6

Decision Making

Q1: Catalyst Ltd. Makes a single product with the following details:

Description	Current Situation	Proposed Change
Selling Price (`/unit)	10	
Direct Costs (`/unit)	5	
Present number of setups per production period, (before each production run, setup is done)	42	
Cost per set up (`)	450	Decrease by ` 90
Production units per run	960	1,008
Engineering hours for production period	500	422
Cost per engineering hour (`)	10	

The company has begun Activity Based Costing of fixed costs and has presently identified two cost drivers, viz. production runs and engineering hours. Of the total fixed costs presently at ` 96,000, after the above, ` 72,100 remains to be analyzed. There are changes as proposed above for the next production period for the same volume of output.

Required:

(i) How many units and in how many production runs should Catalyst Ltd. produce in the changed scenario in order to break-even?

(ii) Should ABC Ltd. continue to break up the remaining fixed costs into activity based costs? Why?

Solution:

Workings

Statement Showing 'Non-unit Level Overhead Costs'

Particulars	Current Situation	Proposed Situation
No. of Production Runs/Setups	42	40 960 runs × 42 setup 1,008 units

Particulars	Current Situation	Proposed Situation
Cost per Setup	` 450	` 360
Production Units per run	960 units	1,008 units
Production Units	40,320 (960 units × 42)	40,320
Engineering Hrs.	500	422
Engineering Cost per hour	` 10	` 10

Requirement of Question

(i) Break Even Point (Changed Scenario)

Break Even Point

$$= \frac{\text{fixed cost} + (\text{setup cost x no.of setups}) + (\text{engineering cost x no.of engineering})}{(\text{price} - \text{unit variable cost})}$$

$$= \frac{\text{Rs } 72{,}100 + (\text{Rs } 360 \times 40 \text{ setups}) + (\text{Rs}10 \times 422 \text{ hrs})}{(Rs10 - Rs5)}$$

= 18,144 units

Break Even Point (No of Production Runs)

$$= \frac{\text{breakEven (units)}}{production\,(unitsperrun)}$$

$$= \frac{18{,}144 \text{ (units)}}{1{,}008 \text{ units}}$$

= 18 Runs

(ii) A company should adopt Activity Based Costing (ABC) system for accurate product costing, as traditional volume based costing system does not take into account the Non-unit Level

Overhead Costs such as Setup Cost, Inspection Cost, and Material Handling Cost etc. Cost Analysis under ABC system showed that while these costs are largely fixed with respect to sales volume, but they are not fixed to other appropriate cost drivers. If break up the remaining ` 72,100 fixed costs consist of only a small portion of these costs, ABC need not be applied.

However, it may also be noted that the primary study has resulted in cost savings. If the savings in cost are expected to exceed the cost of study and implementing ABC, it may be justified.

Further it is pertinent to mention that ABC offers no increase in product-costing accuracy for single-product setting.

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Q2: A Manufacturing Company produces ball pens that are printed with the logos of various companies. Each pen is priced at `5. Coats are as follows:

Cost Driver	Unit variable cost (`)	Level of cost driver

Units Sold	2.5	-
Setups	225	40
Engineering hours	10	250

Other data

Total fixed cost (conventional) `48,000

Total fixed costs (ABC) `36,500

Required:

(i) Compute the break-even points in units using activity-based ananlysis.

(ii) Suppose that company could reduce the setup cost by `75 per setup and could reduce the number of engineering hours needed to 215. How many units must be sold to break even in this case?

Solution: Break Even Points

(i) [Fixed costs + (setup cost x setups) + Engineering Cost x Engineering Hours)]/(sales price – variable cost)

= [36,500 + (`225 × 40) + (`10 × 215)]/(`5 - `2.5)

= 19,200 units

(ii) [Fixed costs + (setup cost x setups) + Engineering Cost x Engineering Hours)]/(sales price – variable cost)

= [36,500 + (`150 × 40) + (`10 × 215)]/(`5 - `2.5)

= 17,860 units

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(BREAK EVEN POINTS WITH SEMI VARIABLE COST)

Q11: Electro Life 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**	
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	**Total**
	(`)	(`)	(`)	(`)	(`)
Revenue	26,00,000	45,20,000	42,40,000	32,00,000	145,60,000
Less: Material Cost	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Less: Labour Cost	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Less: Overheads	8,00,000	7,80,000	3,20,000	12,00,000	31,00,000
Profit/(Loss)	4,00,000	(1,60,000)	7,60,000	(2,00,000)	8,00,000

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

investigation whose findings are below:

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

Machine hour related		6,20,000
Batch related		4,60,000
Product specific fixed overhead:		
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 Electro Life Ltd.

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

Solution

Statement Showing "Profitability of Electro Life 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

Products (Amount in`)					
	Alpha	**Beta**	**Gamma**	**Theta**	**Total**
Product Specific Fixed Overheads	10,00,000	1,00,000	2,00,000	1,00,000	14,00,000
Gross Profit	(60,000)	2,34,000	7,36,000	5,10,000	14,20,000
General Fixed Overheads					6,20,000
Profit					8,00,000

(ii) **Break-even Point**

Total Sale Value of Product 'Alpha'	= `26,00,000
Total Contribution of Product 'Alpha'	= `9,40,000
Specific Fixed Overheads (Product Alpha)	= ` 10,00,000

Break-even Sales (`) = $\frac{\text{SpecificFixedCost}}{\text{ToalContribution}} \times \text{TotalSlaesValue}$

= $\frac{Rs.10.00.000}{Rs.9,40,000} \times \text{Rs.26,00,000}$

=`27,65,957.45

Break-even Sales (units) = $\frac{\text{Rs.27,65,957.45}}{\text{Rs.13.00}}$

= 2,12,766 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 $\left(\frac{Rs.282.20}{Rs.13.00}\right)$

(*) $\left(\frac{Rs.6,00,000+Rs.8,00,000+Rs.1,60,0000+Rs.1,00,000}{2,00,000 units}\right)$

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 (2600 batches × `50)	`80,000 (1,600 batches × `50)	`1,50,000 (3,000 batches × `50)

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Q10: Satish Enterprises is a leading exporter of Kid's Toys.J Ltd. Of USA has approached Satish Enterprises for exporting a special toy named "Jumping Monkey". The order will be valid for next three years at 3,000 toys per month. The export price of the toy will be $ 4.

Cost data per toy is as follows:

Materials…….`60

Labour…….`25

Variable overheads……..`20

Primary packing of the toy……..`15

The toys will be packed in lots of 50 each. For this purpose a special box, which will contain the 50 toys will have to be purchased, cost being` 400 per box. Satish Enterprises will also have to import a special machine for making the toys. The cost of the machine is` 24,00,000 and duty thereon will be at 12%. The machine will have an effective life of 3 years and depreciation is to be charged on straight-line method. Apart from depreciation, annual fixed overheads is estimated at` 4,00,000 for the first year with 6% Increase in the second year. Fixed overheads are incurred uniformly over the year.

Assuming the average conversion rate to be` 50 per $.

Required

(i) Prepare a monthly and yearly profitability statements for the first year and second year assuming the production at 3,000 toys per month.

(ii) Compute a monthly and yearly break-even units in respect of the first year.

(iii) In what contingency can there be a second break-even point for the month and for the year as a whole?

(iv) Have you any comments to offer on the above?

Solution

Profit for First/Second Year on Monthly and Yearly Basis

(Amount in '000)

	First Year		Second Year	
	Monthly	Yearly	Monthly	Yearly

	(`)	(`)	(`)	(`)
Sales Revenue	600 {3,000 units × ($4 × ` 50)}	7,200	600	7,200
Material	180 (3,000 units × ` 60)	2,160	180	2,160
Labour	75 (3,000 units × ` 25)	900	75	900
Variable Overheads	60 (3,000 units × ` 20)	720	60	720
Primary Packing	45 (3,000units × `15)	540	45	540
Boxes Cost	24 $\left(\frac{3000\ units}{50\ units} \times Rs.400\right)$	288	24	288
Total Fixed Overheads (W.N.-1)	108	1,296	110 $\left(\frac{Rs.1,320}{12\ months}\right)$	1,320
Profit	108	1,296	106	1,272

Monthly Break-Even Units for the First Year

	Levels No. of Units (See W.N.-2)			
	1,351-1,400 (`)	1,401-1,450 (`)	1,451-1,500 (`)	1,501-1,505 (`)
Fixed Costs: Total Fixed Overheads *per month*	1,08,000	1,08,000	1,08,000	1,08,000
Semi-Variable Costs : (Special Boxes Cost) (W.N.-2)	11,200 (28 Boxes × `400)	11,600 (29 Boxes × `400)	12,000 (30 Boxes × `400)	12,400 (31 Boxes × `400)
Total Fixed and Semi Variable Costs	1,19,200	1,19,600	1,20,000	1,20,400
Break-even Level (in units)*	1,490 (`1,19,200 /` 80)	1,495 (`1,19,600 /` 80)	1,500 (`1,20,000/ ` 80)	1,505 (`1,20,400/ ` 80)

$$\frac{\text{Total Fixed and Semi- Variable Cost}}{\text{Contribution per unit}}$$

The above statement shows that the first and second break-even level of units, viz., 1,490 and 1,495 units falls outside the range of 1,351 -1,400 and 1,401 -1,450 units respectively. In the present case a monthly break-even level of units is 1,500 units which lies in the range of

1,451-1,500 units.

Yearly Break-Even Units for the First Year

	Levels No. of Units (See W.N.-3)			
	17,851-17,900 (`)	17,901-17,950 (`)	17,951-18,000 (`)	18,001-18,050 (`)
Fixed Costs	12,96,000	12,96,000	12,96,000	12,96,000
Semi-Variable Costs (Special Boxes Cost)	1,43,200 (358 Boxes × `400)	1,43,600 (359 Boxes × ` 400)	1,44,000 (360 Boxes× ` 400)	1,44,400 (361 Boxes × ` 400)
Total Fixed and Semi Variable Costs	14,39,200	14,39,600	14,40,000	14,40,400
Break Even Level (in Units)	17,900 (`14,39,200/ `80)	17,995 (`14,39,600/ `80)	18,000 (`14,40,000/ `80)	18,005 (`14,40,400/ `80)

The above table shows that yearly break-even of units is 18,000 units which lies in the range of 17,951-18,000 units. The other first two figures do not lie in the respect ranges. Hence, they are not acceptable.

(i) In case the number of toys goes beyond *the* level of 1,500, one more box will be required to accommodate each 50 additional units of toys. In such a case the additional cost of a box will be ` 400. This amount can be recovered by the additional contribution of 5 toys. Thus, the second break-even point in such a contingency is 1,505 toys.

In case the number of toys goes beyond the level of 18,000 number, one more box will be required. The additional cost of this box will be ` 400; which can be recovered by the additional contribution of 5 toys. Thus, the second break-even point is 18,005 toys.

(ii) Yearly break-even point of 18,000 units of toys in the first year is equal to 12 times the monthly break-even point of 1,500 units. Thus, both the monthly and yearly figures of break-even point fall on the upper limit of their respective range.

In the second case, it is not so because the monthly and yearly break-even point fall within the range of 50 toys.

Working Notes

(1)

Fixed Overheads	**1st Year**	**2nd Year**
Depreciation `24,00,000 + `2,88,000 (Duty) / 3 Years	` 8,96,000	` 8,96,000
Other Fixed Overheads	`4,00,000	`4,24,000
Total Fixed Overheads	`12,96,000	`13,20,000

(2)

Fixed Overhead *in the first year*	12,96,000

Fixed Overhead *per month*	`1,08,000
Contribution *per unit* (` 200 - ` 120)	`80

Hence the Break-even number of Units will be above 1,350 units $\left(\frac{Rs.1,08,000}{Rs.80}\right)$

(1) Fixed Overhead *in the first year* *`12,96,000*

Contribution *per unit* (`200 – `120) `80

Hence the Break-even Number of Units *to recover fixed cost* will be above 16,200 units

` 12,96,000

`80

But, at this Break -even Point another Fixed Cost will be incurred on Boxes.

Number of Boxed Required $\left(\frac{16,200\ units}{50\ units}\right)$ 324 units

Cost of Boxes (324 units × `400) `1,29,600

Now the Total Fixed Cost (`12,96,000 + `1,29,600) `14,25,000

Therefore the new Break-even point $\left(\frac{Rs.14,25,600}{Rs.80}\right)$ 17,820 units

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CVP, Not for profit

Q18: Sound Well Music Society is a not-for- profit organization that brings guest artist to the community's greater metropolitan area. The music society just bought a small concert hall in the centre of town to house its performances. The lease payments on the concert hall are expected to be `40,000 per month.

The organization pays its guest performer `18,000 per concert and anticipates corresponding ticket sales to be `45,000 per concert. The music society also incurs costs of approximately `10,000 per concert for marketing and advertising. The organization pays its part-time artistic director ` 3,30,000 per year and expects to receive `3,00,000 in donations in addition to its ticket sales.

Required:

1. If the Sound Well Music Society just breaks even, how many concerts does it hold?
2. In addition to the organization's part-time artistic director, the music society would like to hire a part-time marketing director for `2,55,000 per year. What is the breakeven point? The music society anticipates that the addition of a marketing director would allow the organization to increase the number of concerts to 41 per year. What is the music society's operating income/(loss) if it hires the new marketing director?
3. The music society expects to receive a grant that would provide the organization with an additional `1, 70,000 toward the payment of the marketing director's salary. What is the breakeven point if the music society hires the marketing director and receives the grant?

Solution

1.

