

PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING

Question No.1 is compulsory.

Answer any **five** questions from the remaining **six** questions.

In case, any candidate answers extra question(s)/ sub-question(s) over and above the required number, then only the requisite number of questions first answered in the answer-book shall be valued and subsequent extra questions answered shall be ignored.

Working notes should form part of the answer.

Wherever necessary, candidates may make appropriate assumptions and clearly state them.

No statistical table or other table will be provided with this question paper.

Question 1

- (a) X Limited is a manufacturer of cardboard boxes. An analysis of its operating income between 2014 and 2015 shows the following:

	Income Statement (amount in 2014)	Revenue & Cost effect of Growth Component in 2015	Revenue & Cost effect of Price Recovery Component in 2015	Cost effect of Productivity Component in 2015	Income Statement (amount in 2015)
Revenue (₹)	40,00,000	2,00,000(F)	4,20,000(F)	---	46,20,000
Cost (₹)	29,20,000	60,000 (A)	2,56,000(A)	58,000(F)	31,78,000
Operating Income(₹)	10,80,000	1,40,000(F)	1,64,000(F)	58,000(F)	14,42,000

X limited sold 4,00,000 boxes and 4,20,000 boxes in 2014 and 2015 respectively. During 2015, the market for cardboard boxes grew 3% in terms of number of units and all other changes are due to company's differentiation strategy and productivity.

Required

Compute how much of the change in operating income from 2014 to 2015 is due to the industry market size factor, productivity and product differentiation and also reconcile the profit of both years due to these factors. (5 Marks)

- (b) Some statements are given below. Identify name of the cost with examples and state whether it is relevant/non-relevant in decision making.
- (i) Costs are historical costs which have already been incurred and cannot change by any decision made in future.

- (ii) It is measure of benefits foregone by rejecting the second best alternative of resources in favour of the best.
- (iii) It is portioning of cost which involves payments to outsiders i.e., it gives rise to cash expenditure as opposed to such costs as depreciation.
- (iv) Total cost is changed (increase or decrease) due to change in the level of activity, technology or production process or method of production.
- (v) Cost used in evaluation of a product to reflect the use of resources but that have no observable cost. (5 Marks)
- (c) G Ltd., produces and sells 95,000 units of 'X' in a year at its 80% production capacity. The selling price of product is ₹ 8 per unit. The variable cost is 75% of sales price per unit. The fixed cost is ₹ 3,50,000. The company is continuously incurring losses and management plans to shut-down the plant. The fixed cost is expected to be reduced to ₹ 1,30,000. Additional costs of plant shut-down are expected at ₹ 15,000.
- Should the plant be shut-down? Find the shut-down point in units and also in percentage of capacity level of production. (5 Marks)
- (d) A company which has developed a new machine has observed that the time taken to manufacture the first machine is 600 hours.

Required

Calculate the time which the company will take to manufacture the second machine if the actual learning curve rate is (i) 80% and (ii) 90%.

Explain which of the two learning rates will show faster learning. (5 Marks)

Answer

(a) Reconciliation of Operating Income

Particulars	Amount (₹)
Operating Income in 2014	10,80,000
Add: Change Due to Industry Market Size Factor (W.N.-1)	84,000
Changes Due to Productivity (W.N.-2)	58,000
Changes Due to Product Differentiation (W.N.-3)	2,20,000
Operating Income in 2015	14,42,000

Workings

Total Increase in Sale of Cardboard Boxes 20,000 Boxes (4,20,000 Boxes – 4,00,000 Boxes). Out of this increase in Sales of 20,000 Boxes, 12,000 Boxes (3% of 4,00,000) is due to *growth in market size*, and the remaining 8,000 Boxes (20,000 Boxes – 12,000 Boxes) are due to an increase in *market share*.

W.N.1 Effect of the Industry Market Size Factor on operating income:

$$\begin{aligned}
 &= \text{Revenue and Cost Effect of Growth Component in 2015} \times \frac{\text{Increase in Sales Unit Due to Market Growth}}{\text{Total Growth in Sales Unit (from 2014 to 2015)}} \\
 &= ₹1,40,000 \times \frac{12,000 \text{ Boxes}}{20,000 \text{ Boxes}} \\
 &= ₹ 84,000 \text{ (F)}
 \end{aligned}$$

W.N.2. Effect of Productivity on operating income:

$$\begin{aligned}
 &= \text{Cost Effect of Productivity Component in 2015} \\
 &= ₹ 58,000 \text{ (F)}
 \end{aligned}$$

W.N.3 Effect of Product Differentiation on operating income:

Particulars	Amount (₹)
Increase in the Selling Price (Revenue Effect of the Price Recovery Component)	4,20,000 (F)
Increase in Prices of Inputs (Cost Effect of the Price Recovery Component)	2,56,000 (A)
Growth in Market Share Due to Product Differentiation* $\left(₹1,40,000 \times \frac{8,000 \text{ Boxes}}{20,000 \text{ Boxes}} \right)$	56,000 (F)
Total	2,20,000 (F)

* Revenue and Cost Effect of Growth Component in 2015 ×

$$\frac{\text{Increase in Sales Unit Due to Product Differentiation}}{\text{Total Growth in Sales Unit (from 2014 to 2015)}}$$

(b) Relevant / Not Relevant

S. No.	Name of the Cost	Example	Relevant / Not Relevant
(i)	Sunk Cost	Written down value of machine already purchased.	Not Relevant in decision making.
(ii)	Opportunity Cost	Funds invested in business or deposited into bank.	Useful in decision making.
(iii)	Out of Pocket Cost	Commission to salesman on sales, Carriage inward.	Relevant for decision making.

