# Paper 15 – Strategic Cost Management and Decision Making

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**Time Allowed: 3 hours** **Full Marks: 100**

### Section A

**1. Answer the following and each question carries 2 marks. [10×2= 20]**

**(i) If the first time you perform a job takes 60 minutes, how long will the eighth job take if you are on an 80% learning curve?**
**(a) 48 minutes (b) 30.72 minutes (c) 31 minutes (d) None of the above**

**(ii) NPL Ltd. Uses a JIT system and back flush accounting. It does not use a raw material stock control account During May, 8000 units were produced and sold. The standard cost per unit is ₹100; this includes materials of ₹45. During May, ₹4,80,000 of conversion costs were incurred.**
**The debit balance on cost of goods sold account for May was**
**(a) ₹8,00,000 (b) ₹8,40,000 (c) ₹8,80,000 (d) ₹9,20,000**

**(iii) The single price of the selling product manufactured by a company is fixed at ₹1500 per unit. In the coming year, 500 units of the product are likely to be sold. If the total value of investments of the company is ₹15 lakhs and it has a target ROI of 15%, the target cost would be:**
**(a) ₹9.30 (b) ₹9.50 (c) ₹1050 (d) None of these**

**(iv) Which of the following would decrease unit contribution margin the most?**
**(a) 15% decrease in selling price**
**(b) 15% increase in variable costs**
**(c) 15% decrease in variable costs**
**(d) 15% decrease in fixed costs**

**(v) A company determines its selling price by making up variable costs 60%. In addition, the company uses frequent selling price mark down to stimulate sales. If the mark down average 10%, what is the company's contribution margin ratio?**
**(a) 30.6% (b) 44% (c) 86.4% (d) None of these**

**(vi) Back flush costing is most likely to be used when**
**(a) Management desires sequential tracking of costs**
**(b) A Just-in-Time inventory philosophy has been adopted**
**(c) The company carries significant amount of inventory**
**(d) Actual production costs are debited to work-in-progress.**

**(vii) A company produces two joint products, P and V. In a year, further processing costs beyond split-off point spent were ₹ 8,000 and ₹ 12,000 for 800 units of P and 400 units of V respectively. P sells at ₹ 25 and V sells at ₹ 50 per unit. A sum of ₹ 9,000 of joint cost were allocated to product P based on the net realization method. What were the total joint cost in the year?**
**(a) ₹ 20,000 (b) ₹ 10,000 (c) ₹15,000 (d) None of these**

**(viii) When allocation service department cost to production departments, the method that does not consider different cost behavior patterns is the**
**(a) Step method (b) Reciprocal method**
**(c) Single rate-method (d) Dual rate-method**

**(ix) ABC Ltd. has developed a new product just complete the manufacture of first four units of the product. The fist unit took 2 hours to manufacture and the first four units together took 5.12 hours to produce. The Learning Curve rate is**

**(a) 83.50% (b) 80.00% (c) 75.50% (d) None of (a), (b) or (c)**

**(x)**

| | |
|---|---|
| **No. Units Sold Per Day** | **500** |
| **Sales Price** | **₹25** |
| **Direct Materials Cost per unit** | **₹10** |
| **Other Factory Costs per Day** | **₹6000** |
| **No. Hours of bottleneck used per day** | **8** |

**The Return per Factory Hour for product is**

**(a) ₹925 (b) ₹938 (c) ₹883 (d) ₹750**

**Answer: 1**

**(i)** (b) Three doublings from 1 to 2 to 4 to 8 implies $.8^3$. Therefore, we have
$60 \times (.8)^3 = 60 \times .512 = 30.72$ minutes

**(ii)** (b)

| | ₹ |
|---|---|
| Cost of goods sold | 8,00,000 |
| (Less) Material cost | (3,60,000) |
| Conversion cost allocated | 4,40,000 |
| Conversion cost incurred | 4,80,000 |
| Excess charged to cost of goods sold account | 40,000 |

Total dedit on cost of goods sold account = Rs. 8,00,000 + Rs. 40,000 = Rs. 8,40,000

**(iii)** (c) ₹ 1,050

| Particulars | ₹ |
|---|---|
| Sales Revenue = 500 × ₹ 1,500 | 7,50,000 |
| Less: ROI 15% on ₹ 15 Lakhs = | 2,25,000 |
| Target Cost | 5,25,000 |

Target Cost per unit = Target cost / 500 = 5,25,000 / 500 = ₹ 1,050.

**(iv)** (a) A given percentage change in unit sale price must have greater effect on contribution margin than any other factor affected by the same percentage change.