Ticket sales per concert		`45,000
Variable costs per concert:		
Guest performers	`18,000	
Marketing and advertising	10,000	
Total variable costs per concert		28,000
Contribution margin per concert		`17,000

Fixed costs

Salaries	`3,30,000	
Less payments (`40,000 x 12)	`4,80,000	
Total fixed costs		`8,10,000
Less donations		3,00,000
Net fixed costs		`5,10,000

Breakeven point in units = $\frac{net fixed costs}{contribution margin per concert} = \frac{Rs5,10,000}{Rs17,000}$ = 30 concerts

Check

Donations		`3,00,000
Revenue (`45,000 × 30)		13,50,000
Total revenue		**16,50,000**

Less variable costs		
Guest performers (`8,000 × 30)	`5,40,000	
Marketing and advertising (`10,000 × 30)	`3,00,000	
Total variable costs		**8,40,000**
Less fixed costs		
Salaries	`3,30,000	
Mortgage payments	4,80,000	
Total fixed costs		**`8,10,000**
Operating income		` 0

2.

Ticket sales per concert		`45,000
Variable costs per concert:		
Guest performers	`18,000	
Marketing and advertising	10,000	
Total variable costs per concert		28,000
Contribution margin per concert		`17,000

Fixed costs

Salaries (`3,30,000 + `2,55,000)	`5,85,000	
Less payments (`40,000 × 12)	4,80,000	
Total fixed costs		`10,65,000
Less donations		3,00,000
Net fixed costs		`7,65,000

Breakeven point in units = $\frac{netfixedcosts}{contributionmarginperconcert} = \frac{Rs.7,65,000}{Rs.17,000}$ = 45 concerts

Check

Donations		`3,00,000
Revenue (`45,000 × 30)		20,25,000
Total revenue		23,25,000
Less variable costs		

Guest performers (`18,000 × 45)	`8,10,000	
Marketing and advertising (`10,000 × 30)	4,50,000	
Total variable costs		12,60,000
Less fixed costs		
Salaries	` 5,85,000	
Mortgage payments	4,80,000	
Total fixed costs		10,65,000
Operating income		` 0

Operating income if 41 concerts are held

Donations		`3,00,000
Revenue (`45,000 x 30)		18,45,000
Total revenue		21,45,000
Less variable costs		
Guest performers (`18,000 x 41)	`7,38,000	
Marketing and advertising (`10,000 x 41)	4,10,000	
Total variable costs		11,48,000
Less fixed costs		
Salaries	`5,85,000	
less payments	4,80,000	
Total fixed costs		10,65,000
Operating income (loss)		` (68,000)

The Music Society would not be able to afford the new marketing director if the number of concerts were to increase to only 41 events. The addition of the new marketing director would require the Music Society to hold at least 45 concerts in order to breakeven. If only 41 concerts were held, the organization would lose `68,000 annually. The music society could look for other contribution to support the new marketing director's salary or perhaps increase the number of attendees per concert if the number of concerts could not be increased beyond 41.

Ticket sales per concert		`45,000
Variable costs per concert:		
Guest performers	`18,000	
Marketing and advertising	10,000	
Total variable costs per concert		28,000

Contribution margin per concert		`17,000

Fixed costs

Salaries (`3,30,000 + `2,55,000)	`5,85,000	
Less payments (`40,000 x 12)	4,80,000	
Total fixed costs		`10,65,000
Less donations		4,70,000
Net fixed costs		`5,95,000

Breakeven point in units = $\frac{net\,fixed\,costs}{contribution\,margin\,per\,concert} = \frac{Rs.5,95,000}{Rs.17,000}$ = 35 concerts

Check

Donations		`4,70,000
Revenue (`45,000 × 35)		15,75,000
Total revenue		20,45,000
Less variable costs		
Guest performers (`18,000 × 35)	`6,30,000	
Marketing and advertising (`10,000 × 30)	3,50,000	
Total variable costs		9,80,000
Less fixed costs		
Salaries	`5,85,000	
Mortgage payments	4,80,000	
Total fixed costs		10,65,000
Operating income		` 0

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Q24: The skilled labour force is employed under permanent contracts of employment under which they must be paid for 40 hours per week's labour, even if their time is idle to absence of orders. Their rate to pay is $16 per hour, although any overtime is paid at time and a half. In the next two weeks, there is apare capacity of 150 labour hours.

There is no spare capacity for Semi-skilled workers. They are currently paid $12 per hour or time and a half for overtime. However, a local agency can provide additional semi-skilled workers for $14 per hour.

What cost should be included in the quotation for skilled labour and semi-skilled labour?

	Skilled	Semi-skilled
A	$3,600	$4,200
B	$1,200	$4,200
C	$3,600	$5,400
D	$1,200	$5,400

Solution:- If the order require 300 hours

Skilled Labour:-

First 150 hours :- Nil

(Due to Permanent & Spare)

Next 150 hours:- (16+8) = 24

=150 X24 =3600

Semi Skilled:-

New to be appointed due to Low rate as compare to existing (12 +6) =18

New Rate = 14 X 300 = 4200.

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Q25: Which of the following statements about relevant costing are true?

1. An opportunity cost will always be a relevant cost even if it is a past cost.
2. Fixed costs are always general in nature and are therefore never relevant.
3. Committed costs are never considered to be relevant costs.
4. An opportunity cost represents the cost of the best alternative forgone.
5. Notional costs are always relevant as they make the estimate more realistic.
6. Avoidable costs would be saved if an activity did not happen and so are relevant
7. Common costs are only relevant if the viability of the whole process is being assessed
8. DIfferencial costs in a make or buy decision are not considered to be relevant.

A (2), (3), (4) and (6)

B (1), (2), (5) and (7)

C (3), (4), (6) and (7)

D (1), (5) (6) and (8)

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Q26: XL Polymers, located in Sahibabad Industrial Area, manufactures high quality industrial products.

AT Industries has asked XL Polymers for a special job that must be completed within one week. Raw material R1 (highly toxic) will be needed to complete the AT Industries' special job. XL Polymers purchased the R1 two weeks ago for `7,500 for a job 'A' that recently was completed. The R1 currently in stock is the excess from that job and XL Polymers had been planning to dispose of it. XL Polymers estimates that it would cost them `1,250 to dispose of the R1. Current replacement cost of R1 is `6,000.

Special job will require 250 hours of labour G1 and 100 hours of labour G2. XL Polymers pays their G1 and G2 employees `630 and `336 respectively for 42 hours of work per week.

XL Polymers anticipates having excess capacity of 150 [G1] and 200 [G2] labour hours in the coming week. XL Polymers can also hire additional G1 and G2 labour on an hourly basis; these part-time employees are paid an hourly wage based on the wages paid to current employees.

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

Required: CALCULATE the 'Minimum Price' that XL Polymers should bid on this job?

Solution

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

G1 labour:

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

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

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

The minimum price is the price at which XL Polymers just recovers its 'Opportunity Cost'. XL Polymers's 'Total Opportunity Cost' is `250 (`1,500 − `1,250). Accordingly, minimum Price for the

Special Job is `250.

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Q29: Buildico, a company that builds houses presents the following facts relating to a certain housing contract that it wishes to undertake:

The CEO's and Marketing Director's food and hotel expenses of ` 3,750 were incurred for a meeting with a prospective client.

1200 kgs of raw material Z will be required for the house. Inventory of Z available is 550 kg. It was purchased at ` 580 per kg. It is used by Buildico in other projects. Its current market price is ` 650 per kg. Its resale value is ` 350 per kg.

The house will require 90 hours of engineer's time. The engineers are paid a fixed monthly salary of `47,500 per engineer who can work 150 hours a month. Spare time is not available now and an engineer has to be hired for this house for one month. He cannot be used in any other project once he does this contract.

Buildico will use a special earthquake proof foundation material. This was developed by Buildico at a cost of `30,000 for some other project that had to be abandoned. If it does not use it in this project, it can use it in some other project and charge the client `50,000 for it. A list of items is given below. You are required to name the type of cost and state whether it is relevant or not in calculating the cost of the given housing project:

Sl. No.	**Item**	**Type of Cost**	**Relevant (R)/ Irrelevant (IR)**
1.	Food and hotel expenses ` 3,750		
2. (i)	Material Z; 550 kg × ` 580/kg		
(ii)	Material Z: 550 kg × ` 650 per kg		
3. (i)	Engineer's salary ` 47,500		
(ii)	Engineer's free time cost 60/150 × 47,500		
4. (i)	Design cost ` 30,000		
(ii)	Design cost ` 50,000		

Answer:

Si. No.	Item	Type of Cost	Reelvant/irrelevant
1	Food and hotel expenses `3,750	Sunck cost	Irrelevant
2(i)	Mateial Z. 550 kg X `580/kg	Historical cost/Sunk Cost	Irrelevant
2(ii)	Mateiral Z: 550 kg X ` 650 per kg	Repalcement cost	Relevant
3(i)	Engineer's Salary `47,500	Peirod cost	Relevant
3(ii)	Engineer's Free time cost 60/150 X ` 47,500	Committed Cost/Unavoidable cost	Irrelevant
4(i)	Design Cost ` 30,000	Sunk Cost	Irrelevant

4(ii)	Design Cost ` 50,000	Opportunity cost	Relevant

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Q31: A company has to decide whether to accept a special order or not for a certain Product M in respect of which the following information is given:

Mateial A requried	5,000 Kg	Avaialble in stock . I was purchased 5 years ago at `35 per kg. if not used for M, it can be sold as scrap @`15 per kg.
Mateial B required	8,000 kg	This has to be purcjhased at `25 per kg from the market.
Other Hardwar items	10,000	To be incurred
Dept X- Labour oriented	5 men for 1 month @ ` 7,000 per month per man	Labour ro be freshly hired. No spare capacity available
Dept Y- Machine oriented	3,000 machine hours @ ` 5 per machine hour	Existing spare capacity may be used
Pattern & Specification	`15,000	To be incurred for M but after the Order, it can be sold for `2,000.

Answer:

Particulars	**Computation**	`
Mateial A	Already available-Rarely used-can be scrapped-NRV	75,000
Material B	(i.e. Scrap value) lost is relevant as Opportunity cost (5,000 kg × `15)	2,00,000
Other Hardware items	To be purchased hence, out of pocket cost is relevant.	10,000
Department X	(8000 kg × `25)	35,000
Department Y	TO be purchased.hence out of pocket cost is relevant	Nil
Pattern & Specification	To be hired.Hence out of pocket cost is relevant (5 men X 1 month × ` 7000)	13,000
	Spare capacity to be used. Hence `5 per hour is irrelevant (Note: `5 ph is assumed as Absorption rate irrespective of actual usage.)	
	Net effective cost to be incurred is relevant, i.e. `15,000 - ` 2,000	
Minimum Price =Total Reelvant cost as above		3,33,000

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Q34:A Company manufacture a wide range of fashion fabric. The Company is considering whether to add a further product "SUPERB" to the range. A market researcher survey recently undertaken at a Cost of ` 1,00,000 suggest that demand for the superb will last for only year during which 50,000 unit could be sold at ` 1000/- per unit the following information is available regarding the cost of Manufacture "Superb".

Raw Material: Each product required Four types of Raw Material M_1, M_2, M_3, M_4.

@M_1:- For every unit of Superb 1 Kg of M_1 is required at present material M_1 is not available in stock. Current Resale value of M_1, = 2/- Kg. & Current Replacement cost of M_1 = ` 2/- Kg.

M_2:- Each unit of Superb require 2 unit of M_2. The Current stock of M_2 = 1,50,000 unit lying in Go down has no other use. The current Resale value = ` 2.00 or it can be used in place of another material $R_2$, current replacement cost of $R_2$ = ` 3.00 P.U.)]

Current Replacement cost of M_2 = 4.00 Per unit.

M_3:- Material M_3 is also in stock but it is unlikely that any additional supply can be obtained for some considerable time due to of an industrial dispute, at present time material. M_3 can be used in producing a product Z which has SP = 450 Per unit. & total Variable Cost (Excluding or material M_3) is 100 Per unit & 1 unit of Z require 5 unit of M_3. Each unit of Superb require 1 unit of M_3. Current stock available = 2,00,000 units of M_3

Current resale value of M_3 = 20/- Per unit.

Current Replacement value of M_3 = not applicable.

Original cost of M_3 = ` 10/- per unit.

M_4:- Current stock = 20,000 unit

Each unit of Superb require one unit of M_4, if superb could not be produced that material of M_4 need to be disposed at a cost to the Co. of ` 2/- Per unit.

Current Replacement cost = 5/- Per unit.

LABOUR: Each products require 2 hour of skilled(grade I), 3 hours unskilled & 4 hours of Semi skilled labour, Skilled labour (Grade I) rate ` 1 per hour & Skilled labour (Grade I) is employed on casual basis.

Unskilled labour is under utilized & company's policy is to continue to pay unskilled labour (not to retrenched) current wage rate = 2/- per hour.

Semi skilled labour is presently engaged in meeting the demand for product "L" which required 4 hour of semi skilled labour. The contribution from sale of 1 unit of "L" = 24/- current wage rate of semi skilled = 2/- per hour.

Supervisory Labour cost = ` 2,00,000

Supervisory staff will remain whether or not the contract is accepted.

Each product of Superb would require 5 hours of highly skilled labour (Grade II). An employee possessing in necessary skills is available is currently paid ` 5 per hour. A replacement would however to be obtained at rate of 4/- per hour for the work, which would other, wise to be done by Highly skilled employee. (Grade II).

FOREMAN LABOUR COST: 2,40,000.

MACHINERY: Two machines would be required to manufacture "Superb" MT 4 and MT 7. Details of each machine are as under:

	Start of the year	**End of the year**

	`	`
MT 4: Replacement Cost	80,000	65,000
Resale Value	60,000	47,000
MT 7: Replacement Cost	13,000	9,000
Resale value	11,000	8,000

Straight-line depreciation has been charged on each machine for each year of its life. The Company owns a number of MT 4 machines, which are used regularly on various products. Each MT 4 is replaced as soon as it reaches the end of its usual life.

MT 7 machines are no longer used and the one which would be used for "Superb" is the only one the company now has. If it was not used to produce "Superb", it would be sold immediately.

OVERHEADS: A predetermined rate of recovery for overhead is in operation and the fixed overheads are recovered fully from the regular production at ` 3.50 per labour hour. Variable overhead costs are estimated at ` 1.20 per unit produced. For the decision-making, incremental costs based upon relevant cost and opportunity costs are usually computed.

