PAPER – 5 : ADVANCED MANAGEMENT ACCOUNTING

QUESTIONS

Value Added/ Non- Value Added Activities

1. Qwerty manufactures high-quality wooden doors within the forests of Qtown since 1967. Management is having emphasize on creativity, engineering, innovation and experience to provide customers with the door they desire, whether it is a standard design or a one-of-a-kind custom door. The following information pertains to operations during April:

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

(*) average time per batch

Required

Compute the following operational measures:

(i) Average non-value-added time per batch

(ii) Average value added time per batch

(iii) Manufacturing cycle efficiency

(iv) Manufacturing cycle time

Life Cycle Costing and Pricing Strategy

2. OR International Ltd. (ORIL) has developed a new product 'α^3'which is about to be launched into the market. Company has spent ₹ 30,00,000 on R&D of product 'α^3'. It has also bought a machine to produce the product 'α^3' costing ₹ 11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value.

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

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

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

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

Unit variable costs are expected to be as follows:

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

ORIL uses just-in-time production system. Following is the total contribution statement of the product 'α^3' for its Introduction and Growth phase:

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

Required

(i) Prepare the total contribution statement for each of the remaining two phases of the product's life cycle.

(ii) Discuss Pricing Strategy of the product 'α^3'.

(iii) Find possible reasons for the changes in cost during the life cycle of the product 'α^3'.

Note: Ignore the time value of money.

Value Chain Analysis – Primary Activity

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

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

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

   Required

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

Just in Time

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

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

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

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

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

Following other information is given:

(a) All other production costs are either fixed or are not driven by labour hours worked.

(b) Production and sales occur evenly during each month and at present there is no stock at the end of Dec'16.

(c) The labour are to be paid for their minimum contracted hours in each month irrespective of any purchase and production system.

Required

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

Break-even Point – Production in Batches

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

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

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

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

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

Product specific fixed overhead:

Alpha.....10,00,000

Beta.....1,00,000

Gamma..... 2,00,000

Theta..... 1,00,000.....14,00,000

General fixed overheads.....6,20,000

31,00,000

The other information is as follows:-

	Alpha	Beta	Gamma	Theta	Total
Machine Hours	4,00,000	3,90,000	1,60,000	6,00,000	15,50,000
Labour Hours	1,00,000	2,60,000	1,60,000	1,50,000	6,70,000

Required

(i) Prepare a profitability statement that is more useful for decision making than the profit statement prepared by Z Ltd.

(ii) Calculate the break- even volume in batches and also in approximate units for Product 'Alpha'.

Determination of Production Mix/ Production Planning

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

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

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

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

Required

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

Pareto Analysis

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

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

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

Budget and Budgetary Control

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

The other relevant details are as under:

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

Required

Calculate

(i) Number of units of product proposed to be sold and selling price per unit.

(ii) Production budget in units.

(iii) Material purchase budget in units.

Standard Costing – Reconciliation of Budgeted and Actual Profit

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

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

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

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

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

Required

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

(i) The conventional method

(ii) The relevant cost method assuming that

(a) Materials are scarce and are restricted to supply of 20,000 Kgs. for the period.

(b) Labour hours are limited and available hours are only 16,000 hours for the period.

(c) There are no scarce inputs.

Transfer Pricing

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

Details of Division X are as follows:

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

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

Details of Division Y are as follows:

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

The Group Transfer Pricing Policy stipulates that

Transfers must be at opportunity cost.

Y must buy the components from X.

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

Required

(i) Present figures showing the weighted average transfer price, per component transferred to Y and the total profits earned by X for each of the following levels of external demand of X:

External demand = 15,000 components

External demand = 19,000 components

External demand = 35,000 components

(ii) Compute Division Y's profits when Division X has each of the above levels of demand.

(Only relevant figures need to be discussed. A detailed profitability statement for each situation is not required).

Transportation Problem - Degeneracy

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

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

Find the assignment, which minimizes the total cost of the project. Each contractor has to be awarded one job only.

Critical Path Analysis – Missing Figures and Network

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

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

(i) Find??? Figures.

(ii) Draw the network.

(iii) List the paths with their corresponding durations and state when the project can be completed.

PERT and CPM – Basic Concepts

13. State the validity of following statements along with the reasons:

(i) Two activities have common predecessor and successor activities. So, they can have common initial and final nodes.

(ii) In respect of any activity whether real or dummy, the terminal node should bear a number higher than the initial node number.

(iii) The difference between the latest event time and the earliest event time is termed as free float.

(iv) For every critical activity in a network, the earliest start and the earliest finish time as well as the latest finish time and the latest start time are the same.

(v) The optimal duration of a project is the minimum time in which it can be completed.

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

Simulation

14. An Investment Corporation wants to study the investment projects based on four factors: market demand in units, contribution per unit, advertising cost and the investment required. These factors are felt to be independent of each other. In analyzing a new consumer product, the corporation estimates the following probability distributions:

Demand (units)		Contribution per unit		Advertising Cost	
No.	Probability	₹	Probability	₹	Probability
10,000	0.20	25	0.25	50,000	0.22
20,000	0.25	35	0.30	60,000	0.33
30,000	0.30	45	0.35	70,000	0.44
40,000	0.25	55	0.10	80,000	0.01

The data for proposed investments are as follows:

Investment (₹)	50,00,000	55,00,000	60,00,000	65,00,000
Probability	0.10	0.30	0.45	0.15

Using simulation process, repeat the trials 5 times, compute the Return on Investment (ROI) for each trial and find the highest likely return.

