DEPARTMENT OF MANAGEMENT ACCOUNTING

MANAGEMENT ACCOUNTING
TECHNIQUES AS AID IN DECISION - MAKING

ONLY STUDY GUIDE

ACN316-4
ACN306-Y

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INTRODUCTION

We welcome you as student to this module entitled “Management Accounting techniques as aid in decision-making”. This study guide has been compiled to guide you through the prescribed book *“Managerial Accounting”, Frank W Julyan, Chalene Nel, Volume 1, second edition 2003.* It contains practical examples and explanations to help you master the content of the module. We have inserted remarks (indicated with two exclamation marks “**!! Remark:**”) to explain certain issues. Please note that the remarks do not form part of the solution - they only serve as explanations.

Management accounting focuses on the needs of the management in the organisation, rather than on other interested parties. Management accountants are now part of the management team of an organisation. They provide information for planning and control purposes, and act as consultants and advisors to other managers. Management accountants need to adhere to a high standard of ethical conduct. In the USA the Institute of Management Accountants developed ethical standards which include the following:

- competence
- confidentiality
- integrity
- objectivity.

Management accounting is constantly changing, and the role of the management accounting in an organisation has become very important. The first four chapters are a revision of topics covered in second-year modules. In chapters 5, 6 and 7, we discuss cost-volume-profit analysis in more detail. We also introduce you to simple linear regression analysis and the learning curve theory, and discuss how they can be applied. Chapter 8 deals with the technique of optimisation, and the use of limited production factors. In chapter 9 we look at the relevance approach to nonroutine profit-related decisions, and chapter 10 is devoted to decision-making under circumstances of risk and uncertainty. Chapter 11 covers project management by making use of network analysis, and we conclude with inventory and production models in chapter 12.

The following lecturers are responsible for these modules:

Mrs M M Odendaal
Mrs P R Berry
Mrs K Kok

We hope you will enjoy your journey through our study material and wish you every success with this module.

CHAPTER

1

Cost and managerial accounting in perspective

Accounting provides, among other things, quantitative information about the entity. In management accounting, this quantitative data is used mainly for planning and control purposes. Strategic as well as organisational decisions need to be made for the effective running of the entity, and management make these decisions by using different techniques. This chapter places management accounting in perspective, and also emphasises the need for management accounting techniques in order to obtain information which can aid decision-making.

Carefully read chapter 1 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out in the textbook.

CHAPTER

2

Cost classification

Accounting systems provide costs for inventory valuation as well as for planning, control and decision-making purposes. Management accountants use different cost classifications for different purposes, and it is important that you should know the different types of costs and the ways of managing them.

This chapter is a revision of the different cost classifications introduced in your second-year. It is essential that you master cost classification, therefore, you must study this chapter carefully. We recommend that you also revise your second-year work. Without a sound knowledge of cost classification you will not be able to master later chapters, so please make sure you understand the work before you carry on with the rest of this module.

Study chapter 2 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003.* Pay special attention to the learning objectives set out at the beginning of the chapter. Please note the differences between period costs and product costs.

CHAPTER

3

Overhead assignment

This chapter is mainly revision of second-year work. Some students may find that they lack knowledge and proficiency with regard to certain sections of the content, for example the recovery of overheads by making use of activity-based costing.

The recognition and treatment of overheads generally represent a major problem to most students. As a sound knowledge of the treatment of overheads is presumed in Managerial Accounting, it has been considered appropriate to include revision of this part of the second-year work.

Study chapter 3 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003.* Pay special attention to the learning objectives set out at the beginning of the chapter.

CHAPTER

4

Inventory valuation and profit determination

This chapter is mainly revision of second-year work. Students are expected to be skilled in the application of the study material in this chapter, as aspects thereof could be considered presumed knowledge for applications in Managerial Accounting. A revision of the work is therefore deemed to be essential.

Study chapter 4 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003.* Please note the differences between absorption costing and direct costing.

CHAPTER

5

Cost-volume-profit analysis

Cost-volume-profit analysis is the study of the relationships between sales volume, revenue, expenses and profit. It is used to determine the effect that changes in sales volume, selling prices, variable costs and fixed costs have on profit. The calculations done here are valuable to the management accountant for planning and decision-making purposes.

Carefully study chapter 5 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003.* Pay attention to the learning objectives set out at the beginning of the chapter.

In order to become proficient in the application of the technique, you should work through the following questions, solutions and remarks thoroughly. You will benefit most if you answer the questions on your own before you look at the suggested solutions. Your own attempt should then be compared with the suggested solution. Note your mistakes and try to determine why you have made the mistakes. This will ensure that you do not repeat your mistakes later. If you answer the questions as we have suggested, you will find that, it will become easier to solve the problems. When you do revision for examination purposes, your notes on the original attempt will be valuable, as you will be able to recall which mistakes not to make and, to remember the significance of the information provided in a question.

QUESTION 1 (28 marks; 34 minutes)

Sport Centre (Pty) Limited bought a squash centre, consisting of six courts, in a northern suburb of Johannesburg at a price of R900 000.

The deal was financed by means of a loan, which is repayable, annually in arrears, in instalments of R100 000 capital, plus interest at 10% per annum on the outstanding capital. To date, one payment has been made.

The budgeted operating costs of the centre for the next financial year are as follows:

	R
Salaries	48 000,00
Wages (fixed)	9 108,00
Electricity and water	
• fixed	16 800,00
• per court per hour played	1,20
Repair and maintenance costs	
• at 80% capacity utilisation	15 312,00
• at 60% capacity utilisation	12 684,00

Squash courts will be let out at R8 per 30 minutes, which is the average time of one game.