Acceptance of the contract would be expected to encroach on the sale and production of another product, Y that is also made by Co. It is estimated that sales of Y, would then decreases by 5,000 units in the next year only. However this forecast reduction in sales of Y would enable attributable fixed factory overheads of ` 58,000 to be avoided. Information on Y is as follows:

	Per Unit
Sales Price	` 70
Labour-Skilled (Grade-1) 4 Hours per unit	
Materials –relevant costs	` 12
Variable Overhead	1.20

Required: Advise Co. on the desirability of the contract.

Solution:

Statement of cost benefit

	` Lakhs
Revenue (50000 ×1000)	500
Loss – Relevant Cost	
Materials WN-2	40.10
Labour WN-4	17.00
Highly Skilled Labour	10.00
Foreman	2.40

Machine – WN-7	0.18
Overhead (1.2 × 50000)	0.60
Opportunity Cost	2.06
Net Benefit	**427.66**

Decision-

Its better to accept the offer.

W.N.-1

Market Research cost `100000 to be consider or sunk cost due to past cost.

Working Note-2 `

Material M_1-out of stock –CPP (50000 × 2)	100000
M_2 1000000 Kg ×`3 (obsolete/substitute) Sale Sub. Offer `2 or `3	300000
Material –M_3 WN-3 (70 × 50000 ×1)	3500000
M_4 –out of stock 30000 × 5	150000
Benefit to be achieved (20000 × 2)	(40000)
Total	**4010000**

W.N. -4 Labour

Skilled Labour	`
Casual/not busy) 50000 unit × 2 Hrs × `1 Hour	10000
Unskilled (50000 unit × 3 Hrs × 2) Permanent & idle	Nil
Semi-Skilled Labour *50000 Unit ×4 hrs. × `8) Casual/Busy/Short supply **Per Unit** ` **Per Hrs.**	1600000
Revenue - XX Labour Cost - 2	
Material - XY + Contribution - 6	1700000
- Labour - 4× 2 To be Cost 8	
Contribution – 24	

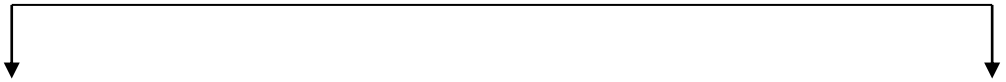
4 Hr.	

Contribution – per Hour `6/per Hours.

W. N. -3 For M_3

M_3

(Regular/Short supply)



Per Unit of Z

` Offer

Revenue -450 `70per unit of M_3

V. Cost -100

(Other then M_3) -

350

M_3 –Original 5 Unit = 70/-

Past Cost

In this situation we should ignore the selling price because it's not possible to sale for same considerable time due to industrial dispute.

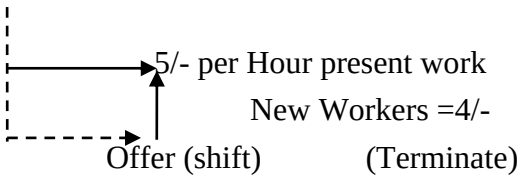
W.N.-5

Supervisory staff will continue to occur irrespective of offer hence called sunk cost.

W.N.6

Highly skilled Labour – Gr-4

Employee (Ram)



If offer not accepted.	**Regular**	**offer**	**Total**
	(Ram) 5	Nil	5
If Offer accept	(Shyam) 4	5/- (Ram)	9
			4

4 Hrs × 5hr × 50000

= `1000000

W.N. -7 Machine

MT_4 Regular use

	`
Cost to be incurred	80000

-Transfer to Regular stock	6500
Difference of Rept-Cost	15000
MT-7 obsolete	
Benefit to be cost	11000
Benefit to be achieved	8000
	3000
Total Cost	= 15000 + 3000 = `18000

WN-8

Rate = Bu –OH =3.5/Hours
B Hrs.

Benefit of 5000 Unit of Y will have to be lost due to acceptance of offer= Opportunity Cost

5000 Unit

Revenue @70 350000
-Mat - @12 6000
-Lab – 5000 × 4H ×1 20000
-VOH 5000 × 1.2 6000
-Avoidable FC 58000
Benefit **20600**

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Q45: ANZB Financial Services Limited is an Indian banking and financial services company headquartered in Chennai, Tamil Nadu. Apart from lending to individuals, the company grants loans to micro, small and medium business enterprises. Listed below are several costs incurred in the loan division of ANZB Financial Services Limited.

Remuneration of the loan division manager.

(ii) Cost of Printer Paper, File Folders, View Binders, Ink, Toner & Ribbons used in the loan division.

(iii) Cost of the division's MacBook Pro purchased by the loan division manager last year.

(iv) Cost of advertising in business newspaper by the bank, which is allocated to the loan division.

Cost Classification

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

Required

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

cost.

Solution:

Cost Incurred – Cost Classification

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

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Relevant Cost Concept

Q50: Golden Pacific Airlines Ltd. operates its services under the brand 'Golden Pacific'. The 'Golden Pacific' route network spans prominent business metropolis as well as key leisure destinations across the Indian subcontinent. 'Golden Pacific', a low-fare carrier launched with the objective of commoditizing air travel, offers airline seats at marginal premium to train fares across India.

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

Income statement for one such flight from 'New Delhi' to 'Leh' (GP - 022) is given below (per flight):

	`	`
Ticket Revenue (175 seats × 60% Occupancy × ` 7,000 ticket price)		7,35,000
Less: Variable Expenses (`1,400 per person)		1,47,000
Contribution Margin		5,88,000

	`	`
Less: Flight Expenses:		
Salaries, Flight Crew	1,70,000	
Salaries, Flight Assistants	31,500	
Baggage Loading and Flight Preparation	63,000	
Overnight Costs for Flight Crew and Assistants at destination	12,600	
Fuel for Aircraft	2,38,000	
Depreciation on Aircraft	49,000*	
Liability Insurance	1,47,000	
Flight Promotion	28,000	
Hanger Parking Fee for Aircraft at destination	7,000	7,46,100
Net Gain/(Loss)		(1,58,100)

** Based on obsolescence*

The following additional information is available about flight GP-022.

1. Members of the flight crew are paid fixed annual salaries, whereas the flight assistants are paid by the flight.
2. The baggage loading and flight preparation expense is an allocation of ground crew's salaries and depreciation of ground equipment.

3. One third of the liability insurance is a special charge assessed against flight GP-022 because in the opinion of insurance company, the destination of the flight is in a "high-risk" area.

4. The hanger parking fee is a standard fee charged for aircraft at all airports.
5. If flight GP-022 is dropped, 'Golden Pacific' Airlines has no authorization at present to replace it with another flight.

Required

Using the data available, prepare an ANALYSIS showing what impact dropping flight GP-022 would have on the airline's profit.

Answer: As per the statement given in the problem, Flight GP-022 incurs a net (loss) of ` 158,100. This is the net result of revenue less costs. Revenue is entirely variable depending upon passenger occupancy. Costs are both variable and fixed nature. To analyze the impact of dropping flight GP-022, we need to *re-compute* net gain/(loss) that Golden Pacific earns when it operates the flight **based on relevant costing principles**.

Net Gain/(Loss)

= Revenue earned from flight operations *less* Variable costs of operation

Revenue earned is the ticket revenue earned from flight operations of GP-022, this is entirely variable. Variable costs of flight operations are those expenses that would be incurred only when the flight is operated. These include variable expenses per passenger, salaries flight assistants, overnight costs for flight crew and assistants, fuel for aircraft, a third portion of flight insurance that is specifically related to this flight sector and flight promotion expense.

These are expenses that will not be incurred if the flight is not operated. Hence, relevant for decision making.

Other expenses like salaries of flight crew and hanger parking fees for aircraft are fixed expenses that will be incurred even if the flight does not operate. Loading and flight preparation expense is an allocated cost that will continue to be incurred even if flight GP-022 does not operate. Depreciation of aircraft and liability insurance expense (2/3 rd portion not related to a specific flight sector) are sunk costs. These expenses have already been incurred and hence are irrelevant to decision making. Therefore, these fixed, allocated and sunk expenses are ignored while analyzing the decision whether to continue operating flight GP-022.

Flight GP-022

Statement Showing Net Gain/(Loss)

	`	`
Contribution Margin *if the flight is continued*		5,88,000
Less: Flight Costs		
Flight Promotion	28,000	
Fuel for Aircraft	2,38,000	
Liability Insurance (1/3 × `1,47,000)	49,000	
Salaries, Flight Assistants	31,500	
Overnight Costs for Flight Crew and Assistants	12,600	3,59,100
	Net Gain/(Loss)	2,28,900

If Golden Pacific Airlines Ltd. discontinues flight GP-022, profits will reduce by ` 2,28,900. The statement showing loss in operations of ` 158,100 is misleading for decision making purpose because it accounts for costs that are fixed and irrelevant. However, since flight GP-022 yields a net gain of ` 2,28,900, flight operations should continue.

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Keep or Drop Decision

Q53: Rabi Ltd. is considering the discontinuance of Division C. The following information is given:

Particulars	**Divisions A & B**	**Division C**	**Total**
Sales (Maximum achievable)	41,40,000	5,17,500	46,57,500
Less: Variable cost	20,70,000	2,76,000	23,46,000
Contribution	20,70,000	2,41,500	23,11,500
Less: Specific avoidable fixed cost	14,49,000	4,14,000	18,63,000
Divisional Income	6,21,000	(1,72,500)	4,48,500

The rates of variable costs are 90% of the normal rates due to the current volume of operation.

There is adequate market demand.

For any lower volume of operation, the rates would go back to the normal rates.

Facilities released by discontinuing Division C cannot be used for any other purpose.

Required: COMMENT on the decision to discontinue Division C using relevant cost approach.

Solution

As given in the problem Rabi Ltd. is considering to discontinue the Division C perhaps by seeing the Division C's income as it is a loss of `1,72,500. Discontinuance of Division C might be saving `4,14,000 on specific fixed costs to the company but due to this decision company will not only be losing `2,41,500 contribution from the Division C but also an additional burden of variable cost of `2,30,000 to Divisions A & B and Rabi Ltd. as a whole.

Let assess the decision of the Rabi Ltd. with the help of the Relevant Cost approach.

Particulars	**Amount (`)**
Savings Due to Discontinuance	
Specific Fixed Cost	4,14,000
Total ...(A)	4,14,000
Loss/Increase in Cost Due to Discontinuance	
Loss of Contribution	2,41,500
Increase in Variable Cost $\frac{` 20,70,000 \times 10}{90}$	2,30,000
Total …(B)	4,71,500
Excess of Loss Over Savings …(B) – (A)	57,500

In a nutshell considering the above analysis we can conclude that the decision of discontinuing Division C will not be beneficial for the Rabi Ltd and it should review its decision on the basis of relevant cost approach to reach at right decision.

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Q57: Wye plc makes and sells four products. The profit and loss statement for April is as follows:

	W	**X**	**Y**	**Z**	**Total**
	$	**$**	**$**	**$**	**$**
Sales	30,000	20,000	35,000	15,000	100,000
Cost of sales	16,000	8,000	22,000	10,000	56,000
Gross profit	14,000	12,000	13,000	5,000	44,000
Overhead cost selling	8,000	7,000	8,500	6,500	30,000
Administration	2,000	2,000	2,000	2,000	8,000
Net profit	4,000	3,000	2,500	(3,500)	6,000

The management team is concerned about the results, particularly those of product Z. and it has been suggested that Wyc plc would be better off if it ceased production of product Z. the production manager has said that if product Z were discontinued the resources which would

become available could be used to increase production of product Y by 40 percent. You have analysed the cost structures of each of the products and discovered the following:

	W	X	Y	Z	Total
	$	$	$	$	$
Variable costs	4,800	1,600	13,200	5,000	24,600
Fixed costs	11,200	6,400	8,800	5,000	31,400
Gross profit	16,000	8,000	22,000	10,000	56,000

The total fixed costs figure includes $20,000 which is not specific to any one product, and which has been apportioned to ech product on the basis of sales values. If the quantity of any product increases by more than 25 percent, then the specific fixed production costs of the product will increase by 30 per cent.

The selling overhead comprises a fixed cost of $5,000 per product plus a variable cost which varies in proportion to sales value. The fixed cost is not specific to any product but the sales director belives that it should be shared equally by the four products.

The administration cost is fixed central overhead cost; it is not affected by the products made.

Required:

(a) Prepare a statement which shows clearly the results of continuing to produce products W, X, Y and Z at the same volumes as were achieved in April. Present your statement in format suitable for management decision-making.

(b) (i) prepare a statement showing clearly the results if product Z is discontinued, and the number of units of Y is increased in accordance with the production manager's statement. (Assume that no change in selling price per unit is necessary to sell the additional units.)

(ii) reconcile the profit calculated in (a) and (b)(i) above; advise the management team as to whether product Z should be discontinued.

(c) Explain briefly any non-financial factors which should be considered before discontinuing a product.

Solution:

(a) The profit statement needs to be restated in a marginal costing format if it is to be useful for decision-making.

	W	X	Y	Z	Total
	$	$	$	$	$
Sales	30,000	20,000	35,000	15,000	
Variable cost of sales	4,800	1,600	13,200	5,000	
Variable selling overhead (*)	3,000	2,000	3,500	1,500	
Contribution	22,200	16,400	18,300	8,500	
Specific fixed costs (W1)	5,200	2,400	1,800	2,000	
Net benefit	17,000	14,000	16,500	6,500	54,000

Non-specific fixed cost of sales					20,000
Fixed selling overhead (W2)					(20,000)
Administration costs					(8000)
Net profit					6,000

(*) Total overhead less $5,000 fixed cost.