Using the sequence (First 4 random numbers for the first trial, etc.)

09 24 85 07 84 38 16 48 41 73 54 57 92 07 99

64 65 04 78 72

Application of Learning Curve in Standard Costing

15. Aldi International Co. is a multiproduct firm and operates standard costing and budgetary control system. During the month of June firm launched a new product. An extract from performance report prepared by Sr. Accountant is as follows:

Particulars	Budget	Actual
Output	30 units	25 units
Direct Labour Hours	180.74 hrs.	118.08 hrs.
Direct Labour Cost	₹ 1,19,288	₹ 79,704

Sr. Accountant prepared performance report for new product on certain assumptions but later on he realized that this new product has similarities with other existing product of the company. Accordingly, the rate of learning should be 80% and that the learning would cease after 15 units. Other budget assumptions for the new product remain valid.

The original budget figures are based on the assumption that the labour has learning rate of 90% and learning will cease after 20 units, and thereafter the time per unit will be the same as the time of the final unit during the learning period, i.e. the 20th unit. The time taken for 1st unit is 10 hours.

Show the variances that reconcile the actual labour figures with revised budgeted figures in as much detail as possible.

Note:

The learning index values for a 90% and a 80% learning curve are −0.152 and −0.322 respectively.

[log 2 = 0.3010, log 3 = 0.47712, log 5 = 0.69897, log 7 = 0.8451, antilog of 0.6213 = 4.181, antilog of 0.63096 = 4.275]

Profitability Analysis

16. A company is planning to improve its profit level at least by 10% from the preliminary budget estimates of a profit of ₹32,80,000 for the coming year. It has worked out the following profit improvement plan:

(i) In the year just concluded the sales of the company were 10% of the total market of 12,00,000 units. For the preparation of the original budget estimate, the same market demand and the same share of market for the company was envisaged. Now it has been estimated that the total market demand will increase by 18% and the company's market share will increase to 11% from the present level of 10%.

(ii) The products are sold in two sizes - large and medium. The sales mix of each size was 50:50 so far. Now it is planned that the sales will be 40% of large and 60% of medium. The medium packs and large packs have a contribution of ₹ 10 and ₹ 8 per pack respectively. The budget proposes to raise the price in such a manner that the contribution per pack will increase by ₹ 0.60 for each size.

(iii) There will be an additional expenditure on sales promotion worth ₹78,000.

(iv) The company proposes to save ₹9,000 by saving on interest cost in the coming year by better financial management.

Required

Draw a profit improvement plan in financial terms and spell out separately the effect of various factors on profit.

SUGGESTED ANSWERS/ HINTS

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

= Inspection Time + Waiting Time + Move Time

= 1.5 hr. + 6.0 hrs. + 7.5 hrs.

= 15 hrs.

(ii) Average Value Added Time per batch

= Processing Time

= 9 hrs.

(iii) Manufacturing Cycle Efficiency

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

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

= 37.5%

(iv) Manufacturing Cycle Time

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

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

= 0.40 hrs. *per unit*

2. (i) Total Contribution Statement

Statement Showing 'Total Contribution' for remaining two phases

Particulars	Maturity		Decline
Weeks	31 - 50	51 - 70	71 - 110
Number of units Produced and Sold	22,000	22,000	22,000

Selling Price per unit (₹)	450	450	300
Unit Variable Cost (₹)	225	188	225
Unit Contribution (₹)	225	262	75
Total Contribution (₹)	49,50,000	57,64,000	16,50,000

(ii) Pricing Strategy for Product α^3

ORIL is following the skimming price strategy that's why it has planned to launch the product α^3 initially with high price tag.

A skimming strategy may be recommended when a firm has incurred large sums of money on research and development for a new product.

In the question, ORIL has incurred a huge amount on research and development. Also, it is very difficult to start with a low price and then raise the price. Raising a low price may annoy potential customers.

Price of the product α^3 is decreasing gradually stage by stage. This is happening because ORIL wants to tap the mass market by lowering the price.

(iii) Possible reasons for the changes in cost during the life cycle of the product 'α^3'

Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Possible reasons for the changes in cost during the life cycle of the product are as follows:

ORIL is expecting reduction in unit cost of the product α^3 over the life of product as a consequence of economies of scale and learning / experience curves.

Learning effect may be the possible reason for reduction in per unit cost if the process is labour intensive. When a new product or process is started, performance of worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of worker improves, time taken per unit reduces and thus his productivity goes up. The amount of improvement or experience gained is reflected in a decrease in cost.

Till the stage of maturity, ORIL is in the expansion mode. The ORIL may be able to take advantages of quantity discount offered by suppliers or may negotiate the price with suppliers.

Product α^3 has the least variable cost ₹188 in last phase of maturity stage; this is because a product which is in the mature stage may require less marketing support than a product which is in the growth stage so, there is a saving of marketing cost per unit.

Again, the cost per unit of the product α^3 jumps to ₹225 in decline stage. As soon as the product reaches its decline stage, the need or demand for the product disappear and quantity discount may not be available. Even ORIL may have to incur heavy marketing expenses for stock clearance.

