180 units per Day) – 1,300 units] × ₹144.00]	4,60,800
Overtime Premium [3,200 units × 1,584 × 0.5]	25,34,400
Payment for Efficiency [3,200 units × 1/9 × 1,584 × 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. × 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 × 90 men × 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'.

3. (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'	17.00

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.

4. **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.

5.

JTC Ltd.

Cost Sheet of One Lot of 250 Croquet Mallets

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

Working Notes

- 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 ($400/40 \times 12$).

Since mallets are produced at the rate of 120 mallets per man day, so total monthly production will be 18,000 mallets ($120 \text{ units} \times 6 \text{ men} \times 25 \text{ days}$).

3. Finishing and painting overheads are assumed to be variable for the production of 20,000 mallets.
4. All the other expenses are fixed and are to be absorbed by 18,000 ($120 \text{ units} \times 6 \text{ men} \times 25 \text{ Days}$) mallets of monthly production.
6. Return of 12% Net (after tax of 40%) on Capital Employed is equivalent to 20% (Gross) [$12\% \div (1 - 0.4)$] on Capital Employed.

Let Selling Price per unit to be 'K'

Since Total Sales = Total Cost + Profit

$$80,000 \text{ K} = 14,60,000 + 20\% (12,00,000 + 0.5 \times 80,000\text{K})$$

$$\text{Or, } 80,000 \text{ K} = 14,60,000 + 2,40,000 + 8,000\text{K}$$

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

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

$$= ₹23.61$$

Hence Selling Price per unit will be ₹23.61.

7.

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
26.50	17.00	9.50	8,500	80,750
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.

8.

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.

9. (i) Efficiency Ratio = $\frac{\text{Standard Hours (for actual production)}}{\text{Actual Hours (worked)}} \times 100$
- $$= \frac{450 \text{ units} \times 10 \text{ hrs.}}{6,000 \text{ hrs.}} \times 100$$
- $$= 75\%$$
- (ii) Activity Ratio = $\frac{\text{Standard Hours (for actual production)}}{\text{Budgeted Hours}} \times 100$
- $$= \frac{450 \text{ units} \times 10 \text{ hrs.}}{528 \text{ units} \times 10 \text{ hrs.}} \times 100$$
- $$= 85.23\%$$

$$\begin{aligned}
 \text{(iii) Capacity Ratio} &= \frac{\text{Actual Hours (worked)}}{\text{Budgeted Hours}} \times 100 \\
 &= \frac{6,000 \text{ hrs.}}{528 \text{ units} \times 10 \text{ hrs.}} \times 100 \\
 &= 113.64\%
 \end{aligned}$$

10. Analysis of WIP Account

	November	December
Opening WIP	36,000	56,600
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	2,10,600
Less: Variable Cost of Goods Manufactured	1,07,500	1,15,900
Ending WIP	56,600	94,700

Analysis of Finished Goods Inventory Account

	November	December
Opening Finished Goods	44,000	28,500
Add: Cost of Goods Manufactured	1,07,500	1,15,900
Cost of Goods Available for Sale	1,51,500	1,44,400
Less: Cost of Goods Sold	1,23,000	99,400
Ending Finished Goods Inventory	28,500	45,000

11. Statement Showing Reconciliation Between Budgeted [F.Y. 2014-15] & Actual Profit [F.Y. 2015-16]

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

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

$$= ₹ 25 (A)$$

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

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

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

$$\begin{aligned}
 &= \text{Budgeted Variable Overheads for Actual Hours} - \text{Actual Variable Overheads} \\
 &\quad \text{Or} \\
 &= \text{Std. Rate per unit} \times \text{Expected Output for Actual Hours Worked} - \\
 &\quad \text{Actual Variable Overheads} \\
 &= ₹ 500 - ₹ 525 \\
 &= ₹ 25 \text{ (A)}
 \end{aligned}$$

Efficiency Variances = Standard Variable Overheads for Production – Budgeted Variable Overheads for Actual Hours

$$\begin{aligned}
 &\quad \text{Or} \\
 &= \text{Std. Rate per unit} \times \text{Actual Output} - \text{Std. Rate per unit} \times \\
 &\quad \text{Expected Output for Actual Hours Worked} \\
 &= ₹ 475 - ₹ 500 \\
 &= ₹ 25 \text{ (A)}
 \end{aligned}$$

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

$$\begin{aligned}
 &= \text{Budgeted Fixed Overheads} - \text{Actual Fixed Overheads.} \\
 &= ₹ 300.00 - ₹ 367.50 \\
 &= ₹ 67.50 \text{ (A)}
 \end{aligned}$$

Working Notes (₹ in lacs)**Note-1:**

Sales in F.Y. 2015-2016	3,277.50
Less: Increase due to <i>price rise</i> [₹ 3,277.50 lacs x 15/115]	427.50
Sales in F.Y. 2015-2016 at F.Y. 2014-2015 Prices [Standard Sales]	2,850.00

Sales in F.Y. 2014-2015	3,000.00
Fall in Sales in F.Y. 2015-2016 [₹ 3,000 lacs - ₹ 2,850 lacs]	150.00
Percentage fall	5%

Note-2:

Material Cost in F.Y. 2014-2015	2,000.00
Less: 5% for Decrease in Volume	100.00
'Standard Material Usage' at F.Y. 2014-15 Prices (Standard Cost of Standard Quantity for Actual output)	1,900.00
Actual Material Cost F.Y. 2015-2016	2,357.50
Less: 15% Increase in Prices [₹ 2,357.50 lakhs x 15/115]	307.50
Actual Materials Used, at F.Y. 2014-2015 Prices (Standard Cost of Actual Quantity)	2,050.00

Note-3:

Variable Overheads Cost in F.Y. 2014-15	500.00
Less: 5% due to fall in Volume of Sales in F.Y. 2015-16	25.00
"Standard Overheads for Production" in F.Y. 2015-16	475.00
Actual Variable Overheads Incurred in F.Y. 2015-16	525.00
Less: 5% for Increase in Price [₹ 525 lacs x 5 / 105]	25.00
Amount Spent in F.Y. 2015-16 at F.Y. 2014-15 Prices (Budgeted Variable Overheads for Actual Hours)	500.00

12. (i) New Product *tie up* --- Innovation / Learning Perspective
(ii) Growth of Volume --- Financial Perspective
(iii) Time for Loan / Fresh Products --- Customer Perspective
13. Let x_1 , x_2 and x_3 denote the number of advertisements to be released in three magazines A, B and C 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:

$$\begin{aligned}
 Z &= (0.40 \times 50,000) x_1 + (0.30 \times 30,000) x_2 + (0.16 \times 20,000) x_3 \\
 &= 20,000x_1 + 9,000x_2 + 3,200x_3
 \end{aligned}$$

Constraints:

The budgeted amount for the advertisements is at the most ₹1,50,000

$$\text{Hence, } 12,000x_1 + 9,000x_2 + 7,500x_3 \leq 1,50,000$$

Also, the magazine A should have no more than 8 advertisements, B and C each should get at least 4 advertisements.

$$\begin{aligned} \text{Hence, } x_1 &\leq 8, \\ x_2 &\geq 4 \text{ and} \\ x_3 &\geq 4 \end{aligned}$$

The linear programming model for the problem:

Maximise	
Z	= 20,000x ₁ + 9,000x ₂ + 3,200x ₃
<i>Subject to the Constraints:</i>	
	12,000x ₁ + 9,000x ₂ + 7,500x ₃ ≤ 1,50,000
	x ₁ ≤ 8
	x ₂ ≥ 4
	x ₃ ≥ 4
Where	x ₁ , x ₂ and x ₃ ≥ 0

14. Dummy machine (X₅) is inserted to make it a balanced cost matrix and assume its installation cost to be zero. Cost of install at cell X₃ (P) and X₂ (R) is very high marked as M.

	P	Q	R	S	T
X ₁	9	11	15	10	11
X ₂	12	9	M	10	9
X ₃	M	11	14	11	7
X ₄	14	8	12	7	8
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	2	6	1	2
X ₂	3	0	M	1	0
X ₃	M	4	7	4	0
X ₄	7	1	5	0	1
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	2	6	1	2
X ₂	3	0	M	1	0
X ₃	M	4	7	4	0
X ₄	7	1	5	0	1
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	2	6	1	2
X ₂	3	0	M	1	0
X ₃	M	4	7	4	0
X ₄	7	1	5	0	1
X ₅ (Dummy)	0	0	0	0	0

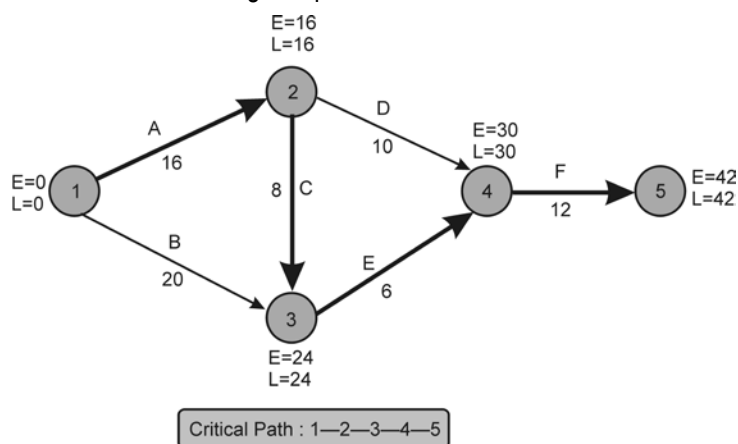
There are five lines which are equal to the order of the matrix. Hence the solution is optimal. We may proceed to make the assignment as under-

	P	Q	R	S	T
X ₁	0	2	6	1	2
X ₂	3	0	M	1	0
X ₃	M	4	7	4	0
X ₄	7	1	5	0	1
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	9
X ₂	Q	9
X ₃	T	7
X ₄	S	7
X ₅ (Dummy)	R	0
Total		32

15. (i) The **Network** for the given problem:



- (ii) **Critical Path:** 1-2-3-4-5 (A-C-E-F).

- (iii) **Total Float and Free Float** for each activity:

Activity	Duration	EST	EFT	LST	LFT	Slack of Tail Event	Slack of Head Event	Total Float	Free 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
A (1-2)	16	0	16	0	16	0	0	0	0
B (1-3)	20	0	20	4	24	0	0	4	4
C (2-3)	8	16	24	16	24	0	0	0	0
D (2-4)	10	16	26	20	30	0	0	4	4
E (3-4)	6	24	30	24	30	0	0	0	0
F (4-5)	12	30	42	30	42	0	0	0	0

16. (i)

₹ / u Avg. / unit (4 units)	
Variable Cost	1,000
Labour	405
Target Contribution	750
Price to be Quoted	2,155

- (ii) No, Corcodile Ltd. cannot quote this price for varying products because the learning curve Ratio does not apply to non-repeated jobs. Each product will carry a different price according to its direct labour hours.

17. (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

18. (i) Invalid; (ii) Invalid; (iii) Invalid; (iv) Valid; (v) Valid

19. (i) Invalid; (ii) Valid; (iii) Valid; (iv) Valid; (v) Valid

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING
QUESTIONS

Activity Based Costing

- 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

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

Value Added/ Non -Value Added Activities

- 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

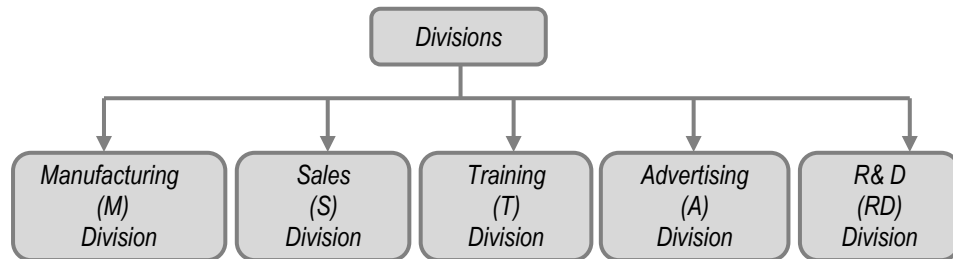
- Prepare a profitability statement that is more useful for decision making than the profit statement prepared by BOSH India Ltd.
- Calculate the break-even volume in batches and also in approximate units for Product 'B'.

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

17. 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

- (i) Find the??? Figures.
 - (ii) Draw the network.
 - (iii) 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'

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

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 allows 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)**

Price Variance = Actual Sales – Standard Sales

= ₹ 3,277.50 – ₹ 2,850.00

= ₹ 427.50 (F)

Volume Variance = Standard Sales – Budgeted Sales

= ₹ 2,850.00 – ₹ 3,000.00

= ₹ 150 (A)

Sales Contribution Variances

Sales Contribution = Sales Price Variance

Price Variance

= ₹ 427.50 (F)

Sales Contribution = Sales Volume Variance × Budgeted PV Ratio

Volume Variance

= ₹ 150 (A) × $\left(\frac{₹ 200 + ₹ 300}{₹ 3,000} \right)$

= ₹ 25 (A)

Material Variances (W.N.2)

Material Price Variance

= Standard Cost of Actual Quantity – Actual Cost

= ₹ 2,050.00 – ₹ 2,357.50

= ₹ 307.50 (A)

Material Usage Variance

= Standard Cost of Standard Quantity for Actual Output –
Standard Cost of Actual Quantity

= ₹ 1,900 – ₹ 2,050

= ₹ 150 (A)

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

= Budgeted Variable Overheads for Actual Hours – Actual Variable Overheads

Or

= Std. Rate *per unit* × Expected Output for Actual Hours Worked – Actual Variable Overheads

= ₹ 500 – ₹ 525

= ₹ 25 (A)

Efficiency Variances = Standard Variable Overheads for Production – Budgeted Variable Overheads for Actual Hours

Or

= Std. Rate *per unit* × Actual Output – Std. Rate *per unit* × Expected Output for Actual Hours Worked

= ₹ 475 – ₹ 500

= ₹ 25 (A)

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

= Budgeted Fixed Overheads – Actual Fixed Overheads.

= ₹ 300.00 – ₹ 367.50

= ₹ 67.50 (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-

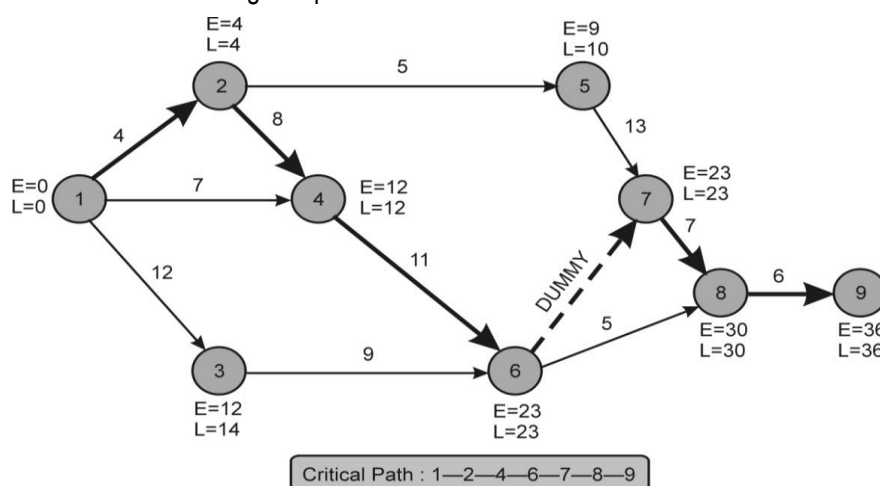
Machines	Location	Costs (₹)
X ₁	P	18
X ₂	Q	18
X ₃	T	14
X ₄	S	14
X ₅ (Dummy)	R	0
Total		64

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

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING
QUESTIONS

Total Quality Management – Quality Cost (Two Wheeler, Manufacturer)

1. Hindustan Bikes Ltd. (HBL) formerly known as HELCO is an Indian multinational company. It's headquarter is located in Bengaluru, India. It has been founded in the year 1990 as a manufacturer of locomotives. The company is presently listed locally as well as in international stock market. HBL's parent company is Hindustan Group. The management of HBL recognizes the need to establish a culture at the company so that -
"Do the right things, right the first time, every time".

Management has provide you following actual information for the most recent month of the current year:

Cost Data

₹

Customer Support Centre Cost	35 per hr.
Equipment Testing Cost	18 per hr.
Warranty Repair Cost	1,560 per bike
Manufacturing Rework Cost	228 per bike

Volume and Activity Data

Bikes Requiring Manufacturing Rework	3,200 bikes
Bikes Requiring Warranty Repair	2,600 bikes
Production Line Equipment Testing Time	1,600 hrs.
Customer Support Centre Time	2,000 hrs.

Additional information

HBL carried out a quality review of its existing suppliers to enhance quality levels during the month at a cost of ₹1,25,000. Due to the quality issues in the month, the bike production line experienced unproductive 'down time' which cost ₹7,70,000.

Required:

Prepare a statement showing 'Total Quality Cost'.

Life Cycle Analysis

2. P & G International Ltd. (PGIL) has developed a new product "K" which is about to be launched into the market and anticipates to sell 80,000 of these units at a sales price of ₹300 over the product's life cycle of four years. Data pertaining to product "K" are as follows:

Costs of Design and Development of Molds, Dies, and Other Tools	₹8,25,000
Manufacturing Costs	₹125 per unit
Selling Costs	₹12,500 per year + ₹100 per unit
Administration Costs	₹50,000 per year
Warranty Expenses	5 Replacement Parts per 25 units at ₹10 per part ; 1 Visit per 500 units (Cost ₹ 500 per visit)

Required:

- Compute the product "K"'s 'Life Cycle Cost'.
- Suppose PGIL can increase sales volume by 25% through 10% reduction in selling price. Should PGIL choose the lower price?

Decision Making using BEP Analysis

- You have been approached by a friend who is seeking your advice as to whether he should give up his job as an engineer, with a current salary of ₹14,800 per month and go into business on his own assembling and selling a component which he has invented. He can procure the parts required to manufacture the component from a supplier.

It is very difficult to forecast the sales potential of the component, but after some research, your friend has estimated the sales as follows:

- Between 600 to 900 components per month at a selling price of ₹250 per component.
- Between 901 to 1,250 components per month at a selling price of ₹ 220 per component for the entire lot.

The costs of the parts required would be ₹ 140 for each completed component. However if more than 1,000 components are produced in each month, a discount of 5% would be received from the supplier of parts on all purchases.

Assembly costs would be ₹ 60,000 per month up to 750 components. Beyond this level of activity assembly costs would increase to ₹ 70,000 per month.

Your friend has already spent ₹ 30,000 on development, which he would write – off over the first five years of the venture.

Required:

- Calculate for each of the possible sales levels at which your friend could expect to benefit by going into the venture on his own.
- Calculate the 'Break – Even Point' of the venture for each of the selling price.
- Advise your friend as to the viability of the venture.

Minimum Price – Relevant Cost Concept

4. XL Polymers, located in Sahibabad Industrial Area, manufactures high quality industrial products. AT Industries has asked XL Polymers for a special job that must be completed within one week.

Raw material R_1 (highly toxic) will be needed to complete the AT Industries' special job. XL Polymers purchased the R_1 two weeks ago for ₹7,500 for a job 'A' that recently was completed. The R_1 currently in stock is the excess from that job and XL Polymers had been planning to dispose of it. XL Polymers estimates that it would cost them ₹1,250 to dispose of the R_1 . Current replacement cost of R_1 is ₹6,000.

Special job will require 250 hours of labour G_1 and 100 hours of labour G_2 . XL Polymers pays their G_1 and G_2 employees ₹630 and ₹336 respectively for 42 hours of work per week. XL Polymers anticipates having excess capacity of 150 [G_1] and 200 [G_2] labour hours in the coming week. XL Polymers can also hire additional G_1 and G_2 labour on an hourly basis; these part-time employees are paid an hourly wage based on the wages paid to current employees.