The centre will be open between 07:00 and 22:00 for 7 days per week, including public holidays.

REQUIRED

(a) (i) Determine the maximum number of games that can be played per annum. (3)

(ii) Determine the fixed and variable elements of repair and maintenance costs. (6)

(iii) Calculate the marginal income per game. (3)

(iv) Determine the number of games that must be played during the next financial year for the company to earn a profit of R24 000. (9)

(v) Determine the capacity utilisation in (iv) above. (1)

(b) The results of a market survey indicate a capacity utilisation of 33 600 games per annum.

In order to improve the expected performance of the company, a suggestion has been made that playing hours be extended by 2 hours per day and that the rental per court be increased by 25%.

It is anticipated that the implementation of the above suggestion will result in salaries increasing by 20% and the expected capacity utilisation decreasing to 90% of the reachable capacity according to the market survey.

REQUIRED

Calculate the expected net income for the next financial year, should the above-mentioned suggestions be accepted. (6)

[28]

SUGGESTED SOLUTION

SPORT CENTRE (PTY) LIMITED

(a) (i) *Number of games per annum*

100% capacity	=	(15 hours x 365 days x 2 x 6 courts) games **!!**	
	=	65 700 games	(3)

!! Remark:

The squash courts are open for 15 hours per day, from 07:00 to 22:00. The courts are hired out for 30 minutes at a time, which means two games can be played in an hour.

(ii) *Fixed and variable elements of repair and maintenance costs*

		Games	**R**
80% capacity		52 560①	15 312
60% capacity		39 420②	12 684
Variable costs :		13 140	2 628

Variable costs per game	=	R2 628 / 13 140	
	=	R0,20	
Fixed costs	=	R15 312 - (52 560 x R0,20)	
	=	R4 800	(6)

Calculations:

①	$^{80}/_{100}$ x 65 700	=	52 560
②	$^{60}/_{100}$ x 65 700	=	39 420

(iii) *Marginal income per game*

	R
Rental	8,00
Less: Variable costs	0,80
Electricity and water (R1,20 ÷ 2)	0,60
Repair and maintenance costs per (a)(ii) above	0,20
Marginal income per game	7,20

(3)

(iv) *Number of games to be played*

Let the number of games = x
Marginal income = fixed costs + profit
$7{,}2x$ = 158 708 ③ + 24 000
$7{,}2x$ = 182 708
x = 25 376,11
∴ Number of games to be played = 25 377 games (9)

(v) *Capacity utilisation*

$$\text{Utilisation} = \frac{25\,377}{65\,700} \times \frac{100}{1}$$

= 38,6% (1)

(b) *Expected net income*

	R
Rental [(R8 x 1,25) x (90% x 33 600)]	302 400
Less: Variable costs [R0,80 x (90% x 33 600)]	24 192
Marginal income	278 208
Less: Fixed costs	168 308
Salaries (R48 000 x 1,20)	57 600
Other (per (a) (iv) R158 708 - R48 000)	110 708
Net income	109 900

(6)

Calculations::

③	*Fixed costs*	**R**
	Salaries	48 000
	Wages	9 108
	Electricity and water	16 800
	Repair and maintenance costs	4 800
	Interest on loan (see below)	80 000
		158 708

Interest on loan	**R**
Capital	900 000
Interest (10% x R900 000)	90 000
	990 000
Less: Repayment made (R100 000 + R90 000)	190 000
Balance	800 000
Interest (10% x R800 000)	80 000

[28]

QUESTION 2 (20 marks; 24 minutes)

Friends of yours have decided to start a bungee jumping facility over weekends and have registered Just Jump CC for purposes of trading. No equipment has been acquired yet.

The procedures for bungee jumping are the following:
A group of six people get into a cage, which is hoisted up to a certain height with a crane. One person jumps at a time, and his/her only connection to the cage is a rubber band. The one end of the rubber band is fixed to the cage; the other end is fixed to the waist or legs of the person jumping. After swinging for some time on the rubber band, the person is released onto a safety mattress on the ground. As soon as everybody has had a turn to jump, the cage is lowered to the ground and ready for a new group of people.

The facility will be made available at different locations, depending on the events in a specific area, therefore the unit to be acquired must be mobile.

There are only two suitable models available, the details of which are as follows:

	Model A	Model B
Height of jump	45 metres	60 metres
Cost price of unit	R450 000	R500 000
Duration of session, based on a group of six people (including the time required to hoist up the cage)	45 minutes	60 minutes
Annual fixed operating expenses	R389 325	R423 950
Variable costs per jump	R13	R13
Selling price of tickets per person per jump	R100	R135

The facility will be in operation from 09:00 daily on every Saturday and Sunday of the year. The last jumpers have to be back on the ground by 21:00. It is envisaged that it would operate at full capacity, no matter which model is acquired.

REQUIRED

(a) Determine the breakeven point in terms of a number of jumps in respect of Model B. (3)

(b) Determine, only with regard to Model A, how many jumps would ensure an annual net profit of R302 325. (5)

(c) Calculate the margin of safety envisaged for Model B and give a brief description of the significance thereof. (7)

(d) State three factors (other than estimated profitability) that your friends should take into account before they decide which model to acquire. (5)

[20]

SUGGESTED SOLUTION

JUST JUMP CC

(a) *Breakeven point in terms of a number of jumps for Model B*

$$\text{Breakeven jumps} = \frac{\text{Fixed costs}}{\text{Marginal income per jump}}$$

$$= \frac{\text{R423 950}}{\text{R(135 - 13) jumps}}$$

$$= 3\,475 \text{ jumps} \quad (3)$$

(b) *Number of jumps with regard to Model A that would ensure an annual net profit of R302 325*

Sales = Variable costs + fixed costs + profit
Let x = number of jumps
$100x = 13x + 389\,325 + 302\,325$ **!!**
$87x = 691\,650$
$x = 7\,950$
∴ 7 950 jumps would ensure an annual net profit of R302 325. (5)

!! Remark:

The price per jump is R100, the variable cost per jump is R13, and the number of jumps for Model A is represented by *x*.

