

# Revisionary Test Paper \_ June 2018

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**Final  
Group III  
Paper 15: Strategic Cost Management - Decision Making  
(SYLLABUS – 2016)**

**PART-I – Objective Question**

1. (A) Choose the most appropriate answer to the following questions giving justification. Each questions carries 2(two) marks.
- (i) Which of the following is not a term normally used in value analysis?
- A. Resale value
  - B. Use value
  - C. Esteem value
  - D. Cost value
- (ii) Which of the following is not suitable for a JIT production system?
- A. Batch production
  - B. Jobbing production
  - C. Process production
  - D. Service production
- (iii) Which of the following is NOT a method of transfer pricing?
- A. Cost plus transfer price
  - B. Internal price transfer price
  - C. Market-based transfer price
  - D. Two part transfer price
- (iv) When is market skimming pricing appropriate?
- A. If demand is very elastic
  - B. If the product is new and different
  - C. If there is little chance of achieving economies of scale
  - D. If demand is inelastic
  - E. If there is little competition and high barriers to entry
- (v) Which of the following is a recognised method of arriving at the selling price for the products of a business?
- (a) Life cycle pricing
  - (b) Price skimming
  - (c) Penetration pricing
  - (d) Target costing
- A. (a) and (b) only
  - B. (a), (b) and (c) only
  - c. (b) and (c) only
  - D. (a), (c) and (d) only
  - E. (a), (b), (c) and (d)

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- (vi) A company has estimated the selling prices and variable costs of one of its products as follows:

Selling price per unit		Variable cost per unit	
₹	Probability	₹	Probability
40	0.30	20	0.55
50	0.45	30	0.25
60	0.25	40	0.20

The company will be able to supply 1,000 units of its product each week irrespective of the selling price. Selling price and variable cost per unit are independent of each other.

The probability that the weekly contribution will exceed ₹20,000 is \_\_\_\_\_% (round to the nearest whole %)

- (A) 40%            (B) 42%            (C) 45%            (D) 55%

- (vii) The shadow price of skilled labour for CBV limited is currently ₹8 per hour. What does this mean?

- A. The cost of obtaining additional skilled labour resources is ₹8 per hour  
 B. There is a hidden cost of ₹8 for each hour of skilled labour actively worked  
 C. Contribution will be increased by ₹8 per hour for each extra hour of skilled labour that can be obtained  
 D. Total costs will be reduced by ₹8 for each additional hour of skilled labour that can be obtained

- (viii) An organisation is considering the costs to be incurred in respect of a special order opportunity.

The order would require 1,250 kgs of material D. This is a material that is readily available and regularly used by the organisation on its normal products. There are 265 kgs of material D in stock which cost ₹795 last week. The current market price is ₹3.24 per kg.

Material D is normally used to make product X. Each unit of X requires 3 kgs of material D, and if material D is casted at ₹3 per kg, each unit of X yields a contribution of ₹15.

The relevant cost of material D to be included in the costing of the special order is nearest to:

- A ₹3,990  
 B ₹4,050  
 C ₹10,000  
 D ₹10,300

- (ix) Aderholt uses activity based costing to allocate its overheads. The budgeted cost/expected for the Supervisor cost pool was:

Budgeted units	5,000
Number of employees	75
Budgeted cost	₹7,500
The actual costs incurred were:	
Actual units	5,500
Actual employees	77
Actual cost	₹8,085

What was the total variance for the setups?

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- A. ₹585 Adverse
- B. ₹165 Favourable
- C. ₹5550 Favourable
- D. ₹385 Adverse

- (x) P operates an activity based costing (ABC) system to attribute its overhead costs to cost objects.

In its budget for the year ending 31 August 2017, the company expected to place a total of 2,895 purchase orders at a total cost of ₹110,010. This activity and its related costs were budgeted to occur at a constant rate throughout the budget year, which is divided into 13 four-week periods.

During the four-week period ended 30 June 2016, a total of 210 purchase orders were placed at a cost of ₹7,650.

The over-recovery of these costs for the four-week period was:

- A. ₹330
- B. ₹350
- C. ₹370
- D. ₹390

- (xi) A manufacturing company recorded the following costs in October for Product X:

	₹
Direct materials	20,000
Direct labour	6,300
Variable production overhead	4,700
Fixed production overhead	19,750
Variable selling costs	4,500
Fixed distribution costs	16,800
Total costs incurred for Product X	72,050

During October 4,000 units of Product X were produced but only 3,600 units were sold. At the beginning of October there was no inventory.

The value of the inventory of Product X at the end of October using throughput accounting was:

- A ₹630
- B ₹1,080
- C ₹1,100
- D ₹2,000

- (xii) A company operates a standard absorption costing system. The budgeted fixed production overheads for the company for the latest year were ₹330,000 and budgeted output was 220,000 units. At the end of the company's financial year the total of the fixed production overheads debited to the Fixed Production Overhead Control Account was ₹260,000 and the actual output achieved was 200,000 units.

The under/over absorption of overheads was

- A. ₹40,000 over absorbed
- B. ₹40,000 under absorbed
- C. ₹70,000 over absorbed
- D. ₹70,000 under absorbed

- (xiii) Company B uses a throughput accounting system. The details of product X per unit

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are as follows:

Selling price	₹50
Material cost	₹16
Conversion costs	₹20
Time on bottleneck resource	8 minutes

The return per hour for product X is:

- A. ₹105      B. ₹225      C. ₹255      D. ₹375

(xiv) A company has 2,000 units of an obsolete item which are carried in inventory at the original purchase price of ₹30,000. If these items are reworked for ₹10,000, they can be sold for ₹18,000. Alternatively, they can be sold as scrap for ₹3,000 in the market. In a decision model used to analyze the reworking proposal, the opportunity cost should be taken as:

- (a) ₹8,000      (b) ₹12,000      (c) ₹3,000      (d) ₹10,000

(xv) The time taken to produce the first unit of a product is 4000 hrs, what will be the total time taken to produce the 5th to 8th unit of the product, when a 90% learning curve applies?

- (a) 10,500 hours      (b) 12,968 hours      (c) 9,560 hours      (d) 10,368 hours

**Answer: 1**

- (i) A: The resale value is normally referred to as the 'exchange value'
- (ii) A: Batch production uses stocks to supply customers whilst other products are being produced. Stocks are avoided in a JIT system. Jobbing production makes products to customer order and is ideal for JIT.
- (iii) B: The internal price is just another name for the TP. So it is not a method of transfer pricing.
- (iv) B: Here market skimming would be more appropriate. A high price could be changed to the 'opinion leaders' who want to be seen to have the new product and are prepared to pay a high price.
- (v) B: At first inspection all four appear to be methods of arriving at selling price. However, target costing is a method to arrive at the cost at which a product should be produced for having worked backwards from the price already set for the product.
- (vi) C: To generate a contribution greater than \$20,000 it is necessary to earn a unit contribution greater than ₹20. Consider each of the feasible combinations:

Selling price	Variable cost	Contribution	Probability
50	20	30	$0.45 \times 0.55 = 0.2475$
60	20	40	$0.25 \times 0.55 = 0.1375$
60	30	30	$0.25 \times 0.25 = 0.0625$

Answer = 0.4475

Answer = 44.75% = 45% to nearest full %

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- (vii) C: A shadow price for a scarce resource is its opportunity cost. It is the amount of contribution that would be lost if one unit less of that resource were available. It is similarly the amount of additional contribution that would be earned if one unit more of that resource were available. (This is on the assumption that the scarce resource is available at its normal variable cost.)
- (viii) B: The material is in regular use by the organization and so would be replaced if it is used on the special order. The material is readily available at a price of 3.24 per kg. Therefore the relevant cost of the material is  $1,250 \text{ kgs} \times 3.24 = 4,050$
- (ix) B: Standard quantity (SQ) =  $75 \text{ employees}/5,000 \text{ units} \times 5,500 \text{ units} = 82.5 \text{ employees}$   
 Standard price (SP) =  $7500/75 \text{ employees} = 100$   
 Standard cost (SQ  $\times$  SP) =  $82.5 \times 100 = 8,250$   
 Actual cost = 8,085  
 Total Variance =  $8250 - 8085 = 165 \text{ F}$
- (x) A: Cost driver rate = Budgeted cost of orders/Budgeted number of orders  
 =  $1,10,000/2895 = 38$  for each order  
 Cost recovered:  $210 \text{ orders} \times 38 = 7,980$   
 Actual costs incurred = 7650  
 Over-recovery of costs for four-week period =  $7980 - 7650 = 330$ .
- (xi) D: Using throughput accounting inventory is valued at material cost  
 Inventory value =  $20,000/4,000 \times 400 \text{ units} = 2,000$
- (xii) A: OAR =  $3,30,000/2,20,000 = 1.50$  per units  
 Overhead absorbed ( $200,000 \text{ units} \times 1.50$ ) = 3,00,000  
 Actual Overhead = 2,60,000.  
 Over absorbed = 40,000
- (xiii) C: Return per minute =  $(\text{Selling price} - \text{material cost})/\text{Time on bottleneck resource}$   
 =  $(50 - 16)/8 = 4.25$ ; Return per hour =  $4.25 \times 60 = 255$
- (xiv) (C) Original price is not relevant

Rework income	₹18,000
Deduct cost of rework	10,000
Net inflow	₹8,000      It is relevant

The other alternative relevant cash flow is from sale as scrap = ₹3,000 Hence, the opportunity cost is ₹3,000.

- (xv) D:

Units	Average Time (hours)	Total Time (hours)
1	4000	4000
2	3600	7200
4	3240	12960
8	2916	23328

Total time for 5th to 8 units =  $23328 - 12960 = 10368 \text{ hrs}$ .

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## Part II: Subjective Questions

### SECTION – A

(Each question carries 16 marks)

#### COST MANAGEMENT

2. (a) Importance of Product Life Cycle Costing.  
(b) DIC Ltd. supports the concept of terotechnology or life cycle costing for new investment decisions covering its engineering activities. The final side of this philosophy is now well established and its principles extended to all other areas of decision-making.

The company is to replace a number of its machines and the Production Manager is torn between the 'X' Machine, a more expensive machine with a life of 12 years and the 'Y' machine with an estimated life of 6 years. If the 'Y' machines chosen it are likely that it would be replaced at the end of 6 years by another 'Y' machine. The pattern of maintenance and running costs differs between the two types of machine and relevant data are shown below.

	'X' ₹	'Y' ₹
Purchase price	19000	13,000
Trade-in value	3000	3,000
Annual repair costs	2000	2,600
Overhaul costs	(at year 8) 4000	(at year 4) 2,000
Estimated financing costs averaged over machine life	10% p.a.	10% p.a.

You are required to:

- (a) Recommend, with supporting figures. Which machine to purchase, stating any assumptions made;

Answer: 2(a)

- Product Life Cycle Costing is considered important due to the following reasons —
- Time based analysis: Life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their life cycle. Costs and revenues can be analysed by time periods. The total magnitude of costs for each individual product can be reported and compared with product revenues generated in various time periods.
  - Overall Cost Analysis: Production costs are accounted and recognized by the routine accounting system. However non-production costs like R&D; design; marketing; distribution; customer service etc. are less visible on a product — by — product basis. Product Life Cycle Costing focuses on recognizing both production and non-production costs.
  - Pre-production costs analysis: the development period of R&D and design is long and costly. A high percentage of total product costs may be incurred before commercial production begin. Hence; the company needs accurate information on such costs for deciding whether to continue with the R&D or not.
  - Effective Pricing Decisions: Pricing decisions; in order to be effective; should include market considerations on one hand and cost considerations on the other.

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Product Life cycle costing and target costing help analyze both these considerations and arrive at optimal price decisions.

- (e) Better Decision Making: Based on a more accurate and realistic assessment of revenues and costs, at least within a particular life cycle stage, better decisions can be taken.
- (f) Long Run Holistic view: Product Life cycle costing can promote long-term rewarding in contrast to short-term profitability rewarding. It provides an overall framework for considering total incremental costs over the entire life span of a product, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- (g) Life Cycle Budgeting: Life cycle Budgeting, i.e., Life cycle costing with target costing principles, facilitates scope for cost reduction at the design stage itself. Since costs are avoided before they are committed or locked in the Company is benefited.
- (h) Review: Life Cycle Costing provides scope for analysis of long term picture of product line profitability, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.

**Answer: 2 (b)**

Machine X-Life 12 years

	Year	Cost ₹	Discount Factor	Discounted Cost ₹
Purchase price	0	19,000	1.00	19,000
Overhead cost	8	4,000	0.47	1,880
Trade-in-value	12	(3,000)	0.32	(960)
Annual repair cost	1-12	2,000	6.81	13,620
				33,540

Annualised equivalent ₹33,540/6.81 = ₹4,925

Machine Y-Life 6 years

	Year	Cost ₹	Discount Factor	Discounted Cost ₹
Purchase price	0	13,000	1.00	13,000
Overhead cost	4	2,000	0.68	1,360
Trade-in-value	6	(3,000)	0.56	(1,680)
Annual repair cost	1-6	2,600	4.36	11,336
				24,016

Annualised equivalent ₹ 24,016/4.36 = ₹5,508

Recommendation: Purchased 'X'

Assumptions:

- (i) Same performance, Capacity and speed.
- (ii) No inflation.
- (iii) 12-year estimates are as accurate as 6-year estimates.
- (iv) Cash flow at the year end.

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3. (a) Advantages of Target Costing?  
 (b) CELO Company has the capacity of production of 80,000 units and presently sells 20,000 units at ₹100 each. The demand is sensitive to Selling Price and it has been observed that for every reduction of 10 in Selling Price, the demand is doubled.

Required:

1. What should be the Target Cost at full capacity, if Profit Margin on Sale is 25%?
2. What should be the Cost Reduction Scheme if at present 40% of Cost is variable, with same % of profit?
3. If Rate of Return desired is 15%, what will be the maximum investment at full capacity?

**Answer 3(a)**

- (i) Innovation: it reinforces top-to-bottom commitment to process and product innovation, and is aimed at identifying issues to be resolved.
- (ii) Competitive Advantage: it enables a Firm to achieve competitive advantage over other Firms in the industry. The firm which achieves cost reduction targets realistically stands to gain in the long run.
- (iii) Market Driven Management: it helps to create a company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success.
- (iv) Real Cost Reduction: it uses management control systems to support and reinforce manufacturing strategies, and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost.

**Answer 3(b)**

**1. Target Cost at Full Capacity**

Selling Price per unit	₹ 100	₹ 90	₹ 80
Demand(units)	20,000	40,000	80,000=Full Capacity

Hence, Target Cost at Full Capacity = Sale Price less Profit Margin  
 = ₹80 less 25% thereon = ₹ 60 p.u.

**2. Determination of Target Cost Reduction**

(a) Since Present Price is ₹100 p.u. and Profit is 25% thereon, Present Cost p.u. =75, of which 40% is variable. So, Fixed Cost is 60% of 75 = 45 p.u. So, Total Fixed Cost =	45 × 80,000 = ₹36 Lakhs
(b) Variable Cost at Full Capacity = (40% of ₹75 p.u.) × 80,000 units =	₹24 Lakhs
(c) Estimated Cost at Full Capacity = Fixed Cost (constant at all levels) +Variable Cost (a + b)	₹60 Lakhs
(d) Target Cost at Full Capacity = ₹60 p.u. for 80,000 units =	₹48 Lakhs
(e) Cost Reduction Target/Scheme =Estimated Cost less Target Cost = (c - d)	₹ 12 Lakhs

**3. Computation of Investment required**

(a) Profit at full capacity = 25% of ₹80 = ₹20 p.u. × 80,000 units	₹16 Lakhs
(b) Since ROCE desired is 16%, Maximum Required Investment = ₹16 Lakhs/ 16%	₹100 Lakhs



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4. (i) State the problems associated with Throughput Accounting.  
 (ii) K Mnf.Ltd produces three products, X, Y and Z. The capacity of K Mnf. Ltd's plant is restricted by process alpha. Process alpha is expected to be operational for eight hours per day and can produce 1,200 units of X per hour, 1,500 units of Y per hour, and 600 units of Z per hour.

Selling prices and material costs for each product are as follows.

Product	Selling price ₹ per unit	Material cost ₹ per unit	Throughput contribution ₹ per unit
X	150	80	70
Y	120	40	80
Z	300	100	200

Conversion costs are ₹ 720,000 per day.

Required:

- (a) Calculate the profit per day if daily output achieved is 6,000 units of X, 4,500 units of Y and 1,200 units of Z.  
 (b) Calculate the TA ratio for each product.  
 (c) In the absence of demand restrictions for the three products, advise K Mnf. Ltd's management on the optimal production plan.

Answer: 4(i)

- When throughput accounting is the driving force behind all production scheduling, a customer that has already placed an order for a product, which will result in a sub-optimal profit level for the manufacturing, may find that its order is never filled.
- The company's ability to create the highest level of profitability is now dependent on the production scheduling staff, who decides, what products are to be manufactured and in what order.
- Another issue is that all costs are totally variable in the long-run since the management then, has the time to adjust them to long-range production volumes.