**(v)** (a)
When V (Var. cost) = 100, SP = 160, M.Cost/SP = 60/100
SP after 10% mark down of SP = 144, Cost = 60-16=44
Contribution Margin Ratio = 44/144=0.3056=30.6%

**(vi)** (b) Back flush costing is most likely to be used when Just-in-Time inventory philosophy has been adopted.

**(vii)** (c)

| Products | P | V | Total |
|---|---|---|---|
| Units | 800 | 400 | |
| S.P. (₹) | 25 | 50 | |
| Sales (₹) | 20,000 | 20,000 | |
| Further costs (₹) | 8,000 | 12,000 | |
| NRV (₹) | 12,000 | 8,000 | 20,000 |

Joint cost appropriated ₹ 9,000
Total Joint Cost = (9,000/12,000) x 20,000 = ₹15,000

**(viii)** (c)

The single rate method combines fixed and variable costs without regard to cost behaviour patterns. A and B do not exactly fit in with the given question as they can be used on a single or dual rate; and Ans D allows variable costs to be allocated on different basis from fixed costs.

**(ix)** (b) 80%

Let the learning rate be x.

Since the first unit took 2 hours, average time for the first two units = 2x and

The average time for the first 4 units = $2x \times x = 2x^2$.

$2x^2 = 5.12 \div 4 = 1.28$.

Or, $x = \sqrt{1.28} \div 2 = \sqrt{0.64}$

= 0.80 i.e. 80%.

**(x)** (c)

| | Working | Amount(₹) |
|---|---|---|
| Sales per Day | (500 x 25) | 12,500 |
| Direct Materials | (500 x 10) | -5,000 |
| | | 7,500 |
| Usage of bottleneck hours per day | | 8 |
| Return per Factory Hour | (7,500/8) | 938 |

## Section B

**Answer any five questions from Question No. 2 to 8**
**Each question carries 16 marks. [5 ×16 = 80]**

**2 (a) K & Co. manufactures and sells 15,000 units of a product. The Full Cost per unit is ₹200. The Company has fixed its price so as to earn a 20% Return on an Investment of ₹18,00,000.**

**Required:**

1. **Calculate the Selling Price per unit from the above. Also, calculate the Mark-up % on the Full Cost per unit.**
2. **If the Selling Price as calculated above represents a Mark-up % of 40% on Variable cost per unit, calculate the Variable cost per unit.**
3. **Calculate the Company's Income if it had increased the Selling Price to ₹230. At this price, the company would have sold 13,500 units. Should the Company have increased the Selling price to ₹460?**
4. **In response to competitive pressures, the Company must reduce the price to ₹210 next year, in order to achieve sales of 15,000 units. The Company also plans to reduce its investment to ₹16,50,000. If a 20% Return on Investment should be maintained, what is the Target Cost per unit for the next year?**

**[8]**

**2 (b) The ORC Club of a large public sector undertaking has a cinema theater for the exclusive use of themselves and their families. It is a bit difficult to get good motion pictures for show and so pictures are booked as and when available.**

**The theater has been showing the picture 'Blood Bath' for the past two weeks. This picture, which is strictly for adults only has been a great hit and the manager of the theater is convinced that the attendance will continue to be above normal for another two weeks, if the show of 'Blood Bath' is extended. However, another popular movie, eagerly looked forward to by both adults and children alike, 'Appu on the Airbus' is booked for next two weeks. Even if 'Blood Bath' is extended the theater has to pay the regular rental on 'Appu on the Airbus' as well.**

**Normal attendance at theater is 2,000 patrons per week, approximately one fourth of whom are children under the age of 12. Attendance of 'Blood Bath' has been 50% greater than the normal total. The manager believes that this would taper off during the second two weeks, 25% below that of the first two weeks, during the third week and 33 1/3 % below that of the first two weeks, during the fourth week. Attendance for 'Appu on the Airbus' would be expected to be normal throughout its run regardless of the duration.**

**All runs at the theater are shown at a regular price of ₹2 for adults and ₹1.20 for children fewer than 12. The rental charge for 'Blood Bath' is ₹ 900 for one week or ₹1,500 for two weeks. For 'Appu on the Airbus' it is ₹ 750 for one week or ₹ 1,200 for two weeks. All other operating costs are fixed - ₹ 4,200 per week, except for the cost of potato wafers and cakes, which average 60% of their selling price, sales of potato wafers and cakes regularly average ₹ 1.20 per patron, regardless of age.**

**The Manager can arrange to show 'Blood Bath' for one week and 'Appu on the Airbus' for the following week or he can extend the show of 'Blood Bath' for two weeks or else he can show 'Appu on the Airbus' for two weeks as originally booked.**

**Show by computation, the most profitable course of action he has to pursue. [8]**

**Answer: 2(a)**

(i) Computation of Selling Price and mark - up % on the Full Cost per unit

| | |
|---|---|
| Target Sale Price per unit = Full Cost + Target Profit = ₹200 +24 | ₹224 |
| So, Martk – up price is | 12% |

(ii) Computation of Variable Cost per unit:

Above sale Price ₹224 = VC + 40% thereon, i.e. 140% on VC. So, Var. Cost = (224/140%)