(iv)	Differential Cost	Include all fixed and variable cost which are increased /decreased.	Relevant in specific decision making.
(v)	Notional Cost	Notional Rent for use of space.	Relevant, if company benefit by using resource alternatively.

(c) **Statement Showing “Operating Loss”**

	If Plant is Continued	If Plant is Shutdown
Sales	7,60,000	---
Less: Variable Cost	5,70,000	---
Contribution	1,90,000	---
Less: Fixed Cost	3,50,000	1,30,000
Less: Additional Cost	---	15,000
Operating Loss	1,60,000	1,45,000

Decision on Shut Down

A comparison of loss figures (indicated as above) points out that loss is reduced by **₹15,000** (₹ 1,60,000 - ₹ 1,45,000) if plant is shut down.

→ Accordingly, plant should be Shut Down.

$$\begin{aligned} \text{Shut Down Point} &= \frac{\text{₹3,50,000} - \text{₹1,45,000}}{\text{₹8} - \text{₹6}} \\ &= 1,02,500 \text{ units} \end{aligned}$$

Capacity Level at Shut Down Point (%)

At 100% Level – Production Capacity

$$= 1,18,750 \left(\frac{95,000 \text{ units}}{0.80} \right)$$

Capacity Level at Shut Down Point

$$= 86.32\% \left(\frac{1,02,500 \text{ units}}{1,18,750 \text{ units}} \right)$$

(d) (i) **Actual learning curve rate is 80%**

$$\begin{aligned} \text{Time taken to produce the first machine} &= 600 \text{ hours} \\ \text{Average time taken to produce two machines} &= 600 \times 80\% \text{ hours} \\ &= 480 \text{ hours} \end{aligned}$$

Cumulative time taken to produce two machines = 480×2 hours
 = 960 hours
 Time taken to produce the second machine = $(960 - 600)$ hours
 = 360

(ii) **Actual learning curve rate is 90%**

Time taken to produce the first machine = 600 hours
 Average time taken to produce two machines = $600 \times 90\%$ hours
 = 540 hours
 Cumulative time taken to produce two machines = 540×2 hours
 = 1,080 hours
 Time taken to produce the second machine = $(1,080 - 600)$ hours
 = 480 hours

The time taken to produce the second machine is lower at **80% learning rate** and hence 80% learning rate shows faster learning rate.

Question 2

- (a) *Speedo Limited is a specialist car manufacturer that produces various models of cars. The organization is due to celebrate its 100th anniversary next year. To mark the occasion, Speedo Limited intends to produce a sports car; the Model Royal. As this will be a special edition, production will be limited to 1,000 numbers of Model Royal Cars.*

Speedo Limited is considering using a target costing approach and has conducted market research to determine the features that consumers require in a sport car. Based on this market research and knowledge of competitor's products, company has decided to price the Model Royal at ₹ 9.75 Lacs. Company requires an operating profit margin of 25% of the selling price of the car. Details for the forthcoming year are as follows:

Forecast of direct costs for a Model Royal Car-

Labour..... ₹ 2,50,000

Material..... ₹ 4,75,000

Forecast of annual overhead costs-

	₹ In lacs	Cost driver
Production line cost	2,310	See note 1
Transportation costs	900	See note 2

Note 1

The production line that would be used for Model Royal has a capacity of 60,000 machine hours per year. The production line time required for Model Royal is 6 machine hours per car. This production line will also be used to make other cars and will be working at full capacity.

Note 2

Some models of cars are delivered to showrooms using car transporters, 60% of the transportation costs are related to the number of deliveries made. 40% of the transportation costs are related to the distance travelled.

The car transporters have forecast to make a total of 640 deliveries in the year and carry 10 cars each time. The car transporter will always carry its maximum capacity of 10 cars.

The total annual distance travelled by car transporters is expected to be 2,25,000 kms. 50,000 kms of this is for the delivery of Model Royal cars only. All 1,000 Model Royal cars that will be produced will be delivered in the year using the car transporters.

Required

- (i) Calculate the forecast total cost of producing and delivering a Model Royal car using Activity Based Costing principles to assign the overhead costs.
 - (ii) Calculate the cost gap that currently exists between the forecast total cost and the target total cost of a Model Royal car. (10 Marks)
- (b) A 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 basis 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 the products.

The cost of these raw materials are as follows:

Ingredient	Cost per kg (₹)
A	64
B	16
C	40
Inter ingredients	16

Selling price of these products are ₹32.60, ₹34.80 and ₹36 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.