(ii)

- (a) Profit per day = throughput contribution – conversion cost  
 $= [(\text{₹}70 \times 6,000) + (\text{₹}80 \times 4,500) + (\text{₹}200 \times 1,200)] - \text{₹}7,20,000$   
 $= \text{₹}3,00,000$
- (b) TA ratio = throughput contribution per factory hour / conversion cost per factory hour

Conversion cost per factory hour = ₹720,000 / 8 = ₹90,000

Product	Throughput contribution per factory hour	Cost per factory hour	TA ratio
X	₹70 × 1,200 = ₹84,000	₹90,000	0.93
Y	₹80 × 1,500 = ₹120,000	₹90,000	1.33
Z	₹200 × 600 = ₹120,000	₹90,000	1.33

- (c) An attempt should be made to remove the restriction on output caused by process alpha's capacity. This will probably result in another bottleneck emerging elsewhere. The extra capacity required to remove the restriction could be obtained by working overtime, making process improvements or product

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specification changes. Until the volume of throughput can be increased, output should be concentrated upon products Y and Z (greatest TA ratios), unless there are good marketing reasons for continuing the current production mix.

Product X is losing money every time it is produced so, unless there are good reasons why it is being produced, for example it has only just been introduced and is expected to become more profitable, A Ltd should consider ceasing production of X.

## 5. Short Notes

- (i) **Various steps and Advantages of cost control system.**
- (ii) **The Variants of Backflush Accounting.**
- (iii) **Characteristics and Principles of Re-engineering Process.**
- (iv) **List the general principles relating to decision-making with Key Factor.**
- (v) **Write short notes on Make or Buy Decisions.**

Answer: 5

### (i) **Various steps and Advantages of cost control system.**

Cost control involves the following steps and covers the various facets of the management:

- (a) **Planning:** First step in cost control is established plans/targets. The plan/target may be in the form of budgets, standards, estimates and even past actual may be expressed in physical as well as monetary terms. These serves as yardsticks by which the planned objective can be assessed.
- (b) **Communication:** the plan and the policy laid down by the management are made known to all those responsible for carrying them out. Communication is established in two directions; directives are issued by higher level of management to the lower level for compliance and the lower level executives report performances to the higher level.
- (c) **Motivation:** the plan is given effect to and performances starts. The performance is evaluated, costs are ascertained and information about results achieved are collected and reported. The fact that costs are being complied for measuring performances acts as a motivating force and makes individuals endeavour to better their performances.
- (d) **Appraisal and reporting:** the actual performance is compared with the predetermined plan and variances, i.e. deviations from the plan are analyzed as to their causes. The variances are reported to the proper level of management.
- (e) **Decision making:** the variances are reviewed and decisions taken. Corrective actions and remedial measures or revision of the target, as required, are taken.

### **The advantages of cost control are mainly as follows:**

- (a) Achieving the expected return on capital employed by maximising or optimizing profit
- (b) Increase in productivity of the available resources

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- (c) Reasonable price of the customers
- (d) Continued employment and job opportunity for the workers
- (e) Economic use of limited resources of production
- (f) Increased credit worthiness
- (g) Prosperity and economic stability of the industry

**(ii) The Variants of Backflush Accounting.**

There are a number of variants of the Back flush system, each differing as to the 'trigger points' at which costs are recognized within the cost accounts and thus associated with products. All variants, however, have the following common features:

- The focus is on output – costs are first associated with output (measured as either sales or completed production) and then allocated between stocks and costs of goods sold by working back.
- Conversion costs (labour and overheads) are never attached to products until they are complete (or even sold) – thus the traditional WIP account doesn't exist. Materials are recognized at different points according to the variant used, but only to the extent of being either stock of raw materials or part of the cost of stock of finished goods. Again, materials are not attached to WIP.

Two variants of the Backflush system are summarized below. Note that in each as conversion costs (labour and overheads) are incurred they will be recorded in a conversion cost (cc) account.

**Variant 1**

This has two trigger points (TP):

TP 1 - purchase of raw materials / components. A 'raw and in process (RIP)' account will be debited with the actual cost of materials purchased, and creditors credited.

TP 2 - completion of good units. The finished goods (FG) account will be debited with the standard cost of unit produced and the RIP and cc account will be credited with the standard cost.

Under this variant, then, there will be two stock accounts:

- raw materials (which may, in fact, be incorporated into WIP)
- finished goods

**Variant 2**

This has only one trigger point – the completion of good units. The FG account is debited with the standard cost of units produced, with corresponding credits to the cc account and the creditors account.

Thus the cost records exclude:

- Raw materials purchased but not yet used for complete production
- The creditors for these materials (and any price variance) and there is only stock account, carrying the standard cost of finished goods stock.

Other variants include those using the sale of complete goods units as a trigger point for the attachment of conversion cost to unit -- thus there is no finished goods account, just a raw materials stock account, carrying the materials cost of raw materials, WIP and finished goods.

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It should be seen that as stock of raw materials, WIP and finished goods are decreased to minimal levels, as in a 'pure' JIT system, these variants will give the same basic results.

## (iii) Characteristics and Principles of Re-engineering Process

Characteristics of Re-engineering Process:

- (i) several jobs are combined into one
- (ii) often workers make decisions
- (iii) the steps in the process are performed in a logical order
- (iv) Work is performed, where it makes most sense
- (v) Quality is built in.
- (vi) manager provides a single point of contact
- (vii) Centralized and decentralized operations are combined.

Seven Principles of BPR:

- (a) Processes should be designed to achieve a desired outcome rather than focusing on existing tasks.
- (b) Personnel who use the output from a process should perform the process
- (c) Information processing should be included in the work, which produces the information
- (d) Geographically dispersed resources should be treated; as if they are centralized
- (e) Parallel activities should be linked rather than integrated
- (f) Doers should be allowed to be self-managing
- (g) Information should be captured once at source.

## (iv) List the general principles relating to decision-making with Key Factor.

1. If Availability < Requirement, that Resource is called a Key Factor or Key Resource.
2. If Availability > Requirement, that Resource is called as an Idle Resource.
3. Key Resource and Idle Resource are mutually exclusive terms, i.e. they do not refer to the same resource as such.
4. Key Resource should not be kept idle, and an Idle Resource will always have spare capacity.
5. Key Resource has Opportunity Costs, while Idle Resources have no Opportunity Costs.
6. A Key Resource, if kept idle, will erode/reduce Contribution.
7. For identifying Key Resource, Availability = Normal Resource Availability at Normal Costs. Any additional resource availability at higher cost (e.g. additional labour hours due to Overtime Work and Premium) will not be considered.
8. For identifying Key Resource, Requirement = Requirement at 100% capacity Levels, i.e. Maximum Output.
9. In case of minimum production condition, minimum resource requirements should be allocated independent of the Key factor Ranking priority. Additional Resource requirements only should be allocated based on Key Factor Ranking.
10. In case of Multiple Products and Multiple Key Factors with difference in ranking priority, Linear Programming (LPP) Techniques may be applied for Resource Allocation decision.
11. Application of Key Factor Principles is subject to- (a) feasibility, and (b) Company policy.

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**(v) Write short notes on Make or Buy Decisions.**

In case of Make or Buy decisions, i.e. whether to produce a component / product internally, or buy it from outside, Marginal Costing and Opportunity Costing approaches are adopted in decision-making. The following are the relevant considerations in Make or Buy decisions -

Relating to Suppliers	<ol style="list-style-type: none"> <li>1. Quality of goods supplied by Supplier.</li> <li>2. Reasonable certainty of the Supplier meeting the delivery dates, i.e. Timeliness.</li> <li>3. Availability of more than one Supplier to reduce the risk involved in buying.</li> <li>4. Lead Time involved in receiving the materials versus time involved in own production.</li> <li>5. Supplier Stability, i.e. whether the Supplier will support the Firm in the long-run also.</li> </ol>
Relating to Labour	<ol style="list-style-type: none"> <li>6. Availability of skilled labour, technical know-how and capability to make the product /component.</li> <li>7. Labour relations - any adverse effect on labour relations if it is decided to buy instead of making.</li> <li>8. Cost of labour redundancies, if any.</li> </ol>
Relating to Capacity	<ol style="list-style-type: none"> <li>9. Cost of Special Machineries to be installed in making the component.</li> <li>10. Possible use of released capacity and facility as a result of buying instead of making.</li> <li>11. Possibility of expanding the existing capacity or creating extra capacity (e.g. Overtime Work, Second Shift)</li> <li>12. Process of making - whether confidential or patented or a general process.</li> <li>13. Technical obsolescence associated with the component- whether investment in machinery is risky or not.</li> </ol>
Other Factors	<ol style="list-style-type: none"> <li>14. Seasonal demand of Components, leading to costs of inventory holding.</li> <li>15. Price Stability and possibility of escalations in the Price of Components purchased.</li> <li>16. Possibility of adverse Foreign Exchange Rate Fluctuations in respect of Imported Components.</li> <li>17. Availability of transport and other infrastructure facilities for procuring the component from outside.</li> <li>18. Behavior of cost of make and cost of buy in the long run.</li> </ol>

### Cost Comparison

Cost of Make	Cost of Buy
Variable Costs + Specific Fixed Cost (if any) + Opportunity Cost (in case of full capacity operations)	Direct Purchase Costs + Purchase Related Costs like Buying Commission, Transportation, etc. + Opportunity Cost if any (e.g. Purchase of different quality Raw Material, leading to reduction in Selling Price of Finished Product).

Decision will be as under-

- If Cost of Make < Cost of Buy, then MAKE.
- If Cost of Make = Cost of Buy, the Firm is indifferent. (Non-cost factors to be considered)
- If Cost of Make > Cost of Buy, then BUY.

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## SECTION - B

### STRATEGIC COST MANAGEMENT TOOLS AND TECHNIQUES

- 6 (a). VCPL Co. produces and sells 4 types of dolls for children. It also produces and sells a set of dress kit for the dolls. The company has worked out the following estimates for the next year -

Doll	Estimated Demand(Units)	Standard Material Cost	Standard Labour Cost	Estimated Sales per unit
A	50,000	₹20	₹15	₹60
B	40,000	₹25	₹15	₹80
C	35,000	₹32	₹18	₹100
D	30,000	₹50	₹20	₹120
Dress Kit	2,00,000	₹15	₹5	₹50

To encourage the sale of Dress Kits, a discount of 20% in its price is offered if it were to be purchased along with the doll. It is expected that all the customers buying dolls will also buy the Dress Kit.

The Company's Factory has effective capacity of 2,00,000 Labour Hours per annum on a single shift basis and it produces all the products on that basis. The Labour Hour Rate is ₹15. Overtime of Labour has to be paid at double the normal rate.

Variable Cost works out to 40% of Direct Labour Cost. Fixed Costs are ₹30 Lakhs per annum.

There will be no inventory at the end of the year. Prepare a conservative estimate of the year's profitability.

- 6 (b). Sri Company Ltd. manufactures and sells in a year 20,000 units of a particular product to definite customers at a price of ₹100 per unit. The Firm has a capacity to produce 25,000 units of the product per annum. To produce beyond 25,000 units per annum, it will have to install a New Equipment at a cost of ₹15 Lakhs. The Equipment will have a life span of 10 years and will have no residual value. There is an offer from a Client to purchase 10,000 units of the product regularly at a price of ₹90 per unit. The order, if accepted, will have to be over and above the existing level of production of 20,000 units.

The Cost Structure of the Product (per unit basis) is Direct Materials - ₹30, Direct Labour- ₹20, Variable Overhead - ₹10 and Profit - ₹20. The present total Fixed Overheads is ₹4,00,000.

During the coming year, it has been estimated that the cost of Direct Material, as compared to the current year will increase by 10%. Because of certain wage agreement Direct Labour Cost will increase by 25%. Fixed OH will increase by 10%. If the new order for 10,000 units is accepted, Fixed Overheads will increase further by ₹ 60,000 due to increased administrative charges.

You are required to analyse whether the concern should accept the order or instead of that try to secure order for the balance unused capacity, as available now, through some Sales Promotion Expenses which will be ₹50,000 per annum. Ignore financial charges for the new investment.

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Answer: 6(a)

1. Computation of Labour Overtime premium

Particulars	Doll A	Doll B	Doll C	Doll D	Dress Kit
(a) Direct Labour Cost per hour	₹15	₹15	₹18	₹20	₹5
(b) Labour Rate per hour (given)	₹15	₹15	₹15	₹15	₹15
(c) Hours required per unit (a ÷ b)	1 hour	1 hour	1.2 hours	1.33 hours	0.33 hours
(d) Sales Demand (units)	50,000	40,000	35,000	30,000	2,00,000
(e) Total Hours required (c x d)	50,000	40,000	42,000	40,000	66,667

Total Hours required for all the dolls and dress kits is 2,38,667 hours. Since only 2,00,000 hours are available, the balance of 38,667 hours will be from Overtime work.

Premium Amt. = 38,667 hrs × ₹15 = ₹5,80,000

2. computation of Discount offered

(a) Total Sale of all Dolls = 50,000 + 40,000 + 35,000 + 30,000 =	1,55,000 units
(b) Hence, Dress Kits sold separately (i.e. without discount) = 2,00,000 - 1,55,000 =	45,000 units
(c) Total Discount offered = 1,55,000 Dress Kits × ₹50 × 20% =	₹15,50,000

This discount is subtracted from the Gross Continuation of Dress Kits, in the statement of profitability.

3. Computation of Contribution and Profits (in ₹)

Particulars	Doll A	Doll B	Doll C	Doll D	Dress Kit
(a) Selling Price p.u	60.00	80.00	100.00	120.00	50.00
(b) Variable Costs p.u					
Materials	20.00	25.00	32.00	50.00	15.00
Labour	15.00	15.00	18.00	20.00	5.00
VOH(40% of Lab.)	6.00	6.00	7.20	8.00	2.00
Total Variable Costs	41.00	46.00	57.20	78.00	22.00
(c) Contribution p.u (a- b)	19.00	34.00	42.80	42.00	28.00
(d) Sales Demand (units)	50,000	40,000	35,000	30,000	2,00,000
(e) Total Contribution (c x d)	9,50,000	13,60,000	14,98,000	12,60,000	56,00,000
(f) Discount					(15,50,000)
(g) Net Contribution (e - f)	9,50,000	13,60,000	14,98,000	12,60,000	40,50,000

Total Net Contribution from all Dolls and Dress Kits from above	₹91,18,000
Less: Fixed Costs (₹30,00,000 + OT Premium ₹5,80,000)	₹35,80,000
Estimated Net Profit for the Sales Demand	₹55,38,000

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Answer: 6(b)

## 1 . Present and Revised Cost and Profit Structure

Particulars	Present	Revised
(a) Sale Price p.u.	Given = ₹100	
(b) Direct Material Cost p.u.	Given = ₹30	₹30 + 10% = ₹33
(c) Direct Labour Cost p.u.	Given = ₹20	₹20 + 25% = ₹25
(d) VOH p.u.	Given = ₹10	No Change = ₹10
(e) Variable Cost pu (b + c + d)	₹60	₹ 68
(f) Fixed OH (Total)	Given = ₹4,00,000	₹ 4,00,000 + 10% = ₹4,40,000

## 2. Options available to the company

Option	Description
I	Continue at present level of 20,000 units
II	Incur Additional SOH and sell upto full capacity = 20,000 + 5,000 = 25,000 units
III	Buy New Equipments, accept special offer of 10,000 units at ₹ 90 pu = 20,000+10,000 = 30,000 units
IV	Accept both Options II and III, and sell 20,000 + 5,000 + 10,000 = 35,000 units

The profits from these options are analysed below.

## 3. Profit Analysis under different options

Particulars	Option I	Option II	Option III	Option IV
(a) Sale Quantity	20,000 units	25,000 units	30,000 units	35,000 units
(b) Sale Price pu	₹100	₹100	20,000 units at ₹100 & 10,000 units at ₹90	25,000 units at ₹100 & 10,000 units at ₹90
(c) Sale Revenue (a × b)	₹20,00,000	₹25,00,000	₹29,00,000	₹34,00,000
(d) VC at ₹68 pu (WN 1)	₹13,60,000	₹17,00,000	₹20,40,000	₹23,80,000
(e) Contribution (c- d)	₹6,40,000	₹8,00,000	₹8,60,000	₹10,20,000
(f) Fixed Costs				
Given (WN 1f)	₹4,40,000	₹4,40,000	₹4,40,000	₹4,40,000
Additional SOH	-	₹50,000	-	₹50,000
Additional AOH	-	-	₹60,000	₹60,000
Department on New Equipment	-	-	₹1,50,000	₹1,50,000
Total Fixed Costs	₹4,40,000	₹4,90,000	₹6,50,000	₹7,00,000
(g) Profit (e - f)	₹2,00,000	₹3,10,000	₹2,10,000	₹3,20,000
(h) Rank I Priority	(iv)	(ii)	(iii)	(i)

Note: Depreciation on New Equipments = ₹15,00,000/10 years = ₹1,50,000.

Decision: Option IV is preferable, due to maximum profits. If it is not possible, the Firm may choose Option II.