(c) *Margin of safety envisaged for Model B*

Capacity envisaged = 12 times per day x 6 persons per time x 2 days per weekend x 52 weekends
= 7 488 jumps

$$\text{Margin of safety} = \frac{\text{Actual jumps - Breakeven jumps}}{\text{Actual jumps}} \times 100\%$$

$$= \frac{7\,488 - 3\,475}{7\,488} \times 100\%$$

$$= 53{,}59\%$$

$$\approx 54\%$$

This figure means that the expected turnover can decrease by 54% without the organisation suffering a loss. (7)

(d) *Three factors regarding the decision on which model to acquire:*

- transportability and accessibility of the respective models,
- the ease of operation of each model,
- customer attitude towards jumps of 45 metres and 60 metres respectively,
- affordability of jumps,
- risk linked to the respective models, based on the expected margins of safety.

Any other valid factor Limited to (5)
[20]

QUESTION 3 (30 marks; 36 minutes)

One of your clients, Mr Giovanni Benito, opened "The Barberos Hamburger Hut" a few years ago. For this purpose a building was rented at R2 400 per month. Three ladies were employed full-time to work at the restaurant and nine students were employed to work for 20 hours per week delivering hamburgers. You were appointed to render tax and accounting services at R1 800 per month. All restaurant equipment and delivery vehicles were initially acquired for cash.

Mr Benito sells hamburgers at R8,00 each. Because of the excellent quality of his food he has expanded his business. Profits have more than doubled since then, but Mr Benito does not understand why his profits have increased more rapidly than his sales volume.
The following is a projected income statement for the year ended 28 February 20.1:

THE BARBEROS HAMBURGER HUT
Projected income statement for the year ending 28 February 20.1

	R	R
Sales		720 000
Purchases	270 000	
Wages and fringe benefits of restaurant employees	62 400	
Wages and fringe benefits of delivery staff	91 520	
Rent	28 800	
Accounting services	21 600	
Depreciation		
- Restaurant equipment	20 000	
- Delivery vehicles	32 000	
Utilities	11 200	
Supplies (soap, floor wax, etc.)	8 400	545 920
Net profit before taxation		174 080
Taxation		60 928
Net profit		113 152

Mr Benito has noticed that expenses for utilities and supplies have remained constant over the years.
Assume that Mr Benito pay income tax at a rate of 35% of his income.
Assume that all transactions are cash transactions.

REQUIRED

(a) Calculate the breakeven point, expressed in terms of a number of hamburgers. (13)

(b) Calculate the cash flow breakeven point expressed in terms of a number of hamburgers. (5)

(c) (i) If Mr Benito withdraws R48 000 for personal use, calculate the cash that will remain from the net cash acquired from business activities for the 20.1 financial year. (5)

(ii) Briefly explain to Mr Benito why the cash remaining from the income producing activities will exceed the profits for the year. (1)

(iii) Determine how much cash Mr Benito can withdraw during the 20.1 financial year, should he want his profit to equal the cash retained. (1)

(d) Mr Benito requires an after-tax net income of R160 000. Calculate the number of hamburgers that should be sold in order to obtain the desired income. (5)

[30]

SUGGESTED SOLUTION

THE BARBEROS HAMBURGER HUT

(a) *Breakeven point in terms of a number of hamburgers*

$$\text{Breakeven point} = \frac{\text{Fixed costs}}{\text{Marginal income per hamburger}}$$

$$= \frac{\text{R275 920 ①}}{\text{R(8,00 - 3,00 ②) hamburgers}}$$

$$= 55\,184 \text{ hamburgers} \quad (13)$$

Calculations::

		Cash and noncash	Cash
①	*Fixed costs*	**R**	**R**
	Wages and fringe benefits of restaurant employees	62 400	62 400
	Wages and fringe benefits of delivery staff	91 520	91 520
	Rent	28 800	28 800
	Accounting services	21 600	21 600
	Depreciation		
	- Restaurant equipment	20 000	-
	- Delivery vehicles	32 000	-
	Utilities	11 200	11 200
	Supplies	8 400	8 400
		275 920	223 920

② *Variable costs*

Purchases = R270 000

Projected sales = R720 000 ÷ R8,00
= 90 000 units

∴ Variable cost per unit = R270 000 ÷ 90 000
= R3,00

(b) *Cash flow breakeven point in terms of a number of hamburgers*

$$\text{Cash flow breakeven point} = \frac{\text{Fixed costs (cash)}}{\text{Marginal income per hamburger}}$$

$$= \frac{\text{R223 920}}{\text{R(8,00 - 3,00) hamburgers}}$$

= 44 784 hamburgers (5)

(c) (i)

	R
Net income after tax	113 152
Add back: Depreciation	52 000
	165 152
Less: Withdrawals	48 000
Cash surplus	117 152

(5)

(ii) Depreciation exceeds withdrawals. (To obtain net cash flow, depreciation has to be added back to net income, while withdrawals have to be deducted from net profit.) (1)

(iii) R52 000 (the point where withdrawals equals depreciation) (1)

(d) *Number of hamburgers to be sold*

After-tax net income required = R160 000

∴ Before-tax net income $= \frac{\text{R160 000}}{0{,}65}$

= R246 154

Let number of hamburgers = x

Sales = Variable costs + Fixed costs + Profit

$8x = 3x + 275\,920 + 246\,154$

$5x = 522\,074$

$\therefore x = 104\,414{,}8$

$\therefore x \approx 104\,415$ hamburgers (5)

[30]

QUESTION 4 (30 marks; 36 minutes)

You have been approached by Mr Meatman, a butcher to advise him on whether he should accept a fixed contract for the supply of biltong (a salted and dried meat delicacy)?