Only formulate this problem as L.P. model to determine the productions (in kg) of each product which will maximize its monthly profit. (6 Marks)

Answer**(a) Workings****Statement Showing “Cost Driver Rate”**

Overhead	Cost(₹) - Lacs	Cost Driver	Cost Driver Rate (₹)
Production Line Cost	2,310	60,000 Machine Hrs.	3,850 <i>per hr.</i> $\left(\frac{2,310\text{lacs}}{60,000\text{hrs.}} \right)$
Transportation Cost			
Delivery Related (60%)	540	640 Deliveries	84,375 <i>per delivery</i> $\left(\frac{540\text{lacs}}{640\text{delivery}} \right)$
Distance Related (40%)	360	2,25,000 Kms.	160 <i>per km</i> $\left(\frac{360\text{lacs}}{2,25,000\text{kms.}} \right)$

(i) Forecast Total Cost using Activity Based Costing Principles

Elements of Cost	₹
Material	4,75,000.00
Labour	2,50,000.00
Overhead	
Production Line Cost (₹3,850 × 6 hrs.)	23,100.00
Transportation Cost -	
Delivery Related $\left(\frac{₹84,375}{10 \text{ cars}} \right)$	8,437.50
Distance Related $\left(\frac{₹160 \times 50,000 \text{ kms}}{1,000 \text{ cars}} \right)$	8,000.00
Total	7,64,537.50

(ii) Calculation of Cost Gap Between Forecast Total Cost and the Target Total Cost

Particulars	Amount (₹)
Target Selling Price	9,75,000.00
Less: Operating Profit Margin (25%)	2,43,750.00

Target Cost (Target Selling Price – Operating Profit)	7,31,250.00
Forecast Total Cost	7,64,537.50
Cost Gap (₹7,64,537.50 – ₹7,31,250)	33,287.50

- (b) 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:

$$\text{Maximize } Z = (\text{Selling Price} - \text{Cost Price}) \times \text{Quantity of Product}$$

$$= (₹32.60 - ₹19.60) x_1 + (₹34.80 - ₹20.80) x_2 + (₹36.00 - ₹28) x_3$$

$$= 13x_1 + 14x_2 + 8x_3$$

Subject to Constraints:

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

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

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

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

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

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

$$x_1 \leq 30$$

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

Question 3

- (a) Zed company manufactures two types of flooring rolls. Budgeted and actual data for 2015 are-

	Static Budget			Actual Result		
	Industrial	Domestic	Total	Industrial	Domestic	Total
Unit Sales in Rolls ('000)	200	600	800	252	588	840
Contribution Margin (₹ In lacs)	100.00	240.00	340.00	119.70	246.96	366.66

In late 2014, a marketing research estimated industrial volume for industrial and domestic flooring at 80 lacs Rolls. Actual industry volume for 2015 was 70 lacs Rolls.

Compute

- (i) Sales Mix Variance and Sales Quantity Variance by type of flooring rolls and in total.
- (ii) Market Share Variance and Market Size Variance. (8 Marks)
- (b) The following table shows for each activity needed to complete the road construction project, the normal time, the shortest time in which the activity can be completed and cost per day for reducing the time of each activity. The contract includes a penalty clause of ₹ 80 per day over 19 days. The overhead cost is ₹ 150 per day. The cost of completing the eight activities in normal time is ₹ 6,000.

Activity	Normal time in days	Shortest time in days	Cost of reduction per day (₹)
1-2	7	5	90
1-3	9	5	100
1-4	7	4	40
2-4	4	4	—
2-5	6	4	50
3-6	13	9	210
4-6	8	5	60
5-6	6	6	—

Required

- (i) Draw the network diagram for the project and identify the critical path and show normal duration and minimum duration of different paths.
- (ii) Calculate the total cost associated to normal duration of the project.
- (iii) Crash the relevant activities systematically and determine the lowest cost and the associated time. (8 Marks)

Answer**(a) Workings****Statement Showing "Budgeted Vs Actual Figures"**

Product	Budgeted Qty. Rolls ('000) [BQ]	Budgeted Margin per Roll (₹) [BM]	Budgeted Margin (₹'in lacs) (₹' in lacs)	Actual Qty. Rolls ('000) [AQ]	Actual Margin per Roll (₹) [AM]	Actual Margin (₹'in lacs) (₹' in lacs)	Revised Actual Qty. ('000) [RAQ]
1	2	3	4 = 2×3	5	6	7 = 5×6	8
Domestic	600	40	240.00	588	42	246.96	630 (840 × 75%)
Industrial	200	50	100.00	252	47.5	119.70	210 (840 × 25%)
	800		340.00	840		366.66	840

$$\text{Budgeted Market Share (in \%)} = \frac{8,00,000 \text{ Rolls}}{80,00,000 \text{ Rolls}}$$

$$= 10\%$$

$$\text{Actual Market Share (in \%)} = \frac{8,40,000 \text{ Rolls}}{70,00,000 \text{ Rolls}}$$

$$= 12\%$$

$$\text{Average Budgeted Margin (per Roll)}$$

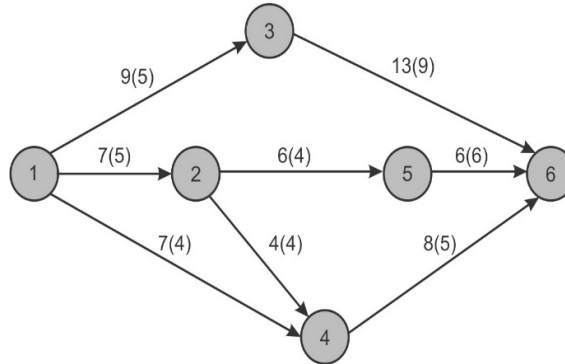
$$= \frac{₹340 \text{ Lacs}}{8,00,000 \text{ Rolls}}$$