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7. AUES manufactures two products P and Q. Both the products pass through the Company's two Departments, A and B. the market demand for a month is 2,500 units of P and 2,000 units of Q. The Company has a normal capacity of 600 hours in Department A and 520 hours in Department B per month. Overtime is acceptable upto 50% of normal hours in each department. Details relating to the products and departments are -

Product	P	Q	Department	A	B
Direct Material Cost	₹10 p.u.	₹5 p.u.	Direct Labour time required - P (minutes per unit) Q (minutes per unit)	6 18	12 12
Fixed OH per month	₹18,000	₹6,400	Direct Wage Rate per hour - Normal Time Overtime	₹10 ₹15	₹12 ₹18

If the Company is not able to fulfill the demand for want of capacity, the balance quantity of products can be sold by buying from a sub-contractor, who has agreed to supply Product P at ₹18 and Product Q at ₹12 per unit.

- Calculate the quantity of each product to be manufactured and / or to be sub-contracted in a most economical way of fulfilling the market demand.
- Present a statement showing the Total Costs involved in your solution above.

Answer: 7

- Identification of Key Factor

Particulars		Department A	Department B
(a) Normal Time Available	Given	600 hours	520 hours
(b) Possible Overtime at 50%	50% of (a)	300 hours	260 hours
(c) Total Time Available	(a+ b)	900 hours	780 hours
(d) Time Read for P Production	P (2500 units)	$2500 \times 6/60 =$ 250 hours	$2500 \times 12/60 =$ 500 hours
(e) Time Read for Q Production	Q (2000 units)	$2000 \times 18/60 =$ 600 hours	$2000 \times 12/60 =$ 400 hours
(f) Total Time required	(d + e)	850 hours	900 hours
(g) Whether Key Factor		(See Note) Yes	Yes

Note: A Resource is considered as a Key Factor when its normal availability is less than its requirement. For this purpose, only the Normal Time as per (a) is compared with Total Requirement as per (f). Overtime is not considered here because - (a) Overtime is only a possibility, not compulsory, and (b) Costs undergo an increase during overtime.

- Computation of Contribution per unit of product: (Production during Normal Time)

Particulars	Product P	Product q
(a) Cost of Buying per unit	₹ 18.00	₹12.00
(b) Variable Cost of Make:		
Materials	₹10.00	₹5.00
Labour - Department A	$₹10 \times 6/60 =$ ₹1.00	$₹10 \times 18/60 =$ ₹3.00
Labour - Department B	$₹12 \times 12/60 =$ ₹2.40	$₹12 \times 12/60 =$ ₹2.40
Total Costs of own make	₹13.40	₹10.40
(c) Savings per unit, if made in Normal Time	₹ 4.60	₹1.60

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Observation: Since there is a savings per unit if made during normal time, the company should first prefer own production of both products and if limited by capacity, may sub-contract (buy) the balance quantity.

### 3. Effect of overtime work on Contribution per unit of the Products

Particulars	Product P	Product Q
(a) Savings per unit, if made during Normal Time	₹ 4.60	₹ 1.60
(b) Effect of Overtime premium: 50% of Normal Costs		
Labour - Department A	$5 \times 6/60 = ₹0.50$	$₹5 \times 18/60 = ₹1.50$
Labour - Department B	$6 \times 12/60 = ₹1.20$	$₹6 \times 12/60 = ₹1.20$
(c) Savings per unit, if made in Overtime	₹2.90	(₹1.10)

Note: Since the Normal Time Labour Cost has already been considered in the computation of Savings per unit, the Overtime Premium is the only incremental cost and is hence relevant.

Observation based on effect of Overtime Work:

- (i) Normal Time Work: Both products P and Q can be produced during normal time as cost of make is less than cost of buy. There is a saving of ₹4.60 and ₹1.60 per unit, on own production.
- (ii) Overtime Work: The effect of overtime work differs for the products as under -
  - Product P can be produced during Overtime Work, either in Department A or Department B in both. There will be a saving of ₹2.90 p.u., due to own production, even if Overtime Work is involved in both Departments A and B.
  - Product Q can be produced during Overtime Work, either in Department A only (saving of ₹0.10) or in Department B only (saving of ₹0.40), but not in both. If Overtime Work is required in both departments for Product Q, it is better to sub-contract the same.

### 4. Computation of Ranking Priority (Savings per Labour Hour in Departments A and B)

Particulars	Product P	Product Q
(a) Savings per unit, if made during normal time	₹4.60	₹1.60
(b) Hours required in Department A	6/60 hours	18/60 hours
(c) Savings per hour in Department A = (a ÷ b)	₹46 per hour	₹5.33 per hour
(d) Ranking for production in Department A	I	II
(e) Hours required in Department B	12/60 hours	12/60 hours
(f) Savings per hour in Department B = (a ÷ e)	₹23 per hour	₹8.00 per hour
(g) Ranking for production in Department B	I	II

Note: Since ranking priorities on the Key Factors are the same, the solution can be obtained as given below. In case of different priorities on Multiple Key Factors, Linear Programming Techniques may be used for resource allocation.

### 5. Key Factor Allocation and Production Decision

Particulars		Department A	Department B
(a) Normal Time Available		600 hours	520 hours
(b) Possible Overtime at 50%		300 hours	260 hours
(c) Total Time Available	(a + b)	900 hours	780 hours
Time Allocation: (see Table below)		Hours Utilised	Hours Utilised
Stage 1: Make - Normal Time	P= 2500 units	$2500 \times 6/60 = 250$ hours	$2500 \times 12/60 =$ 500 hours

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Stage 2: Make - Normal Time	Q= 100 units	$100 \times 18/60 = 30$ hours	(bal.fig.)=20hours
Stage 3: Make -Overtime in B	Q= 1067 units	(bal. fig.) = 320 hours	$1067 \times 12/60 = 213$ hours
Stage 4: Sub-contract	Q = 833 units	No further production possible since OT is involved in both Depts. A and B which is not economical.	

Stage	Explanation
1	Product P has maximum preference for own production. Hence it will be produced first. Time utilised therefore = 250 hours and 500 hours of Normal Time in A and B. Balance time left will be 350 hours in Department A and 20 hours in Department B.
2	Least Normal Time available is 20 hours in Department B. This will be utilised in production of Q, equivalent to $20 \div 12/60$ hours = 100 units. This will utilise $100 \text{ units} \times 18/60 = 30$ hours in Department A.
3	Balance Normal Time is 320 hours in Department A. This will be utilised in production of Q, equal to $320 \div 18/60$ hours = 1067 units. This will utilise $1067 \times 12/60 = 213$ hours (in Overtime) in Dept B. Since this is within the permissible overtime limit of 260 hours, this production is feasible. [Note: If available overtime is less than 213 hours, production of Q will be restricted to that level.]
4	Now both Departments require overtime operation for Product Q. Since this is costlier when compared to sub- contracting, the Firm should purchase the balance requirements of Product Q.

### 6. Statement of Contract Costs

Particulars	Decision	Quantity	Cost per unit	Total Cost
Product P	Make in Normal Time	2,500 units	(WN 2b) ₹13.40	₹33,500.00
Product Q	Make in Normal Time	100 units	(WN 2b) ₹10.40	₹1,040.00
Product Q	Make - Overtime in B	1,067 units	(Note) ₹11.60	₹12,377.20
Product Q	Sub-Contract	833 units	(WN 2a) ₹12.00	₹9,996.00
Fixed Costs	Given= ₹18,000 + ₹6,400			₹24,400.00
				₹81,313.20

Note: Cost of making Q by working Overtime in Department B = Normal Time Cost + OT Premium of Product Q in Department B = ₹10.40 + ₹1.20 (WN 3b) = ₹11.60 per unit.

- 8 (a). You are the Management Accountant of a medium-sized company. You have been asked to provide budgetary information and advice to the Board of Directors for a meeting where they will decide the pricing of an important product for the next period.

The following information is available from the records:

	Previous period ₹'000		Current period ₹'000
Sales: [1,00,000 units at ₹13 each]	1,300	(1,06,000 units at ₹13 each)	1,378.0
Costs	1,000		1,077.4
Profit	300		300.6

You find that between the previous and current periods there was 4% general cost inflation and it is forecast that costs will rise a further 6% in the next period. As a matter of policy, the firm did not increase the selling price in the current period

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although competitors raised their prices by 4% to allow for the increased costs. A survey by economic consultants was commissioned and has found that the demand for the product is elastic with an estimated price elasticity of demand for 1.5. This means that volume would fall by 1-(1/2) times the rate of real price increase.

Various options are to be considered by the Board and you are required:

- (a) to show the budgeted positions if the firm maintains ₹13 selling price for the next period (when it is expected that competitors will increase their prices by 6%);
- (b) to show the budgeted position in the firm also raise its price by 6%;

8 (b). ABC Limited manufactures product Min addition to other products by using the same machines in Departments A and B. The cost data are as under:

Direct Material P : 4 kg @ ₹6 per kg used in Dept. A;

Q : 8 kg @ ₹ 2.50 per kg added in Dept B

Direct Labour: 2 hours @ ₹ 4 per hour in Dept. A;

3 hours @ 3 per hour in Dept. B

Overheads:

Basis of overheads recovery	Dept. A per rupee of direct material P (₹)	Dept. B per direct labour hour (₹)
Recovery rates at 80% of practical capacity		
Variable	0.80	2.00
Fixed	2.20	3.00
Depreciation component of fixed overhead rate	0.80	0.10
Other relevant data:		
Net plant and equipment value	70,00,000	1,20,000
Total depreciation per month	80,000	1,000

The working capital requirement of Product M based on a target volume of output of 1,000 units per month is estimated at ₹1,24,000 per month is estimated at ₹24,000 per annum.

Required:

- (A) Indicate the bottom line selling price of Product M assuming that:
  - (i) Price is adequate to ensure contribution equivalent to 30% on investment made.
  - (ii) The product is a new product about to be introduced in market.
- (B) Calculate the selling price in a situation where Product is well established in the market so as to yield return of 18% on investment.

**Answer: 8 (a)**

Price elasticity of demand (% in quantity demand ÷ % increase in price) = 1.5

When the prices fall by 4%, demand increased by 4% × 1.5 = 6%

When the prices fall by 6%, demand increased by 6% × 1.5 = 9%

Determination of fixed and variable costs:

Adjust current period cost of previous period cost = 1077.4 ÷ (1 + 4% of 1 or 1.04) = 1036

Using high and low method to determine fixed/variable cost split:

Period	Units ('000)	Cost (₹ in thousands)
Current	106	1,036
Previous	<u>100</u>	<u>1,000</u>
	<u>6</u>	<u>36</u>

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Variable cost per unit = ₹36 ÷ 6 = ₹ 6.00

Fixed cost per unit = ₹ 1,000 - (100 × 6) = ₹ 400

Variable cost per unit next period: = ₹ 6 × (1 + 4% of 1) × (1 + 6% of 1) = ₹ 6.6144

Fixed cost for next period: = ₹ 4,00,000 × (1 + 4% of 1) × (1 + 6% of 1) = ₹ 4,40,960

Budgeted Position. Selling Price ₹ 13.00

Sales: 1,06,000 units × (1 + 9% of 1) × ₹13 = ₹15,02,020

Variable cost : 1,06,000 × (1 + 9% of 1) × ₹ 6.6144 = 7,64,228

Contribution 7,37,792

Fixed cost 4,40,960

Profit 2,96,832

(b) Budgeted Position. Selling ₹13.00 + 6%

Sales: 1,06,000 units × (1 + 6%) × ₹ 13 = ₹14,60,680

Variable cost: 1,06,000 units × ₹ 6.6144 = 7,01,126

Contribution 7,59,554

Fixed cost 4,40,960

Profit 3,18,594

### Answer 8 (b):

(A) It is given in the question that contribution equivalent to 30% on investment is adequate. Therefore, for arriving at the bottom line price of product M, it is necessary to work out the cost of production and capital employed (consisting of net fixed assets and working capital).

Statement showing cost of production of product M

Direct material	- Dept. A (P - 4 × ₹ 6)	₹ 24.00	44
	- Dept. B (Q- 8 × ₹ 2.5)	20.00	
Direct labour	- Dept. A (2 × ₹ 4)	8	17
	- Dept. B (3 × ₹ 3)	9	
Variable overheads:	- Dept. A (₹ 24 ₹ 0.8)	19.20	
	- Dept. B (3 hrs × 2)	6.00	25.20
Total variable costs			86.20
Fixed overheads	- Dept. A (₹24 × 2.20)	52.80	
	- Dept. B (3 hrs ₹ 3)	9.00	61.80
Total cost of production			148.00

Statement showing capital employed

	Dept. A	Dept. B
Depreciation per unit of M	₹ 24 × 0.8 = 19.20	3 hrs. × 0.1 = 0.30
Net Fixed Assets	₹ 70,00,000	₹ 1,20,000
Depreciation p.a.	9,60,000	12,000
NFA for 12,000 units p.a.	16,80,000*	36,000@

Total N.F.A.

(₹16,80,000 + ₹ 36,000) = ₹17,16,000

Working Capital 1,24,000

Total capital employed 18,40,000

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- (A) (i) Bottom line price (contribution 30% on investment) = ₹18,40,000 × 0.3 = ₹5,52,000  
 Contribution per unit = ₹5,52,000 ÷ ₹ 12,000 = ₹46  
 Bottom line price as per (a) = ₹86.20 + 46.00 = ₹132.20  
 Bottom line price as per  
 (ii) i.e., for new product (variable cost only) = 86.20.
- (B) Selling price of the well established product = Total cost + 18% on investment  
 = ₹148 + 18% of (18,40,000 + 12,000) = ₹175.60.  
 \*(₹70 lakhs ÷ ₹ 9.60 lakhs) × 19.20 × 12,000  
 @ (₹1.20 lakhs ÷ 0.12 lakhs) × 0.30 × 12,000

9. (a) What do you mean by Dual-Rate Transfer Pricing System?

- (b) A Company is organized on decentralized lines, with each manufacturing division operating as a separate profit centre. Each Division Manager has full authority to decide on sale of division's output to outsiders or to other divisions. Division A manufactures a single standardized product. Some output is sold externally and remaining is transferred to Division X where n is a sub-assembly in the manufacture of that Division's product. The unit cost of Division A and Division X is as follows:

Particulars	Division A	Division X
Transfer from Division A to X	-	₹ 42.00
Direct Material	₹6.00	₹ 35.00
Direct Labour	₹3.00	₹4.50
Direct Expenses	₹3.00	-
Variable Manufacturing Overheads	₹3.00	₹18.00
Fixed Manufacturing Overheads	₹6.00	₹18.00
Variable Selling & Packing Expenses	₹3.00	₹2.50
Total	₹24.00	₹120.00

Division A sold 40,000 units annually at the Standard Price of ₹45 in the external market. In addition to the external sales 10,000 units are transferred annually to Division X at an internal price of ₹42 per unit. Variable Selling and Packing Expenses are not incurred by the Supplying Division for the internal transfer of the product. Division X incorporates the transferred goods into a more advanced product. The Manager of Division X disagrees with the basis used to set the Transfer Price. He argues that Transfer Price should be made at Variable Cost, since he claims that his Division is taking output that Division A should be unable to sell at a price of ₹45.

He also submitted a report of the relationship between Selling Price and demand, to support of his disagreement.

The report of customer demand at various Selling Prices for Division A and for Division X is as follows –

Division A	Selling Price per unit	₹30	₹45	₹60
	Demand	60,000 units	40,000 units	20,000 units
Division X	Selling Price per unit	₹120	₹135	₹150
	Demand	15,000 units	10,000 units	5,000 units

The Company has sufficient capacity to meet demand at various Selling Prices. Internal transfer demanded units will be decided by X Division.

Required:

- To calculate Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹42.

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- To calculate Divisional and Overall Profitability, if Division A transfers demanded units to X at Variable Cost.
- In place of Internal Transfers, Division A can sell 10,000 units of its product in a new external market without affecting existing market, at a price of ₹32 per unit and X Division can purchase these units at the rate of ₹31 in the open market. Calculate Company's Profit by following the above strategies.

Answer 9(a):

- Dual-Rate Transfer Pricing uses two separate Transfer Prices to price each inter-divisional transaction, as under-

Dual Rate Transfer Pricing Method

Debit Cost in Recipient Division Cost = Relevant Costs, i.e. Variable Cost + Opportunity Cost, if any	Credit Income in Transferring Division Income = Market Price, or Full Cost plus mark-up (whether or not Intermediate Product is marketable)
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Under this method, Company Profits = Total of Divisional Profits Less Inter-Divisional Mark-up,

- Advantages:
  - Incentive to Transferring Division: The Transferring Division Manager is motivated to transfer the Intermediate Product internally, since each unit transferred generates a profit (due to mark-up).
  - No Unjust Enrichment: If the Transfer Price is set at the Transferring Division's Marginal Cost for the Intermediate Product, that division will not have any contribution from internal transfers. All the total contribution from inter-divisional trading will be assigned to the Recipient Division. Such unjust enrichment is avoided through the use of mark-up.
  - Optimal Decisions: Since Relevant Cost is used as the second Transfer Price, (for debiting Cost in Recipient Division) the Transfer Pricing system automatically promotes goal congruence by leading to optimal decisions.
- Disadvantages:
  - Confusing: Use of different Transfer Prices causes confusion, particularly when more than two divisions are involved.
  - Artificial: Dual Transfer Prices are considered to be artificial.
  - No incentive: Fixed Price with mark-up protects Transferring Divisions from competition. It gives them little incentive to improve their productivity.
  - Misleading: Dual Transfer Prices can result in misleading information and create a false impression of divisional profits. There is a possibility of double-counting of profits. At the extreme, all divisions may report profits, when the Company as a whole is losing money.