In terms of the contract the following is stipulated:

Weekly supply	:	400 vacuum-packed packets
Price per packet	:	R25,00
Mass per packet	:	500 grams

All biltong is to be made from topside, a cut of beef.

Mr Meatman buys whole beef carcasses from an abattoir. Topside available for biltong making, taken from whole carcasses totals 210 kilograms per week, and costs R15,00 per kilogram. Any additional topside required is purchased from wholesalers at R18,00 per kilogram.

At present, 88 kilograms of biltong is made and sold per week. The selling price is R60,00 per kilogram. All the biltong is made from topside and none of it is vacuum-packed. The fixed contract will not affect the current demand for biltong.

Mr Meatman has supplied you with the following information in respect of the making of biltong:

- 1 kilogram of topside, when dried, renders 0,666 kg of biltong.
- Spices used per kilogram of topside cost R0,50.
- Direct labour for the cutting, salting and hanging of 1 kg of topside is 0,25 hours at R10 per hour.
- Fixed costs amount to R1 000 per week and include the salaries of sales staff, equipment used and all other administrative costs.

Should the fixed contract be accepted, the cutting, salting and hanging of the contract meat will have to be done after hours at a rate of one and a half times the normal wage rate.

Additional fixed costs of R200 per week will also be incurred for additional equipment required.

The vacuum packets suitable for packing 500 grams of biltong cost R0,60 each.

REQUIRED

(a) Calculate the weekly marginal and net income Mr Meatman is currently earning from biltong making. (6)

(b) Determine whether Mr Meatman should accept the fixed contract if he wants to earn a net profit of 20%, based on sales value of the contract. (13)

(c) Calculate the margin of safety ratio of the fixed contract, taking only directly related costs and income into account. (6)

(d) Calculate what the contract price per packet of biltong should be if Mr Meatman wants to earn a net profit of 25% on contract sales. (5)

Round off all calculations to the nearest kilogram or rand, whichever is applicable. **[30]**

SUGGESTED SOLUTION

MR MEATMAN

(a) *Marginal and net income from biltong presently being made*

	R
Sales (R60 x 88)	5 280
Less: Variable costs	2 376
Topside (132① x R15,00)	1 980
Spices (132① x R 0,50)	66
Direct labour (0,25 x 132 x R10,00)	330
Marginal income	2 904
Less: Fixed costs	1 000
Net income	1 904

Calculation::

① $\frac{88}{0,666}$ = 132 kg (6)

(b) *Acceptance or rejection of order based on 20% net profit on sales*

		R
Sales (400 x R25,00)		10 000
Less: Variable costs		6 681
Topside		
- from carcasses	(78② x R15,00)	1 170
- from wholesalers	(222③ x R18,00)	3 996
Spices	[(78 + 222) x R0,50]	150
Labour	(300 x 0,25 x R10 x 1,5)	1 125
Vacuum packaging	(400 x 0,60)	240
Marginal income		3 319
Less: Fixed costs		200
Net profit earned from order		3 119

Net profit % on sales [(R3 119/ R10 000) x 100] = 31,19%

The profit of 31,19% exceeds the required profit of 20%, therefore the order should be accepted.

Calculation::

		kg	
②	Topside available from carcasses	210	
	Less: Used for making biltong sold over the counter ①	132	
	Topside available for the fixed contract	78	
	Topside required for fixed contract (400 x 0,5) ÷ 0,666	300	**!!**
	Less: Available from whole carcasses bought ②	78	
	Topside to be purchased from wholesalers	222	

(13)

!! Remark:

The 400 packets are multiplied by 0,50 because the packets weigh 500g each. This is done to convert the amount into kilograms. The amount is divided by 0,666 because 1 kg topside, when dried, makes 0,666 kg biltong.

(c) *Margin of safety ratio of the fixed contract*

Margin of safety ratio = $\frac{\text{Sales - Breakeven sales}}{\text{Sales}}$

= $\frac{\text{R10 000 - R603④}}{\text{R10 000}}$

= 0,9397 **OR** 93,97%

Calculation::

④ Breakeven sales in rand = $\frac{\text{Fixed costs}}{\text{Marginal income ratio}}$

= $\frac{\text{R200}}{\text{R3 319 ÷ R10 000}}$

= $\frac{\text{R200}}{\text{0,3319}}$

= R602,59

≈ R603 (6)

(d) *Selling price per packet to earn 25% net profit on sales*

Let the selling price per packet = x

Sales = Variable costs + Fixed costs + Profit
$400x$ = 6 681 + 200 + 0,25 ($400x$)
$400x - 100x$ = 6 881
x = 6 881 ÷ 300
x = 22,94

Therefore the selling price per packet should be R22,94. (5)

[30]

QUESTION 5 (30 marks; 36 minutes)

Thompson Limited, a manufacturing company, has presented you with the following income statement:

THOMPSON LIMITED
Income statement for the year ended 30 April 20.1

	R
Sales (90 000 units)	450 000
Less: Cost of sales	317 700
Direct material	79 200
Direct labour	90 000
Manufacturing overheads	
- Variable	34 200
- Fixed	114 300
Gross Profit	132 300
Less: Operating expenses	138 600
Selling expenses	
- Variable (sales commission)	22 500
- Fixed	63 900
Advertising	27 000
Salaries	36 900
Administrative expenses (fixed)	52 200
Net Loss	6 300

Variable manufacturing overheads vary with the units manufactured.