Suppose that material and labour comprise XL Polymers's only costs for completing the special job.

Required:

Calculate the 'Minimum Price' that XL Polymers should bid on this job?

Flexible Budget – Basic Concepts

5. The PLN Co. presents the following static budgets for 4,000 units and 6,000 units activity levels for October 2014:

	Activity Level	
	4,000 units	6,000 units
Overhead A ₹ 12/hr. x 2 hr. / unit	96,000	1,44,000
Overhead B	1,40,000	1,90,000

Overhead C was omitted to be listed out. It is a fixed plant overhead, estimated at ₹ 12.5/hr. at 4,000 units activity level. This has to also feature in the flexible budget. The actual production was 5,000 units and 9,600 hours were needed for production.

Required:

Prepare a statement showing the 'Flexible Budget' amount of each overhead to enable appropriate comparison with the actual figures.

Application of Sales Variances (Marketing Company)

6. Universal LTD. is engaged in marketing of wide range of consumer goods. M, N, O and P are the zonal sales officers for your zones. The company fixes annual sales target for them individually.

You are furnished with the following:

- The standard costs of sales target in respect of M, N, O and P are ₹ 5,00,000, ₹ 3,75,000, ₹ 4,00,000 and ₹ 4,25,000 respectively.
- M, N, O and P respectively earned ₹ 29,900, ₹ 23,500, ₹ 24,500 and ₹ 25,800 as commission at 5% on actual sales effected by them during the previous year.
- The relevant variances as computed by a qualified accountant are as follows:

Particulars	M (₹)	N (₹)	O (₹)	P (₹)
Sales Price Variance	4,000 (F)	6,000 (A)	5,000 (A)	2,000 (A)
Sales Volume Variance	6,000 (A)	26,000 (F)	15,000 (F)	8,000 (F)
Sales Margin Mix Variance	14,000 (A)	8,000 (F)	17,000 (F)	3,000 (A)

Note: (A) = Adverse variance and (F) = Favorable variance

Required:

- Compute the amount of 'Sales Target Fixed' and the 'Actual Margin Earned' in case of each of the zonal sales officer.
- Evaluate the overall performance of these zonal sales officers taking three relevant base factors and then recommend whose performance is the best.

Interpretation of Variances and CSFs (Spices Manufacturer)

7. 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'.

Transfer Pricing Based on Opportunity Cost

8. Division Z is a profit center which produces four products A, B, C and D. Each product is sold in the external market also. Data for the period is:

	A	B	C	D
Market Price <i>per unit</i> (₹)	150	146	140	130
Variable Cost of Production <i>per unit</i> (₹)	130	100	90	85
Labour Hours Required <i>per unit</i>	3	4	2	3

Product D can be transferred to Division Y, but the maximum quantity that may be required for transfer is 2,500 units of D.

The maximum sales in the external market are:

- A 2,800 units
- B 2,500 units
- C 2,300 units
- D 1,600 units

Division Y can purchase the same product at a price of ₹125 per unit from outside instead of receiving transfer of product D from Division Z.

Required:

Calculate the 'Transfer Price' for each unit for 2,500 units of D, if the total labour hours available in Division Z are 20,000 hours?

Balance Score Card (Banking Company)

9. Your Bank Ltd., was established on the 30th September, 1940 under the provisions of Co-operative Societies Act by the eminent professionals to encourage self-help, thrift, cooperation among members. Bank was issued Banking License under Banking

Regulation Act, 1949 on October 25, 1986 to carry out the Banking Business within the national capital and since then the Bank has been growing continuously. At present, Bank has large number of membership of individuals from different sections. The Bank has 12 branches in the NCT of Delhi. Bank offers 'traditional counter service'. Opening hours are designed to coincide with local market days.

Board of Directors were worried from growing popularity of new style banks. These banks offer *diverse range* of services such as direct access to executive management, a single point of contact to coordinate all banking needs, appointment banking to save time, free online banking services 24/7, free unlimited ATM access etc.

It has now been decided that the bank will focus on "What Customers Want" and will use a balanced scorecard to achieve this goal.

Required:

Produce, for each of the three non-financial perspectives of a 'Balanced Scorecard', an *objective* and a *performance measure* that the bank could use with *appropriate reason*.

Customer Profitability Analysis (Pharmaceutical Firm)

10. Oxford Medical Care Co. (OMCC) is a pharmaceutical firm, operating its entire business through its four customers Ox₁, Ox₂, Ox₃, and Ox₄. Ox₁ and Ox₂ are small pharmaceutical stores while Ox₃ and Ox₄ are large discount stores with attached pharmacies. OMCC uses discount pricing strategy and prices its products at variable cost plus 25%.

Item	Small Pharmaceuticals		Large Pharmaceuticals		Activity Rate
	Ox ₁	Ox ₂	Ox ₃	Ox ₄	
Number of Orders	4	9	6	3	₹750
Order Size	₹40,000	₹20,000	₹4,25,000	₹4,00,000	n/a
Average Discount	4.50%	9.50%	17.50%	11.50%	n/a
Regular Deliveries	4	9	6	3	₹375
Expedited Deliveries	2	0	2	0	₹1,250
General Administration Cost	₹20,250		₹48,375		

Required:

- Prepare a 'Customer Profitability Statement' that shows the profit from each customer and each customer channel.
- Recommend some points to improve OMCC's profit.

Balance Score Card (Fitness Centre)

11. Fitness Solution is a family owned fitness club, founded in 2010 by Peter and Albert with traditional style equipment. Club commenced operations in February 2011 within a

shopping mall so that members after working out, can conveniently shop, dine, pick up their children from enrichment classes or go to the cinema.

Peter and Albert, the owners, pride themselves for providing a customized / tailored program by taking into account a person's medical history, present fitness level, fitness goals, fitness interests and offer many other small amenities that might be difficult to get in a larger Fitness Centre. They believe –

“Each individual is unique and requires a specialized program plan which should be customized and tailored to his/her needs.”

They have a number of loyal members even though they offer the traditional style equipment.

Peter and Albert take care of most of the routine operations, along with a small permanent staff, and temporary staff.

Required:

- (i) Identify at least three 'Critical Success Factors' for Fitness Solution.
- (ii) Construct a 'Balance Scorecard' for Fitness Solution. (2 measures for each of the 4 perspectives are sufficient).

Linear Programming – Simplex Method

12. Given below is an iteration in a simplex table for a maximization objective linear programming product mix problem for products x, y and z. Each of these products is processed in three machines KA-07, KB-27 & KC-49 and each machine has limited available hours.

$C_j \rightarrow$			30	40	20	0	0	0
C_B	Basic Variable (B)	Value of Basic Variables b ($=X_B$)	x	y	z	s_1	s_2	s_3
30	x	250	1	0	-26/16	10/16	-12/16	0
40	y	625	0	1	31/16	-7/16	10/16	0
0	s_3	125	0	0	11/16	-3/16	1/8	1

s_1 , s_2 and s_3 are slack variables for machine KA-07, KB-27 and KC-49 respectively. Answer the following questions, giving reasons in brief:

- (i) Does the table above give an 'Optimal Solution'?
- (ii) Are there more than one 'Optimal Solution' / 'Alternate Optimal Solution'?
- (iii) Is this solution 'Feasible'?
- (iv) Is this solution 'Degenerate'?

- (v) Write down the 'Objective Function' of the problem.
- (vi) Write the 'Optimal Product Mix' and 'Profit' shown by the above solution.
- (vii) Which of these machines is being used to the full capacity when producing according to this solution?
- (viii) How much would you be prepared to pay for another hour of capacity each on machine KA-07, machine KB-27, and machine KC-49?
- (ix) If the company wishes to expand the production capacity, which of the three resources should be given priority?
- (x) What happens if 16 machine hours are lost due to some mechanical problem in machine KB-27?
- (xi) A customer would like to have one unit of product z and is willing to pay higher price for z in order to get it. How much should the price be increased so that the company's profit remains unchanged?
- (xii) A new product is proposed to be introduced which would require processing time of 4 hours on machine KA-07, 2 hours on machine KB-27 and 4 hours on machine KC-49. It would yield a profit of ₹12 per unit. Do you think it is advisable to introduce this product?

Transportation Problem – Change in Resource Capacities AND/ OR Destination Requirements

13. The following table shows all the necessary information on the available supply from each warehouse, the requirement of each market and the unit transportation cost in rupees from each warehouse to each market.

Warehouses	Markets				Supply
	I	II	III	IV	
A	5	2	4	3	22
B	4	8	1	6	15
C	4	6	7	5	8
Requirement	7	12	17	9	45/45

The shipping clerk has worked out the following schedule from experience:

12 units from A to II, 1 unit from A to III, 9 units from A to IV, 15 units from B to III, 7 units from C to I and 1 unit from C to III.

- (i) Check if the clerk has made the 'Optimal Schedule'.
- (ii) Find the 'Optimal Schedule' and 'Minimum Total Shipping Cost'.

- (iii) Carrier of route C to II offers to transport entire supply of warehouse C at a reduced price. By how much must the rate be reduced by the Carrier before the clerk should consider giving him business?
- (iv) If the supply from warehouse B reduces to 11 units and simultaneously the requirement of market III reduces to 13 units, find the 'Optimal Transportation Schedule'.
- (v) Further, if supply from warehouse A also reduces to 19 units and simultaneously the requirement of III reduces further to 10 units, will the optimal solution of part (iv) change?

Assignment Problem – The Travelling Salesman Problem

14. A salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. Cost (in ₹ '000) of travelling from one city to another is given below:

	P	Q	R	S	T
P	-	5	14	20	2
Q	17	-	8	23	5
R	23	20	-	11	20
S	35	11	17	-	14
T	2	8	5	23	-

Required:

Find out the 'Least Cost Route'.

Application of Simulation Technique in Project Management

15. The following table gives the activities in a construction project and the time durations with associated probability of each activity:

Activity	Predecessors	Time (in Days)	Probability
A	---	6	0.50
		8	0.50
B	---	4	0.30
		5	0.20
		6	0.50
C	A	8	0.50
		16	0.50

D	A, B	8	0.30
		10	0.70
E	C, D	2	0.20
		4	0.80

To simulate the project, use the following random numbers taking the first five random numbers digits (representing the five activities) for each trial and so on:

11, 16, 23, 72, 94; 83, 83, 02, 97, 99; 83, 10, 93, 4, 33; 53, 49, 94, 37, 7

Required:

Determine the 'Critical Path' and the 'Project Duration' for each trial.

Learning Curve – Steady State

16. AUD International Co. is a multiproduct firm. It is planning to launch a new product 'X-500' in coming months. Production will be in batches of 1,000 units throughout the life of the product. It is also possible to achieve 90% learning rate but the learning would cease after 64th batch. Other relevant data of product 'X-500' is as follows:

Expected Life	2,56,000 units
Selling Price <i>per unit</i>	₹123
Direct Material <i>per unit</i>	₹36
Direct Labour Cost <i>first batch</i>	₹52,500
Other Variable Costs	₹24
Specific Fixed Cost	₹38,75,000

Required:

- Calculate the 'Expected Profit' to be earned from the product over its lifetime.
Note: The learning index for a 90% learning curve is -0.152; $(64)^{-0.152} = 0.5314$; $(63)^{-0.152} = 0.5327$
- It is now thought that a learning effect will continue for all of the 256 batches that will be produced. Calculate the 'Rate of Learning' required to achieve a lifetime product profit of ₹1,00,00,000, assuming that a constant rate of learning applies throughout the product's life.

SUGGESTED ANSWERS/ HINTS**1. Statement Showing “Total Quality Cost”**

Particulars of Costs	₹
Prevention Costs	
Supplier Review	1,25,000
Appraisal Costs	
Equipment Testing (₹18 × 1,600 hrs.)	28,800
Internal Failure Costs	
Down Time	7,70,000
Manufacturing Rework (₹228 × 3,200 bikes)	7,29,600
External Failure Costs	
Customer Support (₹35 × 2,000 hrs.)	70,000
Warranty Repair (₹1,560 × 2,600 bikes)	40,56,000
Total Quality Costs	57,79,400

2. (i) Statement Showing “K’s Life Cycle Cost (80,000 units)”

Particulars	Amount (₹)
Costs of Design and Development of Molds, Dies, and Other Tools	8,25,000
Manufacturing Costs (₹125 × 80,000 units)	1,00,00,000
Selling Costs (₹100 × 80,000 units + ₹12,500 × 4)	80,50,000
Administration Costs (₹50,000 × 4)	2,00,000
Warranty (80,000 units / 25 units × 5 parts × ₹10)	1,60,000
(80,000 units / 500 units × 1 visit × ₹500)	80,000
Total Cost	1,93,15,000

(ii) Statement Showing “K’s Life Cycle Cost (1,00,000 units)”

Particulars	Amount (₹)
Costs of Design and Development of Molds, Dies, and Other Tools	8,25,000
Manufacturing Costs (₹125 × 1,00,000 units)	1,25,00,000
Selling Costs (₹100 × 1,00,000 units + ₹12,500 × 4)	1,00,50,000

Administration Costs (₹50,000 × 4)	2,00,000
Warranty (1,00,000 units / 25 units × 5 parts × ₹10)	2,00,000
(1,00,000 units / 500 units × 1 visit × ₹500)	1,00,000
Total Cost	2,38,75,000

Statement Showing “K’s Life Time Profit”

Particulars	Amount (₹) 80,000 units	Amount (₹) 100,000 units
Sales	2,40,00,000 (80,000 × ₹300)	2,70,00,000 (1,00,000 × ₹270)
Less: Total Cost	1,93,15,000	2,38,75,000
Profit	46,85,000	31,25,000

Decision

Reducing the price by 10% will decrease profit by 33% (₹15,60,000). Therefore, PGIL should not cut the price.

3. The salary of ₹14,800 per month is a benefit foregone by going into business. It should therefore be considered as a minimum profit which must be earned p.m. from the new venture in order to be not worse – off than before.

Sum of ₹30,000 spent on the development work of the new venture cannot be recovered irrespective of the decision and thus it should be ignored.

At a Selling Price of ₹250

Contribution *per unit* (₹250 – ₹140) ₹110

Minimum Sales (units) to recover *assembly costs* of ₹60,000 p.m. and earn a *profit* of ₹14,800 p.m. (Break – even Sales Level)

$$\frac{₹60,000 + ₹14,800}{₹110} = 680 \text{ units}$$

Note that at 600 units and up to 679 units i.e. units below the break-even level the loss would be ₹110/- per unit. From 680 units up to 750 units i.e. on additional 70 units the total profit would be ₹ 7,700 (70 units × ₹110).

Minimum Sales (units) to recover *assembly cost* of ₹70,000 p.m. and earn a *profit* of ₹14,800 p.m. (Break – even Sales Level)

$$\frac{₹70,000 + ₹14,800}{₹110} = 770.909 \text{ units}$$

If the sales units are more than 770.909 units and up to 900 units, profit would be made. The total amount of profit comes to ₹14,200 [(900 units – 770.909 units) × ₹110]

It is not worthwhile to proceed if the demand of components is less than 680 units or between 750 to 770.909 units.

At a Selling Price of ₹220

Minimum Sales (units) to recover *assembly cost* of ₹70,000 p.m. and earn a *profit* of ₹14,800 p.m. (Break even – Sales Level)

$$\frac{₹70,000 + ₹14,800}{₹220 - ₹140} = 1,060 \text{ units}$$

Minimum Sales (units) to recover *assembly cost* of ₹70,000 p.m. and earn a profit of ₹14,800 p.m.; after availing a discount of 5% on the purchases of all parts.

$$\frac{₹70,000 + ₹14,800}{₹220 - \left(₹140 - \frac{5}{100} \times ₹140 \right)} = 974.712 \text{ units}$$

Or 975 units

Conclusion

It is not worthwhile to sell between 900 and 1,000 units when no discount is available. Also, it is worthwhile selling at ₹220 if sales units are in excess of 1,000 units and a discount of 5% is available on the purchase of all components–parts.

Profit on the Sale (1,250 units) ₹23,950 (1,250 units × ₹87 – ₹84,800)

Advice on the viability of the venture

At a selling price of ₹250 he will not be at a loss if the demand of the component exceeds 680 units to 750 units and 770.909 units to 900 units.

At a selling price of ₹220, it is not worthwhile to sell if the demand is less than 1,000 components without availing a discount of 5%.

4. Opportunity Cost of Labour - The G₂ labour has zero opportunity cost as there is no other use for the time already paid for and is available. However, XL Polymers needs to pay an additional amount for G₁ labour. This amount can be save if the special job were not there.

G₁ labour:

Hours Required	250
Hours Available	<u>150</u>
Extra Hours Needed	100
Cost per hour (₹630/42hrs)	<u>₹15</u>
Opportunity Cost	₹1,500

Thus, the 'Opportunity Cost of Labour' for completing the special job is ₹1,500.

Opportunity Cost of Material – XL Polymers has no alternative use for the R₁, they must dispose of it at a cost of ₹1,250. Thus, XL Polymers actually saves ₹1,250 by using the materials for the AT Industries' special job. Consequently, the 'Opportunity Cost of Material' is - ₹1,250 (i.e., the opportunity cost of this resource is negative).

The *minimum price* is the price at which XL Polymers just recovers its 'Opportunity Cost'. XL Polymers's 'Total Opportunity Cost' is ₹250 (₹1,500 – ₹1,250). Accordingly, minimum Price for the Special Job is ₹250.

5. **Statement Showing "Flexible Budget for 5,000 units Activity Level"**

Particulars	Amount (₹)
Overhead A (₹12.00 per hour × 2 hrs. per unit × 5,000 units)	1,20,000
Overhead B* (₹40,000 + ₹ 25 × 5,000 units)	1,65,000
Overhead C (₹12.50 per hour × 2 hrs. per unit × 4,000 units)	1,00,000
Total	3,85,000

Working Note (*):

Overhead B

$$\begin{aligned}
 \text{Variable Cost (per unit)} &= \frac{\text{Change in Overhead Cost}}{\text{Change in Production Units}} \\
 &= \frac{₹ 1,90,000 - ₹ 1,40,000}{6,000 \text{ units} - 4,000 \text{ units}} \\
 &= ₹25 \\
 \text{Fixed Cost} &= ₹1,40,000 - 4,000 \text{ units} \times ₹25 \\
 &= ₹40,000
 \end{aligned}$$

6. **Statement Showing "Sales Target Fixed and Actual Margin"**

Particulars	Zonal Sales Officers			
	M (₹)	N (₹)	O (₹)	P (₹)
Commissioned Earned	29,900	23,500	24,500	25,800
Actual Sales (Commission Earned/ 5%)	5,98,000	4,70,000	4,90,000	5,16,000
Sales Price Variance	4,000(F)	6,000(A)	5,000(A)	2,000(A)
Sales Volume Variance	6,000(A)	26,000(F)	15,000(F)	8,000(F)

Sales Target (Budgeted Sales)	6,00,000	4,50,000	4,80,000	5,10,000
Standard Cost of Sales Target	5,00,000	3,75,000	4,00,000	4,25,000
Budgeted Margin	1,00,000	75,000	80,000	85,000
Sales Margin Mix Variance	14,000(A)	8,000(F)	17,000(F)	3,000(A)
Sales Price Variance	4,000(F)	6,000(A)	5,000(A)	2,000(A)
Actual Margin	90,000	77,000	92,000	80,000

Note: Since no information has been given about Sales Margin Quantity Variance, therefore for calculating actual margin the same has been assumed to be **zero**.