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## Answer 9 (b)

### 1. Computation of Variable Costs per unit in different cases

Particulars	Dir Matl	Dir Lab	Dir Exps	Var POH	Var SOH	Total VC
(a) Divn A (for Ext Sale)	₹6.00	₹3.00	₹3.00	₹3.00	₹3.00	₹18.00
(b) Divn A (for Int Tfr)	₹6.00	₹3.00	₹3.00	₹3.00	-	₹15.00
(c) Divn X (Own VC)	₹35.00	₹4.50	-	₹18.00	₹2.50	₹60.00

Note: Fixed Costs of - (i) Divn A = (50,000 units × ₹6) = ₹3,00,000,  
(ii) Divn X = (10,000 units × ₹18) = ₹1,80,000.

### 2. Determination of Internal Transfer quantity, i.e. Demand by X division

When TP = ₹42						When TP = VC = ₹15 p.u					
Qty	SP p.u	Own VC	TP p.u	Cn p.u	Total Cn	Qty	SP p.u	Own VC	TP p.u	Cn p.u	Total Cn
5,000	₹150	₹60	₹42	₹48	₹2,40,000	5,000	₹150	₹60	₹15	₹75	₹3,75,000
10,000	₹135	₹60	₹42	₹33	₹3,30,000 (maximum)	10,000	₹135	₹60	₹15	₹60	₹6,00,000
15,000	₹120	₹60	₹42	₹18	₹2,70,000	15,000	₹120	₹60	₹15	₹45	₹6,75,000 (maximum)
So, Demanded Internal Transfer Qty = 10,000 units						So, Demanded Internal Transfer Qty = 15,000 units					

### 3. Profit Statement at various Transfer Prices and Output levels

Particulars	Transfer from A to X at TP = ₹42 p.u			Transfer from A to X at TP = VC ₹15		
	Division A		Division X	Division A		Divn X
	Sale	Transfer	Sale	Sale	Transfer	Sale
(a) Qty (units)	40,000	10,000	10,000	40,000	15,000	15,000
(b) Sale Price p.u.	₹45	₹42	₹135	₹45	₹15	₹120
(c) VC p.u.: Own	₹18	₹15	₹60	₹18	₹15	₹60
Transfer in	-	-	₹42	-	-	₹15
Total VC pu	₹18	₹15	₹102	₹18	₹15	₹75
(d) Contribution pu	₹27	₹27	₹33	₹27	-	₹45
(e) Total Contribution (ax d)	₹10,80,000	₹2,70,000	₹3,30,000	₹10,80,000	-	₹6,75,000
	₹13,50,000		₹3,30,000	₹10,80,000		₹6,75,000
(f) Fixed Cost (WN1)	(₹3,00,000)		(₹1,80,000)	(₹3,00,000)		(₹1,80,000)
(g) Profit (e - f)	₹10,50,000		₹1,50,000	₹7,80,000		₹4,95,000
(h) Company Profit	(10,50,000 + 1,50,000) = ₹12,00,000			(7,80,000 + 4,95,000) = ₹12,75,000		

Note: Both Departments have enough capacity to meet Internal & external demands.



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4. Profit Statement when Division X procures its materials from external market

Particulars	Division A		Division X
	Given 40,000 units	New 10,000 units	10,000 units
(a) Sale Quantity (units)			
(b) Selling Price p.u	₹45	₹32	₹135
(c) Variable Cost p.u	₹18	₹18	(60 + 31) = ₹91
(d) Contribution p.u	₹27	₹14	₹44
(e) Total Contribution (a x d)	₹10,80,000	₹1,40,000	₹4,40,000
	₹12,20,000		
(f) Fixed Cost (WN 1)		₹3,00,000	₹1,80,000
(g) Profit		₹9,20,000	₹2,60,000
(h) Company Profit	(9,20,000 + 2,60,000) = ₹11,80,000		

10 (i). Explain how CVP based Sensitivity Analysis, can help Managers with uncertainty.

10 (ii). MN Agarwal owns a Gift-Shop, a Restaurant and a Lodge in Shillong. Typically, he operates these only during the season period of 4 months in a year. For the past season the occupancy rate in the Lodge was 90% and level of activity in case of Gift-Shop and Restaurant at 80%. The relevant data for the past season were as under-

(Amounts in ₹)

	Gift-Shop		Restaurant		Lodge	
	Amount	%	Amount	%	Amount	%
1. Receipts/ Sales	48,000	100	64,000	100	1,80,000	100
2. Expenditure:						
Cost of Sales	26,400	55	35,200	55	-	-
Supplies	2,400	5	6,400	10	14,400	8
Insurance & Taxes	1,920	4	6,400	10	36,000	20
Depreciation	2,880	6	8,000	12(1/2)	39,600	22
Salaries	4,800	10	4,800	7(1/2)	25,200	14
Electricity Charges	960	2	3,200	5	13,500	7(1/2)
Total	39,360	82	64,000	100	1,28,700	71(1/2)
3. Profit	8,640	18	-	-	51,300	28(1/2)

Additional information:

- (a) Cost of Sales and Supplies vary directly with the occupancy rate In case of Lodge and level of activity In case of Gift Shop and Restaurant.
- (b) Insurances and Taxes and Depreciation are for the entire period of twelve months.
- (c) Salaries paid are for the season period except a Chowkidar for the Lodge who is paid for the full year at ₹400 per month.
- (d) Electricity Charges include Fixed Charges of ₹640, ₹1,920 and ₹9,900 for Gift-Shop, Restaurant and Lodge respectively.  
The balance amount varies directly with occupancy rate in case of Lodge and level of activity in case of Gift-Shop and Restaurant. Fixed Electric Charges are for the season except in case of Lodge where ₹6,900 is for the season and ₹3,000 for the entire period of twelve months.

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Agarwal is interested in increasing his Net Income. The following options are under his consideration -

- (a) To continue the operations during the season period only by inserting advertisement in newspapers thereby occupancy rate to reach 100% in case of Lodge and 90% level of activity in respect of Gift-Shop and Restaurant. The costs of advertisement are estimated at ₹12,000).
- (b) To continue operations throughout the entire period of twelve months comprising season period of four months and off- season period of eight months. The occupancy rate is expected at 90% and 40% during season period and off-season period respectively in case of the Lodge. The room rents are bound to be reduced to 50% of the original rates during off- season period. The level of activity of Gift-Shop and Restaurant is expected at 80% and 30% during season and off- season period respectively but 5% discount on the original rates will have to be offered during off-season period.

Which option is profitable? As a Cost Accountant would you like to suggest him any other alternative based upon the above figures, which can be adopted to earn more net profit? (Use Incremental Revenue and Cost Approach.)

Answer: 10(i)

**CVP based Sensitivity Analysis help Managers to cope with uncertainty.**

1. Sensitivity Analysis refers to analysis of the change in one factor on the other related factors. For example, what will be the effect of a 10% increase in Selling Price, on Sales Volume and Profits?
2. Sensitivity Analysis focusses on how a result will be changed if the original estimates of the underlying assumptions change.
3. CVP-based Sensitivity analysis will help top Management to get answers to questions like - What will be the Total Profit if the Sales Mix is changed to include more of Product L and less of Product M? or What will be the Profit if Fixed Costs increase by 30% and Variable Costs decline by 5%?, etc.
4. CVP-based Sensitivity analysis can be performed in a Spreadsheet package, i.e. computerized CVP Models. Computers will quickly show changes both graphically and numerically based on data keyed in.
5. Managers can study various combinations of changes in Selling Prices, Fixed Costs, Variable Costs and Product Mix, and can react quickly without waiting for formal MIS Reports from the Financial Officer.
6. Therefore, use of CVP-based Sensitivity analysis, helps Managers to cope up with uncertainty.

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Answer: 10(ii)

1. Additional Revenues and Costs under Option 1: Operate during Season only (₹)

Particulars	Gift Shop	Restaurant	Lodge	Total
1. Additional Revenue	Given = 48,000 at 80%. So, for extra 10% = $48,000 \times (10/80)$ = 6,000	Given = 64,000 at 80%. So, for extra 10% = $64,000 \times (10/80)$ = 8,000	Given = 1,80,000 at 90%. So, for extra 10% = $180,000 \times (10/90)$ = 20,000	34,000
2. Addnl Costs				
(a) Cost of Sales	$6,000 \times 55%$ = 3,300	$8,000 \times 55% = 4,400$	Nil	7,700
(b) Supplies	$6,000 \times 5% = 300$	$8,000 \times 10% = 800$	$20,000 \times 8% = 1,600$	2,700
(c) Electricity Charges	$(960 - 640) \times (10/80) = 40$	$(3,200 - 1,920) \times (10/80) = 160$	$(13,500 - 9,900) \times (10/90) = 400$	600
(d) Advertisement				12,000
Sub-Total				23,000
3. Addnl Profit				11,000

2. Additional Revenues and Costs under Option 2: Operate during all 12 months (amounts in ₹)

Particulars	Gift Shop	Restaurant	Lodge	Total
1. Additional Revenue	$48,000 \times 2 \times (30%/80%) \times 95%$ = 34,200	$64,000 \times 2 \times (30%/80%) \times 95%$ = 45,600	$1,80,000 \times 2 \times (40%/90%) \times 50%$ = 80,000	1,59,800
2. Addnl Cost				
(a) Cost of Sales	$36,000 \times 55% = 19,800$	$48,000 \times 55% = 26,400$	Nil	46,200
(b) Supplies	$36,000 \times 5% = 1,800$	$48,000 \times 10% = 4,800$	$1,60,000 \times 8% = 12,800$	19,400
(c) Salaries	$4,800 \times 2 = 9,600$	$4,800 \times 2 = 9,600$	$(25,200 - 4,800) \times 2 = 40,800$	60,000
(d) Electricity - Fixed	$640 \times 2 = 1,280$	$1,920 \times 2 = 3,840$	$6,900 \times 2 = 13,800$	18,920
(e) Electricity - Variable	$(960 - 640) \times 2 \times (30%/80%) = 240$	$(3,200 - 1,920) \times 2 \times (30%/80%) = 960$	$(13,500 - 9,900) \times 2 \times (40%/90%) = 3,200$	4,400
Sub-Total				1,48,920
3. Addnl Profit				10,880

3. Decision: Both options are desirable since there is an Additional Net Income. Option 1 is slightly better than Option 2 by ₹120. However, it is suggested that the Firm should adopt a combination of both options in which case, the Total Additional Profit will be ₹11,000 + ₹10,880 = ₹21,880.

11(a). HRO Cycles Ltd has 2 divisions, A and B which manufacture bicycle. Division A produces the bicycle frame and Division B assembles rest of the bicycle on the frame. There is a market for both the sub-assembly and the final product. Each division has been treated as a profit center. The Transfer Price for the sub-assembly has been set at the long run average market price. The following data are available to each division -

Estimated Selling Price for Final Product	₹3,000 p.u.
Long-run Average Market Price for sub-assembly	₹2,000 p.u.
Incremental Costs of completion sub-assembly in Division B	₹1,500 p.u.
Incremental Costs in Division A	₹1,200 p.u.

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Required:

1. If Division A's maximum capacity is 1,000 units per month and sales to the intermediate market are now 800 units. Should 200 units be transferred to Division B at the long run average price basis?
2. What would be the Transfer Price, if the Manager of Division B should be kept motivated?
3. If outside market increases to 1,000 units, should Division A continue to transfer 200 units to Division B or sell entire production to outside market?

11(b). MNC Company assembles bicycles. This year's expected production is 10,000 units. MNC makes the Chains for Its bicycles. Its Accountant reports the following costs for making 10,000 Bicycle Chains-

Particulars	Costs per unit	Total for 10,000 units
Direct Materials	₹4.00	₹40,000
Direct Manufacturing Labour	₹2.00	₹20,000
Power and Utilities (variable)	₹1.50	₹15,000
Inspection, Set-Up and Materials Handling		₹2,000
Machine Rent		₹3,000
Allocated Fixed Costs of Plant Administration, Insurance, etc.		₹30,000
<b>Total Costs</b>		<b>₹1,10,000</b>

MNC received an offer from an outside vendor for the supply of any number of chains at ₹8.20 per Chain. The following additional information is available on MNC's operations -

- Inspection, Set-up and Materials Handling Costs vary with the number of batches in which the Chains are produced. MNC currently produces the Chains in batches of 1000 units. It estimates that 10 batches are required for meeting the expected production requirements.
- MNC rents the machine used to make the Chains. If it chooses to outsource the Chains, machine rent can be avoided.

Required:

1. Should MNC accept the Vendor's offer for 10,000 units? What is the net gain/ (loss)? What is the maximum price payable to the Vendor?
2. Suppose the Chains were purchased outside, the facilities where the Chains are currently made will be used to upgrade the bicycles by adding Mud Flaps and Reflectors. As a result, the Selling Price of the Bicycles can be increased marginally by ₹20. The Variable Costs of the upgrade would be 18 and additional Tooling Costs of ₹16,000 would be incurred. Should MNC make or buy the Chains, at the anticipated production level of 10,000 units? What is the maximum price payable to the Vendor in this situation?
3. MNC's Sales Manager is concerned that the estimate of 10,000 units may be high and believes that only 6,200 units can be sold. Production will be cut back, freeing up work facilities and space. This space can be used to add the Mud Flaps and Reflectors whether MNC outsources the Chains or makes them in-house. At this lower output, MNC will produce the chains in 8 batches of 775 units each. Should MNC purchase the Chains from the Outside Vendor?

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## Answer:11(a)

1. When External Sales = 800 units
  - (a) Since External Sales of Sub-Assembly by Division A is only 800 units, there is a spare capacity of 200 units, which does not involve any Opportunity Costs.
  - (b) Cost of Final Product from Company angle = Variable Costs of A + Variable Costs of B = ₹1,200 + ₹1,500 = ₹2,700 p.u. Since Final Selling Price (3,000) is above cost ₹2,700, there is a Net Contribution of ₹300 p.u. of the Final product. Hence, 200 units may be transferred by Division A.
2. Range of Transfer Prices will be as under -
  - (a) Minimum TP (from Divn A viewpoint) = Variable Costs only = ₹1,200.
  - (b) Maximum TP (from Divn B viewpoint) = Least of- (i) Market Price of Sub-Assembly [or] (ii) Ability to pay = ₹2,000 [or] (₹3,000 - ₹1,500) = ₹1,500.
  - (c) A Transfer Price in the range of ₹1,200 to ₹1,500 will be agreeable to both Managers.
  - (d) To keep the Manager of Division B motivated, the profit earned ₹300 per unit may be shared equally between the two Divisions. Hence, the appropriate Transfer Price for motivating Division B may be Variable Cost of Division A + 50% Share of Profit to be given to Division A = ₹1,200 + ₹150 = ₹1,350.
3. When External Sales = 1,000 units
  - (a) If External Sales by Division A increases to 1,000 units, Internal Transfer would involve Opportunity Costs. Hence Relevant Cost of Internal Transfer = Variable Costs ₹1,200 + Opportunity Costs ₹800 (being Contribution foregone on External Sales) = ₹2,000.
  - (b) Cost of Final Product from Company angle = Relevant Costs of A + Relevant Costs of B = ₹2,000 + ₹1,500 = ₹3,500 p.u. Since Final Selling Price (₹3,000) is below Relevant Cost (₹3,500), there is a Net Loss of ₹500 p.u. of the Final Product. Hence, Internal Transfers are not worthwhile. Division A has to sell the entire output of 1,000 units to the outside market only.

## Answer 11(b):

1. Computation of Relevant Costs of own production

Particulars	Nature and Computation	₹
Direct Materials	Variable and Relevant = ₹4 x 10,000 units	40,000
Direct Manufacturing labour	Variable and Relevant = 2 x 10,000 units	20,000
Power and Utilities	Variable and Relevant = 1.50 x 10,000 units	15,000
Inspection, Set up etc.	Batch Related Production Costs= Specific and Relevant (given)	2,000
Machine Rent	Specifically incurred =relevant	3,000
Fixed Costs	Allocated and Irrelevant	Nil
	<b>Total Relevant Costs for own production</b>	<b>80,000</b>

Average Relevant Cost per unit for own production = (₹80,000/10,000)= ₹8 per unit  
 Since Cost of Buying ₹8.20 p.u. is higher than Average Relevant Cost ₹8, own production is preferable. Hence, the Company should not accept the Vendor's offer.

Maximum Price Payable = Relevant Cost = ₹8.00 per unit.