Variable selling expenses consist of sales commission, which is determined as a percentage of turnover. There was no stock at the beginning or end of the year.

The company has sufficient capacity to manufacture 150 000 units per annum.

In an attempt to improve the company's profitability, certain proposals have been formulated, the facts of which are given below. **Each of the proposals is to be considered independent of each other.**

Proposal 1

The sales volume can be increased by 50% by changing the design of the packaging format. In this case the selling price will simultaneously be increased by 8% per unit.

The current packaging costs amounts to R0,09 per unit and are completely variable. The variable packaging costs relating to the new format will amount to R0,43 per unit.

A single amount of R1 200 will be incurred in redesigning the packaging format. This amount must be recovered in full in the first year during which the product is sold in the new packaging.

REQUIRED

(a) Determine the number of units that will have to be sold during the first year in the new format in order to break even. (13)

(b) Calculate the margin of safety ratio if the above proposal is accepted and implemented. (6)

Proposal 2

It has been established that sales can be influenced by changing the amount spent on advertising.

REQUIRED

Calculate the amount by which advertising expenses can be increased in order to increase the sales volume from 90 000 units to 130 000 units, and to earn a profit of 6%, based on turnover at the same time. (11)

[30]

SUGGESTED SOLUTION

THOMPSON LIMITED

Proposal 1

(a) *Breakeven sales in units*

$$\text{Breakeven sales in units} = \frac{\text{Fixed costs}}{\text{Marginal income per unit}}$$

$$= \frac{\text{R231 600}}{\text{R2,53}} \text{ units}$$

$$= 91\,541{,}50 \text{ units}$$

$$\approx 91\,542 \text{ units} \quad (3)$$

Calculations::

① *Total fixed costs*

	R
Manufacturing overhead	114 300
Selling expenses	63 900
Administrative expenses	52 200
Redesign	1 200
	231 600

(3)

② *Marginal income per unit*

		R
Selling price [(R450 000 ÷ 90 000) x 108%]		5,40
Less: Variable costs		2,87
	Direct material (R79 200 ÷ 90 000)	0,88
	Direct labour (R90 000 ÷ 90 000)	1,00
	Manufacturing overhead [(R34 200 ÷ 90 000) + R0,43 - R0,09]	0,72
	Sales commission (R5,40 x 5%③)	0,27
Marginal income per unit		2,53

(7)

③ R22 500 ÷ R450 000 x 100 = 5%.

(b) *Margin of safety ratio*

$$\text{Margin of safety ratio} = \frac{\text{Actual sales - Breakeven sales}}{\text{Actual sales}} \times \frac{100}{1}$$

$$= \frac{\text{R729 000① - R494 327②}}{\text{R729 000}} \times \frac{100}{1}$$

$$= 32\%$$

Calculations::

① Actual sales = 90 000 x 150% x R5,40
= R729 000

② Breakeven sales = 91 542 x R5,40
= R494 326,8
≈ R494 327

OR

$$\text{Margin of safety ratio} = \frac{\text{Actual sales volume - Breakeven sales}}{\text{Actual sales volume}} \times \frac{100}{1}$$

$$= \frac{135\,000 - 91\,542}{135\,000} \times \frac{100}{1}$$

$$= 32\% \qquad (6)$$

Proposal 2

Amount by which advertising expenses can be increased

Marginal income per unit

	R	
Selling price (R450 000 ÷ 90 000)	5,00	
Less: Variable costs		
[R(79 200 + 90 000 + 34 200 + 22 500) ÷ 90 000]	2,51	
Marginal income per unit	2,49	(3)

Fixed costs	=	Marginal income - profit	
	=	(130 000 x R2,49) - (130 000 x R5 x 6%)	
	=	R323 700 - R39 000	
	=	R284 700	(5)

Total fixed costs	=	R284 700	

Normal fixed costs	=	R(114 300 + 63 900 + 52 200)	
	=	R230 400	

Difference	=	R54 300, which is the amount by which advertising expenses can be increased.	(3)

[30]

CHAPTER

6

Cost-volume-profit analysis using simple linear correlation and regression analysis

The previous chapter explains how cost-volume-profit analysis could be used as a management tool to provide information that could aid operational decision-making. Correlation and regression analysis is a quantitative technique aimed at providing information that can be used in cost-volume-profit analyses.

Correlation indicates the extent to which a relationship exists between two or more sets of data. Once an acceptable correlation has been established, regression analysis can be used to formulate a forecasting model. This is done mathematically with the aid of statistical methods and formulae. This chapter focuses on a linear (or almost-linear) relationship between one dependent and one independent variable, that is, simple linear correlation and regression analysis.

Carefully study chapter 6 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter.

Additional questions and solutions have been included to help you gain the necessary proficiency in the application of the technique. You will benefit most if you work through these as suggested in chapter 5 of this study guide.