$$= ₹42.50$$

Computation of Variances

Sales Mix Variance	=	Standard Margin Less Revised Standard Margin
		<i>Or</i>
	=	$(AQ \times BM) - (RAQ \times BM)$
		<i>Or</i>
	=	$BM \times (AQ - RAQ)$
Domestic	=	$₹40 \times (5,88,000 - 6,30,000)$
	=	₹16,80,000 (A)
Industrial	=	$₹50 \times (2,52,000 - 2,10,000)$
	=	₹21,00,000 (F)
Total	=	₹16,80,000 (A) + ₹21,00,000 (F) = ₹4,20,000 (F)
Sales Quantity Variance	=	Revised Standard Margin Less Budgeted Margin
		<i>Or</i>
	=	$(RAQ \times BM) - (BQ \times BM)$
		<i>Or</i>
	=	$BM \times (RAQ - BQ)$
Domestic	=	$₹40 \times (6,30,000 - 6,00,000)$
	=	₹12,00,000 (F)
Industrial	=	$₹50 \times (2,10,000 - 2,00,000)$
	=	₹5,00,000 (F)
Total	=	₹12,00,000 (F) + ₹5,00,000 (F) = ₹17,00,000 (F)
Market Size Variance	=	Budgeted Market Share % $\times$ (Actual Industry Sales Quantity in units – Budgeted Industry Sales Quantity in units) $\times$ (Average Budgeted Margin per unit)
	=	$10\% \times (70,00,000 \text{ Rolls} - 80,00,000 \text{ Rolls}) \times ₹42.50$
	=	₹42,50,000 (A)
Market Share Variance	=	(Actual Market Share % – Budgeted Market Share %) $\times$ (Actual Industry Sales Quantity in units) $\times$ (Average Budgeted Margin per unit)
	=	$(12\% - 10\%) \times 70,00,000 \text{ Rolls} \times ₹42.50$
	=	₹59,50,000 (F)

(b) (i) The **Network** for the given problem:



Different Paths, Normal Duration and Minimum Duration:

Path	Normal Duration (Days)	Minimum Duration (Days)
1-3-6	22 (9 + 13)	14 (5 + 9)
1-2-5-6	19 (7 + 6 + 6)	15 (5 + 4 + 6)
1-2-4-6	19 (7 + 4 + 8)	14 (5 + 4 + 5)
1-4-6	15 (7 + 8)	9 (4 + 5)

Critical Path is 1-3-6

(ii) **Total Cost of the Project for the Normal Duration:**

$$\begin{aligned}
 &= \text{Normal Cost} + \text{Overhead Cost} + \text{Penalty Cost} \\
 &= ₹6,000 + ₹150 \times 22 \text{ Days} + ₹80 \times 3 \text{ Days} \\
 &= ₹9,540
 \end{aligned}$$

(iii) **Crashing First Step:**

Let us now crash activities on the Critical Path.

Activity	ΔT	$\Delta C/\Delta T$	Remark
1-3	4	100	Least Cost Slope
3-6	4	210	

As activity 1-3 has least cost slope, **crash activity 1-3 by 3 days at a crash cost of ₹100 per day.**

Total Cost of the Project for the 19 Days:

$$\begin{aligned}
 &= \text{Normal Cost} + \text{Overhead Cost} + \text{Crashing Cost} \\
 &= ₹6,000 + ₹150 \times 19 \text{ Days} + ₹100 \times 3 \text{ Days} \\
 &= ₹9,150
 \end{aligned}$$

The Various Paths in the Network with Revised Duration are:

$$\begin{aligned}
 1-3-6 \text{ with Project Duration} &= 19 \text{ Days (Critical Path.1)} \\
 1-2-5-6 \text{ with Project Duration} &= 19 \text{ Days (Critical Path.2)} \\
 1-2-4-6 \text{ with Project Duration} &= 19 \text{ Days (Critical Path.3)} \\
 1-4-6 \text{ with Project Duration} &= 15 \text{ Days}
 \end{aligned}$$

Crashing Second Step:

Let us now crash activities on the Critical Paths.

Critical Path	Activity	ΔT	$\Delta C/\Delta T$	Remark
1	1-3	1	100	Least Cost Slope
	3-6	4	210	
2	1-2	2	90	
	2-5	2	50	Least Cost Slope
	5-6	-	-	-
3	1-2	2	90	
	2-4	-	-	-
	4-6	3	60	Least Cost Slope

Possible Crashing Alternatives are:

Critical Path- Activities	1-3, 2-5 & 4-6	1-3 & 1-2*
Cost Slopes ($\Delta C/\Delta T$)	₹210 (₹100 + ₹50 + ₹60)	₹190 (₹100 + ₹90)
Remark	Independent Activities	Independent Activity + Common Activity*

As crashing cost per day for every alternative is greater than ₹150 i.e. Overhead Cost per day. Therefore, any reduction in the duration of project will increase the cost of project completion.

Hence, the **Lowest Cost of Completion** is **₹9,150** with the **Completion Time** of **19 Days**.