= ₹160

(iii) Calculate the company's Income if selling price are increased

Present Contribution at 15,000 units = (₹224 – ₹ 160) × 15,000 units = ₹ 9, 60, 000

Revised Contribution at 13,500 units = (₹230 – ₹160) × 13,500 units = ₹ 9, 45, 000

₹15, 000

Hence, Increase in Sale Price is not beneficial, due to reduction in Contribution by ₹ 15,000,

(iv) Calculate the company's Target Profit if selling price are reduced and Target cost if investment is ₹ 16,50,000

Target Profit for next year = (16, 50, 000 x 20%)/ 13,500 = ₹24

**Answer: 2(b)**

Statement showing evaluation of alternatives

| | | Blood bath | Blood bath & Appu on the airbus | Appu on the airbus |
|---|---|---|---|---|
| | | ₹ | ₹ | ₹ |
| No. of spectators | | | | |
| Adults: | | | | |
| Third week | 3,000 x 75% | 2,250.00 | 2,250.00 | 1,500.00 |
| fourth week | 3,000 x 2/3 | 2,000.00 | 1,500.00 | 1,500.00 |
| | | 4,250.00 | 3,750.00 | 3,000.00 |
| Children: | | | | |
| Third week | | | | 500.00 |
| fourth week | | | 500.00 | 500.00 |
| | | | 500.00 | 1,000.00 |
| Total spectators: | | 4,250.00 | 4,250.00 | 4,000.00 |
| Revenue: | | | | |
| By sale of tickets | | 8,500.00 | 8,100.00 | 7,200.00 |
| | | | | (3,000 x 2 +1000 x 1.2) |
| Add : contribution from snacks | | 2,040.00 | 2,040.00 | 1,920.00 |
| | | 10,540.00 | 10,140.00 | 9,120.00 |
| Less : Incremental cost | | 1,500.00 | 900.00 | |
| | | 9,040.00 | 9,240.00 | 9,120.00 |

It is found that the net revenue is more at the option of running blood bath and Appu on the Air bus a week each, it must be chosen.

**3. (a) SPOT Ltd. manufactures and sells as single product X whose price is ₹40 per unit and the variable cost is ₹16 per unit.**
**(i) If the fixed costs for this year are ₹4,80,000 and the annual sales are at 60% margin of safety, calculate the rate of net return on sales, assuming an income tax level of 40%.**
**(ii) For the next year, it is proposed to add another product line Y whose selling price would be ₹50 per unit and the variable cost ₹10 per unit. The total fixed costs are estimated at ₹6,66,600. The sales mix of X:Y would be 7:3. At what level of sales next year, would SPOT Ltd. break even? Give separately for both X and Y the break even sales in rupees and quantities. [10]**

**3. (b) Company A can manufacture 1,000 units bicycles in a month for a fixed cost of ₹3,00,000. The variable cost is ₹500 per unit. Its current demand is 600 units which it sales at ₹1,000 per unit. It is approached by Company Z for an order of 200 units of ₹700 per unit. Should the Company A accept the order? Give your views as a CMA. [6]**

**Answer: 3(a)**

(i) Statement showing computation of profit on X:

SP = 40
VC = 16
C = 24

$$\text{P/V Ratio} = \frac{C}{S} \times 100 = \frac{24}{40} \times 100 = 60\%$$

$$\text{BES} = \frac{FC}{PV\,Ratio} = \frac{4,80,000}{60\%} = ₹8,00,000$$

Let x be the total sales

$0.6x = x - 8,00,000$

$\Rightarrow x = 20,00,000$

$\Rightarrow$ No. of units = $\frac{x}{40}$ = 50,000 units

| | | ₹ |
|---|---|---|
| (I) | Sales (50,000 x 40) | = 20,00,000 |
| (II) | Variable Cost | = 8,00,000 |
| (III) | Contribution | = 12,00,000 |
| (IV) | Fixed Cost | = 4,80,000 |
| (V) | Profit | = 7,20,000 |
| (VI) | Tax (7,20,000 x 40%) | = 2,88,000 |
| (VII) | Net Profit | = 4,32,000 |

(ii) Let the break - even units of products X & Y be 7a & 3a respectively.

In order to break even the contribution must be equal to FC

$\rightarrow (7a \times 24) + (3a \times 40) = 6,66,000$

$\rightarrow a = 2314.58$

BES of X = 7a = 16,202.08 x SP = 648080

Y = 3a = 6943.75 x SP = 347200.

**(b)** The CMA will go ahead with the order because in his opinion the special order will yield ₹200 per unit. He knows that the fixed cost ₹3,00,000 is irrelevant because it is going to be incurred regardless of whether the order is accepted or not. Effectively, the additional cost which Company A would have to incur is the variable cost of ₹500 per unit. Hence, the order will yield ₹200 per unit (i.e. ₹700 - ₹500 of variable cost).