Workings:

Statement of Cumulative Sales along with Sales Price and Variable Cost

Weeks	Demand per week	Total Sales	Cumulative Sales	Selling Price per unit (₹)	Variable Cost per unit (₹)
1 - 10	220	2,200	2,200	750	375
11 - 20	550	5,500	7,700	600	300
21 - 30	825	8,250	15,950	525	300
31 - 50	1,100	22,000	37,950	450	225
51 - 70	1,100	22,000	59,950	450	188
71 - 80	880	8,800	68,750	300	225
81 - 90	660	6,600	75,350	300	225
91 - 100	440	4,400	79,750	300	225
101 - 110	220	2,200	81,950	300	225

3. Primary activities are the activities that are directly involved in transforming inputs into outputs and delivery and after-sales support to output. Following are the primary activities in the value chain of Sinopec Ltd:

(i) **Inbound Logistics**: These activities are related to the material handling and warehousing. It also covers transporting raw material from the supplier to the place of processing inside the factory.

(ii) **Operations:** These activities are directly responsible for the transformation of raw material into final product for the delivery to the consumers.

(iii) **Outbound Logistics:** These activities are involved in movement of finished goods to the point of sales. Order processing and distribution are major part of these activities.

(iv) **Marketing and Sales:** These activities are performed for demand creation and customer solicitation. Communication, pricing and channel management are major part of these activities.

(v) **Service:** These activities are performed after selling the goods to the consumers. Installation, repair and parts replacement are some examples of these activities.

4. **Workings**

Statement Showing 'Inventory Holding Cost' under Current System

Particulars		Jan	Feb	Mar	Apr	May	Jun
Opening Inventory*	(A)	---	650	690	430	880	1,030
Add: Production*		3,800	3,800	3,800	3,800	3,800	3,800
Less: Demand*		3,150	3,760	4,060	3,350	3,650	4,830
Closing Inventory*	(B)	650	690	430	880	1,030	-

Average Inventory $\left(\frac{A+B}{2}\right)$	325	670	560	655	955	515
Inventory Holding Cost @ ₹70	22,750	46,900	39,200	45,850	66,850	36,050

(*) *in terms of standard labour hours*

Inventory Holding Cost *for the six months* = ₹2,57,600

(₹ 22,750 + ₹ 46,900 + ₹ 39,200 + ₹ 45,850 + ₹ 66,850 + ₹ 36,050)

Calculation of Relevant Overtime Cost under JIT System

Particulars	Jan	Feb	Mar	Apr	May	Jun
Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Production*	3,150	3,760	4,060	3,350	3,650	4,830
Normal Availablility*	3,800	3,800	3,800	3,800	3,800	3,800
Shortage (=Overtime*) (C)	---	---	260	----	----	1,030
Actual Overtime Hours $\left(\frac{C}{0.95}\right)$	---	---	273.68	----	----	1,084.21
Overtime Payment @ ₹159.50 [110+45%]	---	---	43,652	----	----	1,72,931

(*) *in terms of standard labour hours*

Total Overtime payment = ₹ 2,16,583

(₹ 43,652 + ₹ 1,72,931)

Therefore, saving in JIT system = ₹ 2,57,600 – ₹ 2,16,583 = ₹ 41,017

Comments

Though YPL is saving ₹41,017 by changing its production system to Just-in-time but it has to consider other factors as well before taking any final call which are as follows:-

(i) YPL has to ensure that it receives materials from its suppliers on the exact date and at the exact time when they are needed. Credentials and reliability of supplier must be thoroughly checked.

(ii) To remove any quality issues, the engineering staff must visit supplier's sites and examine their processes, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.

(iii) YPL should also aim to improve quality at its process and design levels with the purpose of achieving "Zero Defects" in the production process.

(iv) YPL should also keep in mind the efficiency of its work force. YPL must ensure that labour's learning curve has reached at steady rate so that they are capable of

performing a variety of operations at effective and efficient manner. The workforce must be completely retrained and focused on a wide range of activities.

5. (i) Statement of Profitability of Z Ltd.

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

(ii) Break-even Point

Total Sale Value of Product 'Alpha' = ₹ 26,00,000

Total Contribution of Product 'Alpha' = ₹ 9,40,000

Specific Fixed Overheads (Product Alpha) = ₹ 10,00,000

$$\text{Break-even Sales (₹)} = \frac{\text{Specific Fixed Cost}}{\text{Total Contribution}} \times \text{Total Sales Value}$$

$$= \frac{₹\,10,00,000}{₹\,9,40,000} \times ₹26,00,000$$

$$= ₹27,65,957.45$$

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

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

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

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

Workings:

W.N.-1

Calculation Showing Overhead Rates

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

W.N.-2

Statement Showing - Overhead Costs Related to Product

Particulars	Alpha	Beta	Gamma	Theta
Machining hrs. related overheads	₹ 1,60,000 (4,00,000 hrs × ₹0.40)	₹ 1,56,000 (3,90,000 hrs × ₹ 0.40)	₹ 64,000 (1,60,000 hrs × ₹ 0.40)	₹ 2,40,000 (6,00,000 hrs × ₹ 0.40)
Batch related overheads	₹1,00,000 (2,000 batches × ₹ 50)	₹1,30,000 (2,600 batches × ₹ 50)	₹80,000 (1,600 batches × ₹ 50)	₹1,50,000 (3,000 batches × ₹ 50)