Question 4

- (a) A company manufactures four products. The annual demand for products, selling prices and variable production costs are as follows:

Product	P	Q	R	S
Demand (Units)	1,20,000	1,86,000	1,71,000	99,000
	₹	₹	₹	₹
Selling price/unit	23.88	28.68	55.08	47.88
Direct Material/Unit	10.08	13.20	30.48	24.96
Direct Labour/unit	4.08	4.08	6.72	6.36
Variable overheads/unit	1.44	1.44	2.40	2.16

Other data:

- The variable overheads are absorbed on a machine hour basis at a rate of ₹ 1.20 per machine hour.
- Fixed overheads total ₹ 46,84,000 per annum.
- Production capacity available 8,15,000 machine hours per annum.
- Products P, Q and R can be bought-in at ₹ 21.36 per unit, ₹ 24 per unit and ₹ 48 per unit respectively.

You are required to calculate the best product mix for the year and the resulting optimal profit. (8 Marks)

- (b) A book-store wishes to carry systems analysis and design in stock. Demand is probabilistic and replenishment of stock takes 2 days (i.e, if an order is placed on March 1, it will be delivered at the end of the day on March 3).

The probabilities of demand are given below:

Demand of books (Daily)	0	1	2	3	4
Probability	0.05	0.10	0.30	0.45	0.10

Each time an order is placed, the store incurs an ordering cost of ₹ 100 per order. The store also incurs a carrying cost of ₹ 5 per book per day. The inventory carrying cost is calculated on the basis of stock at the end of each day. The manager of the book-store wishes to compare two options for his inventory decision:

- Order 5 books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books
- Order 8 books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

Currently (beginning of the first day) the store has stock of 8 books plus 6 books ordered 2 days ago are expected to arrive next day. Further it can be assumed that the demand occurring during the day can be met out of stock received at the end of the day.

Required

Using Monte-Carlo simulation for 10 days, recommend which option the manager should choose?

The two digit random numbers are given below:

89, 34, 78, 63, 61, 81, 39, 16, 13, 73

(8 Marks)

Answer

(a) (i) **Statement Showing “Calculation of Contribution/ unit”**

	P (₹)	Q (₹)	R (₹)	S (₹)
Selling Price ... (A)	23.88	28.68	55.08	47.88
Variable Cost				
Direct Material	10.08	13.20	30.48	24.96
Direct Labour	4.08	4.08	6.72	6.36
Variable Overheads	1.44	1.44	2.40	2.16
Total Variable Cost ... (B)	15.60	18.72	39.60	33.48
Contribution per unit ... (A) - (B)	8.28	9.96	15.48	14.40

(ii) **Calculation of Machine Hours/ unit**

Machine Hours per unit	1.20	1.20	2.00	1.80
------------------------	------	------	------	------

(iii) **Machine Hours Required**

Machine Hours per unit	1,44,000*	2,23,200%	3,42,000@	1,78,200#
Total				8,87,400

* - (1,20,000 × 1.2); % - (1,86,000 × 1.2); @ - (1,71,000 × 2); # - (99,000 × 1.8)

(iv) Total Machine Hours Available 8,15,000. Hence, it is a key factor. Product 'S' is to be manufactured, since it is not available with sub-contractor/ market.

(v) **Statement Showing “Make or Buy for Products P, Q, R”**

	P (₹)	Q (₹)	R (₹)
Sub-Contractor/ Buy Price	21.36	24.00	48.00
Less: Variable Manufacturing Cost	15.60	18.72	39.60

Saving in Cost	5.76	5.28	8.40
Saving in Cost <i>per machine hour</i>	4.8	4.4	4.20
Ranking	I	II	III

(vi) **Statement Showing “Best Product Mix”**

Product	units	Machine Hour/ Unit	Total Machine Hours
S	99,000	1.8	1,78,200
P	1,20,000	1.2	1,44,000
Q	1,86,000	1.2	2,23,200
R (Balance)	1,34,800	2.0	2,69,600
Total			8,15,000

Balance quantity of R to be purchased 36,200 units (1,71,000 – 1,34,800).

(vii) **Profitability Statement**

Product	No of Units	Contribution/unit (₹)	Total Cont. (₹)
P (Mfg)	1,20,000	8.28	9,93,600
Q (Mfg)	1,86,000	9.96	18,52,560
R (Mfg)	1,34,800	15.48	20,86,704
R (Buy)	36,200	7.08 (₹55.08 - ₹48.00)	2,56,296
S (Mfg)	99,000	14.40	14,25,600
Total Contribution			66,14,760
Less: Fixed Overheads			46,84,000
Net Profit			19,30,760

- (b) First of all, random numbers 00 – 99 are allocated in proportion to the probabilities associated with demand as given below:

Demand	Probability	Cumulative Probability	Random Nos.
0	0.05	0.05	00 – 04
1	0.10	0.15	05 – 14
2	0.30	0.45	15 – 44
3	0.45	0.90	45 – 89
4	0.10	1.00	90 – 99

Based on the ten random numbers given, we simulate the demand per day in the table given below:

It is given that stock in hand is 8 units and stock on order is 6 units (expected to receive on next day).

Let us now consider both the options stated in the Problem.