**4. (a) AYX Ltd. manufactures three products. The material cost, selling price and bottleneck resource details per unit are as follows:**

| Particulars | Product X | Product Y | Product Z |
|---|---|---|---|
| Selling price (₹) | 66 | 75 | 90 |
| Material and other variable cost (₹) | 24 | 30 | 40 |
| Bottleneck resource time (minutes) | 15 | 15 | 20 |

**Budgeted factory costs for the period are ₹2,21,600. The bottleneck resources time available is 75,120 minutes per period.**

**Required:**

**(i) Company adopted throughput accounting and products are ranked according to 'product return per minute'. Select the highest rank product.**

**(ii) Calculate throughput accounting ratio and comment on it.**

**[8]**

**4 (b) XYZ Ltd. follows JIT system. It had following transactions in May, 2017:**

**(i) Raw materials were purchased for ₹2,00,000.**

**(ii) Direct labour cost incurred ₹36,000**

**(iii) Actual overhead costs ₹3,00,000**

**(iv) Conversion costs applied ₹3,16,000**

**All materials, that were purchased, were placed into production and the production was also completed and sold during the month. The difference between actual and applied costs is computed.**

**You are required to pass Backflush journal entries. [8]**

**Answer: 4(a)**

(i) Calculation of Rank according to product return per minute (₹)

| Particulars | | X | Y | Z |
|---|---|---|---|---|
| Selling price | | 66 | 75 | 90 |
| Less: Variable cost | | 24 | 30 | 40 |
| Throughput contribution | (a) | 42 | 45 | 50 |
| Minutes per unit | (b) | 15 | 15 | 20 |
| Contribution per minute | (a) ÷ (b) | 2.8 | 3 | 2.5 |
| Ranking | | II | I | III |

(ii) Calculation of Throughput Accounting ratio

| Particulars | X | Y | Z |
|---|---|---|---|
| Factory cost per minute (₹ 2,21,600/75,120 minutes) (₹) | 2.95 | 2.95 | 2.95 |
| TA ratio (Contribution per minute/Cost per minute) | 0.95 | 1.02 | 0.85 |
| Ranking | II | I | III |

Analysis - Product Y yields more contribution compared to average factory contribution per minute, whereas X and Z yield less. J.

**Answer: 4(b)** **In the books of Dandia Ltd.**

**Journal Entries (Backflush)**

| **Particulars** | **Debit (₹)** | **Credit (₹)** |
|---|---|---|
| Raw Material in Process A/c.....Dr. | 2,00,000 | |
| To, Accounts Payable | | 2,00,000 |
| (being purchase of raw materials) | | |
| Conversion Cost Control A/c.....Dr. | 3,36,000 | |
| To, Direct wages A/c | | 36,000 |
| To, Accounts Payable | | 3,00,000 |
| (being overhead cost incurred) | | |
| Finished Goods A/c.....Dr. | 5,16,000 | |
| To, Raw Material in Process A/c | | 2,00,000 |
| To, WIP A/c | | 3,16,000 |
| (Being completion of goods) | | |
| Cost of Goods Sold A/c.....Dr. | 5,16,000 | |
| To, Finished Goods | | 5,16,000 |
| (being cost of finished goods sold transferred) | | |
| Cost of Goods Sold A/c.....Dr. | 20,000 | |
| To, Overhead Control A/c | | 20,000 |
| (being variance is recognized) | | |

**5. (a) A Company with two manufacturing division is organized on profit centre basis. Division 'A' is the only source for the supply of a component that is used in Division B in the manufacture of a product KPO. One such part is used each unit of the product KPO. As the demand for the product is not steady. Division B can obtain order for increased quantities only by spending more on sales promotion and by reducing the selling prices. The manager of Division B has accordingly prepared the following forecast of sales quantities and selling prices.**

| Sales units per day | Average Selling price per unit of KPO (₹) |
|---|---|
| 1,000 | 5.25 |
| 2,000 | 3.98 |
| 3,000 | 3.30 |
| 4,000 | 2.78 |
| 5,000 | 2.40 |
| 6,000 | 2.01 |

**The manufacturing cost of KPO in Division B is ₹3,750 first 1,000 units and ₹750 per 1,000 units in excess of 1,000 units.**

**Division A incurs a total cost of ₹1,500 per day for an output to 1,000 components and the total costs will increase by ₹900 per day for every additional 1,000 components manufactured. The Manager of Division A states that the operating results of Division will be optimised if the transfer price of the component is set at ₹1.20 per unit and he has accordingly set the aforesaid transfer price for his supplies of the component to Division A.**

**You are required:**

**(i) Prepare a schedule showing the profitability at each level of output for Division A and Division B**

**(ii) Find the profitability of the company as a whole at the output level which (A) Division A's net profit is maximum. (B) Division B's net profit is maximum.**

**(iii) If the company is not organised on profit centre basis, what level of output will be chosen to yield the maximum profit. [8]**