Workings

	W	X	Y	Z	Total
	$	$	$	$	$
Fixed costs	11,200	6,400	8,800	5,000	31,400
Non-specific fixed costs (*)	6,000	4,000	7,000	3,000	20,000
Specific fixed costs	5,200	2,400	1,800	2,000	11,400

(*) given as $20,000 apportioned on the basis of sales value (3:2:3:5:1.5)

(b) (i) Z discontinued

	$
Contribution from 40% additional sales of y ($18,300 x 0.4)	7,320
Additional specific fixed costs	(540)
Loss of net benefit from Z	(6,500)
Net gain	280

(ii) Profit reconciliation

	$
Existing profit	6,000
Discontinuation of Z	(6,500)
Additional contribution from Y	7,320
Additional specific fixed costs	(540)
Profit if Z is discontinued and sales of Y substituted	6,280

(b) Non-financial factors to consider include:

(1) Possible redundancies among the workforce

(2) Signals which it may give to competitors, who may perceive the company as being unwilling to support its products

The reaction of customers, particularly those who may recently have purchased the product.

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Q58: It is possible that some costs are avoided in the longer term but not in the short term. For instance, it may be necessary to give notice to cease renting a space occupied by a department. If the notice required is, say three months then the rental is an unavoidable cost until the three months' notice has expired. After that time has becomes an avoidable cost, as long as notice is given now.

The idea of cost is being unavoidable in the short term adds a new dimension to our decision-making. Not only it is necessary to decide whether costs are inherently avoidable, but we may also need to determine when they will become avoidable.

In the very short term almost all costs are unavoidable. In the long term almost all costs are avoidable because the whole organization could be shut down completely. Here we are talking about time horizons in between these two extremes.

The following exercise will give you some practice at identifying the costs which are relevant to a decision to close a department: the avoidable costs. It will also demonstrate how to decide on the correct timing for a decision.

A company is considering the closure of its internal printing department. The department prints all of the company's publicity material and it also carries out other printing jobs are required.

An external firm has offered to produce all of the company's printing requirements for a total cost of £9,000 per month. The internal printing department's costs are as follows:

(a) A total of 80,000 sheets of customized paper are used each month, at a cost of £50 per 1,000 sheets. The contract for supply of the paper requires three months' notice of cancellation. The company does not hold inventory of the paper but any excess can be sold for a net price of £20 per 1,000 sheets.

(b) A total of 400 litres of fluorescent ink are used each month, at a cost of £1.80 per litre. The contract for supply of this ink requires 1 month's notice of cancellation. No inventory of ink is held but any excess can be sold for £0.50 net per litre.

(c) Other paper and materials costs amount to £2,850 per month.

(d) The printing machinery is rented for £4,500 per month. It is operated for 120 hours each month. The rental contract can be cancelled with 2 months notice.

(e) The two employees in the department are each paid £1,000 per month. The company has a no- redundancy policy which means that the employees are guaranteed employment even if the department closes.

(f) Overhead cost for the printing department is as follows:

  (i) Variable overhead: £4 per machine hour

  (ii) Fixed overhead: £3 per machine hour

Variable overhead varies in direct proportion to the machine hours operated. Fixed overhead represents an appointment of central overheads which would not alter as a result of the printing department's closure.

Requirement: Calculate the long-term monthly saving or extra cost which will result from the closure of the printing department. If you consider that the department should be closed, you are asked to advice on the most appropriate timing for its closure.

Solution:

The long term monthly saving or cost can be calculated by identifying the relevant costs, ignoring the effect of the notice required on certain of the contracts.

The labour cost and the fixed overheads are not relevant. They would be incurred even if the department is closed.

Relevant cost of internal printing

	£ per month
Customized paper 80 × £50	4,000
Fluorescent ink 400 × £1.80	720
Other paper and material	2,850
Machine rental	4,500
Variable overhead £4 × 120	480
Total relevant cost of internal printing	12,550
Cost of external printing services	9,000
Monthly saving from closure	3,550

Therefore the offer from the external supplier should be accepted, resulting in a monthly saving of £3,550.

This saving would only be made in the long term', once all of the relevant notice period have expired. In the immediate short term, some cost would still be incurred because of the need to give notice of cancellation. It is possible to demonstrate the effect of this by charting in which month each saving will be made. In the following table, 'month 1' is taken to mean 'one month from now'.

Relevant saving and revenues

	Month 1	**Month 2**	**Month 3**	**Month 4**
	£	**£**	**£**	**£**
Customized paper (note 1)	-	-	-	4,000
Revenue of sales of excess paper	1,600	1,600	1,600	-
Fluorescent ink (note 2)	-	720	720	720
Revenue of sales of excess ink	200	-	-	-
Other paper and materials (note 3)	2,850	2,850	2,850	2,850
Machine rental (note 4)	-	-	4,500	4,500
Variable overhead (note 3)	480	480	480	480
Relevant savings and revenues	5,130	5,650	10,150	12,550
External cost	9,000	9,000	9,000	9,000
Saving/(excess cost) from closure	3,870	3,350	1,150	3,350

Note that the monthly saving settles down as the 'long-term' amount of £3,550 once all of the notice periods have expired.

Notes:

1. The saving on customized paper will not be made until month 4, because 3 month's notice is required and the company is obliged to purchase the paper. However, if printing is ceased immediately the paper could be re-sold for £1,600 per month.
2. The saving on fluorescent ink will not be made until month 2 because the company will be obliged to purchase it for the first month. If printing is ceased immediately the ink could be re-sold for £200 for 1 month.
3. The other material costs and the variable overheads are relevant from month 1, because they can be avoided as soon as the department closes.
4. The machine rental will only be saved from month 3 onwards, because it must be paid for anyway for the next 2 months.

Recommendation

The printing department should be closed in month 3 and £1,150 will be saved in that month. From month 4 onwards the monthly saving will amount to £3,550. In the mean time, notice should be given on the relevant contracts as follows:

Customized paper:	Give immediate notice. Continue to use the paper for 2 months, then resell the supplies in month 3 when the department is closed.
Fluorescent ink:	Give notice at the end of month 1. The notice will then expire at the beginning of month 3 when the department is closed.
Printing machinery:	Give immediate notice. The notice will then expire at the beginning of month 3 when the department is closed.

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Q59: PMS plc is a large diversified organization with several departments. It is concerned over the performance of one of its departments – department P. PMS plc is concerned that department P has not been able to meet its sales target in recent years and is considering either to reduce the level of production or to shut down the department.

The following information has been made available:

Budgeted sales and production in units	50,000
	000
	500
Sales	
Less production costs	
Material A – 1 kg per unit	50
Material B – 1 litre per unit	25
Labour – 1 hour per unit	125
Variable overhead	100
Non-production costs	50

Fixed Overhead	50
Total costs	400
Budgeted profit	100

The following additional information has also been made available:

(i) There are 50,000 kg of material A in inventory. The original cost £1 per kg. material A has no other use and unless it is used by the division it will have to be disposed at a cost of £500 for every 5,000 kg

(ii) There are 30,000 litres of material B in inventory. Any unused material can be used by another department to substitute for an equivalent amount of a material, which currently costs £1.25 per litre. The original cost of material B was £0.50 per litre and it can be replaced at a cost of £1.50 per litre.

(iii) All production labour hours are paid on an hourly basis. Rumours of the closure of the department have led to a large proportion of the department's employees leaving the organizations. Uncertainty over its closure has also resulted in management not replacing these employees. The department is therefore short of labour hours and has sufficient to produce 25,000 units. Output in excess of 25,000 units would require the department to hire contract labour at accost of £3.75 per hour. If the department is shut down the present labour force will be deployed within the organization.

(iv) Included in the variable overhead is the depreciation of the only machine used in the department. The original cost of the machine was £200,000 and it is estimated to have a life of 10 years. Depreciation is calculated on a straight-line basis. The machine has a current resale value of £25,000. If the machinery is used for production it is estimated that the resale value of the machinery will fall at the rate of £100 per 1,000 units produced. All other costs included in variable overhead vary with the number of units produced.

(v) Included in the fixed production overhead is the salary of the manager of department P which amount to £20,000. If the department were to shut down the manger would be made redundant with a redundancy pay of £25,000. All other costs included in the fixed production overhead are general factory overheads and will not be affected by any decision concerning department P.

(vi) The non production cost charged to department P is an apportioned of the total non-production costs incurred by the department.

(vii) The marketing manager suggest that either:

- A sale volume of 25,000 units can be achieved with a selling price of £9.000 per unit and an advertising campaign of £25,000; or
- A sales volume of 35,000 units can be achieved at a selling price of £7.50 with an advertising campaign costing £35,000.

Requirements: As the management accountant of PMC plc you have been asked to investigate the following options available to the organization:

(i) Reduce production to 25,000 units

(ii) Reduce production to 35,000 units

(iii) Shut down department P.

Solution:

Relevant savings	25,000 units	35,000 units	Shut down
And revenue	£	£	£
Sales revenues	225,000	262,500	-
Material B	6,250	-	37,500
Sales of machinery	22,500	21,500	25,000
Total revenue/savings	235,750	284,000	62,500
Relevant costs			
Material A disposal	2,500	1,500	5,000
Purchase material B	-	7,500	-
Labour	62,500	100,000	-
Variable overhead	40,000	56,000	-
(excl. depreciation)			
Advertising campaign	25,000	35,000	-
Manager's salary	20,000	20,000	-
Redundancy pay	-	-	25,000
Total relevant costs	150,000	220,000	30,000
Net savings	103,750	64,000	32,500

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Make or Buy decision

Q61: A company manufacture two models of a pocket calculator. The basic model sells for £5, has a direct material cost of £1.25 and require 0.25 hours of labour time to produce. The other model, the Scientist, sells for £7.50, has a direct material cost of £1.63 and takes 0.375 to produce. Labour, which is paid at the rate of £6 per hour, is currently very scarce, while demand for the company's calculator is heavy. The company is currently producing 8,000 of the basic model and 4,000 of the Scientist model per month, while fixed costs are £24,000 per month.

An overseas customer has offered the company a contract, worth £35,000 for a number of calculators made to its requirements. The estimating department has ascertained the following facts in the respect of the work:

- The labour time for the contract would be 1,200 hours.
- The material cost would be £9,000 plus the cost of a particular component not normally used in the company's models.
- These components could be purchased from a supplier for £2,500 or alternatively, they could be made internally for a material cost of £1,000 and an additional labour time of 150 hours.

Requirement: Advice the management as to the action they should taske.

Solution:

In view of its scarcity labour is taken as the limiting factor.

The decision on whether to make or buy component has to be made before it can be decided whether or not to accept the contract. In order to do this the contribution per labour hour for normal production first be calculated, as the contract will replace some normal production.

Normal products		**Basic**		**Scientist**
	£	**£**	**£**	**£**
Selling price		5.00		7.50
Materials	1.25		1.63	
labour	1.50		2.25	
		2.75		3.88
Contribution		2.25		3.62
Contribution per direct labour hour (@ 0.25/0.375 hrs/unit)		9.00		9.65

Therefore if the company is to make the component it would be better to reduce production of the basic model, in order to accommodate the special order.

The company should now compare the cost of making or buying the component.

An opportunity cost arises due to the lost contribution on the basic model.

Special contract	**Manufacture of component**
	£
Materials	1,000
Labour (£6 × 150 hours)	900
Opportunity cost (150 hours × £9.00)	1,350
	3,250

Since this is higher than the bought-in price of £2,500 the company would be advised to buy the component from the supplier if they accept the contract.

The contract can now be evaluated:

		Contract contribution
	£	**£**
Sales revenue		35,000

		Contract contribution
	£	£
Material cost	9,000	
Component	2,500	
Labour (£6 x 1,200)	7,200	
		18,700
Contribution		16,300
Contribution per direct labour hour		£13.58

Since the contribution is higher than either of the existing products, the company should accept assuming this would not prejudice the market for existing products. As the customer is overseas this seems a reasonable assumption.

Because the contribution is higher for the Scientist model it would be wise to reduce production of the basic model. However, the hours spent on producing the basic model per month are 8,000 units × 0.25 hours = 2,000, and so the contract would displace more than a fortnight's production of the basic model. The recommendation assumes that this can be done without harming long-term sales of the basic model.

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Q64: Aditya Ltd. manufactures four products A-1, B-2, C-3 and D-4 in Gurgaon and one product F-1 in Faridabad. Aditya Ltd. operates under Just-in-time (JIT) principle and does not hold any inventory of either finished goods or raw materials.

Company has entered into an agreement with M Ltd. to supply 10,000 units per month of each product produced from Gurgaon unit at a contracted price. Aditya Ltd. is bound to supply these contracted units to M Ltd. without any fail. Following are the details related with non contracted units of Gurgaon unit.

(Amount in `)

	A-1	B-2	C-3	D-4
Selling Price per unit	360.00	285.00	290.00	210.00
Direct Labour @ ` 45 per hour	112.50	67.50	135.00	67.50
Direct Material M-1 @ ` 50 per kg.	50.00	100.00	---	75.00
Direct Material M-2 @ ` 30 per litre.	90.00	45.00	60.00	---
Variable Overhead (varies with labour hrs)	12.50	7.50	15.00	7.50
Variable Overhead (varies with machine hrs)	9.00	12.00	9.00	15.00
Total Variable Cost	274.00	232.00	219.00	165.00
Machine Hours per unit	3 hours	4 hours	3 hours	5 hours
Maximum Demand per month (units)	90,000	95,000	80,000	75,000

The products manufactured in Gurgaon unit use direct material M-1 and M-2 but product F-1 produced in Faridabad unit is made by a distinct raw material Z. Material Z is purchased from the outside market at ` 200.00 per unit. One unit of F-1 requires one unit of material Z.

Material Z can also be manufactured at Gurgaon unit but for this 2 hours of direct labour, 3 hours of machine time and 2.5 litres of material M-2 will be required.

The Purchase manager has reported to the production manager that material M-1 and M-2 are in short supply in the market and only 6,50,000 Kg. of M-1 and 6,00,000 litre of M-2 can be purchased in a month.

Required:

(i) CALCULATE whether Aditya Ltd. should manufacture material Z in Gurgoan unit or continue to purchase it from the market and manufacture it in Faridabad unit.