QUESTION 1 (24 marks; 29 minutes)

CORRELATION AND REGRESSION ANALYSIS

(a) Briefly describe the purpose of simple linear regression analysis. (4)

(b) Describe the need to determine a coefficient of correlation before applying regression analysis to make forecasts about any two sets of data. (3)

(c) Differentiate between the *x* and y variables. (3)

(d) State the significance of a coefficient of correlation of 1. (3)

(e) Indicate whether a coefficient of correlation of 0,98 represents a better correlation than -0,98. Briefly describe the difference. (3)

(f) Explain whether reliable forecasts can be made in a particular case where the coefficient of correlation is 0,4. (3)

(g) Explain the significance of the *a* and *b* values in the regression equations. (5)

[24]

SUGGESTED SOLUTION

CORRELATION AND REGRESSION ANALYSIS

(a) The purpose of simple linear regression analysis is to make an estimate of a *straight line* between any two sets of data, which have an almost linear relationship with each other. This straight line should be the best fit between the two sets of data, in such a way that the line, if the relationship between the two sets of data is acceptable, can be used to make estimates of the value of one of the variables, where the value of the other one is known. (4)

(b) The coefficient of correlation measures the degree of relationship between two sets of data. It should be determined before applying regression analysis in order to establish the reliability of forecasts made by this means. (3)

(c) The x-variable is the independent variable and the y-variable is the dependent variable. (3)

(d) A coefficient of correlation of 1 implies a perfect linear relationship between two sets of data. In a case like this, forecasts can be made with almost 100% accuracy. (3)

(e) There is no difference in the degree of correlation; the slope of the estimated line is positive in the first case and negative in the second case. (3)

(f) The coefficient of determination reflects the extent to which a change in the independent variable will predict the change in the dependent variable. Given a coefficient of correlation of 0,4, it is 0,16 ($0,4^2$). It should be obvious that reliable forecasts cannot be made by applying regression analysis in this case. (3)

(g) The *a*-value represents the intersection on the y-axis and is interpreted to be the fixed element. The *b*-value represents the slope of the line, and is interpreted to be the variable element. (5)

[24]

QUESTION 2 (27 marks; 32 minutes)

Wonderland Limited manufactures and sells rocking horses and other toys. You are the newly appointed management accountant and have been asked to determine the fixed and variable elements of cost of sales for the purposes of a breakeven analysis.

You have been given the following information:

Month	Number of units	Cost of sales	Sales
		R	R
June	20	3 600	3 600
July	25	3 950	4 500
August	30	4 300	5 400
September	22	3 740	3 960
October	28	4 160	5 040
November	30	4 300	5 400
December	50	5 700	9 000
January	18	3 460	3 240

REQUIRED

(a) Determine the coefficient of correlation and state the meaning of the result obtained. (7)

(b) State if, and why the high-low method can be used with accuracy in this case. (2)

(c) Calculate the fixed and variable elements of the cost of sales, by using the following methods:

(i) The high-low method (3)

(ii) The least squares method (7)

(d) Compare the answers obtained in (c)(i) and (ii) and briefly explain why they agree or differ. (2)

(e) Calculate the breakeven point in units. (6)

Applicable formulae:

$$r = \frac{n\Sigma xy - \Sigma x\Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\ \sqrt{n\Sigma y^2 - (\Sigma y)^2}}$$

$$\Sigma y = na + b\Sigma x$$

$$\Sigma xy = a\Sigma x + b\Sigma x^2$$ **[27]**

WONDERLAND LIMITED

(a) *Coefficient of correlation*

The number of units to be manufactured should have a bearing on the cost of sales, therefore the number of units represents *x*, the independent variable, and the cost of sales y, the dependent variable.

Month	x	y	xy	x^2	y^2
June	20	3 600	72 000	400	12 960 000
July	25	3 950	98 750	625	15 602 500
August	30	4 300	129 000	900	18 490 000
September	22	3 740	82 280	484	13 987 600
October	28	4 160	116 480	784	17 305 600
November	30	4 300	129 000	900	18 490 000
December	50	5 700	285 000	2 500	32 490 000
January	18	3 460	62 280	324	11 971 600
Σ	223	33 210	974 790	6 917	141 297 300

$$r = \frac{n\Sigma xy - \Sigma x\Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\ \sqrt{n\Sigma y^2 - (\Sigma y)^2}}$$

$$r = \frac{8(974\ 790) - (223)(33\ 210)}{\sqrt{8(6\ 917) - (223)^2}\ \sqrt{8(141\ 297\ 300) - (33\ 210)^2}}$$

$$r = \frac{7\ 798\ 320 - 7\ 405\ 830}{\sqrt{55\ 336 - 49\ 729}\ \sqrt{1\ 130\ 378\ 400 - 1\ 102\ 904\ 100}}$$

$$r = \frac{392\ 490}{\sqrt{5\ 607}\ \sqrt{27\ 474\ 300}}$$

$$r = \frac{392\ 490}{74{,}8799 \times 5241{,}59}$$

$$r = \frac{392\ 490}{392\ 490}$$

$$r = 1$$

A perfect relationship therefore exists between the number of units produced, and the cost of sales. Regression analysis can therefore be used to make forecasts. (7)

(b) *Reason why high-low method can be used*

The high-low method can be used with accuracy in this case, as a **perfect** relationship exists between the independent and the dependent variables. (2)

(c) *Fixed and variable elements of cost of sales*

(i) *The high-low method*

	Units	**Cost of sales**
		R
Highest level	50	5 700
Lowest level	18	3 460
Difference	32	2 240