Statement Showing “Evaluation of the Performance of Zonal Sales Officers”

Particulars	Zonal Sales Officers			
	M	N	O	P
Efficiency towards the Target Sales				
(a) Whether target achieved	No	Yes	Yes	Yes
(b) Actual Sales to Target Sales Ratio	99.67%	104.44%	102.08%	101.18%
(c) Rank	IV	I	II	III
Contribution Approach				
(a) Contribution Earned (₹)	90,000	77,000	92,000	80,000
(b) Rank	II	IV	I	III
Margin Vs Sales Ratio				
(a) Budgeted Margin/ Sales Target Ratio	16.67%	16.67%	16.67%	16.67%
(b) Actual Margin Vs Actual Sales Ratio	15.05%	16.38%	18.78%	15.50%
(c) Rank	IV	II	I	III

An analysis on performance of four Zonal Sales Officers based on three base factors, the performance of officer O is the best.

7. (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.

8. “Ranking of Products When Availability of Time is the Key Factor”

Products	A	B	C	D
Market Price (₹)	150	146	140	130
Less: Variable Cost (₹)	130	100	90	85
Contribution per unit (₹)	20	46	50	45
Labour Hours per unit	3 hrs.	4 hrs.	2 hrs.	3 hrs.
Contribution per Labour Hour	6.66..	11.50	25.00	15.00
Ranking	IV	III	I	II
Maximum Demand (units)	2,800	2,500	2,300	1,600
Total No. of Hours	8,400	10,000	4,600	4,800
Allocation of 20,000 Hours on the Basis of Ranking	600*	10,000	4,600	4,800

(*) Balancing Figure

Note -Time required to meeting the demand of 2,500 units of Product D for Division Y is 7,500 hrs. This requirement of time viz. 7,500 hrs for providing 2,500 units of Product D for Division Y can be met by sacrificing 600 hours of Product A (200 units) and 6,900 hours of Product B (1,725 units).

$$\begin{aligned}
 \text{Transfer Price} &= \text{Variable Cost} + \text{Opportunity Cost} \\
 &= ₹85 + \frac{(6,900 \text{ hrs.} \times ₹11.5 + 600 \text{ hrs.} \times ₹6.66...)}{2,500 \text{ units}} \\
 &= ₹85 + \frac{₹79,350 + ₹4,000}{2,500 \text{ units}} \\
 &= ₹85 + ₹33.34 \\
 &= ₹118.34
 \end{aligned}$$

9. Internal Business Process Perspective

Objective: Cross-sell Products

Measure: Products Purchased *per customer*

Reason: Cross-selling, or encouragement customers to purchase additional products e.g. insurance, forex etc. is a *measure of customer satisfaction*. Only if a service is perceived as highly satisfactory the service would be repeated/ additional products or services would be accepted.

Learning and Growth Perspective

Objective: Increase the Number of New Products or Services Sold

Measure: Number of Customers Buying the New Products/ New Services

Reason: Long term financial success requires bank to create new products / services (e.g. internet banking, ATM access) that will meet emerging needs of current / future customers such as 24/7 banking.

Customer Perspective

Objective: Increase Customer Loyalty

Measure: Number of Accounts Closed or Closure Request Received

Reason: Customer loyalty describes the extent to which bank maintains durable relations to its customers. The share of existing customers should have a high importance as it indicates about image and reputation. Closure request is not a good sign. Bank should investigate reasons for the same and take appropriate actions to improve services offered to retain customers.



Other **Objectives** and **Measures** are also possible but they must relate to the bank's **Goal**.

10. Statement Showing “Customer Profitability Analysis”

Particulars	Ox ₁	Ox ₂	Channel Total	Ox ₃	Ox ₄	Channel Total
	Small Stores			Large Stores		
Revenue	1,60,000	1,80,000	3,40,000	25,50,000	12,00,000	37,50,000
Discount	7,200	17,100	24,300	4,46,250	1,38,000	5,84,250
Net Revenue	1,52,800	1,62,900	3,15,700	21,03,750	10,62,000	31,65,750
Variable Costs	1,28,000	1,44,000	2,72,000	20,40,000	9,60,000	30,00,000
Contribution Margin	24,800	18,900	43,700	63,750	1,02,000	1,65,750
Order Processing	3,000	6,750	9,750	4,500	2,250	6,750
Regular Deliveries	1,500	3,375	4,875	2,250	1,125	3,375
Expedited Deliveries	2,500	---	2,500	2,500	---	2,500

Customer Profit	17,800	8,775	26,575	54,500	98,625	1,53,125
Channel Cost			20,250			48,375
Channel Profit			6,325			1,04,750

Recommendations

Small Pharmaceuticals

Even though Ox₁ has lower sales volume (11% lesser from Ox₂), it is contributing around 67% of small store's profit as its order is for larger quantities and discount offered is very less.

OMCC is only just at breakeven point with small pharmaceuticals. To improve profit OMCC should:

- (i) Coordinate with Ox₂ to *increase order size* and try to *negotiate a smaller discount*.
- (ii) Try to work with Ox₁ to *reduce expedited deliveries*.

Large Pharmaceuticals

OMCC makes substantial profit from the large pharmaceuticals. Ox₄ alone contributing around 55% of total customer's profit and its order is for larger quantities. Therefore, Ox₄ is most favorable customer and may be given *little extra attention*. For Ox₃, OMCC may have *no options* but to treat it as less profitable customer as Ox₃ accounts more than 60% of sales.

11. (i) Fitness Solution's main **Critical Success Factors** are
 - (a) Developing and maintaining a high level of customer satisfaction.
 - (b) Offering facilities that are not much below that offered by competition.
 - (c) Keeping a tight cap on costs as there is considerable competitive pressure in this industry and entry barriers are not high.
- (ii) The following is a possible **Balance Scorecard** for Fitness Solution

Financial Perspective	Operating expenses relative to budget
	Cash flow
	Total daily operating revenue
Customer Perspective	Turnover rate among members
	Customer satisfaction rate
Internal Perspective	Number of employee complaints
	Number of equipment not available on average day (due to maintenance)
Innovation and Learning	Number of new equipment put into service
	Number of staff participating in training courses

12. (i) Yes, the given solution is optimal because all $C_j - Z_j$ are less than, or equal to, zero.

$C_j \rightarrow$			30	40	20	0	0	0
C_B	Basic Variable (B)	Value of Basic Variables b ($=X_B$)	x	y	z	s_1	s_2	s_3
30	x	250	1	0	-26/16	10/16	-12/16	0
40	y	625	0	1	31/16	-7/16	10/16	0
0	s_3	125	0	0	11/16	-3/16	1/8	1
$Z_j = \sum C_B X_j$			30	40	115/4	5/4	5/2	0
$C_j - Z_j$			0	0	-35/4	-5/4	-5/2	0

- (ii) No, because for each of the **non - basic variables** z, s_1 and s_2 , the $C_j - Z_j$ is strictly negative. Alternate optimal solution (s) exist when either of non-basic variables has a zero $C_j - Z_j$.

Non Basic Variables	z	s_1	s_2
$C_j - Z_j$	-35/4	-5/4	-5/2

- (iii) Yes, because the given solution has no artificial variable in the basis.
 (iv) No, solution is not degenerate as none of the basic variables has zero quantity.

Basic Variables	x	y	s_3
Quantity	250	625	125

(A solution degenerates if the Quantity of one or more basic variables is zero)

- (v) Maximize $Z = 30x + 40y + 20z$
 (vi) According to the given solution, 250 units of x and 625 units of y are being produced. The total profit is ₹32,500 (250 units × ₹30 + 625 units × ₹40).
 (vii) Machine KA-07 and KB-27 are being used to the full capacity because, the slack variable s_1 and s_2 corresponding to them has a zero value in the solution.
 (viii) The shadow price of hours on machine KA-07, machine KB-27 and machine KC-49 are being ₹5/4, ₹5/2 and ₹0, respectively, these are the maximum prices one would be prepared to pay for another hour of capacity for these three machines.
 (ix) Machine KB-27 may be given priority as its shadow price is the highest.
 (x) When 16 hours are lost, then production of x would increase by 12 units and that of y would decrease by 10 units and the total profit decrease by ₹40.

- (xi) $C_j - Z_j$ for z being $-35/4$, production of each unit of z would cause a reduction of $35/4$ rupee. Thus, the price for z should be increased by at least $35/4$ rupee to ensure no reduction of profits.
- (xii) Shadow prices of times on machines KA-07, KB-27 and KC-49 are ₹5/4, ₹5/2 and ₹0. Production of a unit of the proposed new product would, therefore, reduce profit by ₹10 [(4 hrs. × ₹5/4) + (2 hrs. × ₹5/2) + (4 hrs. × ₹0)]. Since the product would yield a profit of ₹12, it would result in a net increase in profit at a rate of ₹2 per unit. It is advisable, therefore to introduce it.

13. (i) The Initial basic solution worked out by the shipping clerk is as follows-

Warehouse	Market				Supply
	I	II	III	IV	
A	5	2 12	4 1	3 9	22
B	4	8	1 15	6	15
C	4 7	6	7 1	5	8
Req.	7	12	17	9	45

The initial solution is tested for optimality. The total number of independent allocations is 6 which is equal to the desired $(m + n - 1)$ allocations. We introduce u_i 's ($i = 1, 2, 3$) and v_j 's ($j = 1, 2, 3, 4$). Let us assume $u_1 = 0$, remaining u_i 's and v_j 's are calculated as below-

$(u_i + v_j)$ Matrix for **Allocated** / **Unallocated Cells**

					u_i
	1	2	4	3	0
	-2	-1	1	0	-3
	4	5	7	6	3
v_j	1	2	4	3	

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

 Δ_{ij} Matrix

4			
6	9		6
	1		-1

Since one of the Δ_{ij} 's is negative, the schedule worked out by the clerk is not the optimal solution.

- (ii) Introduce in the cell with negative Δ_{ij} [R_3C_4], an assignment. The reallocation is done as follows-

	12	1	9
		+1	-1
		15	
7		1	
		-1	+1

Revised Allocation Table

	12	2	8
		15	
7			1

Now we test the above improved initial solution for optimality-

 $(u_i + v_j)$ Matrix for Allocated / Unallocated Cells

					u_i
	2	2	4	3	0
	-1	-1	1	0	-3
	4	4	6	5	2
v_j	2	2	4	3	

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

Δ_{ij} Matrix

3			
5	9		6
	2	1	

Since all Δ_{ij} for non basic cells are positive, the solution as calculated in the above table is the optimal solution. The supply of units from each warehouse to markets, along with the transportation cost is given below-

Warehouse	Market	Units	Cost per unit (₹)	Total Cost (₹)
A	II	12	2	24
A	III	2	4	8
A	IV	8	3	24
B	III	15	1	15
C	I	7	4	28
C	IV	1	5	5
Minimum Total Shipping Cost				104

- (iii) If the clerk wants to consider the carrier of route C to II only, instead of 7 units to I and 1 unit to IV, it will involve shifting of 7 units from (A, II) to (A, I) and 1 unit to (A, IV) which results in the following table-

Warehouse	Market				Supply
	I	II	III	IV	
A	5 7	2 4	4 2	3 9	22
B	4	8	1 15	6	15
C	4	6 8	7	5	8
Req.	7	12	17	9	45

The transportation cost will become-

Warehouse	Market	Units	Cost per unit (₹)	Total Cost (₹)
A	I	7	5	35
A	II	4	2	8
A	III	2	4	8
A	IV	9	3	27
B	III	15	1	15
C	II	8	6	48
Minimum Total Shipping Cost				141

The total shipping cost will be ₹141.

Additional Transportation Cost ₹37.

The carrier of C to II must reduce the cost by ₹4.63 (₹37/8) so that the total cost of transportation remains the same and clerk can give him business.

(iv) Revised transportation table is shown below-

Warehouse	Market				Supply
	I	II	III	IV	
A	5	2 12	4 2	3 8	22
B	4	8	1 11	6	15/11
C	4 7	6	7	5 1	8
Req.	7	12	17/13	9	45

Since the alterations are restricted to allocated cells only, the present alterations do not disturb the optimal allocation schedule.

(v) In this situation, alterations are not restricted to allocated cells since allocation in cell (A, III) is 2 units only while reduction in requirement of Market III as well as supply of Warehouse A is 3 units. Therefore, it is essential to make alterations in allocations, check solution for optimality test and iterate if required.

14. Row Operation-

	P	Q	R	S	T
P	-	3	12	18	0
Q	12	-	3	18	0
R	12	9	-	0	9
S	24	0	6	-	3
T	0	6	3	21	-

Column Operation-

	P	Q	R	S	T
P	-	3	9	18	0
Q	12	-	0	18	0
R	12	9	-	0	9
S	24	0	3	-	3
T	0	6	0	21	-

We know check if optimal assignment can be made in below table or not. Proceeding, we get following table-

	P	Q	R	S	T
P	-	3	9	18	0
Q	12	-	0	18	0
R	12	9	-	0	9
S	24	0	3	-	3
T	0	6	0	21	-

The above solution is optimum solution with two routes-

P to T to P and

Q to R to S to Q

Above table provides the optimum solution but do not satisfy travelling condition. To solve this problem we have to bring next minimum element in the matrix i.e.3. Now the possible *new assignments* are

P to Q instead of P to T,

S to R instead of S to Q and

S to T instead of S to Q.

Let us consider each of the new assignment independently.

Situation 1-

We make 'assignment' in cell (P, Q) instead of 'assignment' in cell (P, T). The resulting table is shown below-

	P	Q	R	S	T
P	-	3	9	18	0
Q	12	-	0	18	0
R	12	9	-	0	9
S	24	0	3	-	3
T	0	6	0	21	-

The feasible solution is P to Q to R to S to T to P and it involves a cost of ₹40,000 (₹5,000 + ₹8,000 + ₹11,000 + ₹14,000 + ₹2,000).

Situation 2-

We make 'assignment' in cell (S, R) instead of 'assignment' in cell (S, Q). The resulting table is shown below-

	P	Q	R	S	T
P	-	3	9	18	0
Q	12	-	0	18	0
R	12	9	-	0	9
S	24	0	3	-	3
T	0	6	0	21	-

The resulting solution is P to Q to T to P, R to S to R, which is not feasible as it does not satisfy the travelling condition.

Situation 3-

We make 'assignment' in cell (S, T) instead of 'assignment' in cell (S, Q). The resulting table is shown below-

	P	Q	R	S	T
P	-	3	9	18	0
Q	12	-	0	18	0
R	12	9	-	0	9
S	24	0	3	-	3
T	0	6	0	21	-

The resulting table is same as in Situation 1 which gives the feasible solution P to Q to R to S to T to P with cost of ₹40,000.

Hence least cost route is P to Q to R to S to T to P with cost of ₹40,000.

15.

Random Numbers Allocation for each activity

Activity	Time (in Days)	Probability	Cumulative Probability	Allocated Random Number
A	6	0.50	0.50	00-49
	8	0.50	1.00	50-99
B	4	0.30	0.30	00-29
	5	0.20	0.50	30-49
	6	0.50	1.00	50-99
C	8	0.50	0.50	00-49
	16	0.50	1.00	50-99
D	8	0.30	0.30	00-29
	10	0.70	1.00	30-99
E	2	0.20	0.20	00-19
	4	0.80	1.00	20-99

Simulation Table

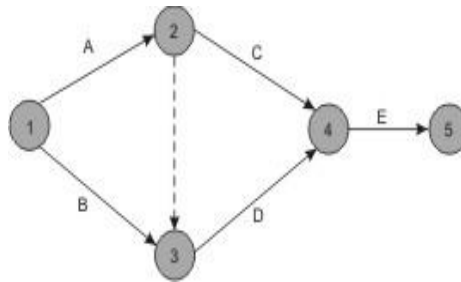
Trial	A		B		C		D		E	
	R. No.	Time	R. No.	Time	R. No.	Time	R. No.	Time	R. No.	Time
1	11	6	16	4	23	8	72	10	94	4
2	83	8	83	6	02	8	97	10	99	4
3	83	8	10	4	93	16	4	8	33	4
4	53	8	49	5	94	16	37	10	7	2

Determination of “Critical Path and Project Duration for each trial”

Trial	Project Duration			Critical Path
	1-2-4-5 (A-C-E)	1-2-3-4-5 (A-D-E)	1-3-4-5 (B-D-E)	
1	18 (6 + 8 + 4)	20 (6 + 10 + 4)	18 (4 + 10 + 4)	1-2-3-4-5 (A-D-E)
2	20 (8 + 8 + 4)	22 (8 + 10 + 4)	20 (6 + 10 + 4)	1-2-3-4-5 (A-D-E)
3	28 (8 + 16 + 4)	20 (8 + 8 + 4)	16 (4 + 8 + 4)	1-2-4-5 (A-C-E)
4	26 (8 + 16 + 2)	20 (8 + 10 + 2)	17 (5 + 10 + 2)	1-2-4-5 (A-C-E)

Working Note

The Network for the given problem:



16. (i) Total Direct Labour Cost for **first 64 batches** based on learning curve of 90% (when the direct labour cost for the first batch is ₹52,500)

The usual learning curve model is

$$y = ax^b$$

Where

y = Average Direct Labour Cost per batch for x batches

a = Direct Labour Cost for first batch

x = Cumulative No. of batches produced

b = Learning Coefficient / Index

$$y = ₹52,500 \times (64)^{-0.152}$$

$$= ₹52,500 \times 0.5314$$

$$= ₹27,898.50$$

Total Direct Labour Cost for first 64 batches

$$= 64 \text{ batches} \times ₹27,898.50$$

$$= ₹17,85,504$$

Total Direct Labour Cost for **first 63 batches** based on learning curve of 90% (when the direct labour cost for the first batch is ₹52,500)

$$y = ₹52,500 \times (63)^{-0.152}$$

$$= ₹52,500 \times 0.5327$$

$$= ₹27,966.75$$

Total Direct Labour Cost for first 63 batches

$$= 63 \text{ batches} \times ₹27,966.75$$

$$= ₹17,61,905$$

Direct Labour Cost for **64th batch** = ₹17,85,504 - ₹17,61,905

$$= ₹23,599$$

Total Labour Cost over the Product's Life

$$= ₹17,85,504 + (192 \text{ batches} \times ₹23,599)$$

$$= ₹63,16,512$$

Statement Showing "Life Time Expected Profit"

Particulars	Amount (₹)
Sales ($₹123 \times 2,56,000$ units)	3,14,88,000
Less: Direct Material ($₹36 \times 2,56,000$ units)	92,16,000
Less: Direct Labour	63,16,512
Less: Other Variable Cost ($₹24 \times 2,56,000$ units)	61,44,000
Less: Specific Fixed Cost	38,75,000
Profit	59,36,488

- (ii) In order to achieve a Profit of ₹1,00,00,000 the Total Direct Labour Cost over the Product's Lifetime would have to equal ₹22,53,000.

Statement Showing "Life Time Direct Labour Cost"

Particulars	Amount (₹)
Sales ($₹123 \times 2,56,000$ units)	3,14,88,000

Less: Direct Material ($\text{₹}36 \times 2,56,000$ units)	92,16,000
Less: Other Variable Cost ($\text{₹}24 \times 2,56,000$ units)	61,44,000
Less: Specific Fixed Cost	38,75,000
Less: Profit	1,00,00,000
Direct Labour	22,53,000

Average Direct Labour Cost *per batch* for 256 batches is ₹8,800.78 ($\text{₹}22,53,000 / 256$ batches).

Total Direct Labour Cost for **256 batches** based on learning curve of $r\%$ (when the direct labour cost for the first batch is ₹52,500)

$$\begin{aligned}
 y &= ₹52,500 \times (256)^b \\
 ₹8,800.78 &= ₹52,500 \times (256)^b \\
 0.1676 &= (256)^b \\
 \log 0.1676 &= b \times \log 2^8 \\
 \log 0.1676 &= b \times 8 \log 2 \\
 \log 0.1676 &= \left(\frac{\log r}{\log 2} \right) \times 8 \log 2 \\
 \log 0.1676 &= \log r^8 \\
 0.1676 &= r^8 \\
 r &= \sqrt[8]{0.1676} \\
 r &= 80\%
 \end{aligned}$$

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Value Added/ Non Value Added

1. Queenstown Furniture (QF) manufactures high-quality wooden doors within the forests of Queenstown since 1952. 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 April:

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

Activity Based Costing at Hospital

2. 'SM' hospital is a primary medical care facility and trauma center that serves National Capital Territory. The hospital offers all the medical/ surgical services of typical small hospital.