**5. (b) XYZ Ltd. makes three main products, using broadly the same production methods and equipment for each. A conventional product costing system is used at present, although and Activity Based Costing (ABC) system is being considered. Details of the three products, for typical period are:**

| | Labour Hours per unit | Machine Hours per unit | Material per unit | Volumes unit |
|---|---|---|---|---|
| Product X | ½ | 1 ½ | ₹20 | 750 |
| Product Y | 1 ½ | 1 | ₹12 | 1,250 |
| Product Z | 1 | 3 | ₹25 | 7,000 |

**Direct labour costs ₹6 per hour and production overheads are absorbed on a machine hour basis. The rate for the period is ₹28 per machine hour.**

**You are required:**

**(i) to calculate the cost per unit for each product using conventional methods. Further analysis shows that the total of production overheads can be divided as follows**

| | % |
|---|---|
| Costs relating to set-ups | 35 |
| Costs relating machinery | 20 |
| Costs relating materials handling | 15 |
| Costs relating to inspection | 30 |
| Total production overhead | 100% |

**The following activity volumes are associated with the product line for the period as a whole. Total activities for the period**

| | Number of Set- ups | Number of movements of materials | Number of Inspections |
|---|---|---|---|
| **Product X** | **75** | **1** | **150** |
| **Product Y** | **115** | **2** | **180** |
| **Product Z** | **480** | **8** | **670** |
| | **670** | **12** | **1,000** |

**You are required:**

**(ii)To calculate the cost per unit for each product using ABC principles; c) to comment on the reasons for any differences in the costs in your answers to (a) and (b). [8]**

**Answer: 5 (a)**

(i) Statement showing profit of division A:

| Sale per day(units) | Sale value | Cost | Profit/(loss) |
|---|---|---|---|
| | ₹ | ₹ | ₹ |
| 1000 | 1200 | 1500 | (300) |
| 2000 | 2400 | 2400 | - |
| 3000 | 3600 | 3300 | 300 |
| 4000 | 4800 | 4200 | 600 |
| 5000 | 6000 | 5100 | 900 |
| 6000 | 7200 | 6000 | 1200 |

Profit of division B:

| No of units | Sales | Transfer price | Other manufacturing cost | Total cost | Profit/(loss) |
|---|---|---|---|---|---|
| | ₹ | ₹ | ₹ | ₹ | ₹ |
| 1000 | 5250 | 1200 | 3750 | 4950 | 300 |
| 2000 | 7960 | 2400 | 4500 | 6900 | 1060 |
| 3000 | 9900 | 3600 | 5250 | 8850 | 1050 |
| 4000 | 11120 | 4800 | 6000 | 10800 | 320 |
| 5000 | 12000 | 6000 | 6750 | 12750 | (750) |
| 6000 | 12060 | 7200 | 7500 | 14700 | (2640) |

(ii) Profitability of the company at the output level where division A's net profit is maximum:

| | ₹ |
|---|---|
| Profit of division A at 6000units | 1200 |
| Profit of division B at 6000units | (2640) |
| Profit /(loss) | (1440) |
| Division B's net profit is maximum: | |
| Profit of division A at 2000 units | - |
| Profit of division B at 2000units | 1060 |
| | 1060 |

(iii) When the company is not organized on profit centre basis

Profit at different levels of output

| Units | Division A | Division B | Total |
|---|---|---|---|
| | ₹ | ₹ | ₹ |
| 1000 | (300) | 300 | — |
| 2000 | -— | 1060 | 1060 |
| 3000 | 300 | 1050 | 1350 |
| 4000 | 600 | 320 | 920 |
| 5000 | 900 | (750) | 150 |
| 6000 | 1200 | (2640) | (1440) |

Best output level is 3000 units

**Answer: 5(b)**

(i) Computation of cost per unit using Conventional Methods:

Total overheads ₹

X = 750 x 1.5 x 28= 31,500

Y = 1250 x 1 x 28= 35,000

Z = 7000 x 3 x 28= 5,88,000

6,54,500

Computation of Cost

| | X | Y | Z |
|---|---|---|---|
| | ₹ | ₹ | ₹ |
| Materials | 20 | 12 | 25 |
| Labour | 3 | 9 | 6 |
| Overheads | 42 | 28 | 84 |
| Factory Cost | 65 | 49 | 115 |

(ii) Under ABC Costing

| | Setup Cost | Machine Cost | Machine Handling Cost | Inspection Expenses | Total |
|---|---|---|---|---|---|
| Costs(₹) | 2,29,075 | 1,30,900 | 98,175 | 1,96,350 | 6,54,500 |
| Cost Driver | No. of setups | Machine hours | No. of Moment of Materials | No. of Inspections | |
| Cost driver rates(₹) | 341.90 (229075/670) | 5.6 (130900/23375) | 818.125 (98,175/120) | 196.35 (196350/1000) | |