Option-A

Order 5 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books:

Day	Random No.	Sales Demand	Op. Stock (in hand)	Qty. Order	Qty. Recd. at End of the Day	Total Qty. on Order	Closing Stock
1	89	3	8	---	---	6	5
2	34	2	5	---	6	---	9
3	78	3	9	---	---	---	6
4	63	3	6	5	---	5	3
5	61	3	3	---	---	5	0
6	81	3	0	5	5	5	2
7	39	2	2	5	---	10	0
8	16	2	0	---	5	5	3
9	13	1	3	---	5	---	7
10	73	3	7	5	---	5	4

Carrying Cost = ₹195 (39 Books × ₹5)

Ordering Cost = ₹400 (4 Orders × ₹100)

Total Cost = ₹595 (₹195 + ₹400)

Option-B

Order 8 Books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books:

Day	Random No.	Sales Demand	Op. Stock (in hand)	Qty. Order	Qty. Recd. at End of the Day	Total Qty. on Order	Closing Stock
1	89	3	8	---	---	6	5
2	34	2	5	---	6	---	9
3	78	3	9	---	---	---	6

4	63	3	6	8	---	8	3
5	61	3	3	---	---	8	0
6	81	3	0	---	8	---	5
7	39	2	5	8	---	8	3
8	16	2	3	---	---	8	1
9	13	1	1	---	8	---	8
10	73	3	8	---	---	---	5

Carrying Cost = ₹225 (45 Books × ₹5)

Ordering Cost = ₹200 (2 Orders × ₹100)

Total Cost = ₹425 (₹225 + ₹200)

Recommendation

Since **Option B** has *lower cost*, Manager should order 8 books.

Question 5

(a) The budget of a hotel for the year 2016 shows following room occupancy:

Quarter	January – March	April – June	July – September	October – December
Average occupancy %	45	60	90	55

Revenue for the year is estimated to be ₹ 60,00,000 and arises from three profit centres namely Accommodation * 45%, restaurant 35% and Bar 20%.

*The accommodation revenue is earned from several different categories of guests each of which pays a different rate per room.

The three profit centres have following percentage of margin:

	Accommodation (%)		Restaurant (%)		Bar (%)	
Revenue		100		100		100
Wages	20		30		15	
Cost of sale	-		35		50	
Direct cost	10	30	15	80	5	70
Gross Margin		70		20		30

Fixed cost for the year is estimated to be ₹9,15,000.

As a means of improving the budgeted profitability by 20%, following two suggestions have been made:

- (1) To offer special two night holidays at a reduced price of ₹250/- per night. It is expected that those accepting the offer would spend an amount equal to 40% of the accommodation charges in the restaurant and 40% of the accommodation charges in the bar.
- (2) To increase prices Management is confident that there will be no drop in volume of sales if restaurant prices are increased by 7.50% and bar prices by 10%. Accommodation prices would also need to be increased.

You are required to:

- (i) Calculate the budgeted profit.
 - (ii) How many two night holidays would need to be sold each week in three quarters, totalling 39 weeks, when occupancy is less, to achieve the desired profitability as per suggestion (1)?
 - (iii) By what percentage the prices of accommodation would need to be increased as per suggestion (2) to achieve the desired profitability? (10 Marks)
- (b) ABC Ltd. produces three products A, B and C. The following information is available for a period:

Product	A	B	C
Contribution per unit (Sales – Direct Materials) (₹)	30	25	15

Machine hours required per unit of production:

Product	Machine hours required per unit			Through put Accounting ratio
	A	B	C	
Machine 1	10	2	4	133.33%
Machine 2	15	3	6	200.00%
Machine 3	5	1	2	66.67%

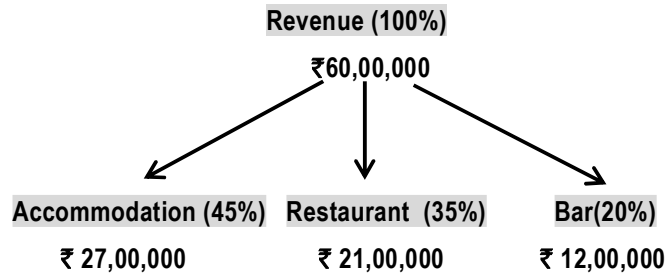
Estimated sales demand for A, B and C are 500 units each and machine capacity is limited to 6,000 hours for each machine.

Required

Analyse the above information and apply theory of constraints process to remove the constraints. How many units of each product will be made? (6 Marks)

Answer

(a) (i)



Statement Showing "Budgeted Profit"

Particulars	Accommodation (₹)	Restaurant (₹)	Bar (₹)	Total (₹)
Revenue	27,00,000	21,00,000	12,00,000	60,00,000
Less: Wages	5,40,000	6,30,000	1,80,000	13,50,000
Cost of Sales	---	7,35,000	6,00,000	13,35,000
Direct Cost	2,70,000	3,15,000	60,000	6,45,000
Contribution	18,90,000	4,20,000	3,60,000	26,70,000
Less: Fixed Cost				9,15,000
Budgeted Profit				17,55,000

(ii) Desired Improvement in Budgeted Profit ₹3,51,000 (20% × ₹17,55,000).

To get Additional Profit of ₹3,51,000 hotel has to Sale 780 (₹3,51,000/ * 450) Two Night Holidays.