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2. Effect of Alternative use of facilities:

Additional Benefit from upgradation = 10,000 units x (₹20 - 18)	=	₹20,000
Less: Fixed Costs incurred specifically	=	<u>₹16,000</u>
Net Additional Benefit	=	<u>₹4,000</u>

Since this benefit will be foregone due to own production of Chains, the relevant cost of own production will then be 80,000 (as per WN 1) + ₹4,000 (Opportunity Cost)= ₹84,000.

Average Relevant Cost per unit for own production=₹84,000/10,000 units= ₹8.40 per unit

Since Cost of Buying ₹8.20 p.u. is less than Average Relevant Cost ₹8.40, buying the chains is preferable now.

Maximum Price Payable = Relevant Cost = ₹8.40 per unit.

3. Computation of Relevant Costs of Own Production, with Revision in Production Estimates

Particulars	Nature and Computation	₹
Direct Materials	Variable and Relevant = ₹4 x 6,200 units	24,800
Direct Manufacturing labour	Variable and Relevant = ₹2 x 6,200 units	12,400
Power and Utilities	Variable and Relevant = ₹1.50 x 6,200 units	9,300
Inspection, Set up etc.	Batch Related Costs = (2,000 + 10 batches) x 8 batches	1,600
Machine Rent	Specifically incurred = relevant	3,000
Fixed Costs	Allocated and Irrelevant	Nil
<b>Total Relevant Costs for own production</b>		<b>₹51,100</b>

- Average Cost per unit for own production = (₹51,100/6,200 units)= ₹8.24 per unit
- Since Cost of Buying ₹8.20 p.u. is less than Average Relevant Cost ₹8.24, buying the chains is preferable.
- Maximum Price Payable = Relevant Cost = ₹8.24 per unit

12(a). A Company following Standard Marginal Costing system has the following Interim Trading Statement for the quarter ending 30<sup>th</sup> June, which reveals a loss off ₹17,000, detailed below-

<b>Income:</b>		
Sales	4,99,200	
Closing Stock (at Prime Cost)	18,000	5,17,200
<b>Costs:</b>		
Direct Material	1,68,000	
Direct Labour	1,05,000	
Variable Overhead	42,000	3,15,000
Fixed Overhead	1,20,000	
Fixed Administration OH	40,000	
Variable Distribution OH	19,200	
Fixed Selling OH	40,000	2,19,200
<b>Total Costs</b>		<b>5,34,200</b>
<b>Loss</b>		<b>17000</b>

Additional Information is as follows:

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1. Sales for the quarter were 1,200 units. Production was 1,400 units, of which 100 units were scrapped after complete manufacture. The factory capacity is estimated at 2,000 units.
2. Because of low production, Labour Efficiency during the quarter is estimated to be 20% below normal level. You are required to analyse the above and report to the Management, giving the reasons for the loss.

12(b). The standard cost sheet of XYZ Ltd. based on the normal output of 30,000 units for a quarter is as under-

Direct Materials	4 kg at ₹2 per kg	₹8
Direct Wages	6 hours at ₹4 per hour	₹24
Overheads	50% of Direct Wages	₹12
Standard Profit		₹6
Selling Price		₹50

The Budgeted Fixed OH is ₹1,44,000 per quarter and it is included in the Overhead Costs given above.

On the basis of the budgeted activity of 36,000 units, the Company estimated its Q-2 profit as under-

	₹
Direct Materials	2,88,000
Direct Wages	8,64,000
Overheads	4,32,000
Total Costs	15,84,000
Profit (balancing figure)	2,16,000
Sales	18,00,000

"The cost records revealed the following actual data for the second quarter of the year - Production was 25,000 units. Direct Materials consumed 96,000 kg at ₹2.25 per kg. Direct Wages paid 1,60,000 hours at ₹4.10 per hour, out of which 6,000 hours being idle time were not recorded on production. Overheads were ₹3,32,000 out of which ₹1,50,000 were fixed. 25,000 units were sold at an Average Price of ₹51.50 per unit.

Required -

1. Prepare a statement of Actual Profit/Loss for Q-2.
2. Analyse the variances and present an Operating Statement reconciling the Budgeted Profit with Actual Profit.

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Answer:12(a)

1. Analysis of the Profit and Loss Account to compute Standards

Particulars	Total(₹)	Standards Per Unit
Sales	4,99,200	$\text{₹}4,99,200 / 1,200 \text{ units} = \text{₹}416$
Less: Cost of Production:		
Materials	1,68,000	$1,68,000 / 1,400 \text{ units} = \text{₹}120$
Labour Cost (at 20% below normal level)	1,05,000	$(1,05,000 \times 80\%) / 1,400 \text{ units} = 60$
VOH(at 20% below normal efficiency)	42,000	$(42,000 \times 80\%) / 1,400 \text{ units} = 24$
Less: Closing Stock (120 + 60) × 100 units	(18,000)	(see Note)
Gross Contribution	2,02,200	$\text{₹}212$
Less: Variable Distribution OH	19,200	$19,200 / 1,200 \text{ units} = \text{₹}16$
Net Contribution	1,83,000	$\text{₹}196$
Less: Fixed Costs(1,20,000 + 40,000 + 40,000)	2,00,000	
Loss	(17,000)	
Note: Production 1,400 units - Sales 1,200 units - Scrapped 100 units = 100 units		

2. Assumptions /Working Notes in analyzing Variances

(a) Sales Variances: Budgeted Capacity = 2,000 units is taken as Budgeted Sales Quantity. Also, it is assumed that

Budgeted Sale Price = Actual Sale Price = ₹416 per unit.

- Sales Price Variance = Nil.
- Sales Volume Variance (Effect on Contribution)  
= (2,000 units- 1,200 units) × 196 = ₹1,56,800A

(b) Material Cost Variances: In the absence of information, Material Cost Variances = Nil.

(c) Labour Cost Variances:

- Labour Rate Variance = Nil.
- Labour Efficiency Variance = 1,05,000 × 20% Efficiency Loss = ₹21,000A

(d) Variable OH Cost Variances:

- VOH Expenditure Variance = Nil.
- VOH Efficiency Variance = 42,000 × 20% Efficiency Loss = ₹8,400A.

(e) FOH Cost Variances: In the absence of information, FOH Cost Variances = Nil.

(f) Effect of Abnormal Loss: Variable Cost of Output scrapped after complete manufacture = (120 + 60 + 24) = 204 × 100 units = ₹20,400A.

(g) Stock Valuation Effect: Since Marginal Costing System in use, the inventories are to be carried at total variable cost. However, since the Company has valued its inventories on Prime Cost basis, i.e. excluding VOH, to that extent, profits will be under--stated. Hence, effect of VOH not included in Stock Valuation = 24 × 100 units = ₹2,400A.

3. Explanation of factors causing Loss during the period

Particulars	₹	₹
Budgeted Contribution for 2,000 units at ₹196	3,92,000	
Less: Budgeted Fixed Costs (1,20,000 + 40,000 + 40,000)	2,00,000	



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Budgeted Profit		1,92,000
Less: Effect of Variances		
Sales Volume Variance	1,56,800A	
Labour Efficiency Variance	21,000A	
VOH Efficiency Variance	8400A	
Abnormal/Loss I Scrap	20,400A	
Stock Valuation Difference	2,400A	(2,09,000)
Loss for the period		(17,000)

Alternative treatment: In the above calculations, Labour Efficiency has been taken to have an impact on VOH, i.e. time related OH also. If such impact is not considered in VOH, Standard Contribution; per unit will be ₹196 (instead of ₹190). All calculations will stand modified accordingly.

**Answer: 12(b)**

### 1. Statement of Actual Profit for Q - 2

Particulars	Computation	₹	₹
Sales	25,000 units at 51.50 per unit		12,87,500
Less: Materials	96,000 kg at ₹2.25 per kg	2,16,000	
Labour	1,60,000 hours at ₹4.10 per hour	6,56,000	
Variable OH	{3,32,000 - 1,50,000}	1,82,000	
Fixed OH	Given	1,50,000	12,04,000
Actual profit			83,500

### 2. Sales Variances (Total Approach)

Col.(1):BQ × BP	Col.(2):AQ × BP	Col.(3):AQ × AP
36,000 uts × 50 = ₹18,00,000	25,000 uts × 50 = ₹12,50,000	25,000 uts × 51.50 = ₹12,87,500
Sales Volume Variance + Sales Price Variance		
=18,00,000 - 12,50,000 = 5,50,000A		= 12,50,000 - 12,87,500 = 37,500F
Total Sales Variance = 18,00,000 – 12,87,500 = ₹5,12,500A		

### 3. Materials Variances (Total Approach)

Col.(1):SQ × SP	Col.(2):AQ × SP	Col.(3):AQ × AP
(25,000 × 4) × 2 = ₹2,00,000	96,000 kg × 2 = ₹1,92,000	96,000 kg × 2.25 = ₹2,16,000
Usage Variance + Price Variance		
=2,00,000- 1,92,000 = ₹8,000 F		=1,92,000 - 2,16,000 = ₹24,000 A
Total Material Cost Variance = 2,00,000 – 2,16,000 = ₹16,000		

Note: Since there is a difference between Normal capacity and Budgeted Capacity, and absorption is based on the Normal Output, Reconciliation is done only under

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Absorption Costing. NP Ratio = Profit = ₹6/₹50 = 12%

Under Absorption Costing Approach, Effect on Profit due to Sales Volume = Net Profit foregone = SW × Budgeted NP Ratio = 5,50,000 A × 12% = ₹66,000 A.

### 4. Labour Variances

Col.(1): SH × SR (25,000 uts x 6 hrs) x 4 = 6,00,000	Col.(2): Net AH × SR (1,60,000- 6,000) hrs × 4 = 6,16,000	Col.(3): Total AH × SR 1,60,000 hrs x 4 = 6,40,000	Col.(4): AH × AR 1,60,000 hrs x 4.10 = 6,56,000
Labour Net Efficiency Variance	Labour Idle Time Variance	Labour Rate Variance	
= 6,00,000- 6,16,000 = ₹16,000A	+ = 6,16,000- 6,40,000 = ₹24,000A	+ = 6,40,000 – 6,56,000 = ₹16,000A	
Total Labour Cost Variance = 6,00,000 – 6,56,000 = ₹56,000A			

### 5. Analysis of VOH and FOH

Total OH = ₹12 × 30,000 units = 3,60,000. This is analysed for the following computations-

Particulars	Fixed OH	Variable OH
(a) Amount of OH	(given) 1,44,000	3,60,000- 1,44,000 = 2,16,000
(b) Budgeted Output (Normal capacity)	30,000 units	30,000 units
(c) OH Rate per unit (a ÷ b)	₹4.80 per unit	₹7.20 per unit
(d) Budgeted Hours	30,000 units x 6 = 1,80,000 hours	30,000 units x 6 = 1,80,000 hrs
(e) OH Rate per hour (a ÷ d)	0.80 per hour	1.20 per hour

### 6. VOH Variances

Col.(1): SH x SR (25,000 uts x 6 hrs) x 1.20 = ₹1,80,000	Col.(2): Net AH x SR (1,60,000 - 6,00) hrs x 1.20 = ₹1,84,800	Col.(3): Total AH x SR 1,60,000 hrs x 1.20 = ₹1,92,000	Col.(4): AVOH (Given) ₹1,82,000
VOH Net Efficiency Variance + VOH Idle Time Variance + VOH Expenditure Variance			
= 1,80,000-1,84,000 = ₹4,800A	= 1,84,800-1,92,000 = ₹7,200A	= 1,92,000 – 1,82,000 = ₹10,000F	
Total VOH Cost Variance = 1,80,000 - 1,82,000 = ₹2,000A			

### 7. FOH Variances

Col. (1): AO x SR 25,000 uts x 4.80 = ₹1,20,000	Col. (2): Net AH x SR (1,60,000 - 600) hrs x 0.80 = ₹1,23,200	Col. (3): Total AH x SR 1,60,000 hrs x 0.80 = ₹1,28,000	Col. (4): BFOH (given) ₹1,44,000	Col.(5): AFOH (given) ₹1,50,000
Net Efficiency Variance + Idle Time Variance + Capacity Variance + Expenditure Variance				
= 1,20,000 - 1,23,200 = ₹ 3,200 A	= 1,23,200 - 1,28,000 = ₹4,800 A	= 1,28,000 - 1,44,000 = ₹16,000 A	= 1,44,000 - 1,50,000 = ₹6,000 A	
Volume Variance = 1,20,000 - 1,44,000 = 24,000 A + Expenditu Variance b/fd as above = 6,000 A				

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Total FOH Cost Variance = 1,20,000 - 1,50,000 = ₹30,000 A

8. Operating Statement / Reconciliation Statement (in ₹):

Particulars	Method 2: Absorption Costing Approach
Budgeted Profit	36,000 units × 6 = 2,16,000
Effect of Sales Variances	
+/- Sales Volume Variance Effect on Profit	5,50,000 A × NP Ratio 12% = (66,000)
Sales Price Variance	37,500
Effect of Cost Variances	
+/- Material Variances Usage	8,000
Price	(24,000)
Labour Variances Net Efficiency	(16,000)
Idle Time	(24,000)
Rate	(16,000)
VOH Variances Net Efficiency	(4,800)
Idle Time	(7,200)
Expenditure	10,000
FOH Variances Net Efficiency	(3,200)
Idle Time	(4,800)
Capacity	(16,000)
Expenditure	(6,000)
<b>Actual Profit</b>	<b>83,500</b>

Note: Budgeted Profit ± Sales Volume Variance impact on Profit, i.e. ₹2,16,000 - ₹66,000 Adv. = ₹1,50,000, is called Standard Profit on Actual Sales, i.e. 25,000 units at ₹6 per unit.

13. ABG & Co. provides you with following data:

Total overhead	₹ 30,10,500	
Total Machine hrs.	2,23,000	
Production :		
Product L	10,000 units	
Product M	3,000 units	
Product N	2,10,000 units	
	Direct cost per unit (₹)	Selling price per unit (₹)
Product L	20	₹50
Product M	20	45
Product N	9	45

Mr Krishnan is the Cost Accountant of this firm and he says that profit of this company is ₹38,74,500. The overhead has been distributed at the rate of ₹13.50 per machine hour and each unit produced in the company is presumed to have used one machine hour. Mr Krishnan has reported that all the units are profit-making.

Mr. Srinivasan is Director Finance of ABG & Co. He is a dynamic personality and is eager to find out ways to improve profit. He wants to implement Activity based Costing. With this objective in mind he has given a project to Mr Gupta to introduce ABC system. Mr. Gupta has held numerous interviews and surveys. He has gathered the following information:

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(i) The overhead is caused by following activities.

(a) Set-up	..... 1,37,600 set-ups to be charged at the rate of ₹10 per set-up.	₹13,76,000
(b) Machining	..... 51,800 machine hours to be charged @ ₹15 per machine hours	₹7,77,000
(c) Engineering	24, 750 engineering hrs. to be charged@ ₹20 per hour	₹4,95,000
(d) Organisation costs cannot be linked with products		₹3,62,500
		₹30,10,500

(ii) Based on the basis of factory records Mr. Gupta has established that activities have been assigned to different products as follows:

	Set-up (hrs.)	Machining (hrs.)	Engineering (hrs.)
Product L	8,000	6,000	1 , 500
Product M	3,600	3,800	2,250
Product N	1,26,000	42,000	21,000
	1,37,600	51,800	24,750

Mr Gupta has recently left the organisation and Mr Srinivasan, who was keeping an overall watch over the project is very hopeful of the validity of the data. He expects you to answer following questions:

- (i) What are the profits made by different products, when conventional costing method of overhead distribution is used and overall profit is ₹ 38,74,500 ?
- (ii) (a) What will be the profit of different products, if ABC costing is used presuming that work done by Mr Gupta is quite reliable ?  
 (b) Can we discontinue any product, if discontinuing a loss-making product does not harm the organisation otherwise? What will be increase in profit, if loss-making product is discontinued?  
 (c) Reasons for difference in results shown by conventional costing and Activity-based Costing System.

Answer: 13

### Product-wise profit position using conventional costing (i.e.,overhead rate per machine hour)

	Product L (10,000 units)		Product M (3,000 units)		Product N (2,10,000 units)		Total
	Per Unit	Total	Per Unit	Total	Per Unit	Total	
Product Revenue	50.00	5,00,000	45.00	1,35,000	40.00	84,00,000	90,35,000
Product Costs:							
Direct	20.00	2,00,000	20.00	60,000	9.00	18,90,000	
Overhead@ ₹13.50 per unit	13.50	1,35,000	13.50	40,500	13.50	28,35,000	51,60,500
Total	33.50	3,35,000	33.50	1,00,500	22.50	47,25,000	
		1,65,000		34,500		36,75,000	38,74,500

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(ii)(a) Product-wise profit position using Activity-based Costing System

	Product L (10,000 units)		Product M (3,000 units)		Product N (2,10,000 units)		Total
	Per unit	Total	Per unit	Total	Per unit	Total	
Product Revenue	50	5,00,000	45	1,35,000	40	84,00,000	90,35,000
Product Cost : Direct	20	2,00,000	20	60,000	9	18,90,000	
Overhead charge for different activities Set-up(Refer to note)	8	80,000	12	36,000	6	12,60,000	
Machining (Refer to note 2)	9	90,000	19	57,000	3	6,30,000	
Engineering: (Refer to note 3)	3	30,000	15	45,000	2	4,20,000	
Total	40	<u>4,00,000</u>	66	<u>1,98,000</u>	20	<u>42,00,000</u>	<u>47,98,000</u>
Product line income/loss		<u>1,00,000</u>		<u>(63,000)</u>			42,37,000
Organisational Costs							<u>3,62,500</u>
							<u>38,74,500</u>

(b) From the table given above it is apparent that product M can be discontinued, because it is a loss-making product. The suggestion is based on the presumption that there will not be adverse consequences of this decision otherwise. The total profit will increase by ₹60,000, if product M is discontinued.