Cost per unit under ABC costing

| | X | | Y | | Z | |
|---|---|---|---|---|---|---|
| | ₹ | ₹ | ₹ | ₹ | ₹ | ₹ |
| Materials | | 20.00 | | 12.00 | | 25.00 |
| Labour | | 3.00 | | 9.00 | | 6.00 |
| Overheads | | | | | | |
| Setup Cost | 34.19 | | 31.45 | | 23.44 | |
| Machine cost | 8.40 | | 5.60 | | 16.80 | |
| Machine Handling Cost | 13.09 | | 13.74 | | 10.17 | |
| Inspection Cost | 39.27 | 94.95 | 28.27 | 79.06 | 18.79 | 69.20 |
| Total Cost | | 117.95 | | 100.06 | | 100.20 |

**6. (a) The ABC Pvt. Ltd., which has a satisfactory preventive maintenances system in its plant has installed a new Hot Air Generator based on electricity instead of fuel oil for drying its finished products. The Hot Air Generator required periodic shutdown maintenance. If the shutdown is scheduled yearly, the cost of maintenance will be as under:**

| Maintenance Cost | Probability |
|---|---|
| ₹15,000 | 0.3 |
| ₹20,000 | 0.4 |
| ₹25,000 | 0.3 |

**The costs are expected to be almost linear, i.e., if the shutdown is scheduled twice a year the maintenance cost will be double.**

**There is no previous experience regarding the time taken between breakdowns. Costs associated with breakdown will vary depending upon the periodicity of maintenance. The probability distribution of breakdown cost is estimated as under:**

| Breakdown Costs per annum | Shutdown once a year | Shutdown twice a year |
|---|---|---|
| ₹75,000 | 0.2 | 0.5 |
| ₹80,000 | 0.5 | 0.3 |
| ₹1,00,000 | 0.3 | 0.2 |

**Simulate the total costs – maintenance and breakdown costs – and recommend whether shutdown overhauling should be resorted to once a year or twice a year? [8]**

**6. (b) A captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows:**

| Batsmen | Batting Position | | | | | |
|---|---|---|---|---|---|---|
| | | III | IV | V | VI | VII |
| | A | 40 | 40 | 35 | 25 | 50 |
| | B | 42 | 30 | 16 | 25 | 27 |
| | C | 50 | 48 | 40 | 60 | 50 |
| | D | 20 | 19 | 20 | 18 | 25 |
| | E | 58 | 60 | 59 | 55 | 53 |

**Make the assignment so that the expected total average runs scored by these batsmen are maximum.**

**[8]**

**Answer: 6(a)**

Assigning random numbers to maintenance cost once a year basis:

| Cost (₹) | Probability | Random Numbers (R.N.) |
|---|---|---|
| 15,000 | 0.30 | 00-29 |
| 20,000 | 0.40 | 30-69 |
| 25,000 | 0.30 | 70-99 |

Assigning random numbers to breakdown costs when overhaulding is once a year basis:

| Cost (₹) | Probability | Random Numbers (R.N.) |
|---|---|---|
| 75,000 | 0.20 | 00-19 |
| 80,000 | 0.50 | 20-69 |
| 1,00,000 | 0.30 | 70-99 |

The total costs will be as under:

| Year | R.N | Maintenance Cost | R.N. | Breakdown Cost | Total |
|---|---|---|---|---|---|
| 1 | 27 | 15,000 | 03 | 75,000 | 90,000 |
| 2 | 44 | 20,000 | 50 | 80,000 | 1,00,000 |
| 3 | 22 | 15,000 | 73 | 1,00,000 | 1,20,000 |
| 4 | 32 | 20,000 | 87 | 1,00,000 | 1,20,000 |
| 5 | 97 | 25,000 | 59 | 80,000 | 1,05,000 |
| | | | | Average Annual Cost | 1,06,000 |

Assigning random numbers to maintenance costs, on twice a year basis:

| Cost | Probability | Random Numbers (RN) |
|---|---|---|
| 30,000 | 0.30 | 00-29 |
| 40,000 | 0.40 | 30-69 |
| 50,000 | 0.30 | 70-99 |

Assigning random numbers to breakdown costs

| Cost | Probability | Random Numbers (RN) |
|---|---|---|
| 75,000 | 0.50 | 00-49 |
| 80,000 | 0.30 | 50-69 |
| 1,00,000 | 0.20 | 80-99 |

The total costs will be as under:

| Year | R.N | Maintenance Cost | R.N. | Breakdown Cost | Total |
|---|---|---|---|---|---|
| 1 | 42 | 40,000 | 54 | 80,000 | 1,20,000 |
| 2 | 04 | 30,000 | 65 | 80,000 | 1,10,000 |
| 3 | 82 | 50,000 | 49 | 75,000 | 1,25,000 |
| 4 | 38 | 40,000 | 03 | 75,000 | 1,15,000 |
| 5 | 91 | 50,000 | 56 | 80,000 | 1,30,000 |
| | | | | Average Annual Cost | 1,06,000 |

[Note R.Ns. are taken from table]

Recommendation: From the above working it may be seen that shutdown maintenance/overhauling once a year will be more economical. The average annual cost will only be ₹1.06 lakhs as against 1.20 lakhs when shutdown is twice a year.