No. of Two Night Holidays need to be Sold in 3 Off Seasons are **20 per week** (780/39).

*Accommodation 70% of 250 × 2 + Restaurant 20% of 500 × 40% + Bar 30% of 500 × 40%

(iii) Desired Improvement in Budgeted Profit ₹3,51,000 (20% × ₹17,55,000).

Statement Showing "Increase in Prices of Accommodation"

Particulars	Amount (₹)
Additional Profit Desired	3,51,000
Less: Extra Contribution – Restaurant (7.5% × ₹21,00,000)	1,57,500
Less: Extra Contribution – Bar (10.0% × ₹12,00,000)	1,20,000
Extra Contribution Required from Accommodation	73,500
Budgeted Revenue – Accommodation	27,00,000

Increase in Prices of Accommodation $\left(\frac{₹73,500}{₹27,00,000} \times 100 \right)$	2.72..%
--	---------



- (1) It has been considered that the Price increases, **without increase in Variable Cost**, further any increase in Revenue *equals* to increase in Contribution.
- (2) This question can also be solve by considering **proportionate increase in Variable Cost**.

- (b) Throughout Accounting Ratio is *highest* for 'Machine 2'. Accordingly, 'Machine 2' is the bottleneck.

Total 6,000 'Machine 2' hours are available.

Statement Showing "Product Mix – Theory of Constraints"

Particulars	A	B	C
Contribution per unit (₹) ... (A)	30	25	15
'Machine 2' Hours ... (B)	15	3	6
Contribution per 'Machine 2' hours ... (C) = (A) / (B)	2	8.33	2.50
Ranking ... (D)	3	1	2
Maximum Demand ... (E)	500	500	500
'Machine 2' Hours Required ... (F) = (B) × (E)	7,500	1,500	3,000
'Machine 2' Hours Available ... (G)	1,500* (Balance)	1,500	3,000
Units ... (H) = (G) / (B)	100	500	500

(*) [6,000 hrs – 1,500 hrs – 3,000hrs]

Question 6

- (a) From the information given below, prepare a cash budget of the company for the first half of 2016, assuming that cost would remain unchanged.
- Sales are both on credit and for cash, the latter being one-third of the former.
 - Realisation from debtors are 25% in the month of sale, 60% in the following month and the balance in the month after that.
 - Company's policy of selling price is 25% over cost.
 - Budgeted sales of each month are purchased and paid for in the preceding month.
 - Rent payable is ₹ 2,000 per month.

- (vi) Sales forecast for the different months are:
 2015– October ₹ 1,60,000; November ₹ 1,80,000; December ₹ 2,00,000
 2016– January ₹ 2,20,000; February ₹ 1,40,000; March ₹ 1,60,000; April ₹ 1,50,000; May ₹ 2,00,000; June ₹ 1,80,000 and July ₹ 1,20,000
- (vii) The company has outstanding debentures of ₹ 2 Lakhs on 1st January carrying interest at 15% per annum payable on the last date of each quarter on calendar year basis. 20% debentures are due for redemption on 30 June 2016.
- (viii) The company has to pay advance tax of ₹ 54,000 in March.
- (ix) Anticipated office costs for the six months are :
 January ₹ 25,000; February ₹ 20,000; March ₹ 40,000; April ₹ 35,000; May ₹ 30,000 and June ₹ 45,000.
- (x) Opening cash balance is ₹ 10,000 on January 1, 2016. (8 Marks)
- (b) 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 in Units
	I	II	III	IV	
A	5	2	4	3	22
B	4	8	1	6	15
C	4	6	7	5	8
Requirement in Units	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.

Required

- (i) Check if the clerk has made the 'Optimum Schedule'.
- (ii) Find the 'Optimum 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? (8 Marks)

Answer**(a) Cash Budget for Jan to Jun, 2016**

Particulars	Jan (₹)	Feb (₹)	Mar (₹)	Apr (₹)	May (₹)	Jun (₹)
Opening Balance:	10,000	77,500	1,10,250	44,500	875	(2,125)
Receipts:						
Cash Sales (1/4 of total sales)	55,000	35,000	40,000	37,500	50,000	45,000
From Debtors (W.N.)	1,51,500	1,47,750	1,17,750	1,15,875	1,23,000	1,40,625
Total Cash Available ... (A)	2,16,500	2,60,250	2,68,000	1,97,875	1,73,875	1,83,500
Payments:						
Purchase	1,12,000	1,28,000	1,20,000	1,60,000	1,44,000	96,000
Office Expenses	25,000	20,000	40,000	35,000	30,000	45,000
Rent	2,000	2,000	2,000	2,000	2,000	2,000
Debenture Interest	-----	-----	7,500	-----	-----	7,500
Advance Tax	-----	-----	54,000	-----	-----	-----
Redemption of Debentures	-----	-----	-----	-----	-----	40,000
Total Payments ... (B)	1,39,000	1,50,000	2,23,500	1,97,000	1,76,000	1,90,500
Closing Balance ... (A - B)	77,500	1,10,250	44,500	875	(2,125)	(7,000)