Required

- (i) Using your (limited, moderate, or in-depth) knowledge of a hospital's operations, identify 4 key activities that are important.
- (ii) For each of the activities, suggest an appropriate cost driver.

Life Cycle Costing

3. In WM Ltd. the 'OB' equipment is about to be replaced either by 'CF' system or by an 'OF' system. Finance costs 12% a year and the other estimated costs are as follows:

	CF (₹)	OF (₹)
Initial Cost	28,000	40,000
Annual Operating Costs	24,000 p.a.	18,000 p.a.

Required

If the company expected the new system (either CF or OF) to last at least for 12 years, which system should be chosen?

4. Examine the **Validity** of following statements:
- In the introduction stage, usual marketing strategy is to strengthen the supply chain relationships to make the product easily accessible by target customers.
 - In the introduction stage, competitors will purchase the product to carry out reverse engineering and understand how the product works, so that they can develop their own similar, but different product.
 - In the introduction phase, the firm will seek to avoid this competition by maintaining its selling price at the end of the introduction stage.
 - In the growth stage, if the product cannot be differentiated in other ways, the firm may need further reductions in selling price to maintain growth.
 - In the maturity stage, firms are tempted to engage in costly promotional price wars to wean away market share from competitors.
 - In the decline stage, failing sales may induce firms to slash marketing expenditure. Brand loyalty will be exploited to create profits.

JIT Production System > Backflush Costing System

5. Napier Company uses a backflush costing system with three trigger points:

- Purchase of Direct Materials
- Completion of Good Finished Units of Product
- Sales of Finished Goods

You are provided with the following information for July 2016.

Direct Materials Purchased	₹2,64,000	Conversion Costs Allocated	₹1,20,000
Direct Materials Used	₹2,55,000	Costs Transferred to Finished Goods	₹3,75,000
Conversion Costs Incurred	₹1,26,600	Cost of Goods Sold	₹3,57,000

Required

- Prepared journal entries for July (without disposing of under allocated/ over allocated conversion costs).
- Under an ideal JIT production system, how would the amounts in your journal entries change from the journal entries in requirement (i)?

Note

- There are no beginning inventories.
- Assume there are no direct material variances.

Cost Classification

6. Swastik Ltd. manufactures and sells 4 Valve Engine (DTK-I). Company appoints Mr. Watson to coordinate shipments of the DTK-I 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. Swastik Ltd. is unsure how to classify his annual salary of ₹24,00,000 in its cost records. The company's cost analyst says that Mr. Watson'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. Watson's salary cost is classified.

Required

Which view point is correct and why?

7. ANZB Financial Services Limited is an Indian banking and financial services company headquartered in Chennai, Tamil Nadu. Apart from lending to individuals, the company grants loans to micro, small and medium business enterprises. Listed below are several costs incurred in the loan division of ANZB Financial Services Limited.
- (i) Remuneration of the loan division manager.
 - (ii) Cost of Printer Paper, File Folders, View Binders, Ink, Toner & Ribbons used in the loan division.
 - (iii) Cost of the division's MacBook Pro purchased by the loan division manager last year.
 - (iv) Cost of advertising in business newspaper by the bank, which is allocated to the loan division.

Cost Classification

Controllable by the loan division manager	Direct cost of the loan division	Sunk Cost
Uncontrollable by the loan division manager	Indirect Cost of the loan division	Out of Pocket Cost

Required

For each Cost, indicate which of the above mentioned Cost Classification best describe the cost.

Note

More than one classification may apply to the same cost item.

Relevant Costing

8. Aves Airlines Ltd. operates its services under the brand 'Yellow Bird'. The 'Yellow Bird' route network spans prominent business metropolis as well as key leisure destinations across the Indian subcontinent. 'Yellow Bird', a low-fare carrier launched with the objective of commoditizing air travel, offers airline seats at marginal premium to train fares across India.

Profits of the 'Yellow Bird' have been decreasing for several years. In an effort to improve the company's performance, consideration is being given to dropping several flights that appear to be unprofitable.

Income statement for one such flight from 'New Delhi' to 'Kullu' (Y-09) is given below (per flight):

	₹	₹
Ticket Revenue (175 seats x 80% Occupancy x ₹7,000 ticket price)		9,80,000
Less: Variable Expenses (₹1,400 per person)		1,96,000
Contribution Margin		7,84,000
Less: Flight Expenses:		
Salaries, Flight Crew	2,05,000	
Salaries, Flight Assistants	45,500	
Baggage Loading and Flight Preparation	72,000	
Overnight Costs for Flight Crew and Assistants at destination	18,000	
Fuel for Aircraft	2,55,000	
Depreciation on Aircraft	51,000*	
Liability Insurance	1,53,000	
Flight Promotion	35,000	
Hanger Parking Fee for Aircraft at destination	15,000	8,49,500
Net Gain / (Loss)		(65,500)

* Based on obsolescence

The following additional information is available about flight Y-09.

- Members of the flight crew are paid fixed annual salaries, whereas the flight assistants are paid by the flight.

- The baggage loading and flight preparation expense is an allocation of ground crew's salaries and depreciation of ground equipment.
- One third of the liability insurance is a special charge assessed against flight Y-09 because in the opinion of insurance company, the destination of the flight is in a "high-risk" area.
- The hanger parking fee is a standard fee charged for aircraft at all airports.
- If flight Y-09 is dropped, 'Golden Bird' Airlines has no authorization at present to replace it with another flight.

Required

Prepare an analysis showing what impact dropping flight Y-09 would have on the airline's profit.

Qualitative Factors

9. State any 5 Qualitative Factors relevant for decision making.

Budget & Budgetary Control

10. Country N's regional administration is organized in 10 states, with 9 of them subdivided into 210 municipalities. The municipal sector is a provider of vital services to the country N's public. The municipalities have wide powers over the local economy, with the state exercising strict supervision. They have the right to tax and to use their resources to support education, libraries, social security, and public works such as streetcar lines, gas and electricity works, roads, and town planning, but they are usually aided in these activities by state funds. The municipalities submit a budget each year to respective state which forms the basis of the fund received.

The following information is available as part of the 2016 budget preparation about a municipality NZ.

Street Maintenance

Like all structures, streets deteriorate over time. Deterioration is primarily due to accumulated damage from vehicles, however environmental effects often contribute. In 2016 it is anticipated that 5 km of the street will need maintenance but a contingency of extra 10% has been decided.

In 2015 the average cost of a street maintenance was ₹14 million per km maintained, but this excluded any cost effects of extreme weather conditions. The following probability estimates have been made in respect of 2016

Weather Type Predicted	Probability	Increase in Maintenance Cost
Good	0.65	0

Poor	0.05	+5%
Lousy	0.30	+30%

Inflation on street revamping costs is anticipated to be 2% between 2015 & 2016.

New Streets

New streets are budgeted on a zero basis and will have to enter for funds along with other capital projects such as hospitals and libraries.

Required

- Calculate the budgets for street maintenances for 2016.
- Explain the process involved for zero based budgeting.

Variance Analysis in Activity Based Costing

- N & S Co. (NSC) is a multiple product manufacturer. NSC produces the unit and all overheads are associated with the delivery of units to its customers.

Particulars	Budget	Actual
Overheads (₹)	4,000	3,900
Output (units)	2,000	2,100
Customer Deliveries (no.'s)	20	19

Required

Calculate Efficiency Variance and Expenditure Variance by adopting ABC approach.

Interpretation of Variances

- State possible **Impact on Variances** in each of the following independent situations:
 - More units were produced than was budgeted.
 - Careless handling of materials by production personnel
 - The purchase of inferior quality material
 - New competition entered the market.
 - New suppliers were used.
 - New production staff were recruited.
 - Market share has fallen from 20% to 18%
- Explain whether a production manager should be accountable for direct labour and direct materials cost variances.

Balanced Score Card

14. AEB Banking Corp. is the world's largest card issuer by purchase volume and having vision statement "to be leading provider of payment solutions in India".

Required

Suggest performance indicators to include in the Balanced Scorecard.

Linear Programming

15. In a chemical industry two products P and Q are made involving two operations. The production of Q also results in a by-product R. The product P can be sold at a profit of ₹ 3 per unit and Q at a profit of ₹ 8 per unit. The by-product R has a profit of ₹ 2 per unit. Forecast show that upto 5 units of R can be sold. The company gets 3 units of R for each unit of Q produced. The manufacturing times are 3 hrs per unit for P on each of the operation one and two and 4 hrs and 5 hrs per unit for Q on operation one and two respectively. Because the product R results from producing Q, no time is used in producing R. The available times are 18 hrs and 21 hrs of operation one and two respectively. The company desires to know that how much P and Q should be produced keeping R in mind to make the highest profit.

Required

Formulate LP model for this problem.

Simulation

16. JCB Ltd. is considering a new project which will require an initial investment of ₹ 25,000. The company has determined the following probabilities for net cash flows for three years generated by this project:

Annual Net Cash Flows

Year 1		Year 2		Year 3	
CF	Prob.	CF	Prob.	CF	Prob.
7,500	0.20	10,000	0.10	7,500	0.10
10,000	0.50	12,500	0.30	10,000	0.20
12,500	0.30	15,000	0.20	12,500	0.50
		17,500	0.40	15,000	0.20

The firm wants to perform 5 simulation runs of this project's life. The firm's cost of capital is 10%.

To simulate the probability distributions of annual net cash flows, use the following sets of random numbers

4, 4, 2; 9, 6, 3; 5, 7, 8; 0, 1, 6; 3, 1, 5

Required

Using simulation results. Calculate the average NPV.

Note

Assign a value ranging from 0 to 9 (in digits) to each year's cash flow in such a way that the number of digits assigned is proportionate to the probability of cash flow.

SUGGESTED ANSWERS/ HINTS

1. (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

$$\begin{aligned}
 &= \frac{\text{Processing Time}}{\text{Processing Time} + \text{Inspection Time} + \text{Waiting Time} + \text{Move Time}} \\
 &= \frac{9.0 \text{ hrs.}}{9.0 \text{ hrs.} + 1.5 \text{ hr.} + 6.0 \text{ hrs.} + 7.5 \text{ hrs.}} \\
 &= 37.5\%
 \end{aligned}$$

- (iv) Manufacturing Cycle Time

$$\begin{aligned}
 &= \frac{\text{Total Production Time}}{\text{Units per Batch}} \\
 &= \frac{24 \text{ hrs.}}{60 \text{ units}} \\
 &= 0.40 \text{ hrs. per unit}
 \end{aligned}$$

2. Activities / Cost Drivers for 'SM' hospital

Activities	Cost Driver
Purchase of medical supplies, maintain records/inventory (dispense medications)	Number of medication orders filled
Reservation/Scheduling, inpatient registration, billing and	Number of patients

insurance verification (admit patients)	admitted
Prepare patient, perform ECG procedure, interpret results (administer ECG tests)	Number of tests
Obtain specimens, perform test, report results (administer laboratory tests)	Number of test by type

3. Calculation of Life-cycle Costs

	CF (₹)	OF (₹)
Initial Cost	28,000	40,000
Add: Annual Operating Costs	1,48,656 (₹24,000 × 6.194)	1,11,492 (₹18,000 × 6.194)
Total Life Cycle Costs	1,76,656	1,51,492

The annuity of 12% finance costs for 12 years is 6.194.

Analysis

When we compare only the initial cost, we will tend to purchase CF system, for its cheap acquisition cost. But when we compare the total life-cycle costs, the OF system is most preferable, for its lowest total life-cycle costs.

4. Valid or Invalid

Sl. No.	Statements	Valid or Invalid
(i)	In the introduction stage, usual marketing strategy is to strengthen the supply chain relationships to make the product easily accessible by target customers.	Valid
(ii)	In the introduction stage, competitors will purchase the product to carry out reverse engineering and understand how the product works, so that they can develop their own similar, but different product.	Valid
(iii)	In the introduction phase, the firm will seek to avoid this competition by maintaining its selling price at the end of the introduction stage.	Invalid
(iv)	In the growth stage, if the product cannot be differentiated in other ways, the firm may need further reductions in selling price to maintain growth.	Valid
(v)	In the maturity stage, firms are tempted to engage in costly promotional price wars to wean away market share from competitors.	Valid

(vi)	In the decline stage, failing sales may induce firms to slash marketing expenditure. Brand loyalty will be exploited to create profits.	Valid
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5. (i) **Journal Entries** for July are as follows

	₹	₹
E.1 Material and In-Process Inventory Control Accounts Payable Control (Direct Materials Purchased)	2,64,000	2,64,000
E.2 Conversion Costs Control Various Accounts (Conversion Cost Incurred)	1,26,600	1,26,600
E.3 Finished Goods Control Materials and In-Process Inventory Control Conversion Costs Allocated (standard cost of finished goods completed)	3,75,000	2,55,000 1,20,000
E.4 Cost of Goods Sold Finished Goods Control (standard cost of finished goods sold)	3,57,000	3,57,000

- (ii) Zero inventory is the goal of an *ideal* JIT production system. Accordingly, entry (E.3) would be ₹3,57,000 finished goods production, not ₹3,75,000. If the marketing division could only sell goods costing ₹3,57,000, the JIT production system would call for direct materials purchases and conversion costs lower than ₹2,64,000 and ₹1,26,600, respectively, in entries (E.1) and (E.2).



When a JIT system is created, the amount of inventory retained in a company drops continuously. Raw materials inventory is reduced because suppliers deliver only small quantities of parts as and when they are needed. Work-in-process inventory drops because the conversion to machine cells and the use of Kanban Cards greatly reduces the need to pile up inventory between machines. Finally, finished goods inventory drops because inventory is produced only when there are orders in hand from customers (though finished goods inventories are also allowed to build if a company experiences high seasonal sales). Consequently, the cost of maintaining inventory declines, which in turn reduces the overhead costs associated with inventories that are charged to products.

6. **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. Watson as described in the problem is coordination of shipments of DTK-I 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.

7. **Cost Incurred – Cost Classification**

S. No.	Cost Incurred	Classification 1	Classification 2	Classification 3
(i)	Remuneration of the loan division manager.	Uncontrollable by the loan division manager.	Direct cost of the loan division.	Out of Pocket Cost
(ii)	Cost of Printer Paper, File Folders, View Binders, Ink, Toner & Ribbons used in the loan division.	Controllable by the loan division manager.	Direct cost of the loan division.	Out of Pocket Cost
(iii)	Cost of the division's MacBook Pro purchased by the loan division manager last year.	Controllable by the loan division manager.	Direct cost of the loan division.	Sunk Cost
(iv)	Cost of advertising in business newspaper by the bank, which is allocated to the loan division.	Uncontrollable by the loan division manager.	Indirect Cost of the loan division.	Out of Pocket Cost

8. **Statement Showing Impact on Airline's Profit if Flight Y-09 is Discontinued**

	₹	₹
Contribution Margin lost if the flight is discontinued		(7,84,000)
Less: Flight Costs which can be avoided if the flight is discontinued:		
Flight Promotion.....	35,000	
Fuel for Aircraft.....	2,55,000	
Liability Insurance (1/3 x ₹1,53,000).....	51,000	

Salaries, Flight Assistants.....	45,500	
Overnight Costs for Flight Crew and Assistants.....	<u>18,000</u>	<u>4,04,500</u>
		(3,79,500)

If Aves Airlines Ltd. goes for discontinuation of flight K-09, its profit will go down by ₹3,79,500.

Following costs are **not relevant** to the decision:

- Salaries, flight crew - Fixed annual salaries which will not change
- Baggage loading and flight preparation- This is an allocated cost, which will continue even if the flight is discontinued.
- Depreciation of aircraft -Sunk Cost
- Liability insurance (two third)
- Hanger parking fee- This cost will be incurred regardless of whether the flight is made.

9. Qualitative Factors may include:

- (i) The liquidity risk;
- (ii) The state of the economy, and its levels of inflation;
- (iii) Effect of new technological breakthroughs;
- (iv) Effect of a decision on employee morale, motivation, leadership and so on;
- (v) Effect of a decision on long-term future profitability;
- (vi) Effect of a decision on a company's public image and the reaction of customers.

10. (i) The street maintenance budget will be based on 5 km of street maintenance; it is common to include a contingency in case streets unexpectedly need maintenance.

The weather conditions could add an extra cost to the budget if poor or lousy conditions exist.

The adjustment needed is based on an expected value calculation:

$$(0.65 \times 0\%) + (0.05 \times 5\%) + (0.30 \times 30\%) = 9.25\%$$

Hence the budget (after allowing for a 2% inflation adjustment) will be:

$$5 \text{ km} \times ₹14 \text{ million} \times 1.0925 \times 1.02 = ₹7,80,04,500$$

(ii) Zero based budgeting involves following main steps:

- Determination of a set of objects is the pre-requisite and essential step in the direction of ZBB technique.
- Deciding about the extent to which the technique of ZBB is to be applied whether in all areas of municipal activities or only in a few selected areas on trial basis.

- Identify those areas where decisions are required to be taken.
- Developing decision packages and *ranking them in order of decreasing benefits*.

For example, The Municipality have to decide which of the activities offer the greatest value for money (VFM) or the greatest benefit for the lowest cost.

Legal obligations are 'must do' activities; others may be viewed as discretionary.

- Preparation of budget that is translating decision packages into practicable units/items and allocating financial/resources.

In real terms the Zero base budgeting is simply an extension of the cost, benefit, analysis method to the area of corporate planning and budgeting.

11. Computation of Variances

Efficiency Variance = Cost Impact of *undertaking activities* more/ less than *standard*
 = (21 deliveries* – 19 deliveries) × ₹200
 = ₹400 F

$$(*) \left(\frac{20 \text{ Deliveries}}{2,000 \text{ units.}} \right) \times 2,100 \text{ units}$$

Expenditure Variance = Cost impact of paying more/ less than standard for actual activities undertaken
 = 19 deliveries × ₹200 – ₹3,900
 = ₹100 (A)

12. Impact on Variances

Sl. No.	Independent Situations	Impact on Variances
(i)	More units were produced than was budgeted.	Favourable Fixed Overhead Volume
(ii)	Careless handling of materials by production personnel	Adverse Material Usage
(iii)	The purchase of inferior quality material	Adverse Material Usage Favourable Material Price
(iv)	New competition entered the market.	Adverse Sales Price
(v)	New suppliers were used.	Adverse Material Price
(vi)	New production staff were recruited.	Adverse Labour Efficiency
(vii)	Market share has fallen from 20% to 18%	Adverse Market Share Variance

13. Performance should be measured against the element of direct cost which the manager can *control*. For example,

The purchase manager is responsible for the price of raw materials to be purchased at the time of *purchase*.

The production manager is responsible for the amount of raw material *used*, and this responsibility exercised when the materials are used in production. However, he/ she may not be able to influence the cost of material, the quality of the material, the cost of labour and the quality of labour.

14. **Balanced Scorecard 'Credit Card Company'.**

Financial Indicators of Performance	Customers Indicators of Performance
Increase market share	Discourage businesses off cheques
Reduce debt	Focus on large spenders
Increase % fee	Issue more cards

Learning and Growth Indicators of Performance	Internal Processes Indicators of Performance
Outsource IT jobs	Increased marketing spend
Improve staff training levels	Achieve economies to scale
Acquire other companies	Offer more products

15. Let y_1, y_2, y_3 be the number of units produced of products P, Q and R respectively.

Objective function:

Then the profit gained by the industry is given by

$$Z = 3y_1 + 8y_2 + 2y_3$$

Here it is assumed that all the units of products P and Q are sold.