**Answer: 6(b)**

| | III | IV | V | VI | VII |
|---|---|---|---|---|---|
| A | 40 | 40 | 35 | 25 | 50 |
| B | 42 | 30 | 16 | 25 | 27 |
| C | 50 | 48 | 40 | 60 | 50 |
| D | 20 | 19 | 20 | 18 | 25 |
| E | 58 | 60 | 59 | 55 | 53 |

Loss Matrix

| | | | | |
|---|---|---|---|---|
| 20 | 20 | 25 | 35 | 10 |
| 18 | 30 | 44 | 35 | 33 |
| 10 | 12 | 20 | 0 | 10 |
| 40 | 41 | 40 | 42 | 35 |
| 2 | 0 | 1 | 5 | 7 |

Row Operation

| $M_3$ | | | | |
|---|---|---|---|---|
| 10 | 10 | 14 | 25 | 0 |
| 0 | 12 | 25 | 17 | 15 |
| 10 | 12 | 19 | 0 | 10 |
| 5 | 6 | 4 | 7 | 0 |
| 2 | 0 | 0 | 5 | 7 |

Column Operation

| | | | | |
|---|---|---|---|---|
| 10 | 10 | 15 | 25 | 0 |
| 0 | 12 | 26 | 17 | 15 |
| 10 | 12 | 20 | 0 | 10 |
| 5 | 6 | 5 | 7 | 0 |
| 2 | 0 | 1 | 5 | 7 |

Improved Matrix

| | | | | |
|---|---|---|---|---|
| 10 | 6 | 10 | 25 | 0 |
| 0 | 8 | 21 | 17 | 15 |
| 10 | 8 | 15 | 0 | 10 |
| 5 | 2 | 0 | 7 | 0 |
| 6 | 0 | 0 | 9 | 11 |

Maximum Average Runs

| | | | | |
|---|---|---|---|---|
| A | → | VII | - | 50 |
| B | → | III | - | 42 |
| C | → | VI | - | 60 |
| D | → | V | - | 20 |

**7.(a) A Company manufactures 3 products which are processed through 3 different production stages. The time required to manufacture one unit of each of the three products and the daily capacity of the stages are given in the following table:**

| State | Time/unit in minutes | | | |
|---|---|---|---|---|
| | Product | Product 2 | Product 3 | Stage capacity (minutes) |
| 1 | 1 | 2 | 1 | 430 |
| 2 | 3 | - | 2 | 460 |
| 3 | 1 | 4 | - | 420 |
| Profit/unit | ₹3 | ₹2 | ₹5 | |

**(i) Set the data in a simplex table.**
**(ii) Find the table for optimum solution** **[8]**

**7. (b) The following table gives data on normal time & cost and crash time& cost for a project.**

| Activity | Normal | | Crash | |
|---|---|---|---|---|
| | Time (days) | Cost (₹) | Time (days) | Cost (₹) |
| 1 – 2 | 6 | 600 | 4 | 1,000 |
| 1 – 3 | 4 | 600 | 2 | 2,000 |
| 2 – 4 | 5 | 500 | 3 | 1,500 |
| 2 – 5 | 3 | 450 | 1 | 650 |
| 3 – 4 | 6 | 900 | 4 | 2,000 |
| 4 – 6 | 8 | 800 | 4 | 3,000 |
| 5 – 6 | 4 | 400 | 2 | 1,000 |
| 6 – 7 | 3 | 450 | 2 | 800 |