6. Computation of Contribution per Key Factor(s) for Various Products

Particulars	Products		
	P	Q	R
Selling Price p. u. (₹)	500	400	800
Variable Cost p. u. (₹):			
Material	400 (₹20 × 20 Kg.)	240 (₹20 × 12 Kg.)	600 (₹20 × 30 Kg.)
Machine Charge	60 (₹20 × 3 hrs)	100 (₹ 20 × 5 hrs)	80 (₹20 × 4 hrs)
Total Variable Cost p. u. (₹)	460	340	680
Contribution p. u. (₹)	40	60	120
Ranking	**III**	**II**	**I**
Requirement of Material (Kg.)	20	12	30

Contribution per Kg. (₹)	2.00	5.00	4.00
Ranking	**III**	**I**	**II**
Requirement of Machine Hours (Hrs.)	3	5	4
Contribution *per hour* (₹)	13.33	12.00	30.00
Ranking	**II**	**III**	**I**

It is clear from the above ranking(s):-

I. Contribution per Unit is maximum in case of product Q & R.

II. Contribution per Kg. of Raw Material also maximum in case of product Q & R.

III. Contribution per Machine Hour is maximum in case of product P & R.

So product R is common in all cases and priority shall be given for production of 'R'. Balance resources should be divided between other two products P & Q.

Statement Showing Balance Resources for Product P & Q

Resources	Maximum Availability (a)	Maximum Production R (b)	Consumption of Resources p.u. (c)	Total Cons. (d) = (b) x (c)	Balance (a) - (d)
Material	50,000 Kg.	750	30 Kg.	22,500 Kg.	27,500 Kg.
Machine Hrs.	9,200 Hrs.	750	4 Hrs.	3,000 Hrs.	6,200 Hrs.

The production of P & Q may be calculated with the help of following equations by utilizing balance resources: -

$$20P + 12Q = 27,500 \quad \ldots(i)$$
$$3P + 5Q = 6,200 \quad \ldots(ii)$$

Then,

$$30P + 18Q = 41,250$$

equation (i) multiplied by 1.5

$$30P + 50Q = 62,000$$

equation (ii) multiplied by 10

$$-32Q = -20,750$$
$$Q = 648.43 \text{ i.e. } 648 \text{ units}$$

Putting the value of Y in equation (ii)

$$3P + (5 \times 648) = 6,200$$

Or

$$3P = 2,960$$

Or

$$P = 986 \text{ units}$$

So the of Product Mix is

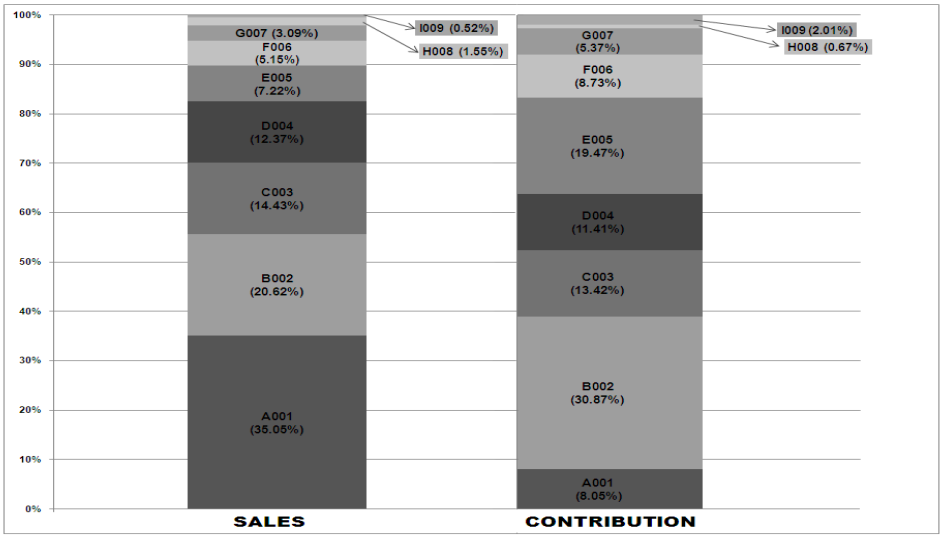
P= 986 units; Q = 648 units; R = 750 units

7. Statement Showing 'Pareto Analysis'

Model	Sales (₹'000)	% of Total Sales	Cumulative Total	Model	Cont. (₹'000)	% of Total Cont.	Cumulative Total %
Pareto Analysis Sales				Pareto Analysis Contribution			
A001	5,100	35.05%	35.05%	B002	690	30.87%	30.87%
B002	3,000	20.62%	55.67%	E005	435	19.47%*	50.34%
C003	2,100	14.43%	70.10%	C003	300	13.42%	63.76%
D004	1,800	12.37%	82.47%	D004	255	11.41%	75.17%
E005	1,050	7.22%	89.69%	F006	195	8.73%*	83.90%
F006	750	5.15%	94.84%	A001	180	8.05%	91.95%
G007	450	3.09%	97.93%	G007	120	5.37%	97.32%
H008	225	1.55%	99.48%	I009	45	2.01%	99.33%
I009	75	0.52%	100.00%	H008	15	0.67%	100.00%
	14,550	100.00%			2,235	100.00%	

(*) *Rounding - off difference adjusted.*

Diagram Showing 'Sales and Contribution' (NOT COMPULSORY)



☞

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

Recommendations

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

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

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

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

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

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

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

8 (i) Workings:

Statement Showing Total Variable Cost *for the year*

Particulars	**Amount (₹)**
Estimated Sales Revenue	3,97,80,000
Less: Desired Profit Margin on Sale @ 20%	79,56,000
Estimated Total Cost	3,18,24,000
Less: Fixed Selling and Distribution Overheads	7,20,000
Total Variable Cost	3,11,04,000

Statement Showing Variable Cost per unit

Particulars	Variable Cost p.u. (₹)
Direct Materials:	
W: 6 Kg. @ ₹16 per Kg.	96
X: 3 Kg. @ ₹10 per Kg.	30
Labour Cost:	
Machine Shop: 4 hrs. @ ₹14 per hour	56
Assembly Shop: 2 hrs. @ ₹7 per hour	14
Factory Overheads: 20% of (₹56 + ₹14)	14
Variable Selling & Distribution Expenses	6
Total Variable Cost *per unit*	216

Number of Units Sold = Total Variable Cost / Variable Cost *per unit*

= ₹3,11,04,000 / ₹216

= 1,44,000 units

Selling Price *per unit* = Total Sales Value / Number of Units Sold

= ₹3,97,80,000 / 1,44,000 units

= ₹276.25

(ii) Production Budget (units)

Particulars	Units
Budgeted Sales	1,44,000
Add: Closing Stock	30,000
Total Requirements	1,74,000
Less: Opening Stock	25,000
Required Production	1,49,000

(iii) Materials Purchase Budget (Kg.)

Particulars	Material W	Material X
Requirement for Production	8,94,000 (1,49,000 units × 6 Kg.)	4,47,000 (1,49,000 units × 3 Kg.)
Add: Desired Closing Stock	80,000	55,000
Total Requirements	9,74,000	5,02,000
Less: Opening Stock	75,000	40,000
Quantity *to be purchased*	8,99,000	4,62,000

9. COMPUTATION OF VARIANCES

Material Usage Variance = Standard Price × (Standard Quantity – Actual Quantity)

= ₹4.00 × (18,000* Kgs. – 20,000 Kgs.)

= ₹ 8,000 (A)

$$*\left(1{,}800\ \text{units} \times \frac{20{,}000\ \text{Kgs.}}{2{,}000\ \text{units}}\right)$$

Labour Efficiency Variance = Standard Rate × (Standard Hours – Actual Hours)

= ₹8.00 × (14,400* hrs. – 14,800 hrs.)

= ₹3,200 (A)

$$*\left(1{,}800\ \text{units} \times \frac{16{,}000\ \text{hrs.}}{2{,}000\ \text{units}}\right)$$

Variable Overhead Efficiency Variance

= Standard Variable Overheads for Production – Budgeted Variable Overheads for Actual hours

= (14,400 hrs. × Rs.3.00) – (₹3.00 × 14,800 hrs.)

= ₹1,200 (A)

Fixed Overhead Volume Variance

= Absorbed Fixed Overheads – Budgeted Fixed Overheads

= (14,400 hrs. × ₹3.00) – (16,000 hrs. × ₹3.00)

= ₹4,800 (A)

Sales Margin Volume Variance

= Standard Margin – Budgeted Margin

= (1,800 units × ₹56.00) – (2,000 units × ₹56.00)

= ₹11,200 (A)

Sales Contribution Volume Variance

= Standard Contribution – Budgeted Contribution

= (1,800 units × ₹80.00) – (2,000 units × ₹80.00)

= ₹16,000 (A)

Statement Showing "Reconciliation Between Budgeted Profit & Actual Profit"

Particulars	Conv. Method (₹)	Relevant Cost Method (₹)		
		Scarce Material	Scarce Labour	No Scarce Inputs
Budgeted Profit (2,000 units × ₹56)	1,12,000	1,12,000	1,12,000	1,12,000
Sales Volume Variance	11,200 (A)	NIL*	12,000$ (A)	16,000 (A)
Material Usage Variance	8,000 (A)	24,000 (A)	8,000 (A)	8,000 (A)
Labour Efficiency Variance	3,200 (A)	3,200 (A)	7,200 (A)	3,200 (A)
Variable Overhead Effi. Variance	1,200 (A)	1,200 (A)	1,200 (A)	1,200 (A)
Fixed Overhead Volume Variance	4,800 (A)	N.A.#	N.A.#	N.A.#
Actual Profit	**83,600**	**83,600**	**83,600**	**83,600**

NOTES

Scarce Material

Based on conventional method, direct material usage variance is ₹8,000 (A) i.e. 2,000 Kg. × ₹4. In this situation material is scarce, and, therefore, material cost variance based on relevant cost method should also include contribution lost per unit of material. Excess usage of 2,000 Kg. leads to lost contribution of ₹16,000 i.e. 2,000 Kgs. × ₹8. **Total material usage variance based on relevant cost method, when material is scarce will be: ₹8,000 (A) + ₹16,000 (A) = ₹24,000 (A).** Since labour is not scarce, labour variances are identical to conventional method.

Excess usage of 2,000 Kgs. leads to loss of contribution from 200 units i.e. ₹16,000 (200 units × ₹80). It is not the function of the sales manager to use material efficiently. Hence, loss of contribution from 200 units should be excluded while computing sales contribution volume variance.

(*)→

Therefore, sales contribution volume variance, when materials are scarce will be NIL i.e. ₹16,000 (A) - ₹16,000 (A).