Variable costs per unit (R2 240/ 32) R70

	R
Total costs	5 700
Less: Variable costs (R70 x 50)	3 500
Fixed costs	2 200

The fixed cost is therefore R2 200 per month and the variable cost R70 per rocking horse. (3)

(ii) *The least squares method*

	Σy	=	$na + b\Sigma x$	(i)
	Σxy	=	$a\Sigma x + b\Sigma x^2$	(ii)
Substitute in (i):	33 210	=	8a + 223b	(1)
Substitute in (ii):	974 790	=	223a + 6 917b	(2)
(1) x 223:	7 405 830	=	1 784a + 49 729b	(3)
(2) x 8:	7 798 320	=	1 784a + 55 336b	(4)
(4) - (3):	392 490	=	5 607b	
	b	=	$\frac{392\ 490}{5\ 607}$	
	b	=	70	

Substitute b = 70 in (1):	33 210	=	8a + 223(70)
	8a	=	33 210 - 15 610
	8a	=	17 600
	a	=	2 200

The fixed element is therefore R2 200 per month and the variable element R70 per rocking horse. (7)

(d) *Comparison of the answers obtained by using the high-low method and the least squares method*

The answers calculated in (c)(i) and (ii) are identical. The answers are identical because a coefficient of correlation of 1 exists. Any two points on the straight line used to calculate the fixed and variable elements of the total cost in terms of the high-low method would therefore result in the same answer as if the least squares method was used. (2)

(e) *Breakeven point in units*

$$\text{Breakeven point in units} = \frac{\text{Fixed costs}}{\text{Marginal income per unit}}$$

$$= \frac{\text{R2 200}}{\text{R110①}}$$

$$= 20 \text{ units}$$

Calculation:

		R
①	Selling price per unit (3 600/ 20)	180
	Less: Variable costs per unit per (b)	70
	Marginal income per unit	110

(6)

[27]

CHAPTER

7

Cost-volume-profit analysis using the learning curve theory

There is a saying that “practice makes perfect”, yet we know that it is almost impossible to achieve perfection. When a new product or process is developed, “learning” takes place. As the output increases, the time required to produce each unit decreases. The effect of this learning on output is often depicted by a learning curve. A learning curve is a graphical expression of the decrease in the average time required to produce each unit as cumulative output increases. The time taken to learn a job has a nonlinear effect on costs. This information enables management to calculate cost changes as the process matures.

Carefully study chapter 7 of the prescribed textbook, “*Managerial Accounting”, Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter.

The use of logarithms does not form part of the syllabus of this module and need therefore not be studied. You will only be examined on situations dealing with a cumulative doubling of units.

Additional questions and solutions have been included to help you gain the necessary proficiency in the application of the technique. You will benefit most if you work through these as suggested in chapter 5 of this study guide.

QUESTION 1 (18 marks; 22 minutes)

Newman Investments Limited supplied local and provincial governments with machinery in terms of annual contracts until recently. These contracts were not renewed. Besides the fact that about 25% of the capacity of the company is now unutilised, it is estimated that profits will decline by almost one third.

The company repositioned itself in the market by extending its product range to include machinery used in the building industry. As a first step, a contract for the manufacturing of eight concrete mixers was obtained. These machines have recently been delivered. **!!**

Buildmix Limited, which is involved in the erection of low-cost housing, has now approached the company for a quotation on eight concrete mixers. As it is vital to obtain this contract in view of a possible long term relationship, the directors wish to quote a fair price. They have consequently decided to base their quotation on the recovery of direct manufacturing costs only, with a markup of 25%, based on the quotation price.

The following information is available about the manufacturing of the first eight concrete mixers:

	R
Direct material	78 400
Direct labour (685,9 hours)	5 830
Variable production overheads	16 000
Fixed production overheads	6 859
	107 089

It took 100 hours to manufacture the first unit and 90 hours to manufacture the second unit.

Additional information:

1. The cost of direct material has increased by 15% since the manufacturing of the first eight concrete mixers.
2. Variable production overheads vary with the number of units manufactured. Fixed production overheads are recovered on the basis of direct labour hours.
3. The effect of the learning curve is expected to continue during the manufacturing of the first 32 concrete mixers.

REQUIRED

(a) Determine the price that could be quoted on the eight concrete mixers. (15)

(b) State the limits between which a learning curve may vary and briefly explain the significance of each limit. (3)

In general, calculations must be rounded off to four decimals. Final figures must be rounded off to the nearest hour/rand. **[18]**

!! Remark:

Read the information carefully. Many students do not realise that the quotation required is for the **second** eight concrete mixers, that is, 9 to 16.

NEWMAN INVESTMENTS LIMITED

Direct cost of manufacturing eight concrete mixers

	R
Direct material [(R78 400 ÷ 8) x 8 x 115%]	90 160
Direct labour [(R5 830 ÷ 685,9) x 617②]	5 244
Variable overheads [(R16 000 ÷ 8) x 8]	16 000
Fixed costs [(R6 859 ÷ 685,9) x 617②]	6 170
Total costs	117 574
Add: Markup $\left(R117\ 574 \times \frac{25}{75}\right)$	39 191
Quotation price	156 765

Calculations:

① *Learning curve*

$$\text{Learning curve} = \frac{\text{Cumulative average time per unit}}{\text{Previous cumulative average time per unit}} \times \frac{100}{1}$$

$$= \frac{(100 + 90) \div 2}{100} \times \frac{100}{1}$$

$$= 95\%$$

② *Time to manufacture eight units*

Average time to manufacture 16 units = $0{,}95^4$ x 100 hours
= 81,4506 hours

Total time required to manufacture 16 units = 81,4506 x 16 hours
= 1303,2096 hours
Less: Time taken for first eight units 685,9000 hours
Time required for units 9 - 16 617,3096
Rounded off to the nearest hour 617 hours (15)

(b) *Limits of the learning curve*

Learning curves vary between:
100% - no learning effect takes place, and
50% - the maximum learning effect takes place (3)

[18]

QUESTION 2 (28 marks; 34 minutes)

Growcon (Pty) Limited is a property developer, and is presently building a complex of 32 identical sectional title townhouses.