Condition-1:

In first operation, P takes 3 hrs of manufacturer's time and Q takes 4 hrs of manufacturer's time. Therefore, total number of hours required in first operation becomes-

$$3y_1 + 4y_2$$

In second operation, per unit of P takes 3 hrs of manufacturer's time and per unit Q takes 5 hrs of manufacturer's time. Therefore, the total number of hours used in second operation becomes

$$3y_1 + 5y_2$$

Since there are 18 hrs available in first operation and 21 hrs in second operation, the restrictions become

$$3y_1 + 4y_2 \leq 18$$

$$3y_1 + 5y_2 \leq 21$$

Condition-2:

Since the maximum number of units of R that can be sold is 5, therefore,

$$y_3 \leq 5$$

Condition-3:

Further, the company gets three units of by product R for every unit of product Q produced, therefore

$$y_3 = 3y_2$$

Now, the allocation problem of the industry can be finally put in the following linear programming problem:

Maximise

$$Z = 3y_1 + 8y_2 + 2y_3$$

Subject to the Constraints:

$$3y_1 + y_2 \leq 18$$

$$3y_1 + 5y_2 \leq 21$$

$$y_3 \leq 5$$

$$y_3 = 3y_2$$

$$y_1, y_2, y_3 \geq 0$$

16. Assigning Digit Values to Cash Flows

Year 1			Year 2			Year 3		
CF	Prob.	Digits	CF	Prob.	Digits	CF	Prob.	Digits
7,500	0.20	0-1	10,000	0.10	0-0	7,500	0.10	0-0
10,000	0.50	2-6	12,500	0.30	1-3	10,000	0.20	1-2
12,500	0.30	7-9	15,000	0.20	4-5	12,500	0.50	3-7
			17,500	0.40	6-9	15,000	0.20	8-9

Identifying Cash Flows Matching Random Numbers

Set	Year 1		Year 2		Year 3	
	R. No.	CF	R. No.	CF	R. No.	CF
1	4	10,000	4	15,000	2	10,000

2	9	12,500	6	17,500	3	12,500
3	5	10,000	7	17,500	8	15,000
4	0	7,500	1	12,500	6	12,500
5	3	10,000	1	12,500	5	12,500

Calculated Simulated Average NPVs

Set	Year 1		Year 2		Year 3		Initial Outflow	NPV
	PVF* = 0.909		PVF* = 0.826		PVF* = 0.751			
	CF	PV	CF	PV	CF	PV		
1	10,000	9,090	15,000	12,390	10,000	7,510	25,000	3,990
2	12,500	11,363	17,500	14,455	12,500	9,388	25,000	10,206
3	10,000	9,090	17,500	14,455	15,000	11,265	25,000	9,810
4	7,500	6,818	12,500	10,325	12,500	9,388	25,000	1,531
5	10,000	9,090	12,500	10,325	12,500	9,388	25,000	3,803
Total								29,340
Average NPV								5,868

* PVF (Present Value Factor) at 10% discount rate.

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING
QUESTIONS

Activity Based Costing

1. A manufacturing company produces Ball Pens that are printed with the logos of various companies. Each Pen is priced at ₹ 5. Costs are as follows:

Cost Driver	Unit Variable Cost (₹)	Level of Cost Driver
Units Sold	2.5	-
Setups	225	40
Engineering hours	10	250

Other Data

Total Fixed Costs (conventional) ₹ 48,000

Total Fixed Costs (ABC) ₹ 36,500

Required

- (i) Compute the break-even point in units using activity-based analysis.
- (ii) Suppose that company could reduce the setup cost by ₹ 75 per setup and could reduce the number of engineering hours needed to 215. How many units must be sold to break even in this case?

Kaizen Costing– Basic Concepts

2. XYZ Ltd. is planning to introduce Kaizen Costing approach in its manufacturing plant. State whether and why the following are *Valid or Not* in respect of Kaizen Costing.
- (i) VP (Finance) is of the view that company has to make a huge initial investment to bring a large scale modification in production process.
 - (ii) Head (Personnel) has made a point that introduction of Kaizen Costing does not eliminate the training requirement of employees.
 - (iii) General Manager (Manufacturing) firmly believes that only shop floor employees and workers' involvement is prerequisite of Kaizen Costing approach.
 - (iv) Manager (Operations) has concerns about creation of confusion among employees and workers regarding their roles and degradation in quality of production.

Life Cycle Costing

3. *t-Connections*, Taiwan based firm, has just developed ultra-thintablet t-5 with few features like the ability to open two apps at the same time. This tablet cost ₹ 5,00,000 to develop; it has undergone extensive research and is ready for production. Currently, the firm is deciding on plant capacity, which could cost either ₹ 35,00,000 or ₹ 52,00,000.

The additional outlay would allow the plant to increase capacity from 500 units to 750 units. The relevant data for the life cycle of the tablet at different capacity level are as under:

Expected Sales	500 units	750 units
Sale Price	₹79,600 per unit	₹69,600 per unit
Variable Selling Costs	10% of Selling Price	10% of Selling Price
Salvage Value - Plant	₹ 6,25,000	₹ 9,00,000
Profit Volume Ratio	40%	

Required

Advise *t-Connections*, regarding the optimal plant capacity to install. The tablet's life cycle is two years.

Note: Ignore the time value of money.

Value Chain Analysis

4. Examine the Validity of following statements along with the reasons:
 - (i) The concepts, tools and techniques of value chain analysis apply only to all those organizations which produce and sell a product.
 - (ii) Procurement activities are included in the Primary activities as classified by Porter under value chain analysis concept.
 - (iii) Value chain analysis in the strategic framework consists of single cost driver concept.

Decision Making

5. Recently, Ministry of Health and Family Welfare along with Drug Control Department have come hard on health care centres for charging exorbitant fees from their patients. Indraprastha Health Care Ltd. (IHCL), a leading integrated healthcare delivery provider company is feeling pinch of measures taken by authorities and facing margin pressures due to this. IHCL is operating in a competitive environment so; it's difficult to increase patient numbers also. Management Consultant of the company has come out with some plan for cost control and reduction.

IHCL provides treatment under package system where fees is charged irrespective of days a patient stays in the hospital. Consultant has estimated 2.50 patient days per patient. He wants to reduce it to 2 days. By doing this, consultant has targeted the general variable cost of ₹ 500 per patient day. Annually 15,000 patients visit to the hospital for treatment.

Medical Superintendent has some concerns with that of Consultant's plan. According to him, reducing the patient stay would be detrimental to the full recovery of patient. They

would come again for admission thereby increasing current readmission rate from 3% to 5%; it means readmitting 300 additional patients per year. Company has to spend ₹ 25,00,000 more to accommodate this increase in readmission. But Consultant has found blessing in disguise in this. He said every readmission is treated as new admission so it would result in additional cash flow of ₹ 4,500 per patient in the form of admission fees.

Required

Calculate the impact of Management Consultant's plan on profit of the company. Also comment on result and other factors that should be kept in mind before taking any decision.

Pricing Strategy

6. 'S' is a leading IT security solutions and ISO 9001 certified company. The solutions are well integrated systems that simplify IT security management across the length and depth of devices and on multiple platforms. 'S' has recently developed an Antivirus Software and company expects to have life cycle of less than one year. It was decided that it would be appropriate to adopt a market skimming pricing policy for the launch of the product. This Software is currently in the Introduction stage of its life cycle and is generating significant unit profits.

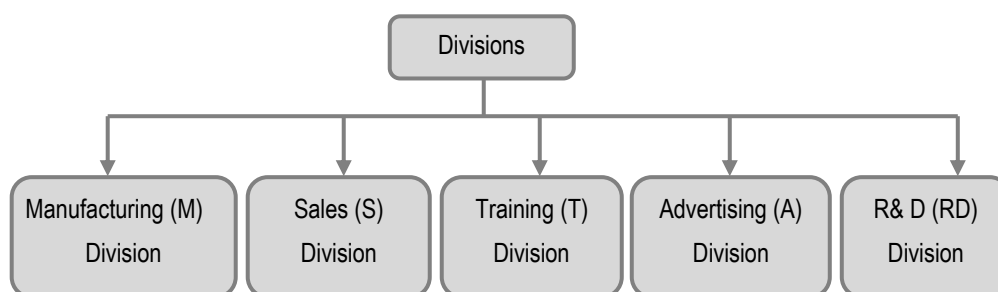
Required

Explain, with reasons, the changes, if any, to the unit selling price that could occur when the Software moves from the Introduction stage to Growth stage of its life cycle.

Also suggest necessary strategies at this stage.

Zero Based Budgeting

7. Capital 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.

Standard Costing – Missing Figures

8. A company produces a product X, using raw materials A and B. The standard mix of A and B is 1: 1 and the standard loss is 10% of input. You are required to COMPUTE the MISSING INFORMATION indicated by “?” based on the data given below:

	A	B	Total
Standard price of raw material (₹ / kg.)	24	30	
Actual input (kg.)	?	70	
Actual output (kg.)			?
Actual price ₹ / kg.	30	?	
Standard input quantity (kg.)	?	?	
Yield variance (sub usage)			270(A)
Mix variance			?
Usage variance	?	?	?
Price variance	?	?	?
Cost variance	0	?	1,300(A)

Transfer Pricing

9. XWB Ltd. has two divisions Division W and Division B. Division W produces product Z, which it sells to external market and also to Division B. Divisions in the XWB Ltd. are treated as profit centres and divisions are given autonomy to set transfer prices and to choose their supplier. Performance of each division measured on the basis of target profit given for each period.

Division W can produce 1,00,000 units of product Z at full capacity. Demand for product Z in the external market is for 70,000 units only at selling price of ₹ 2,500 per unit. To produce product Z Division W incurs ₹ 1,600 as variable cost per unit and total fixed overhead of ₹ 4,00,00,000. Division W has employed ₹ 12,00,00,000 as working capital, working capital is financed by cash credit facility provided by its lender bank @ 11.50% p.a. Division W has been given a profit target of ₹ 2,50,00,000 for the year.

Division B has found two other suppliers C Ltd and H Ltd. who are agreed to supply product Z.

Division B has requested a quotation for 40,000 units of product Z from Division W.

Required

- (i) Calculate the transfer price per unit of product Z that Division W should quote in order to meet target profit for the year.
- (ii) Calculate the two prices Division W would have to quote to Division B, if it became XWB Ltd. policy to quote transfer prices based on opportunity costs.

Balanced Score Card

10. Star Telecom Ltd. is a leading cellular service provider having a global presence. It aims to be the most innovative and trusted telecom company in the world. To achieve this aim, it is constantly working on its overall functioning. It is trying to adopt best managements practices in the world. Following are some information related to the company's performance for a particular period:

Particulars	Current Year	Base Year	Target
Operating Ratio	60%	54%	Reduce it to 50%
Average Revenue <i>per user</i>	₹ 225	₹ 210	Increase it to ₹250
Unresolved Consumer Complaints	27,500	25,000	Reduce it by 20%
Customer Relationship Centres	280	200	Take the total to 250
Employee Coverage under Training Programme	10%	8%	At least 15%

Evaluate the performance of the company using Balance Scorecard approach.

Linear Programming and Transportation

11. Identify three Similarities and three Differences between Linear Programming Model and Transportation Model.

Assignment and Transportation

12. EXPLAIN following statement-

"Assignment problem is special case of transportation problem; it can also be solved by transportation methods"

PERT and CPM

13. State the Validity of following statements along with the reasons:
 - (i) Two activities have common predecessor and successor activities. So, they can have common initial and final nodes.
 - (ii) In respect of any activity whether real or dummy, the terminal node should bear a number higher than the initial node number.

- (iii) The difference between the latest event time and the earliest event time is termed as free float.
- (iv) For every critical activity in a network, the earliest start and the earliest finish time as well as the latest finish time and the latest start time are the same.
- (v) The optimal duration of a project is the minimum time in which it can be completed.
- (vi) Resource leveling aims at smoothening of the resource usage rate without changing the project duration.

Simulation

14. 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 – Sensitivity Analysis

15. Z-Parts Inc., USA based firm, has just invented a new part 'Z-20'. 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.

SUGGESTED ANSWERS/HINTS

1. Break Even Units

1.
$$\frac{[\text{Fixed Costs} + (\text{Setup Cost} \times \text{Setups}) + (\text{Engineering Cost} \times \text{Engineering Hours})]}{(\text{Sale Price} - \text{Variable Cost})}$$

$$= \frac{[36,500 + (\text{₹ } 225 \times 40) + (\text{₹ } 10 \times 250)]}{(\text{₹ } 5 - \text{₹ } 2.5)}$$

$$= 19,200 \text{ units}$$
2.
$$\frac{[\text{Fixed Costs} + (\text{Setup Cost} \times \text{Setups}) + (\text{Engineering Cost} \times \text{Engineering Hours})]}{(\text{Sale Price} - \text{Variable Cost})}$$

$$= \frac{[36,500 + (\text{₹ } 150 \times 40) + (\text{₹ } 10 \times 215)]}{(\text{₹ } 5 - \text{₹ } 2.5)}$$

$$= 17,860 \text{ Units}$$

2. (i) **Invalid:** Kaizen Costing is the system of cost reduction procedures which involves making small and continuous improvements to the production processes rather than innovations or large-scale investment.
- (ii) **Valid:** The training of employees is very much a long-term and ongoing process in the Kaizen costing approach. Training enhances the abilities of employees.
- (iii) **Invalid:** Kaizen costing approach involves everyone from top management level to the shop floor employees. Every employee's active participation is a must requirement.
- (iv) **Invalid:** Though the aim of Kaizen Costing is to reduce the cost but at the same time it also aims to maintain the quality. Kaizen costing also aims to bring the clarity in roles and responsibilities for all employees.

3. Workings

Statement Showing Variable Manufacturing Cost per unit

Particulars of Costs	₹ / unit
Sales	79,600
Less: Contribution (40%)	31,840
Variable Cost	47,760
Less: Variable Selling Costs (₹79,600 × 0.1)	7,960
Variable Manufacturing Cost	39,800

Statement Showing Expected Profit

Particulars of Costs	('000) ₹ / unit	
	500 units	750 units
Sales	39,800	52,200

	(₹79,600 × 500)	(₹69,600 × 750)
Less: Variable Mfg. Cost	19,900 (₹39,800 × 500)	29,850 (₹39,800 × 750)
Less: Variable Selling Cost	3,980 (₹39,800 × 0.1)	5,220 (₹52,200 × 0.1)
Add: Salvage Value	625	900
Less: Cost of Plant	3,500	5,200
Net Profit	13,045	12,830

Development cost is sunk and is not relevant.

Advice---

Based on the above 'Expected Profit' statement which is purely based on *financial considerations* firm may go for high price – low volume i.e. 500 units level. However, *non-financial considerations* are also given due importance as they account for actions that may not contribute directly to profits in the short run but may contribute significantly to profits in long run. Here, it is important to note that life cycle of product is two years and there is no significant difference between the profits at both levels. In this scenario firm may opt the plant having high capacity not only to increase its market share but also to establish a long term brand image.

4. (i) **Invalid:** The concepts, tools and techniques of value chain analysis apply to organizations which produce and sell a product and also to organizations which provide a service.
 - (ii) **Invalid:** Procurement activities are included in the support activities rather than primary activities.
 - (iii) **Invalid:** Value chain analysis in the strategic framework consists of multiple cost drivers concept. In value chain analysis, a set of unique cost drivers is identified for each value activity instead of single cost driver application at the overall firm level. Multiple cost drivers may be classified into Structural drivers and Executional drivers.
5. (i) **Impact of Management Consultant's Plan on Profit of the IHCL**

**Indraprastha Health Care Ltd.
Statement Showing Cost Benefit Analysis**

Particulars	₹
Cost:	
Incremental Cost <i>due to</i> Increased Readmission	25,00,000
Benefit:	
Saving in General Variable Cost <i>due to</i> Reduction in Patient Days [15,000 Patients × (2.5 Days – 2.0 Days) × ₹500]	37,50,000

Revenue from Increased Readmission (300 Patients × ₹4,500)	13,50,000
Incremental Benefit	26,00,000

(ii) Comment

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

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

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

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

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

6. Following acceptance by early innovators, conventional consumers start following their lead. New competitors are likely to now enter the market attracted by the opportunities for large scale production and profit. 'S' may wish to discourage competitors from entering the market by lowering the price and thereby lowering the unit profitability. The price needs to be lowered so that the product becomes attractive to different market segments thus increasing demand to achieve the growth in sales volume. Strategies at this stage may include the following
 - (i) Improving quality and adding new features such as Data Theft Protection, Parental Control, Web Protection, Improved Scan Engine, Anti Spyware, Anti Malware etc.
 - (ii) Sourcing new market segments/ distribution channels.
 - (iii) Changing marketing strategy to increase demand.
 - (iv) Lowering price to attract price-sensitive buyers.
7. 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.

8. Working for Finding – Missing Figures

$$\begin{aligned}\text{Cost Variance}_A &= 0 \\ \text{Cost Variance}_{(A+B)} &= ₹ 1,300 (A) \\ \text{Yield Variance}_{(A+B)} &= ₹ 270 (A)\end{aligned}$$

Standard Cost and Actual Cost (Incomplete Information)

Raw Material	Standard Data			Actual Data		
	Qty. (Kg.) [SQ]	Price (₹) [SP]	Amount (₹) [SQ x SP]	Qty. (Kg.) [AQ]	Price (₹) [AP]	Amount (₹) [AQ x AP]
A	???	24	???	???	30	???
B	???	30	???	70	???	???
Total	???		???	???		???

$$\begin{aligned}\text{Material Cost Variance}_A &= \text{Standard Cost} - \text{Actual Cost} \\ \Rightarrow 0 &= (SQ_A \times ₹ 24 - AQ_A \times ₹ 30) \\ \Rightarrow SQ_A &= 1.25 AQ_A \\ \text{Material Yield Variance}_{(A+B)} &= \text{Average Standard Price per unit of Standard Mix} \times [\text{Total Standard Quantity (units)} - \text{Total Actual Quantity (units)}] \\ \Rightarrow ₹ 270 (A) &= \left(\frac{₹ 24 \times SQ_A + ₹ 30 \times SQ_B}{SQ_A + SQ_B} \right) \times [(SQ_A + SQ_B) - (AQ_A + 70)]\end{aligned}$$

$SQ_A = SQ_B$ as Standard Mix is in ratio 1:1

$$\begin{aligned}\Rightarrow ₹ 270 (A) &= \left(\frac{₹ 24 \times SQ_A + ₹ 30 \times SQ_A}{SQ_A + SQ_A} \right) \times [(SQ_A + SQ_A) - (AQ_A + 70)] \\ \Rightarrow ₹ 270 (A) &= 27 \times [2 \times SQ_A - (AQ_A + 70)] \\ \Rightarrow ₹ 270 (A) &= 27 \times [2 \times 1.25 AQ_A - (AQ_A + 70)] \\ \Rightarrow AQ_A &= 40 \text{ Kg.} \\ \text{As } SQ_A &= 1.25 AQ_A\end{aligned}$$

$$\begin{aligned}
 &= 1.25 \times 40 \text{ Kg.} \\
 &= 50 \text{ Kg.} \\
 \text{As } SQ_B &= SQ_A \\
 &= 50 \text{ Kg.} \\
 \text{Cost Variance } (A+B) &= \text{Standard Cost} - \text{Actual Cost} \\
 \Rightarrow 1,300 \text{ (A)} &= (50 \text{ Kg.} \times ₹ 24 + 50 \text{ Kg.} \times ₹ 30) - (40 \text{ Kg.} \times ₹ 30 + 70 \text{ Kg.} \times AP_B) \\
 \Rightarrow AP_B &= ₹ 40
 \end{aligned}$$

Standard Cost and Actual Cost (Complete Information)

Raw Material	Standard Data			Actual Data			Std. Cost of Actual Qty. (₹) [AQ x SP]
	Qty. (Kg.) [SQ]	Price (₹) [SP]	Amount (₹) [SQ x SP]	Qty. (Kg.) [AQ]	Price (₹) [AP]	Amount (₹) [AQ x AP]	
A	50	24	1,200	40	30	1,200	960
B	50	30	1,500	70	40	2,800	2,100
Total	100		2,700	110		4,000	3,060

Computation of Variances

$$\begin{aligned}
 \text{Material Cost Variance} &= \text{Standard Cost} - \text{Actual Cost} \\
 &= SQ \times SP - AQ \times AP \\
 (A) &= ₹ 1,200 - ₹ 1,200 \\
 &= ₹ 0 \\
 (B) &= ₹ 1,500 - ₹ 2,800 \\
 &= ₹ 1,300 \text{ (A)} \\
 \text{Total} &= ₹ 0 + ₹ 1,300 \text{ (A)} \\
 &= ₹ 1,300 \text{ (A)} \\
 \text{Material Price Variance} &= \text{Standard Cost of Actual Quantity} - \text{Actual Cost} \\
 &= AQ \times SP - AQ \times AP \\
 &\text{Or} \\
 &= AQ \times (SP - AP) \\
 (A) &= 40 \text{ Kg.} \times (₹ 24.00 - ₹ 30.00) \\
 &= ₹ 240 \text{ (A)}
 \end{aligned}$$

	(B)	=	70 Kg. × (₹ 30.00 – ₹ 40.00)	
		=	₹ 700 (A)	
	Total	=	₹ 240 (A) + ₹ 700 (A)	
		=	₹ 940 (A)	
Material Usage Variance		=	Standard Cost of Standard Quantity for Actual Output – Standard Cost of Actual Quantity	
		=	SQ × SP – AQ × SP	
			Or	
		=	SP × (SQ – AQ)	
	(A)	=	₹ 24 × (50 Kg. – 40 Kg.)	
		=	₹ 240 (F)	
	(B)	=	₹ 30 × (50 Kg. – 70 Kg.)	
		=	₹ 600 (A)	
	Total	=	₹ 240 (F) + ₹ 600 (A)	
		=	₹ 360 (A)	
Material Mix Variance		=	Total Actual Quantity (units) × (Average Standard Price Per unit of Standard Mix – Average Standard Price per unit of Actual Mix)	
		=	110 Kg. × $\left(\frac{₹ 2,700}{100 \text{ Kg.}} - \frac{₹ 3,060}{110 \text{ Kg.}} \right)$	
		=	₹ 90 (A)	
Material Yield Variance		=	Average Standard Price per unit of Standard Mix × [Total Standard Quantity (units) – Total Actual Quantity (units)]	
		=	$\left(\frac{₹ 2,700}{100 \text{ Kg.}} \right) \times (100 \text{ Kg.} - 110 \text{ Kg.})$	
		=	₹ 270 (A)	(Given)
Standard Output		=	Standard Input – Standard Loss	
		=	100 Kg. – 10 Kg.	
		=	90 Kg.	
Actual Output		=	90 Kg.	