Scarce Labour

Material is no longer scarce, and, therefore, the direct material variances are same as in conventional method. In conventional method, excess labour hours used are: 14,400 hrs. – 14,800 hrs. = 400 hrs. Contribution lost per hour = ₹10. Therefore, total contribution lost, when labour is scarce will be: 400 hrs. × ₹10 = ₹4,000. **Therefore, total labour efficiency variance, when labour hours are scarce will be ₹7,200 (A) i.e. ₹3,200 (A) + ₹4,000 (A).**

Excess usage of 400 hrs. leads to loss of contribution from 50 units i.e. ₹4,000 (50 units × ₹80). It is not the function of the sales manager to use labour hours efficiently. Hence, loss of contribution from 50 units should be excluded while computing sales contribution volume Variance.

($)→

Therefore, sales contribution volume variance, when labour hours are Scarce will be ₹12,000 (A) i.e. ₹16,000 (A) - ₹4,000 (A).

Fixed Overhead Volume Variance

(#) →

The fixed overhead volume variance does not arise in marginal costing system. In absorption costing system, it represents the value of the under or over absorbed fixed overheads due to change in production volume. When marginal costing is in use there is no overhead volume variance, because marginal costing does not absorb fixed overheads.

10. (i) Computation of Weighted Average Transfer Price

Particulars	External Demand 15,000 Components	External Demand 19,000 Components	External Demand 35,000 Components
Component's Transfer Price (Base)	Variable Cost	Variable Cost *plus* Opportunity Cost for 4,000 Components	Variable Cost *plus* Opportunity Cost for 20,000 Components
Variable Cost	₹157.00	₹157.00	₹157.00
Opportunity Cost	0	₹28.60 $\left(\frac{4,000}{20,000}\times ₹143\right)$	₹143.00 $\left(\frac{20,000}{20,000}\times ₹143\right)$
Transfer Price	₹157.00	₹185.60	₹300.00

Opportunity Cost for a Component is the Contribution *forgone* by not Selling it to the market.

Contribution = Market Selling Price – Variable Cost

= ₹300 – ₹157 = ₹143

Statement Showing Profitability of Division- X

Particulars	External Demand 15,000 Components (₹)	External Demand 19,000 Components (₹)	External Demand 35,000 Components (₹)
Sales :			
Division-Y	31,40,000	37,12,000	60,00,000

	(₹157 × 20,000)	(₹185.60 × 20,000)	(₹300 × 20,000)
Market	45,00,000 (₹300 × 15,000)	45,00,000 (₹300 × 15,000)	45,00,000 (₹300 × 15,000)
Total Revenue	76,40,000	82,12,000	1,05,00,000
Less: Variable Cost (₹157 × 35,000)	54,95,000	54,95,000	54,95,000
Less: Fixed Cost	20,62,000	20,62,000	20,62,000
Profit	83,000	6,55,000	29,43,000

(ii) Statement Showing Profitability of Division- Y

Particulars	**External Demand 15,000 Components (₹)**	**External Demand 19,000 Components (₹)**	**External Demand 35,000 Components (₹)**
Selling Price *per unit*	1,200.00	1,200.00	1,200.00
Less: Variable Cost *per unit:*	314.00 (₹157 × 2)	371.20 (₹185.60 × 2)	600.00 (₹300 × 2)
Component –X			
Others	375.00	375.00	375.00
Contribution *per unit*	511.00	453.80	225.00
No. of units	10,000	10,000	10,000
Total Contribution	51,10,000	45,38,000	22,50,000
Less: Fixed Cost	13,50,000	13,50,000	13,50,000
Profit	37,60,000	31,88,000	9,00,000

11.

☞

Once the initial basic feasible solution is done, we have to do the optimality test. If it satisfy the condition that number of allocation is equal to m+n-1 where m= number of rows, n= number of columns. If allocation is less than m+n-1, then the problem shows degenerate situation. In that case we have to allocate an infinitely small quantity (e) in least cost and independent cell. Independent cells in Transportation Problems mean the cells which do not form a closed loop with occupied cells.

The table obtained after using VAM contains 4 occupied cells against the required number of 4 + 4 – 1 = 7, hence the solution is degenerate.

To remove degeneracy, a letter 'e' is placed in three independent cells. The problem for test of optimality is reproduced in table below:

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

☞

Alternatively, **'e'** can also be allocated to cell C_{42} instead of C_{11}.

Now total number of allocations become equal to m + n -1 i.e. 7. This solution is tested for optimality.

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

					u_i
	112.50	100.00	110.00	167.50	0
	117.50	105.00	115.00	172.50	5.00
	122.50	110.00	120.00	177.50	10.00
	102.50	90.00	100.00	157.50	-10.00
v_j	112.50	100.00	110.00	167.50	

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

Δ_{ij} Matrix

		17.50	
25.00		42.50	-35.00
	20.00		-17.50
	22.50	50.00	-20.00

Since all values of Δ_{ij} are not positive, the solution given above is not optimal. Let us include the cell with highest negative Δ_{ij} which is C_{24} as a basic cell and try to improve the solution. The reallocated solution is given below which is tested for optimality-

e	e +1		1 -1
	1 -1		 +1
e		1	
1			

Revised allocations (improved initial solution) are as follows-

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

☞

Again there is a situation of degenracy to remove this situation a new **'e'** has been allocated to least cost independent cell **C_{22}**.