(c) Reasons for difference

The overhead distribution was not based on activity consumption in conventional costing. Due to this reason product N's position was poorly shown. Product M was shown as making profit whereas it in making loss of ₹60,000. Even position of product L was not properly shown. It is making a profit of ₹1,00,000, whereas in conventional costing, it was shown making a profit of ₹1,65,000. Illogical overhead distribution was the main reason for distorted results.

Working Notes

1. Set- Up	Product L	8,000 x ₹10	₹ 80,000
	Product M	3,600 x 10	36,000
	Product N	1,26,000 x 10	<u>12,60,000</u>
			<u>13,76,000</u>
2. Machining	Product L	6,000 x ₹15	₹90,000
	Product M	3,800 x 15	57,000
	Product N	42,000 x 15	<u>6,30,000</u>
			<u>7,77,000</u>
3. Engineering	Product L	1,500 x ₹20	₹30,000
	Product M	2,250 x 20	45,000
	Product N	21,000 x 20	<u>4,20,000</u>
			<u>4,95,000</u>

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- 14 (i) As a Cost Accountant, you decide to experiment by applying the principles of ABC to the four products currently made and sold by your company. Details of the four products and relevant information are given below for one period:

Product	A	B	C	D
Output in units	120	100	80	120
Costs per units:				
Direct material (₹)	40	50	30	60
Direct labour (₹)	28	21	14	21
Machine hours (per unit)	4	3	2	3

The four products are similar and are usually produced in production runs of 20 units and sold in batches of 10 units.

The production overhead is currently absorbed by using a machine hour rate, and the total of the production overhead for the period has been analysed as follows :

Machine department costs (rent, business, rates, depreciation and supervision) ₹10,430

Set-up costs	₹5,250
Stores receiving	₹3,600
Inspection/Quality control	₹2,100
Materials handling and dispatch	₹4,620

You have ascertained that the 'cost drivers' to be used are as listed below for the overhead costs shown:

Cost	Cost Driver
Set-up costs	Number of production runs
Stores receiving	Requisitions raised
Inspection/Quality control	Number of production runs
Materials handling and dispatch	Orders executed

The number of requisitions raised on the stores, was 20 for each product and the number of orders executed as 42, each order being for a batch of 10 of a product.

You are required:

- to calculate the total costs for each product if all overhead costs are absorbed on a machine hour basis.
- to calculate the total costs for each product, using activity - based costing.
- to calculate and list the unit product costs from your figures in (a) and (b) above, to show the difference and to comment briefly on any conclusions which may be drawn which could have pricing and profit implications.

- 14(ii). AXE Ltd wants to implement a JIT Programme, with the impact on the three types of Stocks as given below. Find out the Cost Savings to the Company, due to implementation of JIT with the following Information-

Particulars	Present Situation, i.e. before JIT	After JIT
Sales Value	₹ 12,00,00,000	Same as present
Percentage of Costs to Sales Value	Materials 40%, Conversion 30%	Materials 44%, Conversion 32%
Stockholding	Raw Materials: 1 month WIP: 0.5 month Finished Goods: 0.5 month	Raw Materials: 25% less than present WIP: 50% less than present Finished Goods: 40% less than present
Percentage of	Materials 90%,	Materials 90%,

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Completion of WIP	Conversion 75%	Conversion 75%
Stock-related Costs are as under -		
Raw Materials		
Fixed	₹2,00,000	15% less than present
Variable	₹0.09 per Rupee of Stock held	₹0.05 per Rupee of Stock held
WIP		
Fixed	₹3,00,000	20% less than present
Variable	₹ 0.04 per Rupee of Stock held	₹0.02 per Rupee of Stock held
Finished Goods		
Fixed	₹2,50,000	40% less than present
Variable	₹0.02 per Rupee of Stock held	₹0.01 per Rupee of Stock held

Financial Charges due to Impact of stockholding on working capital requirement = 18% per annum on the value of stocks held.

Answer: 14 (i)

- (a) Statement showing total cost of different products, assuming absorption of overhead on a machine hour basis:

	Product A	Product B	Product C	Product D
Direct material	40	50	30	60
Direct labour	28	21	14	21
Overhead*	80	60	40	60
Cost of production per unit	148	131	84	141
Output in units	120	100	80	120
Total cost (₹)	17,760	13,100	6,720	16,920

\*Rate per machine hr. = 26,000/1300hrs = ₹20;

Machine hours = 480 + 300 + 160 + 360 = 1,300

- (b)

Cost	₹	Drivers	No.	Cost/unit of Driver
Set-ups	5,250	Prod. Runs	21*	₹250
Stores/receiving	3,600	Requisitions	80@	45
Inspection/quality	2,100	Prod. Runs	21	100
Handling/dispatch	4,620	Orders	42	110

\* Production runs = (120 + 20) + (100 + 20) + (80 + 20) + (120 + 20)

@ Requisitions = 20 for each product or 80 in total.

It may be pointed out that machine department cost of ₹10,430 will continue to be absorbed on a machine hour basis as before. The relevant absorption rate will be ₹10,430 ÷ 1,300 = ₹8.02 per machine hour.

	Total Cost (₹)			
	A	B	C	D
Direct material	4,800	5,000	2,400	7,200
Direct labour	3,360	2,100	1,120	2,520
Set-ups	1,500	1,250	1,000	1,500
Stores/receiving	900	900	900	900
Inspection/ quality	600	500	400	600

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Handling/ dispatch	1,320	1,100	880	1,320
Machine deptt. costs	<u>3,851</u>	<u>2,407</u>	<u>1,284</u>	<u>2,888</u>
	<u>16,331</u>	<u>13,257</u>	<u>7,984</u>	<u>16,928</u>
Cost per unit	136.09	132.57	99.80	141.07
(c) Cost per unit (a)	148.00	131.00	84.00	141.00
Cost per unit (b)	<u>136.09</u>	<u>132.57</u>	<u>99.80</u>	<u>141.07</u>
Difference	(11.91)	1.57	15.80	0.07

The total overheads which are spread over the four products have been apportioned on different bases, causing the product cost to differ substantially in respect of products A and C. A change from traditional machine hour rate to an activity-based system may have effect on:

- (i) Pricing and profits to the extent that pricing is based on a 'cost-plus' approach
- (ii) Reported profits to the extent that stock levels fluctuate between reporting periods.

### Answer 14(ii):

Particulars	Before JIT Programme		After JIT Programme	
	Computation	₹	Computation	₹
1. Sales Value		12,00,00,000	Given	12,00,00,000
2. Raw Material Stock	12,00,00,000x40% RM Cost x 1/12 Stockholding	40,00,000	(12,00,00,000× 44% RM Cost x1/12 Stockholding) less 25%	33,00,000
3. RM Related Costs				
Fixed	Given	2,00,000	₹2,00,000 less 15%	1,70,000
Variable	₹40,00,000 × ₹0.09	3,60,000	₹33,00,000 × 0.05	1,65,000
Interest	₹40,00,000 × 18%	7,20,000	₹33,00,000 × 18%	5,94,000
Sub-Total		12,80,000		9,29,000
			Cost Saved = ₹3,51,000	
4. WIP Stock (Note)	12,00,00,000× 58.5% WIP Cost x 0.5/12 Stockholding	29,25,000	12,00,00,000x63.6% WIP Cost × 0.5/12 Stockholding × 50%	15,90,000
5. WIP Related Costs				
Fixed	Given	3,00,000	3,00,000 less 20%	2,40,000
Variable	₹29,25,000 × 0.04	1,17,000	15,90,000 × ₹0.02	31,800
Interest	29,25,000 × 18%	5,26,000	22,80,000 × 18%	2,86,000
Sub-Total		9,43,000		5,58,000
			Cost Saved = ₹3,85,000	
6. Finished Goods Stock	12,00,00,000x70% FG Cost × 0.5/12 Stockholding	35,00,000	12,00,00,000 × 76% FG Cost × 0.5/12 Stock holding × 60%	22,80,000



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7.FG Related Costs				
Fixed	Given	2,50,000	₹2,50,000 less 40%	1,50,000
Variable	$₹35,00,000 \times 0.02$	70,000	$₹22,80,000 \times 0.01$	22,800
Interest	$35,00,000 \times 18\%$	6,30,000	$₹22,80,000 \times 18\%$	4,10,400
		9,50,000		5,83,200
			Cost Saved = 3,66,800	

Note: WIP Cost is computed as under -

Before: (Materials 90% Complete  $\times$  40%) + (Conversion 75% Complete  $\times$  30%)  
 $= 36\% + 22.5\% = 58.5\%$  on Sales.

After: (Materials 90% Complete  $\times$  44%) + (Conversion 75% Complete  $\times$  32%)  
 $= 39.6\% + 24\% = 63.6\%$  on Sales.

Total Cost Savings = ₹3,51,000 + ₹3,85,500 + ₹3,66,800 = ₹11,03,300

**15(a).A Company manufactures a single product, which requires two components. The Company purchases one of the components from two Suppliers: A Ltd and B Ltd.**

The price quoted by A Ltd is ₹180 per hundred units of the component and it is found that on an average 3% of the total receipt from this Supplier is defective. The corresponding quotation from B Ltd is ₹174 per hundred units, but the defective would go up to 5%. If the defectives are not detected, they are utilized in production causing a damage of ₹180 per 100 units of the component.

The Company Intends to introduce a system of inspection for the components on receipt. The Inspection cost is estimated at ₹24 per 100 units of the component. Such an inspection will be able to detect only 90% of the defective components received. No payment will be made for components found to be defective In Inspection.

Required:

1. Advise whether Inspection at the point of receipt is justified?
2. Which of the Suppliers should be asked to supply? Assume total requirement is 10,000 units of the component.

**15 (b) Describe some business situation where Pareto Analysis can be applied.**

**Answer: 15(a)**

1. Computation of Cost per 100 units of good components without Inspection

Particulars	A Ltd	B Ltd
(a) Purchase Price	$₹180 \times 10,000/100 = ₹18,000$	$₹174 \times 10,000/100 = 17,400$
(b) Production Damage	$(18,000 \times 3\%) = 540$	$(17,400 \times 5\%) = 870$
(c) Total Costs (a + b)	₹18,540	₹18,270
(d) Number of good components	$(10,000 - 300) = 9,700$ units	$10,000 - 500 = 9,500$ units
(e) Cost per 100 good components (c $\div$ d)	$₹18,540/9,700$ units $\times$ 100 =191.13	$₹18,270/9,500$ units $\times$ 100 =192.31

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### 2. Computation of Cost per 100 units of good components with Inspection

Particulars	A Ltd	B Ltd
(a) Total Units Required	10,000 units	10,000 units
(b) Defective Units	3% of 10,000 = 300 units	5% of 10,000 = 500 units
(c) Defectives not detected (10%)	30 units	50 units
(d) Defectives Detected	270 units	450 units
(e) Components paid for (a-d)	9,730 units	9,550 units
(f) Purchase Price	$(9,730 \times 180) \div 100$ = ₹17,514	$(9,550 \times 174) \div 100$ = 16,617
(g) Inspection Cost	$(10,000 \times 24) \div 100 =$ ₹2,400	$(10,000 \times 24) \div 100 = 2,400$
(h) Production Damage	$(30 \times 180) \div 100 = ₹54$	$(50 \times 174) \div 100 = 87$
(i) Total Costs (f + g + h)	₹19,968	₹19,104
(j) Cost per 100 good components	$(₹19,968/9,700\text{units})$ $\times 100 = ₹205.86$	$(₹19,104/9,500\text{units})$ $\times 100 = ₹201.09$

#### Conclusion:

- Inspection at the point of receipt is not advantageous, due to additional cost per 100 good components, i.e.  $(₹205.86 - ₹191.13) = ₹14.73$  in case of A Ltd, and  $(₹201.09 - ₹192.31) = ₹8.78$  in case of B Ltd.
- Purchase from A Ltd is cheaper, as there is cost saving of ₹1.18 per 100 good components.

#### Answer: 15(b)

Pareto analysis may be applicable in the presentation of Performance indicators data through selection of representative process characteristics that truly determine or directly or indirectly influence or conform the desired quality or performance result or outcome. The Pareto Analysis is generally applicable to the following business situations:

##### (i) Pricing of a product:

- In the case of a firm dealing with multi products, it would not be possible for it to analyse cost-profit- price -volume relationships for all of them. In practice, in case of such firm approximately 20% of products may account for about 80% of total sales revenue. Pareto Analysis is used for analysing the firm estimated sales revenues from various products and it might indicate that approximately 80% of its total sales revenue is earned from about 20% of its products.
- Such analysis helps the top management to delegate the pricing decision for approximately 80% of its products to the lower levels of management, thus freeing themselves to concentrate on the pricing decisions for products approximately 20% which are essential for the company's survival.
- Thus, a firm can adopt more sophisticated pricing methods for small proportion of products that jointly accounts for approximately 80% of total sales revenue. For

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the remaining 80% of the products which account for 20% of total sales revenue the firm may use cost based pricing method.

- (ii) Customer Profitability analysis:
  - Instead of analysing products, customers can be analysed for their relative profitability to the organisation.
  - Again it is often found that approximately 20% of customers generate 80% of the profit. There will always be some customers who are less profitable than others, just as some products are less profitable than others.
  - Such an analysis is useful tool for evaluation of the portfolio of customer profile and decision making such as whether to continue serving a same customer group, what is the extent of promotion expenses to be incurred.
- (iii) ABC analysis- Stock Control: Another application of Pareto analysis is in stock control where it may be found that only a few of the goods in stock make up most of the value. In practice approximately 20% of the total quantity of stock may account for about 80% of its value. The outcome of such analysis is that by concentrating on small proportion of stock items that jointly accounts for 80% of the total value, a firm may well be able to control most of monetary investment in stocks.
- (iv) Application in Activity Based Costing: in activity Based costing it is often said that 20% of an organisation cost drivers are responsible for 80% of the total cost. By analysing, monitoring and controlling those cost drivers that cause most cost, a better control and understanding of overheads will be obtained.
- (v) Quality Control:
  - Pareto analysis seeks to discover from an analysis of defect report or customer complaints which "vital few" causes are responsible for most of the reported problems.
  - Often, 80% of reported problems can usually be traced to 20% of the various underlying causes. By concentrating once efforts on rectifying the vital 20%, one can have the greatest immediate impact on product quality.
  - The Pareto Analysis indicates how frequently each type of failure (defect) occurs. The purpose of the analysis is to direct management attention to the area where the best returns can be achieved by solving most of quality problems, perhaps just with a single action.

## 16. Short Notes on:

- (a) Advantages of Uniform costing
- (b) Traditional vs. Activity Based Costing
- (c) Reasons for the Implementation of ERP by Companies
- (d) Types of Benchmarking
- (e) Six Sigma process in Quality Control

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Answer:

**(a) Advantages of Uniform costing:**

Main advantages of a Uniform Costing System are summarised below:

- (i) It provides comparative information to the members of the organisation / association which may by them to reduce or eliminate the evil effects of competition and unnecessary expenses arising from competition.
- (ii) It enables the industry to submit the statutory bodies reliable and accurate data which might be required to regulate pricing policy or for other purposes.
- (iii) It enables the member concerns to compare their own cost data with that of the others detect the weakness and to take corrective steps for improvement in efficiency.
- (iv) The benefits of research and development can be passed on the smaller members of the association lead to economy of the industry as a whole.
- (v) It provides all valuable features of sound cost accounting such as valued and efficiency of the workers, machines, methods, etc., current reports of comparing major cost items with the predetermined standards, etc.
- (vi) It serves as a prerequisite to Cost Audit and inter firm comparison.
- (vii) Uniform Costing is a useful tool for management control. Performance of individual units can be measured against norms set for the industry as a whole.
- (viii) It avoids cut-throat completion by ensuring that competition among member units proceeds on healthy lines.
- (ix) The process of pricing policy becomes easier when Uniform Costing is adopted.
- (x) By showing the one best way of doing things, Uniform Costing creates cost consciousness and provides the best system of cost control and cost presentation in the entire industry.
- (xi) Uniform costing simplifies the work of wage boards set up to fix minimum wages and fair wages for an industry.

**(b) Traditional vs. Activity Based Costing**

Activity-Based costing (ABC) is a system that focuses on activities as the fundamental cost objects and uses the cost of these activities for computing the costs of products. There are several reasons why managers are preferring ABC to traditional system.