(Actual Output and Standard Output are always equal numerically in any Material Variance Analysis)

9. (i) **Transfer Price *per unit* of Product Z that Division W Should Quote *in order to meet Target Profit***

Quotation for the 40,000 units of product Z should be such that meet Division W's target profit and interest cost on working capital. Therefore the minimum quote for product Z will be calculated as follows:

Particulars	Amount (₹)
Target Profit (given for the year)	2,50,00,000
Add: Interest Cost on Working Capital (₹12,00,00,000 @11.5%)	1,38,00,000
Required Profit	3,88,00,000
Add: Fixed Overhead	4,00,00,000
Target Contribution	7,88,00,000
Less: Contribution Earned --- External Sales {60,000 units × (₹2,500 – ₹1,600)}	5,40,00,000
Contribution Required – Internal Sales	2,48,00,000
Contribution <i>per unit</i> of Product Z (₹2,48,00,000 ÷ 40,000 units)	620
Transfer Price of Product Z to Division B (Variable Cost <i>per unit</i> + Contribution <i>per unit</i>)	2,220

(ii) **The Two Transfer Prices Based on Opportunity Costs**

For the 30,000 units (i.e. maximum capacity – maximum external market demand) at variable cost of production i.e. ₹1,600 per unit.

For the next 10,000 units (i.e. external market demand – maximum possible sale) at market selling price i.e. ₹2,500 per unit.

10. The balanced scorecard is a method which displays organisation's performance into four dimensions namely financial, customer, internal and innovation. The four dimensions acknowledge the interest of shareholders, customers and employees taking into account of both long-term and short-term goals. The detailed analysis of performance of the company using Balance Scorecard approach as follows:

(i) **Financial Perspective:** Operating ratio and average revenue will be covered in this prospective.

Company is unable to achieve its target of reducing operating ratio to 50% instead it has increased to 60%. Company is required to take appropriate steps to control and manage its operating expenses. Average revenue per user has increased from ₹ 210 to ₹ 225 but remains short of targeted ₹ 250. This is also one of the reasons

of swelled operating ratio. Company can boost up its average revenue per user either by increasing the price of its services or by providing more paid value added services.

- (ii) **Customer Perspective:** Service complaints will be covered under this perspective. The company had set a target of reducing unresolved complaints by 20% instead unresolved complaints have risen by 10% $[(27,500-25,000)/(25,000) \times 100]$. It shows dissatisfaction is increasing among the consumers which would adversely impact the consumer's general perception about the company and company may lose its consumers in long run.
- (iii) **Internal Business Perspective:** Establishing customer relationship centres will be covered under this perspective. Company has established 80 relationship centres in the current period exceeding its target of 50 (250-200) to cater to the needs of existing consumers as well as soliciting new consumers. This shows the seriousness of the company towards the consumer satisfaction and would help them in the long run.
- (iv) **Learning and Growth Perspective:** Employee training programmes are covered under this perspective.

Company had set a target to cover at least 15% employee under its training programmes but covered only 10%. This could hurt capabilities of the employees which are needed for long term growth of the organisation necessary to achieve the objectives set in the previous three perspectives. People or the Indraprastha resource of the company is one of the three principle sources where organisational learning and growth comes.

11. Similarities

- (i) Both the models have an objective function.
- (ii) Both models' objective functions are linear.
- (iii) Both the models require non-negativity constraints.

Differences

- (i) The general linear programming problem may be of *maximization* or *minimization* type, whereas, transportation problem predominately deals with *minimization* problem.
- (ii) A general linear programming problem is solved by using *simplex algorithm*; whereas transportation problem is solved by using *transportation algorithm* (as simplex method is less appropriate to solve).
- (iii) The resources, for which the structural constraints are built up is *homogeneous* in transportation model; whereas in Linear Programming model they are *heterogeneous*.

12. The assignment problem is special case of transportation problem; it can also be solved by transportation method. But the solution obtained by applying this method would be severely degenerate. This is because the optimality test in the transportation method requires that there must be $m+n-1$ allocations/assignments. But due to the special structure of assignment problem of order $n \times n$, any solution cannot have more than n assignments. Thus, the assignment problem is naturally degenerate. In order to remove degeneracy, $n-1$ * number of dummy allocations will be required in order to proceed with the transportation method. Thus, the problem of degeneracy at each solution makes the transportation method computationally inefficient for solving an assignment problem.



$$(*) \quad \underline{m+n-1} - n \Rightarrow \underline{n+n-1} - n \Rightarrow \underline{2n-1} - n \Rightarrow \underline{n-1}$$

13. (i) **Invalid**

Reason: As per the rules of network construction, parallel activities between two events, without intervening events, are prohibited. Dummy activities are needed when two or more activities have same initial and terminal events. Dummy activities do not consume time or resources.

(ii) **Valid**

Reason: As per the conventions adopted in drawing networks, the head event or terminal node always has a number higher than that of initial node or tail event.

(iii) **Invalid**

Reason: The difference between the latest event time and the earliest event time is termed as slack of an event. Free float is determined by subtracting head event slack from the total float of an activity.

(iv) **Invalid**

Reason: For every critical activity in a network, the earliest start time and the latest start time is same and also the earliest finish time and the latest finish time is same.

(v) **Invalid**

Reason: The optimum duration is the time period in which the total cost of the project is minimum.

(vi) **Valid**

Reason: Resource leveling is a network technique used for reducing the requirement of a particular resource due to its paucity or insufficiency within a constraint on the project duration. The process of resource leveling utilizes the large floats available on non-critical activities of the project and cuts down the demand of the resource.

14. 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

(&#x20B9 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

15. 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
 $[12,398.08 \text{ hrs.} \times \text{₹ } 20]$
- Revised Labour Cost for zero profit = ₹ 3,22,961.60
 $[\text{₹ } 2,47,961.60 + \text{₹ } 75,000]$
- Total Time for 256 parts (Revised) = 16,148.08 hrs.
 $[\text{₹ } 3,22,961.60 / \text{₹ } 20]$
- 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)

PAPER – 5 : ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Value Added/ Non- Value Added Activities

1. Qwerty manufactures high-quality wooden doors within the forests of Qtown since 1967. 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 April:

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

Life Cycle Costing and Pricing Strategy

2. OR International Ltd. (ORIL) has developed a new product 'α³' which is about to be launched into the market. Company has spent ₹ 30,00,000 on R&D of product 'α³'. It has also bought a machine to produce the product 'α³' costing ₹ 11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value.

The company has decided to charge price that will change with the cumulative numbers of units sold:

Cumulative Sales (units)	Selling Price ₹ per unit
0 to 2,200	750
2,201 to 7,700	600
7,701 to 15,950	525
15,951 to 59,950	450
59,951 and above	300

Based on these selling prices, it is expected that sales demand will be as shown below:

Weeks	Sales Demand per week (units)
1-10	220
11-20	550
21-30	825
31-70	1,100
71-80	880
81-90	660
91-100	440
101-110	220
Thereafter	NIL

Unit variable costs are expected to be as follows:

	₹ per unit
First 2,200 units	375
Next 13,750 units	300
Next 22,000 units	225
Next 22,000 units	188
Thereafter	225

ORIL uses just-in-time production system. Following is the total contribution statement of the product 'α³' for its Introduction and Growth phase:

	Introduction	Growth	
Weeks	1 - 10	11 - 30	
Number of units Produced and Sold	2,200	5,500	8,250
Selling Price per unit (₹)	750	600	525
Variable Cost per unit (₹)	375	300	300
Contribution per unit (₹)	375	300	225
Total Contribution (₹)	8,25,000	16,50,000	18,56,250

Required

- Prepare the total contribution statement for each of the remaining two phases of the product's life cycle.
 - Discuss Pricing Strategy of the product 'α³'.
 - Find possible reasons for the changes in cost during the life cycle of the product 'α³'.
- Note: Ignore the time value of money.

Value Chain Analysis – Primary Activity

3. Sinopec Ltd. is engaged in business of manufacturing branded readymade garments. It has a single manufacturing facility at Surat. Raw material is supplied by various suppliers.

Majority of its revenue comes from export to Euro Zone and US. To strengthen its position further in the Global Market, it is planning to enhance quality and provide assurance through long term warranty.

For the coming years company has set objective to reduce the quality costs in each of the primary activities in its value chain.

Required

State the primary activities as per Porter's Value Chain Analysis in the value chain of Sinopec Ltd with brief description.

Just in Time

4. YP Ltd. (YPL) manufactures and sells one product called "YEIA". Managing Director is not happy with its current purchasing and production system. There has been considerable discussion at the corporate level as to use of 'Just in Time' system for "YEIA". As per the opinion of managing director of YPL Ltd. - *"Just-in-time system is a pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales. By using Just in Time system, it is possible to reduce carrying cost as well as other overheads"*.

YPL is dependent on contractual labour which has efficiency of 95%, for its production. The labour has to be paid for minimum of 4,000 hours per month to which they produce 3,800 standard hours.

For availing services of labour above 4,000 hours in a month, YPL has to pay overtime rate which is 45% premium to the normal hourly rate of ₹110 per hour. For avoiding this overtime payment, YPL in its current production and purchase plan utilizes full available normal working hours so that the higher inventory levels in the month of lower demand would be able to meet sales of month with higher demand level. YPL has determined that the cost of holding inventory is ₹70 per month for each standard hour of output that is held in inventory.

YPL has forecast the demand for its products for the first six months of year 2017 as follows:

Month	Demand (Standard Hrs)
Jan'17	3,150
Feb'17	3,760
Mar'17	4,060
Apr'17	3,350
May'17	3,650
Jun'17	4,830

Following other information is given:

- (a) All other production costs are either fixed or are not driven by labour hours worked.
- (b) Production and sales occur evenly during each month and at present there is no stock at the end of Dec'16.
- (c) The labour are to be paid for their minimum contracted hours in each month irrespective of any purchase and production system.

Required

As a chief accountant, you are requested to comment on managing director's view.

Break-even Point – Production in Batches

5. Z 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:

	Alpha	Beta	Gamma	Theta	Total
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	
	(₹)	(₹)	(₹)	(₹)	(₹)
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:

Alpha.....	10,00,000
Beta.....	1,00,000
Gamma.....	2,00,000
Theta.....	<u>1,00,000</u> 14,00,000
General fixed overheads.....	<u>6,20,000</u>
	<u>31,00,000</u>

The other information is as follows:-

	Alpha	Beta	Gamma	Theta	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 Z Ltd.
- Calculate the break- even volume in batches and also in approximate units for Product 'Alpha'.

Determination of Production Mix/ Production Planning

6. A company is producing three products P, Q & R. Relevant information is given below:

Product	P	Q	R
Raw material per unit (kg)	20	12	30
Machine hours per unit (hours)	3	5	4
Selling price per unit (₹)	500	400	800
Maximum limit of production Unit	1,500	1,500	750

Only 9,200 hours are available for production at a cost of ₹20 per hour and maximum 50,000 kgs. of material @ ₹ 20 per kg., can be obtained.

(Only product mix quantities are to be shown, calculation of total profit at that product mix not required to be shown)

Required

On the basis of the above information determine the product-mix to give the highest profit if at least two products are produced.

Pareto Analysis

7. Generation 2050 Technologies Ltd. develops cutting-edge innovations that are powering the next revolution in mobility and has nine tablet smart phone models currently in the market whose previous year financial data is given below:

Model	Sales (₹'000)	Profit-Volume (PV) Ratio
Tab - A001	5,100	3.53%
Tab - B002	3,000	23.00%
Tab - C003	2,100	14.29%
Tab - D004	1,800	14.17%
Tab - E005	1,050	41.43%
Tab - F006	750	26.00%
Tab - G007	450	26.67%
Tab - H008	225	6.67%
Tab - I009	75	60.00%

Using the financial data, carry out a Pareto analysis (80/20 rule) of Sales and Contribution. Discuss your findings with appropriate recommendations.

Budget and Budgetary Control

8. KLM Ltd manufactures and sells a single product and has estimated sales revenue of ₹397.80 lacs during the year based on 20% profit on selling price. Each unit of product requires 6 kg of material W and 3 kg of material X and processing time of 4 hours in machine shop and 2 hours in assembly shop. Factory overheads are absorbed at a blanket rate of 20% of direct labour. Variable selling & distribution overheads are ₹ 6 per unit sold and fixed selling & distribution overheads are estimated to be ₹7,20,000.

The other relevant details are as under:

Purchase Price	Material W	₹16 per kg	
	Materials X	₹10 per kg	
Labour Rate	Machine Shop	₹14 per hour	
	Assembly Shop	₹7 per hour	
	Finished Stock	Material W	Material X
Opening Stock	25,000 units	75,000 kg	40,000 kg
Closing Stock	30,000 units	80,000 kg	55,000 kg

Required

Calculate

- (i) Number of units of product proposed to be sold and selling price per unit.
- (ii) Production budget in units.
- (iii) Material purchase budget in units.

Standard Costing – Reconciliation of Budgeted and Actual Profit

9. KYC Toys Ltd. manufactures a single product and the standard cost system is followed. Standard cost per unit is worked out as follows:

	₹
Materials (10 Kgs. @ ₹4 per Kg)	40
Labour (8 hours @ ₹8 per hour)	64
Variable overheads (8 hours @ ₹3 per hour)	24
Fixed overheads (8 hours @ ₹3 per hour)	24
Standard Profit	56

Overheads are allocated on the basis of direct labour hours. In the month of April 2018, there was no difference between the budgeted and actual selling price and there were no opening or closing stock during the period.

The other details for the month of April 2018 are as under

	Budgeted	Actual
Production and Sales	2,000 Units	1,800 Units
Direct Materials	20,000 Kgs. @ ₹ 4 per kg	20,000 Kgs. @ ₹ 4 per kg
Direct Labour	16,000 Hrs. @ ₹ 8 per Hr.	14,800 Hrs. @ ₹ 8 per Hr.
Variable Overheads	₹ 48,000	₹ 44,400
Fixed Overheads	₹ 48,000	₹ 48,000

Required

Reconcile the budgeted and actual profit with the help of variances according to each of the following method:

- (i) The conventional method
- (ii) The relevant cost method assuming that
 - (a) Materials are scarce and are restricted to supply of 20,000 Kgs. for the period.
 - (b) Labour hours are limited and available hours are only 16,000 hours for the period.
 - (c) There are no scarce inputs.

Transfer Pricing

10. Divisions X and Y are two divisions in XY Ltd. Division X manufactures a component (X) which is sold to external customers and also to Division Y.

Details of Division X are as follows:

Market price per component	₹ 300
Variable cost per component	₹ 157
Fixed costs per production period	₹ 20,62,000
Demand from Y Division per production period	20,000 components
Capacity per production period	35,000 components

Division Y assembles a product (Y) which is sold to external customers. Each unit of Y requires two units of X.

Details of Division Y are as follows:

Selling price per unit	₹1,200
Variable cost per unit:	
(i) Two components from X	2@ transfer price
(ii) Other variable costs per unit	₹ 375
Fixed costs per production period	₹ 13,50,000
Demand per production period	10,000 units
Capacity per production period	10,000 units

The Group Transfer Pricing Policy stipulates that

Transfers must be at opportunity cost.

Y must buy the components from X.

X must satisfy the demand from Y before making external sales.

Required

- (i) Present figures showing the weighted average transfer price, per component transferred to Y and the total profits earned by X for each of the following levels of external demand of X:
 - External demand = 15,000 components
 - External demand = 19,000 components
 - External demand = 35,000 components
- (ii) Compute Division Y's profits when Division X has each of the above levels of demand. (Only relevant figures need to be discussed. A detailed profitability statement for each situation is not required).

Transportation Problem - Degeneracy

11. A project consists of four (4) major jobs, for which four (4) contractors have submitted tenders. The tender amounts, in thousands of rupees, are given in the each cell. The initial solution of the problem obtained by using Vogel's Approximation Method is given in the Table below:

Contractors	Job P	Job Q	Job R	Job S
A	112.50	100.00	127.50	167.50 1
B	142.50	105.00 1	157.50	137.50
C	122.50	130.00	120.00 1	160.00
D	102.50 1	112.50	150.00	137.50

Find the assignment, which minimizes the total cost of the project. Each contractor has to be awarded one job only.

Critical Path Analysis – Missing Figures and Network

12. 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

- Find??? Figures.
- Draw the network.

- (iii) List the paths with their corresponding durations and state when the project can be completed.

PERT and CPM – Basic Concepts

13. State the validity of following statements along with the reasons:

- (i) Two activities have common predecessor and successor activities. So, they can have common initial and final nodes.
- (ii) In respect of any activity whether real or dummy, the terminal node should bear a number higher than the initial node number.
- (iii) The difference between the latest event time and the earliest event time is termed as free float.
- (iv) For every critical activity in a network, the earliest start and the earliest finish time as well as the latest finish time and the latest start time are the same.
- (v) The optimal duration of a project is the minimum time in which it can be completed.
- (vi) Resource leveling aims at smoothening of the resource usage rate without changing the project duration.