(ii) CALCULATE the optimum monthly usage of Gurgaon unit's available resources and make decision accordingly.

(iii) CALCULATE the purchase price of material Z at which your decision in (i) can be sustained.

Solution

(i) Manufacturing Cost of Material Z, if Manufactured in Gurgaon unit

	Amount (`)
Direct Labour (2 hours × `45)	90.00
Direct Material M-2 (2.5 litre × `30)	75.00
Variable Overhead, Varies with Labour Hours (2hours × `5)	10.00
Variable Overhead, Varies with Machine Hours (3hours × `3)	9.00
Total Variable Cost	184.00

The purchasing cost of material Z from the outside market is `200, which is more than the cost to manufacture it in Gurgaon unit. Hence, it will be beneficial for the Aditya Ltd. to manufacture material Z in Gurgaon unit itself.

(ii) Monthly Requirement of Direct Material M-1 & M-2

For Contracted units

	A-1	**B-2**	**C-3**	**D-4**	**Total**
Units to be Supplied to M Ltd. (units)	10,000	10,000	10,000	10,000	40,000
Direct Material M-1 (in Kg) [W.N.-1]	10,000	20,000	---	15,000	45,000
Direct Material M-2 (in Litre) [W.N.-2]	30,000	15,000	20,000	---	65,000

For Non-Contracted units

	A-1	**B-2**	**C-3**	**D-4**	**Total**
Demand in Outside Market (units)	90,000	95,000	80,000	75,000	3,40,000
Direct Material M-1 (in Kg) [W.N.-1]	90,000	1,90,000	---	1,12,500	3,92,500

Direct Material M-2 (in Litre) [W.N.-2]	2,70,000	1,42,500	1,60,000	---	5,72,500

Availability and Demand Comparison

	Direct Material M-1 (in Kg)	**Direct Material M-2 (in Litre)**
Availability in Market	6,50,000	6,00,000
Requirement	4,37,500 (45,000+3,92,500)	6,37,500 (65,000+5,72,500)

Material M-2 is a limiting factor as its availability is less than its requirement to produce contracted as well as for non-contracted units.

To optimum usage of resources available in Gurgaon unit, prioritization of production of products is necessary. The following is the comparison table of product A-1, B-2, C-3 and Z.

Product D-4 is not taken into comparison as material M-2 is not required to produce product D-4.

Calculation of Contribution per litre of M-2

	A-1	**B-2**	**C-3**	**Z**
Contribution per unit (W.N-3 & 4)	` 86.00	` 53.00	` 71.00	` 16.00
Quantity of Material M-2 per unit	3 litre	1.5 litre	2 litre	2.5 litre
Contribution per litre of M-2	` 28.67	` 35.33	` 35.50	` 6.40
Rank	III	II	I	IV

Since, contribution per unit of material Z is lowest as compared to other products consuming material M-2. Material –Z cannot be manufactured under the given resource constraint. Hence only existing products of Gurgaon units should be manufactured.

Optimum Production Plan

Product	**No. of Units**	**Quantity of M-2 Required (in Litre)**	**Balance Availability of M-2 (in Litre)**
C-3	90,000	1,80,000 (90,000 units × 2 litre)	4,20,000 (6,00,000 – 1,80,000)
B-2	1,05,000	1,57,500 (1,05,000 units × 1.5 litre)	2,62,500 (4,20,000 – 1,57,500)
A-1	87,500*	2,62,500 (87,500 units × 3 litre)	0 (2,62,500 – 2,62,500)

(*) Units that can be produced with the help of available quantity of M-2 i.e. 2,62,500 litre.

(iii) Decision in requirement (i) will be changed as material Z cannot be manufactured in Gurgaon unit as noted in requirement (ii). The minimum purchase price of material Z at which decision taken in (i) above can be sustained is calculated as below:

Working Notes

(1) Quantity of M-1 required per unit of production

	A-1	B-2	D-4
Cost per unit	`50	`100	`75
Rate per Kg.	`50	`50	`50
Quantity per unit of Production	1Kg.	2Kg.	1.5Kg.

(2) Quantity of M-2 required per unit of production

	A-1	B-2	C-3
Cost of per unit	`90	`45	`60
Rate per Kg.	`30	`30	`30
Quantity per unit of Production	3 litre	1.5 litre	2 litre

(3) Contribution per unit (`)

	A-1	B-2	C-3	D-4
Selling Price per unit	360	285	290	210
Less: Variable Cost per unit	274	232	219	165
Contribution per unit	86	53	71	45

(4) Contribution (Benefit) per unit of Material Z

	(`)
Purchasing Cost per unit	200
Less: Cost of Manufacture	184
Contribution per unit	16

(5) The next best product to material Z is A-1 {as calculated in (ii) above} which has a contribution of `28.67 per litre of M-2 which is `22.27 (`28.67 – `6.40) higher than the contribution per litre of M-2 for material Z. Material Z required 2.5 litre of M-2, therefore, purchase price of material Z would have to `55.68 (2.5 litre × `22.27) higher than the existing market price.

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Q65: Robber Co. manufactures control panel for burglar alarm, a very profitable product. Every product comes with a one year warranty offering free repairs if any faults arise in this period.

If currently produces and sells 80,000 units per annum, with production of them being restricted by the short supply of labour. Each control panel includes two main components- one key pad and one display screen. At present Robert Co manufactures both of these components in-house. However, the company is currently considering outsourcing the production of keypads and/or display screens. A newly established company based in Burgistan is keen to secure a place in the market, and has offered to supply the keypads for

the equivalent of $4.10 per unit and the display screens for the equivalent of $4.30 per unit. This price has been guaranteed for two years.

The current total annual cost of producing the keypads and the display screens are:

	Keypads	**Display screens**
Production	80,000 units	80,000 units
	$000	**$000**
Direct materials	160	116
Direct labour	40	60
Heat and power costs	64	88
Machine costs	26	30
Depreciation and insurance costs	84	96
Total annual production costs	374	390

Materials cost for keypads are expected to increase by 5% in six months' time; materials costs for display screens are only expected to increase by 2%, but with immediate effect.

Direct labour costs are purely variable and not expected to change over the next year.

Heat and labour costs include an appointment of the general factory overhead for heat and power as well as the cost of heat and power directly used for the production of keypads and display screens. The general apportionment included is calculated using 50% of the direct labour cost for each component are manufactured in-house or not.

Machine costs are semi-variable; the variable element relates to set up costs, which are based upon the number of batches made. The keypad s' machine has fixed costs of $4,000 per annum and the display screens' machine has fixed costs of $6,000 per annum. Whilst both components are currently made in batches of 500, this would need to change, with immediate effect, to batches of 400.

60% of depreciation and insurance costs relate to an apportionment of the general factory depreciation and insurance costs; the remaining 40% is specific to the manufacture of keypads and display screens.

Required:

(a) Advice Robber Co whether it should continue to manufacture the keypads and display screens in-house or whether it should outsource their manufacture to the supplier in Burgistan, assuming it continues to adopt a policy to limit manufacture and sales to 80,000 control panels in the coming year.

(b) Robber Co takes 0.5 labour hours to produce a keypad and 0.75 labour hours to produce a display screen. Labour hours are restricted to 100,000 hours and labour is paid at $1 per hour. Robber Co wishes to increase its supply top 100,000 control panels (i.e. 100,000 each of keypads and display screens).

Advice Robber Co as to how many units of keypads and display panels they should either manufacture and/or outsource in order to minimize their costs.

Discuss the non-financial factors that Robber Co should consider when making a decision about outsourcing the manufacture of keypads and display screens.

Solution

Make or buy decision

(all working amounts in $000)	**Keypads**	**Display screens**
Variable costs	**$**	**$**
Materials ($160 × $^{6}/_{12}$) + ($160 x 1.05 × $^{6}/_{12}$)	164,000	
($116 x 1.02)		118,320
Direct labour	40,000	60,000
Machine set-up costs		
($26 - $4) x 500 ÷ 400	27,500	
($30 - $6) x 500 ÷ 400		30,000
	231,500	208,320
Attributable fixed costs		
Heat and power ($64 - $20) ÷ ($88 - $30)	44,000	58,000
Fixed machine costs	4,000	6,000
Depreciation and insurance ($84/$96 x 40%)	33,600	38,4000
	81,600	102,400
Total incremental costs of making in-house	313,100	310,720
Cost of buying (80,000 x $4.10/$4.30)	328,800	344,000
Total saving from making	14,900	33,280

Robber should therefore make all of the keypads and display screens in-house.

Tutorial note: It is assumed that the fixed set-up costs only arise if production takes place.

Alternative method

Relevant costs	**Keypads**	**Display screens**
Direct materials	**$**	**$**
($^{1}/_{2}$ × $160,000) +($^{1}/_{2}$ × $160,000 × 1.05)	164,000	
$116,000 x 1.02		118,320
Direct labour	40,000	60,000
Heat and power		
$64,000 – (50% × $40,000)	44,000	
$88,000 – (50% × $60,000)		58,000
Machine set up costs		

Relevant costs	**Keypads**	**Display screens**
Direct materials	**$**	**$**
Avoidable fixed costs	4,000	6,000
Activity related costs (W)	27,500	30,000
Avoidable depreciation and insurance costs: 40% x $84,000/$96,000	33,600	38,400
Total relevant manufacturing costs	313,1000	310,720
Relevant cost per unit:	3.91375	3.884
Cost per unit of buying in	4.1	4.3
Incremental cost of buying in	0.18625	0.416

As each of the components is cheaper to make in-house than to buy in, the company should continue to manufacture keypads and display screens in-house.

Working

Current no. of batches produced = 80,000 ÷500 = 160

New no. of batches produced = 80,000 ÷400 = 200

Current cost per batch for keypads = ($26,000 - $4,000) ÷ 160 = $137.5

Therefore new activity related batch cost = 200 x $137.5 = $27,500

Current cost per batch for display screens = ($30,000 - $6,000) ÷ 160 = $150

Therefore new activity related batch cost = 200 x $150 = $30,000

(b) make or buy – higher production level

The attributable fixed costs remain unaltered irrespective of the level of production of keypads and display screens, because as soon as one unit of either is made, the costs rise. We know that we will make at least one unit of each component as both are cheaper to make them buy. Therefore they are an irrelevant common cost.

	Keypads	**Display screens**
	$	**$**
Buy	4.1	4.3
Variable cost of making ($231,500 ÷80,000)	2.89	
($208,320 ÷ 80,000)		2.6
Saving from making per unit	1.21	1.7
Labour hour per unit	0.5	0.75
Saving from making per unit of limiting factor	2.42	2.27
Priority of making	1	2

Total labour hours available = 100,000

Make maximum keypads (i.e. 100,000) using 50,000 labour hours (100,000 X 0.5 hours)

Make 50,000 ÷0.75 display screens (i.e. 66,666 display screens).

Therefore buy in 33,334 display screens (100,000 – 66,666).

Non-financial factors

- The company offering to supply the keypads and display screens is a new company. This would make it extremely risky to rely on it for continuity of supplies. Many new businesses fail within the first year of starting and without these two crucial components, Robber would be unable to meet demand for sales to control panels. Robber would need to consider whether there are any other potential suppliers of the components. This would be useful both as a price comparison now and also to establish the level of dependency that would be committed to if this new supplier is used. If the supplier were to go out of business, would any other company be able to step in? if so, at what cost?
- The supplier has only agreed to these prices for the first two years. After this, it could put up its prices dramatically. By this stage, Robber would probably be unable to begin easily making its components in house again, as it would probably have sold off its machinery and committed to larger sales of control panels.
- The quality of the components could not be guaranteed. If they turn out to be poor quality, this will give rise to problems in the control panels, leading to future loss of sales and high repair costs under warranties for Robber. The fact that the supplier is based overseas increases the risk of quality and continuity of supply, since it has even less control of these than it would if it was a UK supplier.

Robber would need to establish the supplier is with meeting promises for delivery times. This kind of information may be difficult to establish because of the fact that the supplier is a new company. Late delivery could have a serious impact on robber's production and delivery schedule.

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Make or buy with ABC

Q66: The Bharti Televenture manufactures cellular modems. It manufactures its own cellular modern circuit boards (CMCB), an important part of the cellular modem. It reports the following cost information about the costs of making CMCBs in 2006 and the expected costs in 2007:

	Current costs in 2006	**Expected costs in 2007**
Variable manufacturing costs		
Direct material cost per CMCB	`1,800	`1,700
Direct manufacturing labour cost per CMCB	500	450
Variable manufacturing cost per batch for setups, material handling, and quality control	16,000	15,000
Fixed manufacturing cost		
Fixed manufacturing overhead costs that can be avoided if CMCBs are not made	32,00,000	32,00,000

	Current costs in 2006	Expected costs in 2007
Fixed manufacturing overhead costs of plant depreciation, insurance, and administration that cannot be avoided even if CMCBs are not made	80,00,000	80,00,000

Bharti manufactured 8,000 CMCBs in 2006 in 40 batches of 200 each. In 2007, Bharti anticipates a requirement of 10,000 CMCBs. The CMCBs would be needed in 80 batches of 125 each.

The Reliance Infocom has approached Bharti about supplying CMCBs to Bharti in 2007 at `3,000 per CMCB on whatever delivery schedule Bharti wants.

Required: Calculate the total expected manufacturing cost per unit of making CMCBs in 2007.

Suppose the capacity currently used to make CMCBs will become idle if Bharti purchases CMCBs from Reliance. On the basis of financial considerations alone, should Bharti make CMCBs or buy them from Relaince? Show your calculations.

Now suppose that if Bharti purchases CMCBs from Reliance, its best alternative use of the capacity currently used for CMCBs is to make and sell special circuit boards (CB3s) to the Airtel Corporation. Bharti estimates the following incremental revenues and costs from CB3s:

Total expected incremental future revenues	`2,00,00,000
Total expected incremental future costs	`2,15,00,000

On the basis of financial considerations alone, should Bharti make CMCBs or buy them from Reliance?