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

				u_i
112.50	100.00	110.00	132.50	0
117.50	105.00	115.00	137.50	5.00

	122.50	110.00	120.00	142.50	10.00
	102.50	90.00	100.00	122.50	-10.00
v_j	112.50	100.00	110.00	132.50	

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

Δ_{ij} Matrix

		17.50	35.00
25.00		42.50	
	20.00		17.50
	22.50	50.00	15.00

Since all the entries in the above Δ_{ij} Matrix table are non-negative, this solution is optimal. The optimal assignment is given below-

Contractor	Job	Cost of Project
A	Q	100.00
B	S	137.50
C	R	120.00
D	P	102.50
	Total	460.00

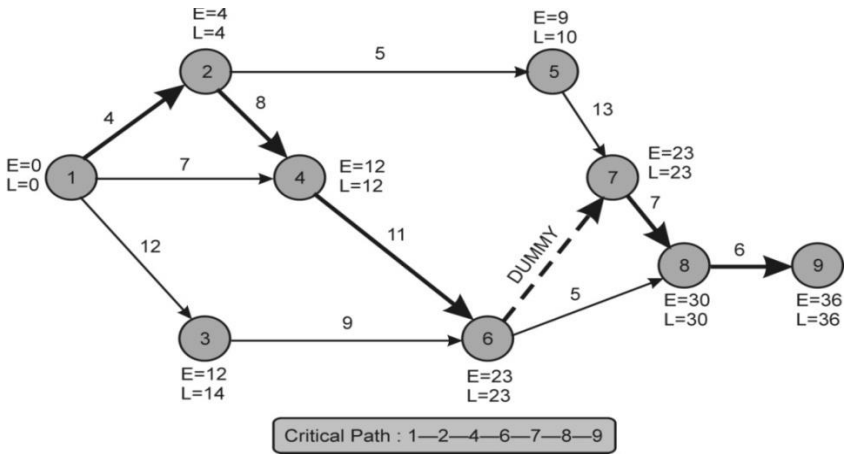
12. (i) Calculation of Missing Figures

Statement Showing Calculation of Missing Figures

Activity	Duration	EST	EFT	LST	LFT	Total Float
	D_{ij}	E_i	$E_i + D_{ij}$	$L_j - D_{ij}$	L_j	LST− EST
1–2	4	0	4	0	4	0
1–3	12	0	12	2	14	2
1–4	7	0	7	5	12	5
2–4	8	4	12	4	12	0
2–5	5	4	9	5	10	1
3–6	9	12	21	14	23	2
4–6	11	12	23	12	23	0
5–7	13	9	22	10	23	1

Activity	Duration	EST	EFT	LST	LFT	Total Float
	D_{ij}	E_i	$E_i + D_{ij}$	$L_j - D_{ij}$	L_j	LST− EST
6–7	0	23	23	23	23	0
6–8	5	23	28	25	30	2
7–8	7	23	30	23	30	0
8–9	6	30	36	30	36	0

(ii) The Network for the given problem:



(iii) Paths with their corresponding durations

The Various Paths in the Network are:

1–2–4–6–7–8–9 with Duration 36 Days

1–2–5–7–8–9 with Duration 35 Days

1–3–6–7–8–9 with Duration 34 Days

1–2–4–6–8–9 with Duration 34 Days

1–3–6–8–9 with Duration 32 Days

1–4–6–7–8–9 with Duration 31 Days

1–4–6–8–9 with Duration 29 Days

The Critical Path is 1–2–4–6–7–8–9 with Duration 36 Days.

13. (i) Invalid

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

(ii) Valid

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

(iii) Invalid

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

(iv) Invalid

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

(v) Invalid

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

(vi) Valid

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

14. Allocation of Random Numbers

Demand (units)

Units	Probability	Cumulative Probability	Random Nos.
10,000	0.20	0.20	00 – 19
20,000	0.25	0.45	20 – 44
30,000	0.30	0.75	45 – 74
40,000	0.25	1.00	75 – 99

Contribution per unit

₹	Probability	Cumulative Probability	Random Nos.
25	0.25	0.25	00 – 24
35	0.30	0.55	25 – 54
45	0.35	0.90	55 – 89
55	0.10	1.00	90 – 99

Advertising Cost

₹	Probability	Cumulative Probability	Random Nos.
50,000	0.22	0.22	00 – 21
60,000	0.33	0.55	22 – 54
70,000	0.44	0.99	55 – 98
80,000	0.01	1.00	99 – 99

Investment

₹	Probability	Cumulative Probability	Random Nos.
50,00,000	0.10	0.10	00 – 09
55,00,000	0.30	0.40	10 – 39
60,00,000	0.45	0.85	40 – 84
65,00,000	0.15	1.00	85 – 99

Simulation Table

Random Number	Demand Units	Contribution Per unit (₹)	Adv. Cost (₹)	Return (₹)	Investment (₹)	Return on Investment
09, 24, 85, 07	10,000	25	70,000	1,80,000	50,00,000	3.60%
84, 38, 16, 48	40,000	35	50,000	13,50,000	60,00,000	22.50%
41, 73, 54, 57	20,000	45	60,000	8,40,000	60,00,000	14.00%
92, 07, 99, 64	40,000	25	80,000	9,20,000	60,00,000	15.33%
65, 04, 78, 72	30,000	25	70,000	6,80,000	60,00,000	11.33%

Highest Likely Return is 22.50% relating to trial 2.