Simulation

14. An Investment Corporation wants to study the investment projects based on four factors: market demand in units, contribution per unit, advertising cost and the investment required. These factors are felt to be independent of each other. In analyzing a new consumer product, the corporation estimates the following probability distributions:

Demand (units)		Contribution per unit		Advertising Cost	
No.	Probability	₹	Probability	₹	Probability
10,000	0.20	25	0.25	50,000	0.22
20,000	0.25	35	0.30	60,000	0.33
30,000	0.30	45	0.35	70,000	0.44
40,000	0.25	55	0.10	80,000	0.01

The data for proposed investments are as follows:

Investment (₹)	50,00,000	55,00,000	60,00,000	65,00,000
Probability	0.10	0.30	0.45	0.15

Using simulation process, repeat the trials 5 times, compute the Return on Investment (ROI) for each trial and find the highest likely return.

Using the sequence (First 4 random numbers for the first trial, etc.)

09 24 85 07 84 38 16 48 41 73 54 57 92 07 99
64 65 04 78 72

Application of Learning Curve in Standard Costing

15. Aldi International Co. is a multiproduct firm and operates standard costing and budgetary control system. During the month of June firm launched a new product. An extract from performance report prepared by Sr. Accountant is as follows:

Particulars	Budget	Actual
Output	30 units	25 units
Direct Labour Hours	180.74 hrs.	118.08 hrs.
Direct Labour Cost	₹ 1,19,288	₹ 79,704

Sr. Accountant prepared performance report for new product on certain assumptions but later on he realized that this new product has similarities with other existing product of the company. Accordingly, the rate of learning should be 80% and that the learning would cease after 15 units. Other budget assumptions for the new product remain valid.

The original budget figures are based on the assumption that the labour has learning rate of 90% and learning will cease after 20 units, and thereafter the time per unit will be the same as the time of the final unit during the learning period, i.e. the 20th unit. The time taken for 1st unit is 10 hours.

Show the variances that reconcile the actual labour figures with revised budgeted figures in as much detail as possible.

Note:

The learning index values for a 90% and a 80% learning curve are -0.152 and -0.322 respectively.

[log 2 = 0.3010, log 3 = 0.47712, log 5 = 0.69897, log 7 = 0.8451, antilog of 0.6213 = 4.181, antilog of 0.63096 = 4.275]

Profitability Analysis

16. A company is planning to improve its profit level at least by 10% from the preliminary budget estimates of a profit of ₹32,80,000 for the coming year. It has worked out the following profit improvement plan:
- In the year just concluded the sales of the company were 10% of the total market of 12,00,000 units. For the preparation of the original budget estimate, the same market demand and the same share of market for the company was envisaged. Now it has been estimated that the total market demand will increase by 18% and the company's market share will increase to 11% from the present level of 10%.
 - The products are sold in two sizes - large and medium. The sales mix of each size was 50:50 so far. Now it is planned that the sales will be 40% of large and 60% of medium. The medium packs and large packs have a contribution of ₹ 10 and ₹ 8 per pack respectively. The budget proposes to raise the price in such a manner that the contribution per pack will increase by ₹ 0.60 for each size.

- (iii) There will be an additional expenditure on sales promotion worth ₹78,000.
- (iv) The company proposes to save ₹9,000 by saving on interest cost in the coming year by better financial management.

Required

Draw a profit improvement plan in financial terms and spell out separately the effect of various factors on profit.

SUGGESTED ANSWERS/ HINTS

1. (i) Average Non Value Added Time *per batch*
- $$= \text{Inspection Time} + \text{Waiting Time} + \text{Move Time}$$
- $$= 1.5 \text{ hr.} + 6.0 \text{ hrs.} + 7.5 \text{ hrs.}$$
- $$= 15 \text{ hrs.}$$
- (ii) Average Value Added Time per batch
- $$= \text{Processing Time}$$
- $$= 9 \text{ hrs.}$$
- (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
- $$= \frac{\text{Total Production Time}}{\text{Units per Batch}}$$
- $$= \frac{24 \text{ hrs.}}{60 \text{ units}}$$
- $$= 0.40 \text{ hrs. per unit}$$

2. (i) **Total Contribution Statement**

Statement Showing 'Total Contribution' for remaining two phases

Particulars	Maturity		Decline
Weeks	31 - 50	51 - 70	71 - 110
Number of units Produced and Sold	22,000	22,000	22,000

Selling Price per unit (₹)	450	450	300
Unit Variable Cost (₹)	225	188	225
Unit Contribution (₹)	225	262	75
Total Contribution (₹)	49,50,000	57,64,000	16,50,000

(ii) Pricing Strategy for Product α^3

ORIL is following the skimming price strategy that's why it has planned to launch the product α^3 initially with high price tag.

A skimming strategy may be recommended when a firm has incurred large sums of money on research and development for a new product.

In the question, ORIL has incurred a huge amount on research and development. Also, it is very difficult to start with a low price and then raise the price. Raising a low price may annoy potential customers.

Price of the product α^3 is decreasing gradually stage by stage. This is happening because ORIL wants to tap the mass market by lowering the price.

(iii) Possible reasons for the changes in cost during the life cycle of the product ' α^3 '

Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Possible reasons for the changes in cost during the life cycle of the product are as follows:

ORIL is expecting reduction in unit cost of the product α^3 over the life of product as a consequence of economies of scale and learning / experience curves.

Learning effect may be the possible reason for reduction in per unit cost if the process is labour intensive. When a new product or process is started, performance of worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of worker improves, time taken per unit reduces and thus his productivity goes up. The amount of improvement or experience gained is reflected in a decrease in cost.

Till the stage of maturity, ORIL is in the expansion mode. The ORIL may be able to take advantages of quantity discount offered by suppliers or may negotiate the price with suppliers.

Product α^3 has the least variable cost ₹188 in last phase of maturity stage; this is because a product which is in the mature stage may require less marketing support than a product which is in the growth stage so, there is a saving of marketing cost per unit.

Again, the cost per unit of the product α^3 jumps to ₹225 in decline stage. As soon as the product reaches its decline stage, the need or demand for the product disappear and quantity discount may not be available. Even ORIL may have to incur heavy marketing expenses for stock clearance.

Workings:**Statement of Cumulative Sales along with Sales Price and Variable Cost**

Weeks	Demand per week	Total Sales	Cumulative Sales	Selling Price per unit (₹)	Variable Cost per unit (₹)
1 - 10	220	2,200	2,200	750	375
11 - 20	550	5,500	7,700	600	300
21 - 30	825	8,250	15,950	525	300
31 - 50	1,100	22,000	37,950	450	225
51 - 70	1,100	22,000	59,950	450	188
71 - 80	880	8,800	68,750	300	225
81 - 90	660	6,600	75,350	300	225
91 - 100	440	4,400	79,750	300	225
101 - 110	220	2,200	81,950	300	225

3. Primary activities are the activities that are directly involved in transforming inputs into outputs and delivery and after-sales support to output. Following are the primary activities in the value chain of Sinopec Ltd:
- (i) **Inbound Logistics:** These activities are related to the material handling and warehousing. It also covers transporting raw material from the supplier to the place of processing inside the factory.
 - (ii) **Operations:** These activities are directly responsible for the transformation of raw material into final product for the delivery to the consumers.
 - (iii) **Outbound Logistics:** These activities are involved in movement of finished goods to the point of sales. Order processing and distribution are major part of these activities.
 - (iv) **Marketing and Sales:** These activities are performed for demand creation and customer solicitation. Communication, pricing and channel management are major part of these activities.
 - (v) **Service:** These activities are performed after selling the goods to the consumers. Installation, repair and parts replacement are some examples of these activities.

4. Workings**Statement Showing 'Inventory Holding Cost' under Current System**

Particulars	Jan	Feb	Mar	Apr	May	Jun
Opening Inventory* (A)	---	650	690	430	880	1,030
Add: Production*	3,800	3,800	3,800	3,800	3,800	3,800
Less: Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Closing Inventory* (B)	650	690	430	880	1,030	-

Average Inventory $\left(\frac{A+B}{2} \right)$	325	670	560	655	955	515
Inventory Holding Cost @ ₹70	22,750	46,900	39,200	45,850	66,850	36,050

(*) in terms of standard labour hours

$$\begin{aligned} \text{Inventory Holding Cost for the six months} &= ₹2,57,600 \\ &= (₹ 22,750 + ₹ 46,900 + ₹ 39,200 + ₹ 45,850 + ₹ 66,850 + ₹ 36,050) \end{aligned}$$

Calculation of Relevant Overtime Cost under JIT System

Particulars	Jan	Feb	Mar	Apr	May	Jun
Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Production*	3,150	3,760	4,060	3,350	3,650	4,830
Normal Availability*	3,800	3,800	3,800	3,800	3,800	3,800
Shortage (=Overtime*) (C)	---	---	260	---	---	1,030
Actual Overtime Hours $\left(\frac{C}{0.95} \right)$	---	---	273.68	---	---	1,084.21
Overtime Payment @ ₹159.50 [110+45%]	---	---	43,652	---	---	1,72,931

(*) in terms of standard labour hours

$$\begin{aligned} \text{Total Overtime payment} &= ₹ 2,16,583 \\ &= (₹ 43,652 + ₹ 1,72,931) \\ \text{Therefore, saving in JIT system} &= ₹ 2,57,600 - ₹ 2,16,583 = ₹ 41,017 \end{aligned}$$

Comments

Though YPL is saving ₹41,017 by changing its production system to Just-in-time but it has to consider other factors as well before taking any final call which are as follows:-

- YPL has to ensure that it receives materials from its suppliers on the exact date and at the exact time when they are needed. Credentials and reliability of supplier must be thoroughly checked.
- To remove any quality issues, the engineering staff must visit supplier's sites and examine their processes, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.
- YPL should also aim to improve quality at its process and design levels with the purpose of achieving "Zero Defects" in the production process.
- YPL should also keep in mind the efficiency of its work force. YPL must ensure that labour's learning curve has reached at steady rate so that they are capable of

performing a variety of operations at effective and efficient manner. The workforce must be completely retrained and focused on a wide range of activities.

5. (i) **Statement of Profitability of Z Ltd.**

	Products (Amount in ₹)				
	Alpha	Beta	Gamma	Theta	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**

Total Sale Value of Product 'Alpha' = ₹ 26,00,000

Total Contribution of Product 'Alpha' = ₹ 9,40,000

Specific Fixed Overheads (Product Alpha) = ₹ 10,00,000

Break-even Sales (₹) = $\frac{\text{Specific Fixed Cost}}{\text{Total Contribution}} \times \text{Total Sales Value}$

$$= \frac{₹ 10,00,000}{₹ 9,40,000} \times ₹ 26,00,000$$

$$= ₹ 27,65,957.45$$

Break-even Sales (units) = $\frac{₹ 27,65,957.45}{₹ 13.00} = 2,12,766 \text{ units}$

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 'Alpha' 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	Alpha	Beta	Gamma	Theta
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)

6. Computation of Contribution per Key Factor(s) for Various Products

Particulars	Products		
	P	Q	R
Selling Price p. u. (₹)	500	400	800
Variable Cost p. u. (₹):			
Material	400 (₹20 × 20 Kg.)	240 (₹20 × 12 Kg.)	600 (₹20 × 30 Kg.)
Machine Charge	60 (₹20 × 3 hrs)	100 (₹ 20 × 5 hrs)	80 (₹20 × 4 hrs)
Total Variable Cost p. u. (₹)	460	340	680
Contribution p. u. (₹)	40	60	120
Ranking	III	II	I
Requirement of Material (Kg.)	20	12	30

Contribution per Kg. (₹)	2.00	5.00	4.00
Ranking	III	I	II
Requirement of Machine Hours (Hrs.)	3	5	4
Contribution <i>per hour</i> (₹)	13.33	12.00	30.00
Ranking	II	III	I

It is clear from the above ranking(s):-

- I. Contribution per Unit is maximum in case of product Q & R.
- II. Contribution per Kg. of Raw Material also maximum in case of product Q & R.
- III. Contribution per Machine Hour is maximum in case of product P & R.

So product R is common in all cases and priority shall be given for production of 'R'. Balance resources should be divided between other two products P & Q.

Statement Showing Balance Resources for Product P & Q

Resources	Maximum Availability (a)	Maximum Production R (b)	Consumption of Resources p.u. (c)	Total Cons. (d) = (b) x (c)	Balance (a) - (d)
Material	50,000 Kg.	750	30 Kg.	22,500 Kg.	27,500 Kg.
Machine Hrs.	9,200 Hrs.	750	4 Hrs.	3,000 Hrs.	6,200 Hrs.

The production of P & Q may be calculated with the help of following equations by utilizing balance resources: -

$$20P + 12Q = 27,500 \quad \dots(i)$$

$$3P + 5Q = 6,200 \quad \dots(ii)$$

Then,

$$30P + 18Q = 41,250$$

equation (i) multiplied by 1.5

$$30P + 50Q = 62,000$$

equation (ii) multiplied by 10

$$\begin{array}{r} - \quad - \quad - \\ -32Q = -20,750 \end{array}$$

$$Q = 648.43 \text{ i.e. } 648 \text{ units}$$

Putting the value of Y in equation (ii)

$$3P + (5 \times 648) = 6,200$$

$$\text{Or} \quad 3P = 2,960$$

$$\text{Or} \quad P = 986 \text{ units}$$

So the of Product Mix is

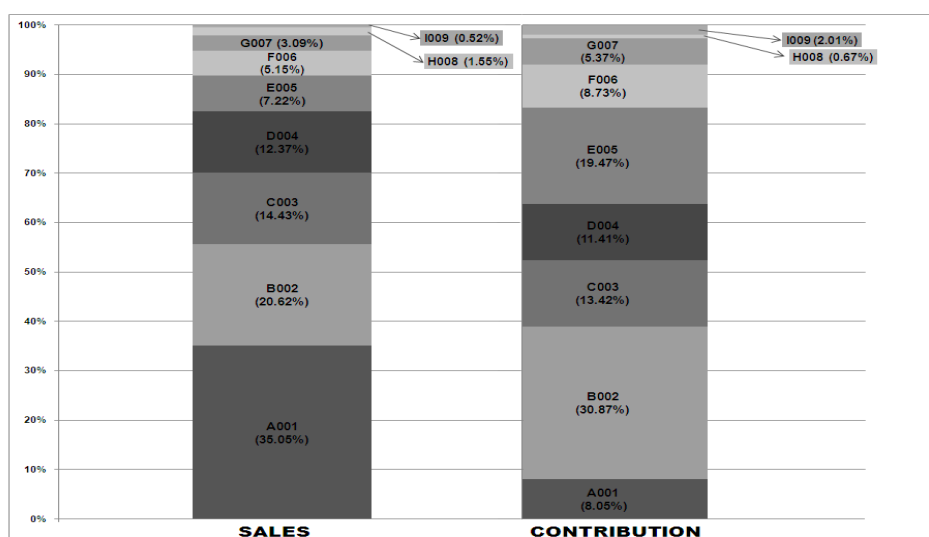
P= 986 units; Q = 648 units; R = 750 units

7. **Statement Showing 'Pareto Analysis'**

Model	Sales (₹'000)	% of Total Sales	Cumulative Total	Model	Cont. (₹'000)	% of Total Cont.	Cumulativ e Total %
Pareto Analysis Sales				Pareto Analysis Contribution			
A001	5,100	35.05%	35.05%	B002	690	30.87%	30.87%
B002	3,000	20.62%	55.67%	E005	435	19.47%*	50.34%
C003	2,100	14.43%	70.10%	C003	300	13.42%	63.76%
D004	1,800	12.37%	82.47%	D004	255	11.41%	75.17%
E005	1,050	7.22%	89.69%	F006	195	8.73%*	83.90%
F006	750	5.15%	94.84%	A001	180	8.05%	91.95%
G007	450	3.09%	97.93%	G007	120	5.37%	97.32%
H008	225	1.55%	99.48%	I009	45	2.01%	99.33%
I009	75	0.52%	100.00%	H008	15	0.67%	100.00%
	14,550	100.00%			2,235	100.00%	

(*) Rounding - off difference adjusted.

Diagram Showing 'Sales and Contribution' (NOT COMPULSORY)



This Diagram is shown for **better understanding** of the concept.

Recommendations

Pareto Analysis is a rule that recommends focus on most important aspects of the decision making in order to simplify the process of decision making. The very purpose of this analysis is to direct attention and efforts of management to the product or area where best returns can be achieved by taking appropriate actions.

Pareto Analysis is based on the 80/20 rule which implies that 20% of the products account for 80% of the revenue. But this is not the fixed percentage rule; in general business sense it means that a few of the products, goods or customers may make up most of the value for the firm.

In present case, five models namely A001, B002, C003, D004 account for 80% of total sales where as 80% of the company's contribution is derived from models B002, E005, C003, D004 and F006.

Models B002 and E005 together account for 50.34% of total contribution but having only 27.84% share in total sales. So, these two models are the key models and should be the top priority of management. Boths C003 and D004 are among the models giving 80% of total contribution as well as 80% of total sales so; they can also be clubbed with B002 and E005 as key models. Management of the company should allocate maximum resources to these four models.

Model F006 features among the models giving 80% of total contribution with relatively lower share in total sales. Management should focus on its promotional activities.

Model A001 accounts for 35.05% of total sales with only 8.05% share in total contribution. Company should review its pricing structure to enhance its contribution.

Models G007, H008 and I009 have lower share in both total sales as well as contribution. Company can delegate the pricing decision of these models to the lower levels of management, thus freeing themselves to focus on the pricing decisions for key models.

8 (i) Workings:

Statement Showing Total Variable Cost for the year

Particulars	Amount (₹)
Estimated Sales Revenue	3,97,80,000
Less: Desired Profit Margin on Sale @ 20%	79,56,000
Estimated Total Cost	3,18,24,000
Less: Fixed Selling and Distribution Overheads	7,20,000
Total Variable Cost	3,11,04,000

Statement Showing Variable Cost per unit

Particulars	Variable Cost p.u. (₹)
Direct Materials:	
W: 6 Kg. @ ₹16 per Kg.	96
X: 3 Kg. @ ₹10 per Kg.	30
Labour Cost:	
Machine Shop: 4 hrs. @ ₹14 per hour	56
Assembly Shop: 2 hrs. @ ₹7 per hour	14
Factory Overheads: 20% of (₹56 + ₹14)	14
Variable Selling & Distribution Expenses	6
Total Variable Cost <i>per unit</i>	216

$$\begin{aligned}
 \text{Number of Units Sold} &= \text{Total Variable Cost} / \text{Variable Cost per unit} \\
 &= ₹3,11,04,000 / ₹216 \\
 &= 1,44,000 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{Selling Price per unit} &= \text{Total Sales Value} / \text{Number of Units Sold} \\
 &= ₹3,97,80,000 / 1,44,000 \text{ units} \\
 &= ₹276.25
 \end{aligned}$$

(ii) Production Budget (units)

Particulars	Units
Budgeted Sales	1,44,000
Add: Closing Stock	30,000
Total Requirements	1,74,000
Less: Opening Stock	25,000
Required Production	1,49,000

(iii) Materials Purchase Budget (Kg.)