Show your calculations.

Solution

Make versus buy, activity based costing

The expected manufacturing cost per unit of CMCBs in 2007 is as follows:

	Total manufacturing costs of CMCB (1)	Manufacturing cost per unit (2)= (1) ÷10,000
Direct materials `1,700 × 10,000	`1,70,00,000	`1,700
Direct manufacturing labour `450 × 10,000	45,00,000	450
Variable batch manufacturing cost `15,000 × 80	12,00,000	120
Fixed manufacturing costs		
Avoidable fixed manufacturing costs	32,00,000	320

Unavoidable fixed manufacturing costs	80,00,000	800
Total manufacturing costs	`3,39,00,000	`3,390

The following table identifies the incremental costs in 2007 if Bharti (a) made CMCBs and (b) purchased CMCBs from Reliance.

	Total incremental costs		**Per-unit incremental costs**	
Incremental items	**Make**	**Buy**	**Make**	**Buy**
Cost of purchasing CMCbs from Reliance		`3,00,00,000		`3,000
Direct materials	`1,70,00,000		`1,700	
Direct manufacturing labour	45,00,000		450	
Variable batch manufacturing cost	12,00,000		120	
Avoidable fixed manufacturing costs	32,00,000		320	
Total incremental costs	`2,59,00,000	`3,00,00,000	`2,590	`3,000
Reference in favor of making	`41,00,000		`410	

That the opportunity cost of using capacity to make CMCBs is zero since Bharti would keep this capacity idle if it purchases CMCBs from Reliance

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Key factors Decision

Q70: Lucky Ltd manufactures and sells three products, X,Y and Z for which budgeted sales demand, unit selling prices and unit variable costs are as follows.

Budgeted Sales demand		**X 550 units**		**Y 500 units**		**Z 400 units**	
		$	**$**	**$**	**$**	**$**	**$**
Unit sales Price			16		18		14
Variable Costs:	Materials	8		6		2	
	Labour	4		6		9	
			12		12		11
Unit contribution			4		6		3

The company has existing stocks of 250 units of X and 200 units of Z, which it is quite willing to use up to meet sales demand.

All three products use the same direct materials and the same type of direct labour . in the next year, the available supply of materials will be restricted to $4,800(at cost) and the available supply of labour to $6,600 (at cost).

Required:

Determine what product mix and sales mix would maximize the company's profit in the next year.

Solution:

There appear to be two scare resources, direct materials and direct labour. This is not certain, however, and because there is a limited sales demand as well, either of the following might apply.

There is no limiting factor at all, except sales demand.

There is only one scarce resource that prevents the full potential sales demand being achieved.

Step 1: Establish which of the resources, f any, is scare.

	X	Y	Z
	Units	Units	Units
Budgeted Sales	550	500	400
Stock in hand	250	0	200
Minimum production to meet demand	**300**	**500**	**200**

	Minimum production to meet sales demand Units	Required materials at cost $	Required labour at cost $
X	300	2.400	1,200
Y	500	3,000	3,000
Z	200	400	1,800
Total required		5,800	6,000
Total available		4,800	6,600
(Shortfall)/Surplus		(1,000)	600

Materials are a limiting factor, but labour is not.

Step 2. Rank X, Y and Z in order of contribution earned per $1 of direct materials consumed.

	X	Y	Z
	$	$	$

Unit Contribution	4	6	3
Cost of materials	8	6	2
Contribution per $1 materials	$0.50	$1.00	$1.50
Ranking	3rd	2nd	1st

Step 3: Determine a production plan Z should be manufactured up to the limit where units produced plus units in stock will meet sales demand, then Y second and X third, until all the available material are used up.

Ranking	**Product**	**Sales demand less units in stock Units**	**Production Quantity units**		**Material cost $**
1st	Z	200	200	(X $2)	400
2nd	Y	500	500	(x $6)	3,000
3rd	X	300	175	(x$8)	1,400
			Total available		4,800

Step 4. Draw up a budget. The profit maximizing budget is as follows.

	X	**Y**	**Z**
	Units	**Units**	**Units**
Opening stock	250	0	200
Add production	175	500	200
Sales	**425**	**500**	**400**

	X	**Y**	**Z**	**Total**
	$	**$**	**$**	**$**
Revenue	6,800	9,000	5,600	21,400
Variable costs	5,100	6,000	4,400	15,500
Contribution	**1,700**	**3,000**	**1,200**	**5,900**

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Q76: Jaya-Surya Ltd. (JSL) manufactures and sells two products ‘Jaya’ and ‘Surya’. Both Jaya and Surya use a regular machine while Surya uses another high-precision machine as well. The following information is available for the next quarter.

	Jaya	Surya
Selling Price per unit (`)	1,500	2,000
Variable Manufacturing Cost per unit (`)	900	1,600
Variable Marketing Cost per unit (`)	250	150
Budgeted Allocation of Fixed Overhead Costs (`)	18,00,000	85,00,000
Regular Machine Hours per unit	2.0	1.0

Further information is available as follows:

JSL faces a capacity constraint of 60,000 hours on the regular machine for the next quarter and there is no constraint on the high precision machine for the next quarter.

Out of ` 85,00,000 budgeted allocation of fixed overhead costs to product Surya, ` 60,00,000 is payable for hiring the high precision machine. This cost is charged entirely to product Surya. The hiring agreement can be cancelled at any time without penalties.

All other overhead costs are fixed and cannot be changed.

A minimum quantity of 12,500 units per quarter of Jaya must be produced to fulfill a commitment to a customer.

Any quantity of any product can be sold at the given prices.

Required:

(i) Calculate the product mix of Jaya and Surya which would maximise the relevant operating profit of JSL in the next quarter.

(ii) JSL can double the quarterly capacity of regular machine at a cost of ` 28,00,000. Calculate the new product mix and the amount by which the relevant operating profit will increase.

Solution:

Calculation of Contribution Margin *per machine hour*

	Jaya (`)	Surya (`)
Selling Price *per unit*	1,500	2,000
Less: Variable Manufacturing Cost *per unit*	(900)	(1,600)
Less: Variable Marketing Cost *per unit*	(250)	(150)
Contribution Margin *per unit*	350	250
Number of Regular Machine Hours	2.0	1.0
Contribution Margin *per machine hour*	175	250
Ranking	II	I

Based on the ranking above, manufacturing preference will be given to Surya but after the committed production of 12,500 units of Jaya.

Since to manufacture Surya, a hiring cost of ` 60,00,000 is also paid for high precision machine, so the result obtained through the above ranking may not be beneficial. For this

purpose we solve this problem taking two options.

Option 1: 12,500 units of Jaya and 35,000* units of Surya:

*[60,000 hours – (12,500 units of Jaya × 2 hours) ÷ 1 hour to produce one unit of Surya]

	Amount (`)
Contribution Margin on Jaya (12,500 units × ` 350)	43,75,000
Contribution Margin on Surya (35,000 units × ` 250)	87,50,000
Total Contribution Margin	1,31,25,000
Less: Hire Charges on High Precision Machine	(60,00,000)
Net Relevant Contribution	71,25,000

Option 2: Produce only Jaya i.e. 30,000 units:

Contribution Margin/Net Relevant Contribution (30,000 units × ` 350)

= ` 1,05,00,000

Even though Surya has the higher contribution margin per machine hour but net relevant contribution option 1 is lower than the option 2. Hence, JSL should produce 30,000 units of Jaya only to earn more profit.

(ii) Based on the above ranking, if preference is given to production of Surya after the production of committed units of Jaya i.e. 12,500 units of Jaya and 95,000 units of Surya.

Option 1: 12,500 units of Jaya and 95,000* units of Surya:

*[1,20,000 hours – (12,500 units of Jaya × 2 hours) ÷ 1 hour to produce one unit of Surya]

	Amount (`)
Contribution Margin on Jaya (12,500 units × ` 350)	43,75,000
Contribution Margin on Surya (95,000 units × ` 250)	2,37,50,000
Total Contribution Margin	2,81,25,000
Less: Hire Charges on High Precision Machine	(60,00,000)
Less: Capacity Enhancement Cost	(28,00,000)
Net Relevant Contribution	1,93,25,000

Option 2: Produce only Jaya i.e. 60,000 units:

	Amount (`)
Contribution Margin (60,000 units × ` 350)	2,10,00,000
Less: Capacity Enhancement Cost	(28,00,000)
Net Relevant Contribution	1,82,00,000

When capacity of the regular machine is doubled, the optimum product mix will be 12,500 units of Jaya and 95,000 units of Surya.

Increase in operating profit will be ` 88,25,000 ` 1,93,25,000 – ` 1,05,00,000).

While calculating relevant contribution from the option 1 and option 2 in requirements (i) and (ii) above, the contribution from the 12,500 units of Jaya may also be ignored as this is same under the two options.

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Q78: DFG manufactures two products from different combination of the same resources. Unit selling prices and cost details for each product are as follows:

Product	**D**	**G**
	£/unit	**£/unit**
Selling price	115	120
7Direct material A (£5 per kg)	20	10
Direct material B (£3 per kg)	12	24
Skilled labour (£7 per hour)	28	21
Variable overhead (£2 per machine hour)	14	18
Fixed overhead*	28	36
Profit	13	11

*fixed overhead is absorbed using an absorption rate per machine hour. It is an unavoidable central overhead cost that is not affected by the mix or volume of products produced.

The maximum weekly demand for product D and G is 400 units and 450 units respectively and this is the normal weekly production volume achieved by DFG. However, for the next four weeks the achievable product level will be reduced due to a shortage of available resources. The resources that are expected to be available as follows:

Direct material A	1,800 kg
Direct material B	3,500 kg
Skilled labour	2,500 hours
Machine time	6,500 machine hours

Required:

(a) Using graphical linear programming identify the weekly production scheduled for products D and G that maximizes the profits of DFG during the next four weeks.

(b) Explain the relevance of these values to the management of DFG.

Note: assume that demand is not affected by the selling price. You are not required to perform any calculation.

Solution

Step 1 Define variables

Let D be the number of product D produced

Let g be the number of product G produced

Step 2 Resources required by each product

	D	G
Direct material A	$^{20}/_{5} = 4$kg	= 2kg
Direct material B	$^{12}/_{3} = 4$kg	= 8 kg
Skilled labour	$^{28}/_{7} = 4$ hours	$^{21}/_{7} = 3$ hours
Machine time	$^{14}/_{2} = 7$ hours	$^{18}/_{2} = 9$hours

Step 3 Establish objective function

The objective function should be to maximize contribution rather than profit, as fixed overheads are not affected by the mix or volume of products produced.

	D	G
	$	**$**
Selling price	115	120
Total variable costs	74	73
Contribution per unit	41	47

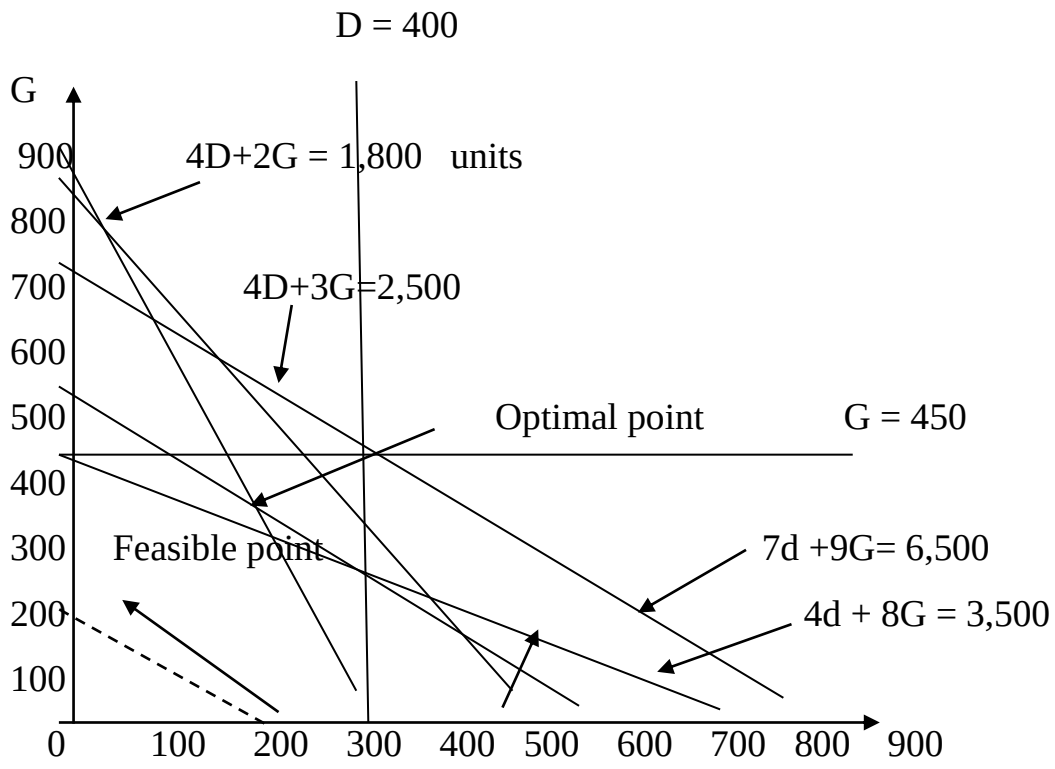
The objective function to be maximized is:

Contribution = 41D + 47G

Step 4 Establish constraints

Use the per unit resources required that were calculated in step 2.

Direct Material A:	$4D + 2G \leq 1{,}800$
Direct Material B:	$4D + 8G \leq 3{,}500$
Skilled Labour:	$4D + 3G \leq 2{,}500$
Machine Time:	$7D + 9G \leq 6{,}500$
Product d demand:	$D \leq 400$
Product G demand:	$G \leq 450$
Non-negativity:	$D \geq 0; G \geq 0$



ISO-CONTRIBUTION LINES 41D+47G

The optimal point is reached at the intersection between:

4D + 2G = 1,800 (1)

4D + 8G = 3,500 (2)

Deduct equation (1) from equation (2)

6G = 1,700

G = 283

Substitute G = 283 into equation (1)

4D + (2 x 283) = 1,800

4D + 566 = 1,800

4D = 1,234

$$D = \frac{1,234}{4}$$

D = 309

Therefore, profit is maximized when 309 units of D and 283 units of g are produced contribution would be $25,970.