**The direct cost per day is ₹100**

**(i) Draw the network and identify the critical path [8]**

**(ii) What are the normal project duration and associated cost?**

**Answer: 7(a)**

Let $x_1$ be the no. of units of product 1

Let $x_2$ be the no. of units of product 2

Let $x_3$ be the no. of units of product 3

**Objective function**: Max $Z = 3x_1+2x_2 + 5x_3$

**Subject to constraints**:

$x_1+2x_2+ x_3 \leq 430$

$3x_1+2x_3 \leq 460$

$x_1+4x_2 \leq 420$

And $x_1, x_2, x_3 \geq 0$

$x_1+2x_2+ x_3+S_1 = 430$

$3x_1+2x_3 +S_2 = 460$

$x_1+4x_2 + S_3 = 420$

Max $Z = 3x_1+2x_2 + 5x_3+0.S_1+0.S_2+0.S_3$

$\therefore$ $x_1 = 0$

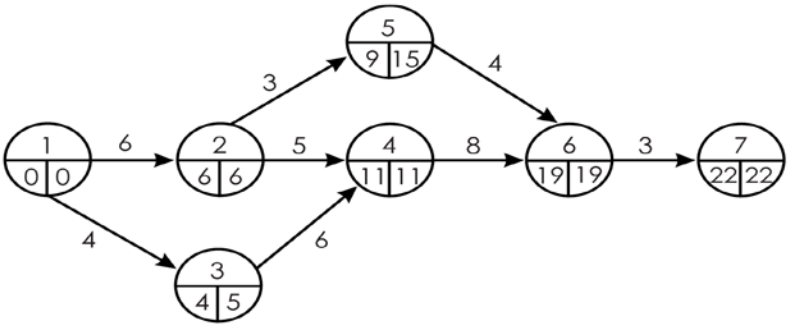
$x_2 = 100$

$x_3 = 230$

$z = 1350$

**Answer: 7(b)**

(i) The network for normal activity times indicates a project time of 22 weeks with the critical path 1-2-4-6-7.




(ii) Normal project duration is 22 weeks and the associated cost is as follows:

Total cost = Direct normal cost + Indirect cost for 22 weeks.

= 4,700 + 100 x 22 = ₹ 6,900.

**8. Write Short note (any four)** **[4×4 =16]**

**(a) Advantages of Activity Based Costing**
**(b) Lean Accounting**
**(c) Vogel's Approximation Method (VAM)**
**(d) Steps to be followed to increase the throughput**
**(e) Benefits of Inter-firm Comparison**

**Answer:**

**8 (a) Advantages of Activity Based Costing**

(i) It provides more accurate product costing information by reducing arbitrary cost allocations.
(ii) It improves the quality of information available for decision making by answering the questions such as what activities and events are driving cost and where efforts should be made to control cost?
(iii) It is easiest way to allocate overhead in the product.
(iv) It helps to identify the activities that can be eliminated.
(v) It links up cause and effect relationship.
(vi) A BC helps to identify the value added activities (that increase the customer's satisfaction) and non- value added activities (that creates the problems in customer's satisfaction)
(vii) ABC translates cost in to a language that people can understand and that can be linked up to business activities.

**(b) Lean Accounting**

Lean Accounting is the general term used for the changes required to a company's accounting, control, measurement, and management processes to support lean manufacturing and lean thinking. Most companies embarking on lean manufacturing soon find that their accounting processes and management methods are at odds with the lean changes they are making. Lean manufacturing breaks the rules of mass production, and so the traditional accounting and management methods are (at best) unsuitable and usually actively hostile to the lean changes the company is making.

Lean Accounting is itself lean, low-waste, and visual, and frees up finance and accounting people's time so they can become actively involved in lean change instead of being merely "bean counters." Companies using Lean Accounting have better information for decision-making, have simple and timely reports that are clearly understood by everyone in the company, they understand the true financial impact of lean changes, they focus the business around the value created for the customers, and Lean Accounting actively drives the lean transformation. This helps the company to grow, to add more value for the customers, and to increase cash flow and value for the stock-holders and owners.

**(c) 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 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) Steps to be followed to increase the throughput**

The theory of constraints is applied within an organisation by following what are called 'the five focusing steps.' These are a tool that Goldratt developed to help organisations deal with constraints, otherwise known as bottlenecks, within the system as a whole (rather than any discrete unit within the organisation.) The steps are as follows:

(a) Identify the bottle neck in the system i.e., identification of the limiting factor of the production (or) process such as installing capacity or hours etc.
(b) Decide how to exploit the systems bottleneck that means bottleneck resource should be actively and effectively used as much as possible to produce as many goods as possible.
(c) Subordinate everything else to the decision made in step (b). The production capacity of the bottleneck resource should determined production schedule.
(d) Augment the capacity of the bottleneck resource with the minimum capital input.
(e) Identify the new bottlenecks in the process and repeat the same above steps to address the bottlenecks.

**(e) Benefits of Inter-firm Comparison**

(a) Inter-firm Comparison makes the management of the organisation aware of strengths and weakness in relation to other organisations in same industry.
(b) As only the significant items are reported to the Management time and efforts are not unnecessary wasted.
(c) The management is able to keep up to data information of the trends and ratios and it becomes easier for them to take the necessary steps for improvement.
(d) It develops cost consciousness among the members of the industry.
(e) Information about the organisation is made available freely without the fear of disclosure of confidential data to outside market or public.
(f) Specialized knowledge and experience of professionally run and successful organisations are made available to smaller units who can take the advantages it may be possible for them to have such an infrastructure.
(g) The industry as a whole benefits from the process due to increased productivity, standardization of products, elimination of unfair comparison and the trade practices.
(h) Reliable and collective data enhance the organising power in deal in with various authorities and Government bodies.
(i) Inter firm comparison assists in a big way in identifying industry sickness and gives a timely warning so that effective remedial steps can be taken to save the organisation.