Particulars	Material W	Material X
Requirement for Production	8,94,000 (1,49,000 units × 6 Kg.)	4,47,000 (1,49,000 units × 3 Kg.)
Add: Desired Closing Stock	80,000	55,000
Total Requirements	9,74,000	5,02,000
Less: Opening Stock	75,000	40,000
Quantity to be purchased	8,99,000	4,62,000

9. COMPUTATION OF VARIANCES

$$\begin{aligned}
 \text{Material Usage Variance} &= \text{Standard Price} \times (\text{Standard Quantity} - \text{Actual Quantity}) \\
 &= ₹4.00 \times (18,000^* \text{ Kgs.} - 20,000 \text{ Kgs.}) \\
 &= ₹ 8,000 \text{ (A)}
 \end{aligned}$$

$$* \left(1,800 \text{ units} \times \frac{20,000 \text{ Kgs.}}{2,000 \text{ units}} \right)$$

$$\begin{aligned}
 \text{Labour Efficiency Variance} &= \text{Standard Rate} \times (\text{Standard Hours} - \text{Actual Hours}) \\
 &= ₹8.00 \times (14,400^* \text{ hrs.} - 14,800 \text{ hrs.}) \\
 &= ₹3,200 \text{ (A)}
 \end{aligned}$$

$$* \left(1,800 \text{ units} \times \frac{16,000 \text{ hrs.}}{2,000 \text{ units}} \right)$$

Variable Overhead Efficiency Variance

$$\begin{aligned}
 &= \text{Standard Variable Overheads for Production} - \text{Budgeted Variable Overheads for Actual hours} \\
 &= (14,400 \text{ hrs.} \times \text{Rs.}3.00) - (\text{₹}3.00 \times 14,800 \text{ hrs.}) \\
 &= ₹1,200 \text{ (A)}
 \end{aligned}$$

Fixed Overhead Volume Variance

$$\begin{aligned}
 &= \text{Absorbed Fixed Overheads} - \text{Budgeted Fixed Overheads} \\
 &= (14,400 \text{ hrs.} \times \text{₹}3.00) - (16,000 \text{ hrs.} \times \text{₹}3.00) \\
 &= ₹4,800 \text{ (A)}
 \end{aligned}$$

Sales Margin Volume Variance

$$\begin{aligned}
 &= \text{Standard Margin} - \text{Budgeted Margin} \\
 &= (1,800 \text{ units} \times \text{₹}56.00) - (2,000 \text{ units} \times \text{₹}56.00) \\
 &= ₹11,200 \text{ (A)}
 \end{aligned}$$

Sales Contribution Volume Variance

$$\begin{aligned}
 &= \text{Standard Contribution} - \text{Budgeted Contribution} \\
 &= (1,800 \text{ units} \times \text{₹}80.00) - (2,000 \text{ units} \times \text{₹}80.00) \\
 &= ₹16,000 \text{ (A)}
 \end{aligned}$$

Statement Showing “Reconciliation Between Budgeted Profit & Actual Profit”

Particulars	Conv. Method (₹)	Relevant Cost Method (₹)		
		Scarce Material	Scarce Labour	No Scarce Inputs
Budgeted Profit (2,000 units × ₹56)	1,12,000	1,12,000	1,12,000	1,12,000
Sales Volume Variance	11,200 (A)	NIL *	12,000\$ (A)	16,000 (A)
Material Usage Variance	8,000 (A)	24,000 (A)	8,000 (A)	8,000 (A)
Labour Efficiency Variance	3,200 (A)	3,200 (A)	7,200 (A)	3,200 (A)
Variable Overhead Effi. Variance	1,200 (A)	1,200 (A)	1,200 (A)	1,200 (A)
Fixed Overhead Volume Variance	4,800 (A)	N.A.#	N.A. #	N.A. #
Actual Profit	83,600	83,600	83,600	83,600

NOTES**Scarce Material**

Based on conventional method, direct material usage variance is ₹8,000 (A) i.e. 2,000 Kg. × ₹4. In this situation material is scarce, and, therefore, material cost variance based on relevant cost method should also include contribution lost per unit of material. Excess usage of 2,000 Kg. leads to lost contribution of ₹16,000 i.e. 2,000 Kgs. × ₹8. **Total material usage variance based on relevant cost method, when material is scarce will be: ₹8,000 (A) + ₹16,000 (A) = ₹24,000 (A).** Since labour is not scarce, labour variances are identical to conventional method.

Excess usage of 2,000 Kgs. leads to loss of contribution from 200 units i.e. ₹16,000 (200 units × ₹80). It is not the function of the sales manager to use material efficiently. Hence, loss of contribution from 200 units should be excluded while computing sales contribution volume variance.

(*)→

Therefore, sales contribution volume variance, when materials are scarce will be NIL i.e. ₹16,000 (A) - ₹16,000 (A).

Scarce Labour

Material is no longer scarce, and, therefore, the direct material variances are same as in conventional method. In conventional method, excess labour hours used are: 14,400 hrs. – 14,800 hrs. = 400 hrs. Contribution lost per hour = ₹10. Therefore, total contribution lost, when labour is scarce will be: 400 hrs. × ₹10 = ₹4,000. **Therefore, total labour efficiency variance, when labour hours are scarce will be ₹7,200 (A) i.e. ₹3,200 (A) + ₹4,000 (A).**

Excess usage of 400 hrs. leads to loss of contribution from 50 units i.e. ₹4,000 (50 units × ₹80). It is not the function of the sales manager to use labour hours efficiently. Hence, loss of contribution from 50 units should be excluded while computing sales contribution volume Variance.

(\$) →

Therefore, sales contribution volume variance, when labour hours are Scarce will be ₹12,000 (A) i.e. ₹16,000 (A) - ₹4,000 (A).

Fixed Overhead Volume Variance

(#) →

The fixed overhead volume variance does not arise in marginal costing system. In absorption costing system, it represents the value of the under or over absorbed fixed overheads due to change in production volume. When marginal costing is in use there is no overhead volume variance, because marginal costing does not absorb fixed overheads.

10. (i) Computation of Weighted Average Transfer Price

Particulars	External Demand 15,000 Components	External Demand 19,000 Components	External Demand 35,000 Components
Component's Transfer Price (Base)	Variable Cost	Variable Cost <i>plus</i> Opportunity Cost for 4,000 Components	Variable Cost <i>plus</i> Opportunity Cost for 20,000 Components
Variable Cost	₹157.00	₹157.00	₹157.00
Opportunity Cost	0	₹28.60 $\left(\frac{4,000}{20,000} \times ₹143 \right)$	₹143.00 $\left(\frac{20,000}{20,000} \times ₹143 \right)$
Transfer Price	₹157.00	₹185.60	₹300.00

Opportunity Cost for a Component is the Contribution *forgone* by not Selling it to the market.

$$\begin{aligned} \text{Contribution} &= \text{Market Selling Price} - \text{Variable Cost} \\ &= ₹300 - ₹157 = ₹143 \end{aligned}$$

Statement Showing Profitability of Division- X

Particulars	External Demand 15,000 Components (₹)	External Demand 19,000 Components (₹)	External Demand 35,000 Components (₹)
Sales :			
Division-Y	31,40,000	37,12,000	60,00,000

	(₹157 × 20,000)	(₹185.60 × 20,000)	(₹300 × 20,000)
Market	45,00,000 (₹300 × 15,000)	45,00,000 (₹300 × 15,000)	45,00,000 (₹300 × 15,000)
Total Revenue	76,40,000	82,12,000	1,05,00,000
Less: Variable Cost (₹157 × 35,000)	54,95,000	54,95,000	54,95,000
Less: Fixed Cost	20,62,000	20,62,000	20,62,000
Profit	83,000	6,55,000	29,43,000

(ii) Statement Showing Profitability of Division- Y

Particulars	External Demand 15,000 Components (₹)	External Demand 19,000 Components (₹)	External Demand 35,000 Components (₹)
Selling Price <i>per unit</i>	1,200.00	1,200.00	1,200.00
Less: Variable Cost <i>per unit</i> :	314.00 (₹157 × 2)	371.20 (₹185.60 × 2)	600.00 (₹300 × 2)
Component –X			
Others	375.00	375.00	375.00
Contribution <i>per unit</i>	511.00	453.80	225.00
No. of units	10,000	10,000	10,000
Total Contribution	51,10,000	45,38,000	22,50,000
Less: Fixed Cost	13,50,000	13,50,000	13,50,000
Profit	37,60,000	31,88,000	9,00,000

11.



Once the initial basic feasible solution is done, we have to do the optimality test. If it satisfy the condition that number of allocation is equal to $m+n-1$ where m = number of rows, n = number of columns. If allocation is less than $m+n-1$, then the problem shows degenerate situation. In that case we have to allocate an infinitely small quantity (ϵ) in least cost and independent cell. Independent cells in Transportation Problems mean the cells which do not form a closed loop with occupied cells.

The table obtained after using VAM contains 4 occupied cells against the required number of $4 + 4 - 1 = 7$, hence the solution is degenerate.

To remove degeneracy, a letter 'e' is placed in three independent cells. The problem for test of optimality is reproduced in table below:

Contractors	Job P	Job Q	Job R	Job S
A	112.50 e	100.00 e	127.50	167.50 1
B	142.50	105.00 1	157.50	137.50
C	122.50 e	130.00	120.00 1	160.00
D	102.50 1	112.50	150.00	137.50



Alternatively, 'e' can also be allocated to cell C_{42} instead of C_{11} .

Now total number of allocations become equal to $m + n - 1$ i.e. 7. This solution is tested for optimality.

$(u_i + v_j)$ Matrix for Allocated / Unallocated Cells

					u_i
	112.50	100.00	110.00	167.50	0
	117.50	105.00	115.00	172.50	5.00
	122.50	110.00	120.00	177.50	10.00
	102.50	90.00	100.00	157.50	-
v_j	112.50	100.00	110.00	167.50	10.00

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

Δ_{ij} Matrix

		17.50	
25.00		42.50	-35.00
	20.00		-17.50
	22.50	50.00	-20.00

Since all values of Δ_{ij} are not positive, the solution given above is not optimal. Let us include the cell with highest negative Δ_{ij} which is C_{24} as a basic cell and try to improve the solution. The reallocated solution is given below which is tested for optimality-

e	e		1
	1		-1
	-1		+1
e		1	
1			

Revised allocations (improved initial solution) are as follows-

Contractors	Job P	Job Q	Job R	Job S
A	112.50 e	100.00 1	127.50	167.50
B	142.50	105.00 e	157.50	137.50 1
C	122.50 e	130.00	120.00 1	160.00
D	102.50 1	112.50	150.00	137.50



Again there is a situation of degeneracy to remove this situation a new 'e' has been allocated to least cost independent cell C_{22} .

$(u_i + v_j)$ Matrix for Allocated / Unallocated Cells

				U_i
112.50	100.00	110.00	132.50	0
117.50	105.00	115.00	137.50	5.00

	122.50	110.00	120.00	142.50	10.00
	102.50	90.00	100.00	122.50	-
					10.00
v_j	112.50	100.00	110.00	132.50	

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

Δ_{ij} Matrix

		17.50	35.00
25.00		42.50	
	20.00		17.50
	22.50	50.00	15.00

Since all the entries in the above Δ_{ij} Matrix table are non-negative, this solution is optimal. The optimal assignment is given below-

Contractor	Job	Cost of Project
A	Q	100.00
B	S	137.50
C	R	120.00
D	P	102.50
Total		460.00

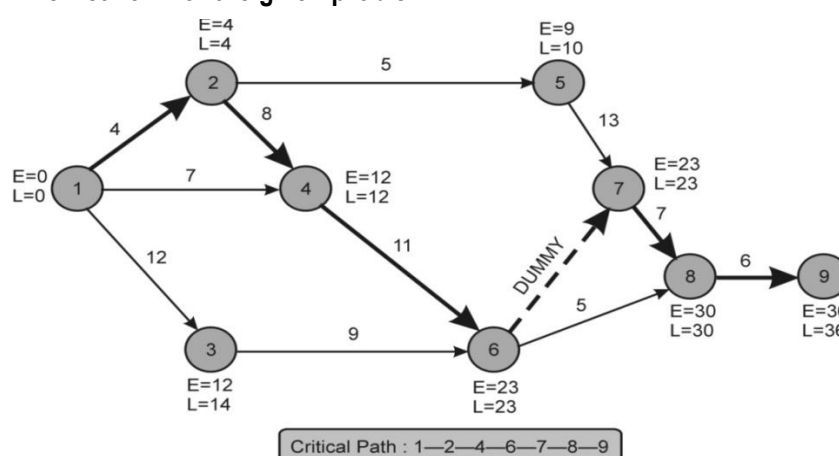
12. (i) Calculation of Missing Figures

Statement Showing 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

Activity	Duration	EST	EFT	LST	LFT	Total Float
	D_{ij}	E_i	$E_i + D_{ij}$	$L_j - D_{ij}$	L_j	$LST - EST$
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) Paths with their corresponding durations

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

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

13. (i) Invalid

Reason: As per the rules of network construction, parallel activities between two events, without intervening events, are prohibited. Dummy activities are needed when two or more activities have same initial and terminal events. Dummy activities do not consume time or resources.

(ii) Valid

Reason: As per the conventions adopted in drawing networks, the head event or terminal node always has a number higher than that of initial node or tail event.

(iii) Invalid

Reason: The difference between the latest event time and the earliest event time is termed as slack of an event. Free float is determined by subtracting head event slack from the total float of an activity.

(iv) Invalid

Reason: For every critical activity in a network, the earliest start time and the latest start time is same and also the earliest finish time and the latest finish time is same.

(v) Invalid

Reason: The optimum duration is the time period in which the total cost of the project is minimum.

(vi) Valid

Reason: Resource leveling is a network technique used for reducing the requirement of a particular resource due to its paucity or insufficiency within a constraint on the project duration. The process of resource leveling utilize the large floats available on non-critical activities of the project and cuts down the demand of the resource.

14. Allocation of Random Numbers**Demand (units)**

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

Contribution per unit

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

Advertising Cost

₹	Probability	Cumulative Probability	Random Nos.
50,000	0.22	0.22	00 – 21
60,000	0.33	0.55	22 – 54
70,000	0.44	0.99	55 – 98
80,000	0.01	1.00	99 – 99

Investment

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

Simulation Table

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

Highest Likely Return is 22.50% relating to trial 2.

15. Working Note

The usual learning curve model is

$$y = ax^b$$

Where

y = Average time per unit for x units

a = Time required for first unit

x = Cumulative number of units produced

b = Learning coefficient

W.N.1

Time required for first 15 units based on revised learning curve of 80% (when the time required for the first unit is 10 hours)

$$\begin{aligned}
 y &= 10 \times (15)^{-0.322} \\
 \log y &= \log 10 - 0.322 \times \log 15 \\
 \log y &= \log 10 - 0.322 \times \log (5 \times 3) \\
 \log y &= \log 10 - 0.322 \times [\log 5 + \log 3] \\
 \log y &= 1 - 0.322 \times [0.69897 + 0.47712] \\
 \log y &= 0.6213 \\
 y &= \text{antilog of } 0.6213 \\
 y &= 4.181 \text{ hours} \\
 \text{Total time for 15 units} &= 15 \text{ units} \times 4.181 \text{ hours} \\
 &= 62.72 \text{ hours}
 \end{aligned}$$

Time required for first 14 units based on revised learning curve of 80% (when the time required for the first unit is 10 hours)

$$\begin{aligned}
 y &= 10 \times (14)^{-0.322} \\
 \log y &= \log 10 - 0.322 \times \log 14 \\
 \log y &= \log 10 - 0.322 \times \log (2 \times 7) \\
 \log y &= \log 10 - 0.322 \times [\log 2 + \log 7] \\
 \log y &= 1 - 0.322 \times [0.3010 + 0.8451] \\
 \log y &= 0.63096 \\
 y &= \text{antilog of } 0.63096 \\
 y &= 4.275 \text{ hrs} \\
 \text{Total time for 14 units} &= 14 \text{ units} \times 4.275 \text{ hrs} \\
 &= 59.85 \text{ hrs}
 \end{aligned}$$

Time required for 25 units based on revised learning curve of 80% (when the time required for the first unit is 10 hours)

$$\begin{aligned}
 \text{Total time for first 15 units} &= 62.72 \text{ hrs} \\
 \text{Total time for next 10 units} &= 28.70 \text{ hrs } [(62.72 - 59.85) \text{ hours} \times 10 \text{ units}] \\
 \text{Total time for 25 units} &= 62.72 \text{ hrs} + 28.70 \text{ hrs} \\
 &= 91.42 \text{ hrs}
 \end{aligned}$$

W.N.2**Computation of Standard and Actual Rate**

$$\begin{aligned}
 \text{Standard Rate} &= \frac{\text{₹1,19,288}}{180.74 \text{ hrs.}} \\
 &= \text{₹ 660.00 per hr.} \\
 \text{Actual Rate} &= \frac{\text{₹79,704}}{118.08 \text{ hrs.}} \\
 &= \text{₹ 675.00 per hr.}
 \end{aligned}$$

W.N.3**Computation of Variances**

$$\begin{aligned}
 \text{Labour Rate Variance} &= \text{Actual Hrs} \times (\text{Std. Rate} - \text{Actual Rate}) \\
 &= 118.08 \text{ hrs} \times (\text{₹660.00} - \text{₹675.00}) = \text{₹1,771.20 (A)} \\
 \text{Labour Efficiency Variance} &= \text{Std. Rate} \times (\text{Std. Hrs} - \text{Actual Hrs}) \\
 &= \text{₹660} \times (91.42 \text{ hrs} - 118.08 \text{ hrs}) \\
 &= \text{₹17,595.60 (A)}
 \end{aligned}$$

Statement of Reconciliation (Actual Figures Vs Budgeted Figures)

Particulars	₹
Actual Cost	79,704.00
Less: Labour Rate Variance (Adverse)	1,771.20
Less: Labour Efficiency Variance (Adverse)	17,595.60
Budgeted Labour Cost (Revised)*	60,337.20

Budgeted Labour Cost (Revised)*

$$\begin{aligned}
 &= \text{Std. Hrs.} \times \text{Std. Rate} \\
 &= 91.42 \text{ hrs.} \times \text{₹660} \\
 &= \text{₹ 60,337.20}
 \end{aligned}$$

16.

Statement Showing Change in Profit

Particulars	Large (₹)	Medium (₹)	Total (₹)
I. Effect of Product Mix Changes			
Revised Estimated Sales Quantity (Ratio 40:60)	62,304	93,456	1,55,760
Revised Estimated Sales Quantity (Ratio 50:50)	77,880	77,880	1,55,760
Difference in Sales Quantity	(15,576)	15,576	NIL
Contribution Effect Thereon @ ₹8.60 and ₹10.60	(1,33,953.60)	1,65,105.60	31,152

II Effect of Volume Change			
Revised Estimate of Sales Quantity (50:50)	77,880	77,880	
Original Estimate of Sales Quantity (50:50)	60,000	60,000	
Difference in Sales Quantity	17,880	17,880	35,760
Contribution Effect Thereon @ ₹8 and ₹10	1,43,040	1,78,800	3,21,840
III. Effect of Price Change			
Revised Estimate of Sales Quantity (Ratio 40:60)	62,304	93,456	1,55,760
Difference in Price p.u.	0.60	0.60	0.60
Contribution Effect	37,382.40	56,073.60	93,456
IV. Effect of Expenses			
Sales Promotion Expenses			(78,000)
Savings in Interest			9,000
Overall Increase in Profit			3,77,448

Total Improvement in Profit ₹3,77,448 (11.51%).

Workings

Budget for Original and Revised Contribution

Particulars	Original Budget Estimate		Revised Estimate	
	Description	(₹)	Description	(₹)
Market- Sales Quantity	12,00,000 units		14,16,000	
Company's Share	1,20,000 units (10% of total)		1,55,760 units (11% of total)	
Sales Quantity				
Large	60,000 units (50% of mix)		62,304 (40% of mix)	
Medium	60,000 units (50% of mix)		93,456 (60% of mix)	
Contribution Earned				
Large	60,000 units × ₹8	4,80,000	62,304 units × ₹8.60	5,35,814.40
Medium	60,000 units × ₹10	6,00,000	93,456 units × ₹10.60	9,90,633.60
Effect of Expenses				
Sales Promotion		---		-78,000
Interest		---		9,000
Revised Contribution		10,80,000		14,57,448



This question can also be solved by computing Sales Contribution Price Variance, Sales Contribution Mix Variance, Market Size Variance, Market Share Variance.