(b) <u>Shadow price</u>

The shadow price of a resource which is limiting factor on production is the amount by which total contribution would fall if the organization was deprived of one unit of that resource. Alternatively, it is the amount by which total contribution would rise if an extra unit of that resource became available.

<u>Skilled labour: Shadow price = £0</u>

This indicates that skilled labour, although a limiting factor, is not a binding constraint on production, given the current status of the other resources. Contribution would not be affected if skilled labour was increased or reduced by one hour.

Direct Material A: Shadow price = £5.82

If direct material A was increased by one kg, contribution would increase by £5.82. Similarly if supply of this material was reduced by one kg , contribution would fall by £5.82. Direct material A is a binding constraint on production as the shadow price is greater than zero.

(c) Selling price sensitivity analysis

The sensitivity of the optimal solution to changes in the selling price of product D can be determined by changing the slope of the iso-contribution line. As the selling price of product D increased, the slope of the iso-contribution line would become steeper. The optimal solution will change when the slope of the iso- contribution line is such that its last point in the feasible region is no longer 309 units of product d and 283 units of product G.

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Q79: W/plc provides two cleaning services for staff uniform to hotels and similar businesses. One of laundry service and the other is a dry cleaning service. Both of the services use the same resource different quantities. Details of the expected resource requirements, revenues and costs of each are given below.

		Laundry	**Dry clean**
		$ per service	**$ per service**
Selling price		7.00	12.00
Cleaning material	($10.00 per litre)	2.00	3.00
Direct labour	($6.00 per hour)	1.20	2.00
Variable machine cost	($3.00 per hour)	0.50	1.50
Fixed costs*		1.15	2.25
profit		2.15	3.25

*The fixed costs per service were based on meeting the budget demand for December 20 × 3.

W plc has already prepared its budget for December based on sales and operational activities services and 10,500 dry cleaning services, but it is now revising its plans because of forecast.

The maximum resources expected to be available in December 20X3 are

Cleaning materials	5,000 litres
Direct labour hours	6,000 hours
Machine hours	5,000 hours

W plc has one particular contract which is entered into six months ago with a local hotel to guide laundry services and 2,000 dry cleaning services every month, if W plc does not honour this can pay substantial financial penalties to the local hotel.

Required:

(a) Calculate the mix of services that should be provided by W plc so as to maximize its pro 20 × 3.

(b) The sales director has reviewed the selling prices being used by W plc and has provided further information.

(1) If the price for laundry were to be reduced to $5.60 per service, this would increase 14,000 services.

(2) If the price for dry cleaning were to be increased to $13.20 per service, this would demand to 9,975 services.

Required: Assuming that such selling price changes would apply to all sales and that the resources limitations continue to apply, and that a graphical linear programming solution is to be used to maximize profit:

(i) State the constraints and objective function.

(ii) Use a graphical programming solution to advice W plc whether it should revise its selling prices.

Solution

Step 1 Cleaning materials

	Litres
Required laundary ($^{2}/_{10}$ x 8,000)	1,600
Dry cleaning ($^{3}/_{10}$ x 10,500)	3,150
Available	4,750
Spare	5,000
	250

Therefore, not scarce

Direct labour hours

	Hours
Required laundary ($^{1.2}/_{6}$ x 8,000)	1,600
Dry cleaning ($^{2}/_{6}$ x 10,500)	3,500
Available	5.100
Spare	6,000
	900

Therefore not scares

Machine hours

	Hours
Required laundary ($^{0.5}/_{3}$ x 8,000)	1,333.3
Dry cleaning ($^{1.5}/_{3}$ x 10,500)	5,250.0
Available	6,583.3
Spare	5,000.0
	1,583.3

Therefore, scares

Step 2 Rank the services in terms of contribution per hour of machine time

	Laundry	**Dry cleaning**
Unit contribution		
$(2.15 + 1.15)		
$(3.25 + 2.25)	$3.30	
Machine hours per service		
($0.5/$3)		
($1.5/$3)	$^{1}/_{6}$	
Contribution per hour of machine time	$19.80	
ranking	1	

Step 3 Determine a production plan

	Demand	**Machine hours required**	
Contracted services			
Laundry	1,200 (×)	200	
Dry cleaning	2,000 (×)	1,000	
Non-contracted services			
Laundry	6,800* (×)	1,133	
Dry cleaning	5,333**(×)	2,666	

*8,000 – 1,2000

**2,666 $^{2}/_{3} \div$ $^{1}/_{2}$

Profit-maximising mix of services

Laundry: 8,000 services

Dry cleaning: 7,333 services

(b) (i) define variables

Let l = number of laundry services provided

Let d = number of dry cleaning services provided

Establish objective function

Fixed costs will be the same irrespective of the optimal mix and so the objective contribution (c).

Laundry: revised contribution = \$5.60 - \$(2 + 1.2 + 0.5) = \$1.90

Dry cleaning: revised contribution = \$13.20 - \$(3 + 2 +_1.5) = \$6.70

Maximize c = 1.91 + 6.7d, subject to the constraints below.

Establish constraints

Cleaning materials: $^{2}/_{10}\,l + \ ^{3}/_{10}\,d \leq 5{,}000$

$^{1}/_{15}\,l + \ ^{3}/_{10}\,d \leq 5{,}000$

Direct labour: $^{1.2}/_{6}\,l + \ ^{2}/_{6}\,d \leq 6{,}000$

$^{1}/_{5}\,l + \ ^{1}/_{3}\,d \leq 6{,}000$

Variable machine cost: $^{0.5}/_{3}\,l + \ ^{1.5}/_{13}\,d \leq 5{,}000$

$^{1}/_{16}\,l + \ ^{1}/_{12}\,d \leq 5{,}000$

Maximum and minimum services (for contract): $14{,}000 \geq l \geq 1{,}200$

$9{,}975 \geq d \geq 2{,}000$

(ii) Establish coordinates to plot lines representing the inequalities

Cleaning materials: if l = 0, d = 16,667

If d = 0, l = 25,000

Direct labour: if l = 0, d = 18,000

If d = 0, l = 30,000

Variable machine cost: if l = 0, d = 10,000

If d = 0, l = 30,000

Also plot the lines l = 1,200 and d = 2,000, and l = 14,000 and d = 9,975

Construct an iso-contributional line

C = 1.9l + 6.7d

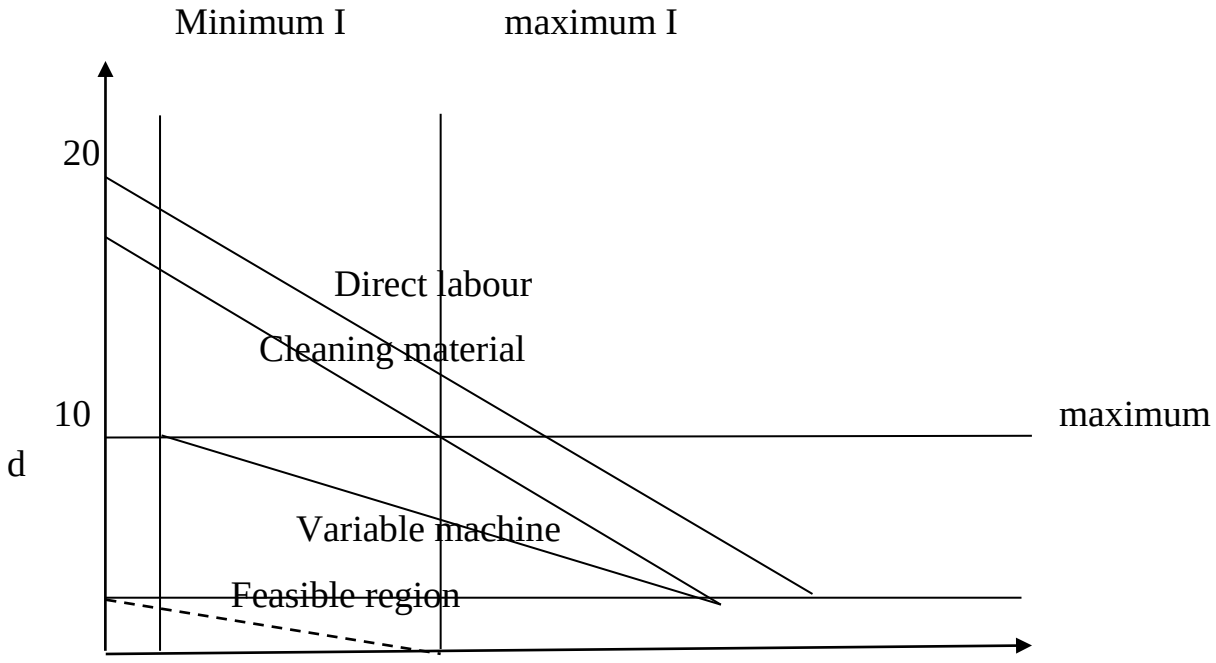
If c = (1.9 x 6.7 x 1,000) = 12,730

Then: If l = 6,700, d = 0

If d = 1,900, l = 0

Draw the graph (graph to show profit- maximizing mix of services)

D '000 services



Find the optimal solution

By moving the iso-contribution line out across the graph, it is clear that the optimal solution lies at the intersection of lines representing the constraints for minimum number of laundry services and machine hours.

Therefore, optimal solution occurs when:

L = 1,200 and $^1/_6 l + {}^1/_2 d = 5{,}000$

If l = 1,200, then d = (5,000 - 200) × 2 = 9,600

The optimal solution is to carry out 1,200 laundry services and 9,600 dry cleaning services. Check the validity of revising selling prices

Maximum profit per mix in (a)

		$
Contribution		
Laundry:	8,000 x unit contribution of $3.30	26,400.0
Dry cleaning:	7,333 x unit contribution of $5.50	40,331.5
		66,731.5
Less: fixed costs	{(8,000 × $1.15) + (10,500 × $2.25)}	(32,825.00)

		$
		33,906.50

Maximum profit based on revised selling prices

		$
Contribution		
Laundry:	1,200 × unit contribution of $1.90	2,280
Dry cleaning:	9,600 × unit contribution of $6.70	64,320
		66,600
Less: fixed costs	{(8,000 × $1.15) + (10,500 × $2.25)}	32,825
		33,775

By revising the selling prices, maximum profit achievable falls by $(33,906.5 – 33,775) = $131.50

Therefore, in theory, prices should not be revised but the difference is so small that managers should check carefully the reasonableness of the estimates used.

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Q80: A company manufactures two products. Each product passes through two departments A and B before it becomes a finished product. The data for the year are as under:

	Product X	**Product Y**
Maximum Sales Potential (in units)	7,400	10,000
Product unit data:		
Selling Price p.u.	`90	`80
Machine hrs. p.u.		
Department A hrs. @ `40/hr.	0.50	0.30
Department B hrs. @ `60/hr.	0.40	0.45

Maximum Capacity of Department A is 3,400 hrs. and Department B is 3,640 hrs.

Maximum Quantity of Direct Materials available is 17,000 kgs. Each product requires 2 kg. of Direct Materials. The Purchase Price of direct materials is ` 5/kg.

Required:

(i) FIND optimum product mix.

(ii) In view of the aforesaid production capacity constraints, the company has decided to produce only one of the two products during the year. Which of the two products should be produced and sold in the year to maximise profit? State the number of units of that product and relevant contribution. Using Linear programming approach to solve above problem.

Solution

(i) Calculation of Optimum Production Mix

Statement Showing Limiting Factor

Particulars	Material	Hours in Department A	Hours in Department B
Required: X	14,800 kg.	3,700 hrs.	2,960 hrs.
Required: Y	20,000 kg.	3,000 hrs.	4,500 hrs.
Total Requirement	34,800 kg.	6,700 hrs.	7,460 hrs.
Available Resources	17,000 kg.	3,400 hrs.	3,640 hrs.
Shortage	17,800 kg.	3,300 hrs.	3,820 hrs.

Hence all the three resources are limiting factors.

Statement of Rank

Particulars	Product X	Product Y
Sales	90	80
Less: Direct Material	10	10
Dept. A	20	12
Dept. B	24	27
Contribution p.u.	36	31
Contribution per kg. of Raw Material	18	15.5
Rank	**I**	**II**
Contribution/hr. of Dept. A	72	103.33
Rank	**II**	**I**
Contribution/hr. of Dept. B	90	68.89
Rank	**I**	**II**

To find the optimum mix of products that shall lead to maximum profits while taking into consideration of shortage of resources (i.e. constraints), we have to use **Linear Programming**.

Let x1 and x2 donate quantities of product ‘x’ and product ‘y’ respectively.