Working Notes**Receipts from Sundry Debtors**

Particulars	Oct (₹)	Nov (₹)	Dec (₹)	Jan (₹)	Feb (₹)	Mar (₹)	Apr (₹)	May (₹)	Jun (₹)
Sales	1,60,000	1,80,000	2,00,000	2,20,000	1,40,000	1,60,000	1,50,000	2,00,000	1,80,000
Cash Sales	40,000	45,000	50,000	55,000	35,000	40,000	37,500	50,000	45,000
Credit Sales (3/4 of total sales)	1,20,000	1,35,000	1,50,000	1,65,000	1,05,000	1,20,000	1,12,500	1,50,000	1,35,000
Cash Collection from Debtors:									
25% in the same month				41,250	26,250	30,000	28,125	37,500	33,750
60% in the next month				90,000	99,000	63,000	72,000	67,500	90,000
15% in the third month				20,250	22,500	24,750	15,750	18,000	16,875
Total				1,51,500	1,47,750	1,17,750	1,15,875	1,23,000	1,40,625

- (b) (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
		15	
7		1	

+1 -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.

Question 7

Answer any **four** out of the following five questions:

- (a) A company manufactures two products X and Y. Product X requires 5 hours to produce while Y requires 10 hours. In a month of 25 effective working days of 8 hours a day, 1,000 units of X and 600 units of Y were produced. The company employs 50 workers in the production department to produce X and Y. The budgeted hours are 1,02,000 for the year.

Calculate Capacity Ratio, Activity Ratio and Efficiency Ratio. Also establish their inter-relationship. (4 Marks)

- (b) State the limitations of uniform costing (4 Marks)

- (c) Briefly explain the principles associated with synchronous manufacturing. (4 Marks)

- (d) Enumerate the users of Pareto Analysis. (4 Marks)

- (e) Distinguish clearly between the skimming pricing policy and penetration pricing policy. (4 Marks)

Answer

(a)

Particulars	Standard Hours Produced		
	Product X	Product Y	Total
Output (units)	1,000	600	
Hours per unit	5	10	
Standard Hours	5,000	6,000	11,000

Actual Hours Worked: (50 workers × 8 hours × 25 days) 10,000

Budgeted Hours per month: (1,02,000 / 12) 8,500

Capacity Ratio	$= \frac{\text{Actual Hours}}{\text{Budgeted Hours}} \times 100 = \frac{10,000}{8,500} \times 100$	117.65%
Efficiency Ratio	$= \frac{\text{Standard Hours Produced}}{\text{Actual Hours}} \times 100 = \frac{11,000}{10,000} \times 100$	110.00%
Activity Ratio	$= \frac{\text{Standard Hours Produced}}{\text{Budget Hours}} \times 100 = \frac{11,000}{8,500} \times 100$	129.41%

Relationship

$$\begin{aligned}
 \text{Activity Ratio} &= \text{Efficiency Ratio} \times \text{Capacity Ratio} \\
 &= \frac{110.00 \times 117.65}{100} && \mathbf{129.41\%}
 \end{aligned}$$

(b) Limitations of Uniform Costing are:

- (i) Sometimes it is not possible to adopt uniform standards, methods and procedures of costing in different firms due to differing circumstances in which they operate. Hence, the adoption of uniform costing becomes difficult in such firms.
- (ii) Disclosure of cost information and other data is an essential requirement of a uniform costing system. Many firms do not wish to share such information with their competitors in the same industry.
- (iii) Small firms in an industry believe that uniform costing system is only meant for big and medium size firms, because they cannot afford it.
- (iv) It induces monopolistic trend in the business, due to which prices may be increased artificially and supplies withheld.

(c) Synchronous Manufacturing:

It is an all-encompassing manufacturing management philosophy which includes a set of principles, procedures, and techniques where every action is evaluated in terms of common goals of the organization.

The seven principles are:

- (i) Focus on synchronizing the production flow than on idle capacities.
- (ii) Value of time at a bottleneck resource is equal to the throughput rate of products processed by the bottleneck.
- (iii) Value of time at a non-bottleneck resource is negligible.
- (iv) Level of utilization of a non-bottleneck resource is controlled by other constraints within the system.
- (v) Resources must be utilized, not simply activated.
- (vi) Transfer batch should not be equal to the process batch.
- (vii) A process batch should be variable both along its route and overtime.

(d) Pareto Analysis is useful to:

- (i) Prioritize problems, goals and objectives.
- (ii) Identify the root causes.
- (iii) Select and define the key quality improvement programs, key employee relations improvement programs etc.

- (iv) Verify the operating procedures and manufacturing processes.
- (v) Allocate physical, financial and human resources effectively.
- (vi) Maximise research and product development time.

(e)

Basis	Skimming Price	Penetration Pricing
Meaning	Pricing Policy of highly pricing a product at the entry level into the market and reducing it later.	Pricing Policy of entering the market with a low price, then establishing the product and then increasing the price.
Use	This method is preferred in the beginning because in the initial periods when the demand for the product is not known the price covers the initial cost of production.	This is used by companies with established markets, when products are in any stage of their life cycle, to avoid competition. This is also known as "stay-out pricing".
Target Market	It is used when market is price insensitive, demand inelastic or to recover high promotional costs	It is a policy of using a low price as the principal instrument for penetrating mass markets early.
Example	Electronic goods, mobile phone, TVs, etc.	Entry of a new model small segment car into the market.