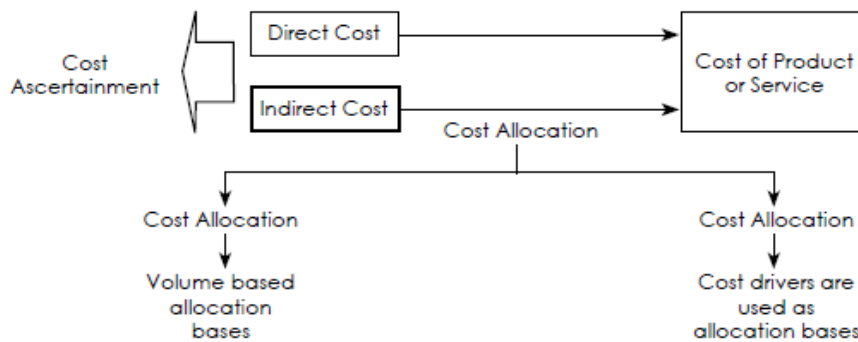
- (i) In the traditional system cost analysis is done by product. In ABC managers focus attention on activities rather than products because activities in various departments may be combined and costs of similar activities ascertained, e.g. quality control, handling of materials, repairs to machines etc. If detailed costs are kept by activities, the total company costs for each activity can be obtained, analysed, planned and controlled.
- (ii) Managers manage activities and not products. Changes in activities lead to changes in costs. Therefore, if the activities are managed well, costs will fall and resulting products will be more competitive.
- (iii) Allocating overhead cost to production based on a single cost driver (allocation base, such as unit basis, percentage of material, percentage of prime cost, labour hour rate, machine hour rate etc.) can result in an unrealistic product cost

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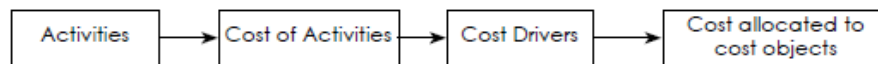
because the traditional system fails to capture cause-and-effect relationships. To manage activities better and to make wiser economic decisions, managers need to identify the relationships of causes (activities) and effects (costs) in a more detailed and accurate manner.

- (iv) ABC highlights problem areas that deserve management's attention and more detailed analysis. Many actions are possible, on pricing, on process technology, on product design, on operational movements and on product mix.

Traditional costing can lead to undercosting or overcosting of products or services. Over or under costing of products distorts cost information. A poor quality of cost information causes management to make poor decisions for pricing, product emphasis, make or buy etc. ABC differs from the traditional system only in respect of allocations of overheads or indirect costs. Direct costs are identified with, or assigned to, the cost object, in the same manner as is done in case of traditional costing system. Overhead costs are linked to the cost objects based on activities. This is shown in the following figure:



The following figure explains the entire process of cost allocation under ABC.



## (c) Reasons for the Implementation of ERP by Companies

- (i) Improve a company's business performance: ERP automates the tasks involved in performing a business process – such as order fulfillment which involves taking an order from a customer, shipping it and billing for it. With ERP, when a customer service representative takes an order from a customer, he or she has all the information necessary to complete the order (the customer's credit rating and order history, the company's inventory levels and the shipping dock's trucking schedule). Everyone else in the company sees the same computer screen and has access to the single database that holds the customer's new order. When one departments finishes with the order it automatically routed via the ERP system to the next department. To find out where the order is at any point, one need only to log into the ERP system and track it down. With luck, the order process moves like a bolt of lightning through the organisation, and customers get their orders faster and with fewer errors than before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting.
- (ii) Standardize manufacturing processes: manufacturing companies --- especially those with an appetite for mergers and acquisitions --- often find that multiple business units across the company make the same widget using different methods and computer systems, standardizing those processes and using a single,

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integrated computer system can save time, increase productivity & reduce headcount.

- (iii) Integrate financial data: as the CEO tries to understand the company's overall performance, he or she may find many different versions of the truth. Finance has its own set of revenue numbers, sales has another version, and the different business units may each have their own versions of how much they contributed to revenues. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.
- (iv) To standardise HR information : Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employee time and communicating with them about benefits and services. ERP can fix that.
- (v) Reduction in cycle time: cycle time is the time between receipt of the order and delivery of the product. ERP systems are helpful in both make-to-order and make-to-stock situations. In both cases, cycle time can be reduced by the ERP systems, but the reduction will be more in the case of make-to-order systems. ERP packages go a long way in reducing the cycle times due to automation achieved in material procurement, production planning and the efficiency achieved through the plant maintenance and production systems of the ERP packages.
- (vi) Improved Resource Utilization: as manufacturing processes become more sophisticated and as the philosophies of elimination of waste and constraint management achieve broader acceptance, manufacturer place increased emphasis upon planning and controlling capacity. The capacity planning feature of ERP systems offer both rough-cut and detailed capacity planning. The system loads each resource with production requirements from master Production scheduling, materials requirements Planning and shop floor Control. The ERP systems have simulation capabilities that help the capacity and resource planners to simulate the various capacity and resource utilization scenarios and choose the best option. The ERP systems help the organisation in drastically improving the capacity and resource utilization.
- (vii) Better Customer Satisfaction: Customer satisfaction means meeting or exceeding customer's requirements for a product or service. The customer could get technical support by either accessing the company's technical support knowledge base (help desk) or by calling the technical support. Since all the details of the product and the customer are available to the person at the technical support department, the company will be able to better support the customer. All this is possible because of use of latest developments in information technology by the ERP systems.
- (viii) Improved Supplier Performance: the quality of the raw materials or components and the capability of the vendor to deliver them ontime are of critical importance for the success of any organisation. For this reason, an organisation chooses its suppliers or vendors very carefully and monitor their activities very closely. To realise these benefits, corporations rely heavily on supplier management and control systems to help, plan, manage and control the complex processes associated with global supplier partnerships.

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(d) **Types of Benchmarking:** The different types of Benchmarking are:

- (i) **Product Benchmarking (Reverse Engineering):** is an age old practice of product oriented reverse engineering. Every organization buys its rival's products and tears down to find out how the features and performances etc., compare with its products. This could be the starting point for improvement.
- (ii) **Competitive Benchmarking:** this has moved beyond product-oriented comparisons to include comparisons of process with those of competitors. In this type, the process studied may include marketing, finance, HR, R&D etc.,
- (iii) **Process Benchmarking:** is the activity of measuring discrete performance and functionality against organization through performance in excellent analogous business process e.g. for supply chain management – the best practice would be that of Mumbai dubbawallas.
- (iv) **Internal Benchmarking:** is an application of process benchmarking, within an organization by comparing the performance of similar business units or business process.
- (v) **Strategic Benchmarking:** differs from operational benchmarking in its scope. It helps to develop a vision of the changed organizations. it will develop core competencies that will help sustained competitive advantage.
- (vi) **Global Benchmarking:** is an extension of Strategic Benchmarking to include benchmarking partners on a global scale. E.g. Ford Co. of USA benchmarked its A/c payable functions with that of Mazada in Japan and found to its astonishment that the entire function was managed by 5 persons as against 500 in Ford.

(e) **Six Sigma process in Quality Control**

Six Sigma is a set of practices originally developed by Motorola to systematically improve processes by eliminating defects. A defect is defined as non-conformity of a product or service to its specifications.

While the particulars of the methodology were originally formulated by Bill Smith at Motorola in 1986, Six Sigma was heavily inspired by six preceding decades of quality improvement methodologies such as quality control, TQM, and Zero Defects. Like its predecessors, Six Sigma asserts the following:

- (a) Continuous efforts to reduce variation in process outputs is key to business success
- (b) Manufacturing and business processes can be measured, analyzed, improved and controlled
- (c) Succeeding at achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

The term "Six Sigma" refers to the ability of highly capable processes to produce output within specification. In particular, processes that operate with six sigma quality produce at defect levels below 3.4 defects per (one) million opportunities (DPMO). Six Sigma's implicit goal is to improve all processes to that level of quality or better.

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## SECTION - C

### STRATEGIC COST MANAGEMENT - APPLICATION OF STATISTICAL TECHNIQUES IN BUSINESS DECISIONS

17. An electronics firm which has developed a new type of Fire-Alarm System has been asked to quote for a prospective contract.

The customer requires separate price quotations for each of the following possible orders -

Order	First	Second	Third
Number of Fire-Alarm Systems	100	60	40

The Firm estimates the following cost per Amount for the first order-

Direct Materials	500
Direct Labour: Department A (Highly automatic)	20 hours at 10 per hour
Department B (Skilled Labour)	40 hours at 15 per hour
Variable Overheads	20% of Direct Labour
Fixed Overheads absorbed: Department A	8 per hour
Department B	5 per hour

Determine a price per unit for each of the orders, assuming the Firm uses a mark-up of 25% on total costs and allows for an 80% Learning Curve. Extract from 80% Learning Curve table -

X	1.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Y%	100.0	91.7	89.5	87.6	86.1	84.4	83.0	81.0	80.0

X represents the cumulative total volume produced to date expressed as a multiple of the initial order.

Y is the Learning Curve Factor, for a given X value, expressed as a percentage of the cost of the initial order.

**Answer:**

1. Computation of Selling Price per unit of First Order (100 units)

Particulars	Computation	₹
Direct Materials	100 units × 500 per unit	50,000
Direct Labour:		
Department A	100 units × 20 hours × 10 per hour	20,000
Department B	100 units × 40 hours × 15 per hour	60,000

Particulars	Computation	₹
Variable OH	20% of (20,000 + 60,000)	16,000
Fixed OH:		
Department A	100 units × 20 hours × 8 per hour	16,000
	100 units × 40 hours × 5 per hour	20,000
<b>Total Cost</b>		<b>1,82,000</b>
Add: Profit at 25% of cost	1,82,000 × 25%	45,500
<b>Sale Value</b>		<b>2,27,500</b>
<b>Sale Price per unit</b>	2,27,500 ÷ 100 units	<b>2,275</b>

Note: Department A is highly automatic and there is no Learning Effect in respect of machine/mechanical operations. Hence, Learning Effect is applicable for Department B only, where Skilled Labour is involved.



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2. Computation of Selling Price per unit of Second Order (60 units) (See Note below for Learning Effect)

Particulars	Computation	₹
Direct Materials	60 units × 500 per unit	30,000.00
Direct Labour: Department A	60 units × 20 hours × 10 per hour	12,000.00
Department B	1,510.40 hours × 15 per hour	22,656.00
Variable OH	20% of (12,000 + 22,656)	6,931.20
Fixed OH: Department A	60 units × 20 hours × 8 per hour	9,600.00
Department B	1,510.40 hours × 5 per hour	7,552.00
Total Cost		88,739.20
Add: Profit at 25% of cost	88,739.20 × 25%	22,184.80
Sale Value		1,10,924.00
Sales Price Per Unit	1,10,924.00 ÷ 60 units	1,848.73

Learning Effect: Since Second Order is for 60 units the relevant "X" factor is 1.6 (cumulative quantity = 160 units) and "Y" factor is 86.1%. Hence, the additional time taken for the Second Order is determined as under -

$$\begin{aligned} \text{Total Time for First and Second Order} &= (40 \text{ hours p.u} \times 86.1\%) \times 160 \text{ units} = 5,510.40 \text{ hours.} \\ \text{Less: Total Time for First Order only} &= (40 \text{ hours p.u} \times 100 \text{ units}) = 4,000.00 \text{ hours.} \\ \text{Additional Time for Second Order} &= 1,510.40 \text{ hours.} \end{aligned}$$

3. Computation of Selling Price per unit of Second Order (40 units) (See Note below for Learning Effect)

Particulars	Computation	₹
Direct Materials	40 units × 500 per unit	20,000.00
Direct Labour: Department A	40 units × 20 hours × 10 per hour	8,000.00
Department B	889.60 hours × 15 per hour	13,344.00
Variable OH	20% of (8,000 + 13,344)	4,268.80
Fixed OH: Department A	40 units × 20 hours × 8 per hour	6,400.00
Department B	889.60 hours × 5 per hour	4,448.00
Total Cost		56,480.80
Add: Profit at 25% of cost	56,480.80 × 25%	14,120.20
Sale Value		70,601.00
Sales Price Per Unit	70,601.00 ÷ 40 units	1,765.03

Learning Effect: Since Third Order is for 40 units, the relevant "X" factor is 2.0 (Cumulative quantity = 200 units) and "Y" factor is 80%. Hence, the additional time taken for the Third Order is determined as under -

$$\begin{aligned} \text{Cumulative time upto Third Order} &= (40 \text{ hours p. u} \times 80\%) \times 200 \text{ units} = 6,400.00 \text{ hours.} \\ \text{Less: Cumulative time upto Second Order} &= (\text{as calculated earlier}) = 5,510.40 \text{ hours.} \\ \text{Additional Time for Third Order} &= 889.60 \text{ hours} \end{aligned}$$

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18. A leading Firm of Cost Accountants is attempting to determine a best investment portfolio and is considering six alternative investment proposals. The following table indicates point estimates for the price per share, the annual growth rates in the price per share, the amount of dividend per share and a measure of the risk associated with each investment.

Portfolio Data

Particulars	Shares under consideration					
	A	B	C	D	E	F
Current Price per Share (₹)	80	100	160	120	150	200
Projected Annual Growth	0.08	0.07	0.10	0.12	0.09	0.15
Projected Annual Dividend per Share (₹)	4.00	4.50	7.50	5.50	5.75	0.00
Projected Risk In Return	0.05	0.03	0.10	0.20	0.06	0.08

The total amount available for investment is ₹25 Lakhs and the following conditions are to be satisfied.

- The maximum rupee amount to be invested in alternative F is ₹2,50,000
- Not more than ₹5,00,000 should be invested in alternatives A and B combined.
- Total Weighted Risk should not be greater than 0.10 where-
- Total Weighted Risk = 
$$\frac{(\text{Amount Invested in Alternative } i) \times (\text{Risk of Alternative } i)}{\text{Total Amount invested in all alternatives}}$$
- For the sake of diversity, at least 100 shares of each stock should be purchased.
- At least 10% of the total investment should be in alternatives A and B combined.
- Dividends for the year should be at least ₹ 10,000

Rupees Return per Share is defined as the Price per Share one year hence less Current Price per Share plus Dividend per Share. If the objective is to maximize Total Rupee Return, formulate (but do not solve) the LPP for determining the optimum number of share to be purchased in each of the Shares under consideration. Assume that the time horizon for the Investment is one year.

**Answer:**

Let A, B, C, D, E and F be the number of shares to be purchased in each of the above investment proposals. Given Return Per Share = Price Per Share one year hence Less Current Price Per Share Plus Dividend Per Share  
Hence, Return per Share = (Current Price per Share × Projected Annual Growth Rate) + Dividends per Share.

Particulars Number of shares purchase	Shares under consideration					
	A	B	C	D	E	F
a. Current price per share (₹)	80	100	160	120	150	200
b. Projected Annual growth Rate (given)	0.08	0.07	0.10	0.12	0.09	0.15
c. Increase in price per share = a × b (in ₹)	6.40	7.00	16.00	14.40	13.50	30.00
d. Projected Annual Dividend per share (in ₹)	4.00	4.50	7.50	5.50	5.75	0.00
e. Rupee return per share = c + d (in ₹)	10.40	11.50	23.50	19.90	19.25	30.00

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Maximise  $Z = 10.40 A + 11.50 B + 23.50 C + 19.90 D + 19.25 E + 30.00 F$ .....(objective Function)

Subject to the following constraints

$80A + 100B + 160C + 120D + 150E + 200F \leq 25,00,000$  ..... (Funds Availability)

$200F \leq 2,50,000$  ..... (Investment F Condition)

$80A + 100B \leq 5,00,000$  .....((investment A & B Condition)

$$\frac{[(5\% \times 80A) + (3\% \times 100B) + (10\% \times 160C) + (20\% \times 120D) + (6\% \times 150E) + (8\% \times 200F)]}{80A + 100B + 160C + 120D + 150E + 200F} \leq 10\%$$

On simplification, we have  $-4A - 7B + 12D - 6E - 4F \leq 0$  .....(Weighted risk Condition)

$A, B, C, D, E, F \geq 10,000$  .....(Dividend condition)

$(80A + 100B) \geq (80A + 100B + 160C + 120D + 150E + 200F) \times 10\%$

Simplifying, we have,  $72A + 90B - 16C - 12D - 115E - 20F \geq 0$  .....(Minimum Investment in A & B)

$4A + 4.50B + 7.50C + 5.50D + 5.75E \geq 10,000$  .....(Dividend Condition).

Note: Non- negativity Assumption is not necessary in the given case, since the Diversity condition is applicable.

19. The owner of Excel Sports wishes to determine how many advertisements to place in the selected three monthly magazines A B and C. His objective is to advertise in such a way that total exposure to principal buyers of expensive sports goods is maximized. Percentages of readers for each magazine are known. Exposure in any particular magazine is the number of advertisements placed multiplied by the number of principal buyers. The following data may be used:

	Magazine		
	A	B	C
Readers	1 lakh	0.6 lakh	0.4 lakh
Principal Buyers	20%	15%	8%
Cost per Advertisement (₹)	8.000	6.000	5.000

The budgeted amount is at most ₹ 1 lakh for the advertisements. The owner has already decided that magazine A should have not more than 15 advertisements and that B and C each have at least 8 advertisements. Formulate on LP model for the problem.