The linear programming model for the given problem is:

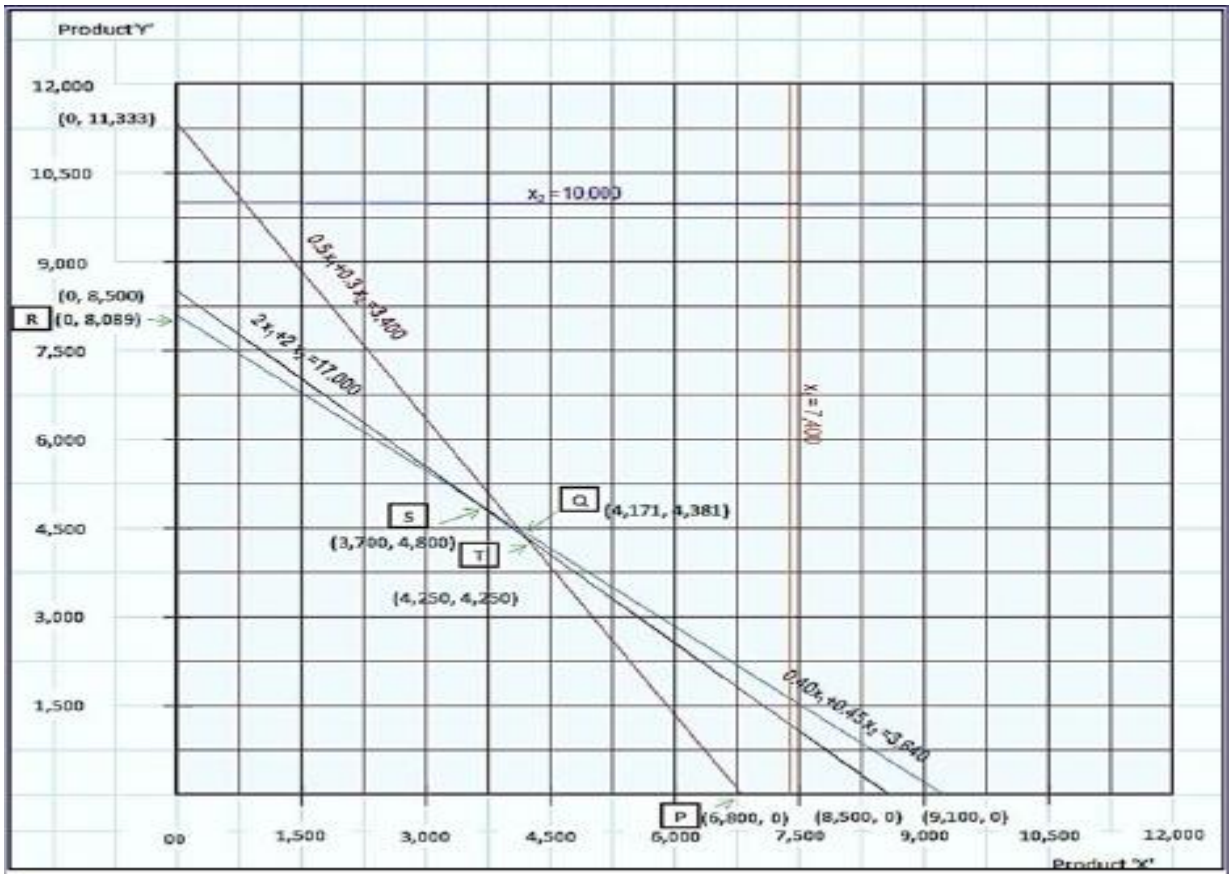
$Z_{max} = 36x1 + 31x2$

Subject to:

$2x1 + 2x2 \leq 17$	…(for material)
$0.5x1 + 0.3x2 \leq 3$	…(for dept. A)
$0.4x1 + 0.45x2 \leq 3$	…(for dept. B)
$x1 \leq 7$	…(demand constraint)

$x2 \leq 10$	…(demand constraint)

The graphical solution for the problem is given below:



So, different combination of product mix include,

Combination	x1	x2	Total Contribution (in `)	Rank
P	6,800	0	2,44,800	IV
Q*	4,171	4,381	2,85,967	-
R	0	8,089	2,50,759	III
S	3,700	4,800	2,82,000	II
T	4,250	4,250	2,84,750	I

Note (*)

Combination Q (4,171, 4,381) is not possible as it is satisfying three conditions out of above four conditions. To produce combination Q (4,171, 4,381), requirement of the material will be 17,104 Kgs. (2 Kg × 4,171 units + 2 Kg × 4,381 units). However, material is available 17,000 Kgs. Accordingly, this combination is not possible.

Therefore, optimum product mix = X 4,250 units and Y 4,250 units.

(b) Statement Showing Product with Higher Contribution

	Maximum Demand	Maximum Production by	Maximum Production	Maximum Production with	Feasible Maximum	Contribution

	(a)	Dept. A (b)	by Dept. B (c)	available materials (d)	Production (lower of a, b, c and d)	(`)
X	7,400	6,800	9,100	8,500	6,800	2,44,800
Y	10,000	11,333	8,089	8,500	8,089	2,50,759

Therefore, Product Y should be produced at 8,089 units resulting in a contribution of `2,50,759.

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Q81: The managers of Albion Co are reviewing the operations of the company with a view to making operational decisions for the next month. Details of some of the products manufactured by the company are given below.

Product	**AR2**	**GL3**	**HT4**	**XY5**
Selling price ($/unit)	21.00	28.50	27.30	
Material R2 (kg/unit)	2.0	3.0	3.0	
Material R3 (kg/unit)	2.0	2.2	1.6	3.0
Direct labour (hours/unit)	0.6	1.2	1.5	1.7
Variable production overheads ($/unit)	1.10	1.30	1.10	1.40
Fixed production overhead ($/unit)	1.50	1.60	1.70	1.40
Expected demand for next (units)	950	1,000	900	

Products AR2, GL3 and HT4 are sold to customers of Albion, while Product XY5 is a component that is used in the manufacture of other products. Albion manufactures a wide range of products in addition to those detailed above.

Material R2, which is not used in any other of Albion's products, is expected to be in short supply in the next month because of industrial action at a major producer of the material. Albion has just received a delivery of 5,500 kg of Materials R2 and this is expected to be the amount held in Inventory at the start of the next month. The company does not expect to be able to obtain further supplies of material R2 unless it pays a premium price. The normal market price is $2.50 per kg.

Material R3 is available at a price of $2.00 per kg and Albion does not expect any problems in securing supplies of this material. Direct labour is paid at a rate of $4.00 per hour.

Folam Co has recently approached Albion with an offer to supply a substitute for product XY5 at a price of $10.20 per unit. Albion would need to pay an annual fee of $50,000 for the right to use this patented substitute.

Required:

(a) Determine the optimum production schedule for product AR2, GL3 and HT4 for the next month, on the assumption that additional supplies of Material R2 are not purchased.

(b) If Albion Co decides to purchase further supplies of Material R2 to meet demand for Products AR2, GL3 and HT4, calculate the maximum price per kg that the company should pay.

(c) Discuss whether Albion Co should manufacture Product XY5 or buy the substitute offered by Folam Co. your answer must be supported by appropriate calculations.

Solution

Optimum production schedule

The optimum production schedule is found using limiting factor analysis.

Per unit:	**AR2**	**GL3**	**HT4**
	$	**$**	**$**
Material R2	2.5 x 2 = 5.00	2.5 x 3 = 7.50	2.5 x 3 = 7.50
Material R3	2 x 2 = 4.00	2 x 2.2 = 4.40	2 x 1.6 = 3.20
Labour	4 x 0.6 = 2.40	4 x 1.2 = 4.80	4 x 1.5 = 6.00
Variable overhead	1.10	130	1.10
Variable costs	12.50	18.00	17.80
Selling price	21.00	28.50	27.30
Contribution	8.50	10.50	9.50
Material R2 (kg/unit)	2	3	3
Contribution ($/kg of R2)	8.5 ÷2 = 4.25	10.5 ÷3 = 3.50	9.5 ÷3 = 3.17
Ranking	1	2	3

Product	**Demand units**	**R2 used kg**	**Production units**	**Contribution $**
AR2	950	1,900	950	8,075
GL3	1,000	3,000	1,000	10,500
HT4	900	600	200	1,900
		5,500		20,475

The optimum production schedule is 950 units of product AR2, 1,000 units of GL3 and 200 units of HT4, giving a total contribution of $20,475. The fixed production overheads are ignored in this analysis because they are assumed not to vary with changes in the level of production.

(B) Further supplies of Material R2 will be used to produce additional units of product HT4. The contribution per kg of Material R2 of product HT4 is $3.17and so if Albion pays 3.17 + 2.50 per kg for Material R2, the additional units of Product HT4 produced will make a zero contribution towards fixed costs. $5.67 is therefore the maximum price.

(C) The variable cost of Product XY5:

	$/unit

Material R3: 3 x 2 =	6.00
Labour: 1.7 x 4 =	6.80
Variable overhead:	1.40
	14.20

The substitute offered by Folam gives a saving of $4 per unit. However, Albion plc would also pay an annual fee of $50,000 for the right to use the substitute. The company would need to manufacture more than 50,000/4 = 12,500 units per year of Product XY5, or 1,042 units per month, in order for the offered substitute to be financially acceptable. If it needed less than 12,500 units of Product XY5 per year, it would be cheaper to manufacture the product in house. This evaluation is from a short-term perspective: in the longer term, buying in may lead to fixed cost savings and lower investment, increasing the benefits of buying in and lowering the break-even point.

Albion plc would also need to assure itself that the quality of the substitute was acceptable and that this quality could be maintained: the lower price offered by Folam might be associated with poorer quality than that deemed necessary by Albion plc. Orders for the substitute product would also need to be delivered promptly in order to avoid production hold-ups.

Albion plc could also become dependent on Folam Limited for supplies of the substitute product and might be vulnerable to future price increases by the supplier. Such price increases might reduce or even eliminate the cost saving of buying in.

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Outsourcing Part-II

Q84:Lee Electronics manufactures four types of electronic products A, B, C and D. All these products have a good demand in the market. The following figures are given to you:

	A	B	C	D
Material cost (`/u)	32	36	44	20
Machine cost (`/u) @ ` 8 per hour)	48	32	64	24
Other variable costs (`/u)	64	72	45	56
Selling price (`/u)	162	156	178	118
Market demand (units)	52000	48,500	26,500	30,000

Fixed overheads at different levels of operation are:

Level of operation (in production hours)	Total fixed Cost (`)
upto 1,50,000	10,00,000
1,50,001-3,00,000	10,50,000
3,00,001-4,50,000	11,00,000
4,50,001-6,00,000	11,50,000

At present, the available production capacity in the company is 4,98,000 machine hours. This capacity is not enough to meet the entire market demand and hence the production manager wants to increase the capacity. The company wants to retain the customers by meeting their demands through alternative ways. One alternative is to sub-contract a part of its production.

The sub-contract offer received is as under:

	A	**B**	**C**	**D**
Sub-contract Price (`/u)	146	126	155	108

The company seeks your advice in terms of products and quantities to be produced and/or sub-contracted, so as to achieve the maximum possible profit. You are required to also compute the profit expected from you suggestion.

Solution

Demand (Units)				
	52,000 A	**48,500 B**	**26,500 C**	**30,000 D**
Selling Price	162	156	173	118
Direct Material	64	72	45	56
Manufacturing Cost	48	32	64	24
Other Variable Cost	32	36	44	20
Contribution (`/u)	18	16	20	18
Machine Hours *per unit*	6	4	8	3
Contribution (`/M/c hr.)	3	4	2.5	6
Ranking	III	II	IV	I
Sub-Contract Cost `/u)	146	126	155	108
Contribution (`/u) on (Sub-Contract)	16	30	18	10

Decision

It is more profitable to **sub-contract B**, since contribution is higher sub-contract.

1st Level of Operations

Produce D *as much as possible*	*= 30,000 units*
Hours Required	*= 90,000 hrs (30,000 units X 3 hrs.)*
Balance Hours Available	*= 60,000 hrs*
Produce the Next Best	*= 10,000 units of A* $\left(\frac{60,000\,Rs}{6\,hrs/u}\right)$

**Since B is better to be outsourced.*

Product	**Particulars**	**Contribution/unit**	**Contribution (`)**

	Produce: 10,000 units	18	1,80,000
A	Outsource: 42,000 units	16	6,72,000
B	Outsource Fully: 48,500 units	30	14,55,000
C	Outsource Fully: 26,500 units	18	4,77,000
D	Fully Produce: 30,000 units	18	5,40,000
Total Contribution			33,24,000
Less: Fixed Cost			10,00,000
Net Gain			23,24,000

2nd Level of Operation

Both A and C increase contribution by own manufacture only by `2/- per unit. 1,50,000 hrs can produce 25,000 units of A.

Contribution increases by `50,000 (25,000 units × `2) [Difference in Contribution *sub-contract* and *own manufacturing* is ` 2]

But increase in Fixed Cost by `50,000.

At the 2nd level of operation, the *increase in contribution* by own manufacturing is *exactly set up* by *increase in fixed costs* by ` 50,000/-. It is a *point of financial indifference*, but otherconditions like reliability or possibility of the sub-contractor increasing his price may beconsidered and decision may them but towards own manufacture.

3rd Level of Operation

Additional Hrs Available	= 1,50,000 hrs.
Unit of A that are Needed	= [52,000 – 25,000 (2nd Level) – 10,000
	(1st Level)]
	= 17,000 units
Hrs. Required for A	17,000 units × 6 hrs/u
	1,02,000 hrs
Balance Hours Available for C	1,50,000 hrs – 1,02,000 hrs
	48,000 hrs
Units of C can be Produced	6,000 units
Increase in Contribution over Level 1st or 2nd	`46,000
	(A: 17,000 units × `2 + C: 6,000 units × `2)
Increase in Fixed Cost	50,000
Additional Loss	`50,000 - `46,000
	`4,000
4th Level of Operation	
Additional Hrs Available	1,50,000 hrs

Additional 1,50,000 can give	18,750 units of C
	$\left(\frac{1,50,000\ hrs}{8\ hrs}\right)$
Increase in Contribution	`37,500
	(C: 18,750 units × 2)
Increase in Fixed Cost	50,000
Additional Loss	`50,000 - `37,500
	= 12,500
Level 1st Profit will *go down by*	= `12,500 +`4,000
	= `16,500

Advice

Do not Expand Capacities.

Summary

Product	**Produce (Units)**	**Sub-Contract (Units)**	**Contribution (Production)**	**Contribution (Sub-Contract)**	**Total Contribution**
A	10,000	42,000	1,80,000	6,72,000	8,52,000
B	—	48,500	—	14,55,000	14,55,000
C	—	26,500	—	4,77,000	4,77,000
D	30,000	—	5,40,000	—	5,40,000
Total Contribution					33,24,000
Less: Fixed Cost					10,00,000
Profit					23,24,000

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