15. Working Note

The usual learning curve model is

$$y = ax^b$$

Where

y = Average time per unit for x units

a = Time required for first unit

x = Cumulative number of units produced

b = Learning coefficient

W.N.1

Time required for first 15 units based on revised learning curve of 80% (when the time required for the first unit is 10 hours)

$$y = 10 \times (15)^{-0.322}$$

$$\log y = \log 10 - 0.322 \times \log 15$$

$$\log y = \log 10 - 0.322 \times \log (5 \times 3)$$

$$\log y = \log 10 - 0.322 \times [\log 5 + \log 3]$$

$$\log y = 1 - 0.322 \times [0.69897 + 0.47712]$$

$$\log y = 0.6213$$

$$y = \text{antilog of } 0.6213$$

$$y = 4.181 \text{ hours}$$

$$\text{Total time for 15 units} = 15 \text{ units} \times 4.181 \text{ hours}$$

$$= 62.72 \text{ hours}$$

Time required for first 14 units based on revised learning curve of 80% (when the time required for the first unit is 10 hours)

$$y = 10 \times (14)^{-0.322}$$

$$\log y = \log 10 - 0.322 \times \log 14$$

$$\log y = \log 10 - 0.322 \times \log (2 \times 7)$$

$$\log y = \log 10 - 0.322 \times [\log 2 + \log 7]$$

$$\log y = 1 - 0.322 \times [0.3010 + 0.8451]$$

$$\log y = 0.63096$$

$$y = \text{antilog of } 0.63096$$

$$y = 4.275 \text{ hrs}$$

$$\text{Total time for 14 units} = 14 \text{ units} \times 4.275 \text{ hrs}$$

$$= 59.85 \text{ hrs}$$

Time required for 25 units based on revised learning curve of 80% (when the time required for the first unit is 10 hours)

Total time for first 15 units = 62.72 hrs

Total time for next 10 units = 28.70 hrs [(62.72 − 59.85) hours × 10 units]

Total time for 25 units = 62.72 hrs + 28.70 hrs

= 91.42 hrs

W.N.2

Computation of Standard and Actual Rate

Standard Rate = $\frac{₹1,19,288}{180.74 \text{ hrs.}}$

= ₹ 660.00 per hr.

Actual Rate = $\frac{₹79,704}{118.08 \text{ hrs.}}$

= ₹ 675.00 per hr.

W.N.3

Computation of Variances

Labour Rate Variance = Actual Hrs × (Std. Rate – Actual Rate)

= 118.08 hrs × (₹660.00 – ₹675.00) = ₹1,771.20 (A)

Labour Efficiency Variance = Std. Rate × (Std. Hrs – Actual Hrs)

= ₹660 × (91.42 hrs – 118.08 hrs)

= ₹17,595.60 (A)

Statement of Reconciliation (Actual Figures Vs Budgeted Figures)

Particulars	₹
Actual Cost	79,704.00
Less: Labour Rate Variance (Adverse)	1,771.20
Less: Labour Efficiency Variance (Adverse)	17,595.60
Budgeted Labour Cost (Revised)*	60,337.20

Budgeted Labour Cost (Revised)*

= Std. Hrs. × Std. Rate

= 91.42 hrs. × ₹660

= ₹ 60,337.20

16. Statement Showing Change in Profit

Particulars	Large (₹)	Medium (₹)	Total (₹)
I. Effect of Product Mix Changes			
Revised Estimated Sales Quantity (Ratio 40:60)	62,304	93,456	1,55,760
Revised Estimated Sales Quantity (Ratio 50:50)	77,880	77,880	1,55,760
Difference in Sales Quantity	(15,576)	15,576	NIL
Contribution Effect Thereon @ ₹8.60 and ₹10.60	(1,33,953.60)	1,65,105.60	**31,152**

II Effect of Volume Change			
Revised Estimate of Sales Quantity (50:50)	77,880	77,880	
Original Estimate of Sales Quantity (50:50)	60,000	60,000	
Difference in Sales Quantity	17,880	17,880	35,760
Contribution Effect Thereon @ ₹8 and ₹10	1,43,040	1,78,800	**3,21,840**
III. Effect of Price Change			
Revised Estimate of Sales Quantity (Ratio 40:60)	62,304	93,456	1,55,760
Difference in Price p.u.	0.60	0.60	0.60
Contribution Effect	37,382.40	56,073.60	**93,456**
IV. Effect of Expenses			
Sales Promotion Expenses			**(78,000)**
Savings in Interest			**9,000**
Overall Increase in Profit			**3,77,448**

Total Improvement in Profit ₹3,77,448 (11.51%).

Workings

Budget for Original and Revised Contribution

Particulars	Original Budget Estimate		Revised Estimate	
	Description	(₹)	Description	(₹)
Market- Sales Quantity	12,00,000 units		14,16,000	
Company's Share	1,20,000 units (10% of total)		1,55,760 units (11% of total)	
Sales Quantity				
Large	60,000 units (50% of mix)		62,304 (40% of mix)	
Medium	60,000 units (50% of mix)		93,456 (60% of mix)	
Contribution Earned				
Large	60,000 units × ₹8	4,80,000	62,304 units × ₹8.60	5,35,814.40
Medium	60,000 units × ₹10	6,00,000	93,456 units × ₹10.60	9,90,633.60
Effect of Expenses				
Sales Promotion		---		-78,000
Interest		---		9,000
Revised Contribution		10,80,000		14,57,448

☞

This question can also be solved by computing Sales Contribution Price Variance, Sales Contribution Mix Variance, Market Size Variance, Market Share Variance.