**Answer:**

**Step 1.** The key decision to be made is to determine how many advertisements to place in the selected three monthly magazines A. B. and C so that total exposure to principal buyers of expensive sports goods is maximised

**Step 2.** Decision variables

Let  $x_1$  = number of insertions in magazine A,

$x_2$  = number of insertions in magazine B, and

$x_3$  = number of insertions in magazine C,

**Step 3.** Feasible alternatives are sets of values of  $x_1, x_2, x_3$ .

where  $x_1, x_2, x_3$  each  $\geq 0$

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## Formulation of LP Model

The objective is to maximise (total exposure)

$$\begin{aligned} \text{Maximise } Z &= (20\% \text{ of } 1,00,000)x_1 + (15\% \text{ of } 60,000)x_2 + (8\% \text{ of } 4,000)x_3 \\ &= 20,000x_1 + 9,000x_2 + 3,200x_3 \end{aligned}$$

Subject to constraints

$$8,000x_1 + 6,000x_2 + 5,000x_3 \leq 1,00,000 \quad (\text{Budgeted amount})$$

$$x_1 \leq 15, \quad x_2 \geq 8 \text{ and } x_3 \geq 8 \quad (\text{Advertisement})$$

$$x_1 \geq 0, \quad x_2 \geq 0 \text{ and } x_3 \geq 0 \quad (\text{Insertions assumed to be non-negative})$$

20. To stimulate interest and provide an atmosphere for intellectual discussion, a finance faculty in a management school decides to hold special seminars to four contemporary topics-leasing, portfolio management, private mutual funds, swaps and options. Such seminars should be held once in a week in the afternoons. However, scheduling these seminars (one for each topic, and not more than one seminar per afternoon) has to be done carefully so that the number of students unable to attend is kept to a minimum. A careful study indicates that the number of students who cannot attend a particular seminar on a specific day is as follows:

	Leasing	Portfolio management	Private mutual funds	Swaps and Options
Monday	50	40	60	20
Tuesday	40	30	40	30
Wednesday	60	20	30	20
Thursday	30	30	20	30
Friday	10	20	10	30

Find an optimum schedule of the seminars. Also find out the total number of students who will be missing at least one seminar.

**Answer:**

This is an unbalanced minimisation assignment problem. We first of all balance it by adding a dummy topic.

	Leasing	Portfolio Management	Private Mutual funds	Swaps and options	Dummy
Monday	50	40	60	20	0
Tuesday	40	30	40	30	0
Wednesday	60	20	30	20	0
Thursday	30	30	20	30	0
Friday	10	20	10	30	0

Subtracting the minimum element of each column from all elements of that column, we get the following matrix.

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	Leasing	Portfolio Management	Private Mutual funds	Swaps and options	Dummy
Monday	40	20	50	0	0
Tuesday	30	10	30	10	0
Wednesday	50	0	20	0	0
Thursday	20	10	10	10	0
Friday	0	0	0	10	0

The minimum number of lines to cover all zeros is 4, which is less than the order of the matrix (i.e., 5), the above matrix will not give the optimal solution. Subtract the minimum uncovered element (i.e., 10) from all uncovered elements and add it to the elements lying on the intersection, we get the following matrix:

	Leasing	Portfolio Management	Private Mutual funds	Swaps and options	Dummy
Monday	30	20	40	0	0
Tuesday	20	10	20	10	0
Wednesday	40	0	10	0	0
Thursday	10	10	0	10	0
Friday	0	10	0	20	10

Since the minimum number of lines to cover all zeros is 5, which is equal to order of the matrix, the above matrix will give the optimum solution which is given below:

	Leasing	Portfolio Management	Private Mutual funds	Swaps and options	Dummy
Monday	30	20	40	0	0
Tuesday	20	10	20	10	0
Wednesday	40	0	10	0	0
Thursday	10	10	0	10	0
Friday	0	10	0	20	10

The optimal schedule is:

Day	Contemporary topics	No. of students missing
Monday	Swaps and Options	20
Tuesday	No Seminar	0
Wednesday	Portfolio	20
Thursday	Private mutual funds	20
Friday	Leasing	10
	Total	70

Thus number of students, who will be missing at least one seminar is 70.

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21. The management of ABC company is considering the question of marketing a new product. The fixed cost required in the project is ₹ 4,000. Three factors are uncertain, viz., the selling price, variable cost and the annual sales volume. The product has a life of only one year. The management has the data on these three factors as under:

Selling price (₹)	Probability	Variable cost (₹)	Probability	Sales volume (units)	Probability
3	0.2	1	0.3	2,000	0.3
4	0.5	2	0.6	3,000	0.3
5	0.3	3	0.1	5,000	0.4

Consider the following sequence of thirty random numbers:

81, 32, 60, 04, 46, 31, 67, 25, 24, 10, 40, 02, 39, 68, 08,  
59, 66, 90, 12, 64, 79, 31, 86, 68, 82, 89, 25, 11, 98, 16

Using the sequence (first 3 random numbers for the first trial, etc.), simulate the average profit for the above project on the basis of 10 trials.

**Answer:**

First, we assign random numbers to the three uncertain factors.

Selling Price (₹)	Probability	Cum. Probability	Random Numbers
3	0.2	0.2	00 - 19
4	0.5	0.7	20- 69
5	0.3	1.0	70- 99
<b>Variable Cost (₹)</b>			
1	0.3	0.3	00- 29
2	0.6	0.9	30- 89
3	0.1	1.0	90- 99
<b>Sales Volume (units)</b>			
2,000	0.3	0.3	00- 29
3, 000	0.3	0.6	30- 59
5, 000	0.4	1.0	60- 99

Simulation sheet for finding average profit is developed as under:

S. No.	RN	Selling Price (₹)	RN	Variable Cost (₹)	RN	Sales Volume ('000 units)
1	81	5	32	2	60	5
2	04	3	46	2	31	3
3	67	4	25	1	24	2
4	10	3	40	2	02	2
5	39	4	68	2	08	2
6	59	4	66	2	90	5
7	12	3	64	2	79	5
8	31	4	86	2	68	5
9	82	5	89	2	25	2
10	11	3	98	3	16	2

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Simulated profit in 10 trials would be as follows:

S. No	Simulated profit	Total Simulated profit
1	$(5 - 2) \times 5,000 - 4,000$	11,000
2	$(3 - 2) \times 3,000 - 4,000$	-1,000
3	$(4 - 1) \times 2,000 - 4,000$	2,000
4	$(3 - 2) \times 2,000 - 4,000$	-2,000
5	$(4 - 2) \times 2,000 - 4,000$	0
6	$(4 - 2) \times 5,000 - 4,000$	6,000
7	$(3 - 2) \times 5,000 - 4,000$	1,000
8	$(4 - 2) \times 5,000 - 4,000$	6,000
9	$(5 - 2) \times 2,000 - 4,000$	2,000
10	$(3 - 3) \times 2,000 - 4,000$	-4,000
		21,000

Average Profit = ₹21,000 + 10 = ₹2,100.

22. An Investment Company wants to study the investment projects based on market demand, profit and the investment required. Which are independent of each other. Following probability distribution are estimated for each of the three factors.

Annual Demand (units)	25,000	30,000	35,000	40,000	45,000	50,000	55,000
Probability	0.05	0.10	0.20	0.30	0.20	0.10	0.05

Profit pu (₹)	3	5	7	9	10
Probability	0.10	0.20	0.40	0.20	0.10

Investment (₹)	27,50,000	30,00,000	35,00,000
Probability	0.25	0.50	0.25

Using Simulation Process, repeat the trial 10 times and compute the investment on each trial taking these factors into trial. What is the most likely return? Use the following Random Numbers. (30, 12, 16), (59, 09, 69), (63, 94, 26), (27, 08, 74), (64, 60, 61), (28, 28, 72), (31, 23, 57), (54, 85, 20), (64, 68, 18), (32, 31, 87). In the bracket above, the first Random Number is for Annual Demand, the second one is for Profit and the last one is for the Investment required.

Answer:

### 1. Random Number Allocation Tables

**Table 1:** Random Numbers for Demand

Demand	Prob.	Cum Prob.	Random Nos.
25,000 units	0.05	0.05	00 - 04
30,000 units	0.10	0.15	05 - 14
35,000 units	0.20	0.35	15 - 34
40,000 units	0.30	0.65	35 - 64
45,000 units	0.20	0.85	65 - 84
50,000 units	0.10	0.95	85 - 94
55,000 units	0.05	1.00	95 - 99

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**Table 2:** Random Numbers for Profit

Profit	Prob.	Cum Prob	Random Nos.
₹3	0.10	0.10	00 – 09
₹5	0.20	0.30	10 – 29
₹7	0.40	0.70	30 – 69
₹9	0.20	0.90	70 – 89
₹10	0.10	1.00	90 - 99

**Table 3:** Random Numbers for Investment

Investment	Prob.	Cum Prob	Random Nos.
₹27,50,000	0.25	0.25	00 – 24
₹30,00,000	0.50	0.75	25 – 74
₹35,00,000	0.25	1.00	75 - 99

### 2. Simulation table

Trial	R. No. (Demand)	Demand Qty (units)	R. No. (Profit)	Profit p.u. (₹)	R. No. (Invnt)	Investment (₹)	Return = Qty x Pft (₹)	ROI=(R Invnt) × 100
1	30	35,000	12	5	16	27,50,000	1,75,000	6.36%
2	59	40,000	09	3	69	30,00,000	1,20,000	4.00%
3	63	40,000	94	10	26	30,00,000	4,00,000	13.33%
4	27	35,000	08	3	74	30,00,000	1,05,000	3.50%
5	64	40,000	60	7	61	30,00,000	2,80,000	9.33%
6	28	35,000	28	5	72	30,00,000	1,75,000	5.83%
7	31	35,000	23	5	57	30,00,000	1,75,000	5.83%
8	54	40,000	85	9	20	27,50,000	3,60,000	13.09%
9	64	40,000	68	7	18	27,50,000	2,80,000	10.18%
10	32	35,000	31	7	87	35,00,000	2,45,000	7.00%
	<b>Total</b>							<b>78.45%</b>

**Result:** Most Likely Average Return = 78.45% ÷ 10 trials = 7.85% (approximately).

Also, Highest ROI = 13.33% relating to Trial 3, Investment = ₹30 Lakhs and Demand = 40,000 units.

23. A Network is given below-

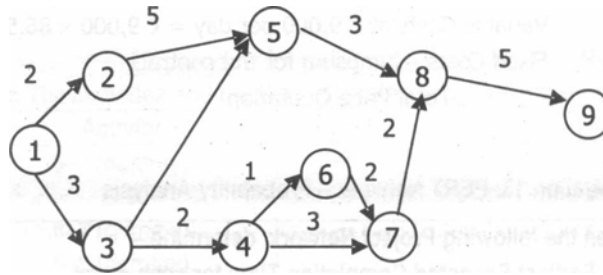
- Name the Paths and give their total duration.
- Give three different ways of reducing the above project duration by four weeks.

Activity	Duration	Activity	Duration
1 – 2	2 weeks	4 – 7	3 weeks
1 – 3	3 weeks	5 – 8	3 weeks
2 – 5	5 weeks	6 – 7	2 weeks
3 – 4	2 weeks	7 – 8	2 weeks
4 – 6	1 weeks	8 – 9	5 weeks



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Answer:



Path	1-2-5-8-9	1-3-5-8-9	1-3-4-6-7-8-9	1-3-4-7-8-9
Path No.	I	II	III	IV
Duration	2+5+3+5 = 15 weeks	3+0+3+5 = 11 weeks	3+2+1+2+2+5 = 15 weeks	3+2+3+2+5 = 15 weeks

The different ways of reducing the Project Duration by four weeks are –

1. Reduce duration of Activity 8- 9 by 4 weeks (presently 5 weeks), since this is a common activity on all Paths.
2. Reduce duration of Activity 1- 3 (Common for Paths II, III and IV), and any one of Activities 1 - 2 and 2- 5 (on Path I) such that total time reduction is 4 weeks.
3. Reduce duration of Activity 3-4 or 7- 8 (Common for Paths III & IV), and Activity 5-8 (Common for Paths I & II).

## 24. Short Notes on:

- (a) Uses of Learning curve
- (b) Vogel's Approximation Method (VAM)
- (c) Application & Advantages of Simulation

Answer:

### (a) Uses of Learning curve

Learning curve is now being widely issued in business. Some of the uses are as follows:

- (i) Where applicable the learning curve suggest great opportunities for cost reduction to be achieved by improving learning.
- (ii) The learning curve concept suggests a basis for correct staffing in continuously expanding production. The curve shows that the work force need not be increased at the same rate as the prospective output. This also helps in proper production planning through proper scheduling of work; providing manpower at the right moment permitting more accurate forecast of delivery dates.

Learning curve concept provides a means of evaluating the effectiveness of training programs. What level of cumulative cost reduction do they accomplish?

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- (iii) How does the learning curve for this group or shop compare with others? Whether any of the employees who lack the aptitude to meet normal learning curve should be eliminated.
- (iv) Learning curve is frequently used in conjunction with establishing bid price for contracts. Usually, the bid price is based on the cumulative average unit cost for all the units to be produced for a given contract. If production is not interrupted. Additional units beyond this quantity should be costed at the increment costs incurred, and not at the previous cumulative average. If the contract agreement so provides, a contract may be cancelled and production stopped before the expected efficiency is reached. This would mean that the company having quoted on the basis of cumulative average unit cost is at a disadvantage because it can not reap the benefit of leaning. The contractor must provide for these contingencies so that it will be reimbursed for such loss.
- (v) The use of learning curve, where applicable, is important in the working capital required. If the requirement is based on average cumulative unit cost, the revenues from the first few units may not cover the actual expenditures. For instance, if the price was based on the average cumulative unit cost of 328 hours the first unit when produced and sold will cause a deficit of 4.72 hours (8.00 – 3.28). Provision should therefore, be made to cover the deficit of working capital in the initial stages of production.
- (vi) As employees become more efficient, the rate of production increases and so more materials are needed, the work-in-progress inventory turns over faster, and finished goods inventory grows at an accelerated rate. A knowledge of the learning curve assists in planning the inventories of materials. Work-in-progress, and finished goods.
- (vii) Learning curve techniques are useful in exercising control, Variable norms can be established for each situation, and a comparison between these norms and actual expenses can be made. Specific or average incremental unit cost should be used for this purpose.
- (viii) The learning curve may be used for make-or- buy decisions especially if the outside manufacturer has reached the maximum on the learning curve. Help to calculate the sensitive rates in wage bargaining.

**(b) Vogel's Approximation Method (VAM):**

This method is preferred over the other two methods because the initial basic feasible solution obtained is either optimum or very close to the optimum solution. Therefore, the amount of time required to arrive at the optimum solution is greatly reduced. Various steps of this method are summarized as under:

- Step 1: Compute a penalty for each row and column in the transportation table. The penalty for a given row and column is merely the difference between the smallest cost and the next smallest cost in that particular row or column.
- Step 2: Identify the row or column with the largest penalty. In this identified row or column, choose the cell which has the smallest cost and allocate the maximum possible quantity to the lowest cost cell in that row or column so as to exhaust either the supply at a particular source or satisfy demand at a warehouse. If a tie occurs in the penalties, select that row/column which has minimum cost. If there is a tie in the minimum cost

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also, select that row/column which will have maximum possible assignments. It will considerably reduce computational work.

Step 3: Reduce the row supply or the column demand by the amount assigned to the cell.

Step 4: If the row supply is now zero, eliminate the row, if the column demand is now zero, eliminate the column, if both the row supply and the column demand are zero, eliminate both the row and column.

Step 5: Recompute the row and column difference for the reduced transportation table, omitting rows or columns crossed out in the preceding step.

Step 6: Repeat the above procedure until the entire supply at factories are exhausted to satisfy demand at different warehouses.

## (d) Application & Advantages of Simulation

Application of Simulation

- (i) Scheduling aircraft,
- (ii) Job-ship scheduling and personnel scheduling,
- (iii) Manpower-hiring decisions,
- (iv) Traffic light-timing,
- (v) Transport-scheduling,
- (vi) Evaluating alternative investment opportunities, and
- (vii) Design of parking lots, harbor, and communication systems etc.

Advantages of Simulation

- (a) Enables to experiment and study complex interactions of a system (e.g. company operations, economic policies).
- (b) Possible to study the effects of organizational environment informational changes in the operations of a system (e.g. number of stocking points, industrial policies).
- (c) Better insight and understanding of a complex system to indication for improvement. (d) Assists in teaching and training (management games).
- (e) New situations policies can be protested.
- (f) Probabilistic features can be easily incorporated.
- (g) A process can be studies in extended or compressed time.
- (h) Risks involved in experimenting with real problems can be eliminated.