The project manager, who is constructing a network diagram of the project, has approached you, the accountant, to help him with the estimation of the time that will be required to make and erect the roof trusses.

As many other activities cannot commence before the roof trusses have been erected, he realises that this activity probably lies on the critical path. Any delays during the construction process will cost the company R310 per weekday, owing to discretionary fixed costs and finance charges.

A subcontractor has been appointed to make and erect the roof trusses. To date, the trusses of two townhouses have been made and erected, the time taken for the first townhouse being 16 hours. The subcontractor works on weekdays from 07:00 to 16:00, with an hour break for lunch. The project manager has noticed that the second roof took less time to erect than the first roof. He has calculated that a learning curve of 97% will be applicable to the manufacturing of the roof trusses of the 32 townhouses.

A carpenter, Mr Woody, has approached the project manager and offered to do the roofs on a daily wage basis. He earns R200 and his two workers each R50 per eight-hour day, or part thereof. The project manager has explained to him that the contract for the roof trusses has already been awarded to the subcontractor. The project manager has asked you to compare the cost of employing Mr Woody and that of using the subcontractor, to serve as a basis for decisions on future developments.

You have determined the following:

- Size of each townhouse in square metres $150m^2$
- Subcontractor's rate per square metre R10

Expected number of hours that Mr Woody and his team would have worked:

	Hours
• First roof	24,00
• Second roof	23,04

It is expected that the learning curve will be maintained for the manufacturing of the roof trusses of the 32 townhouses.

The company would have to supply Mr Woody and his team with tools, whereas the subcontractor supplies his own tools. The cost of these tools is R5 000, and they are expected to have no resale value on completion of the complex.

REQUIRED

(a) Calculate the total number of weekdays that will be needed by the subcontractor for the making and erection of the roof trusses of the whole complex. (6)

(b) Calculate the number of weekdays that will be needed by the subcontractor to complete the making and erection of the remaining roof trusses of the complex. (3)

(c) Calculate the cost of Mr Woody and his team making and erecting the roof trusses, and compare it to the subcontractor's costs. Advise the project manager in view of future projects. (18)

(d) State if the making and erection of roofs for 12 townhouses represents a cumulative doubling of units, and motivate your answer. (1)

Round off the hours to two decimals. You may not use logarithms. **[28]**

SUGGESTED SOLUTION

GROWCON (PTY) LIMITED

(a) *The expected total weekdays for the completion of the roof trusses of the whole complex*

Units	Doubling	Cumulative average time per roof Hours	Total time Hours
1	-	16,00	16,00
2	1	15,52①	31,04⑥
4	2	15,05②	60,20⑦
8	3	14,60③	116,80⑧
16	4	14,16④	226,56⑨
32	5	13,74⑤	439,68⑩

∴ the total expected weekdays (439,68 ÷ 8) = 54,96 weekdays
or rounded off to 55 weekdays

Calculations:

① 16 x 0,97 = 15,52
② 15,52 x 0,97 = 15,05
③ 15,05 x 0,97 = 14,60
④ 14,60 x 0,97 = 14,16
⑤ 14,16 x 0,97 = 13,74
⑥ 15,52 x 2 = 31,04
⑦ 15,05 x 4 = 60,20
⑧ 14,60 x 8 = 116,80
⑨ 14,16 x 16 = 226,56
⑩ 13,74 x 32 = 439,68

OR

	Hours	
Cumulative average time per unit (16 x $0,97^5$)	13,74	
Total expected time (13,74 x 32)	439,68	(6)

(b) *The weekdays needed to complete the roof trusses of the complex*

	Hours
Total expected time for the whole complex	439,68
Less: First two units already completed	31,04
Expected hours to complete the complex	408,64
Days required to complete the work on the roof of the project (408,64 ÷ 8)	51,08 days
Rounded off to	52 days.

(3)

(c) *Comparison of costs of Mr Woody and his team and the subcontractor*

Subcontractor		R
Subcontracting fee	(32 x 150 x R10)	48 000
Mr Woody and his team		
Wages:		
- Mr Woody	(R200 x 87①)	17 400
- Two workers	(R50 x 2 x 87①)	8 700
Tools required		5 000
Additional costs due to delay	[R310 x (87 - 55)]	9 920
Total costs		41 020

(8)

Calculations:

① *Number of days taken by Mr Woody and his team*:

$$\text{Learning curve} = \frac{\text{Cumulative average time per unit}}{\text{Previous cumulative average time per unit}} \times \frac{100}{1}$$

$$\text{Learning curve} = \frac{(24 + 23,04) \div 2}{24} \times \frac{100}{1}$$

$$= 98\%$$ (4)

		Hours
	Cumulative average time per unit for 32 units (24 x $0,98^5$)	21,69
	Total expected time (21,69 x 32)	694,08
∴	Total expected days (694,08 ÷ 8)	86,76 days
∴	Rounded off to	87 days

Therefore, based purely on the difference in costs, Mr Woody and his team would have resulted in a saving of R6 980. The fact that Mr Woody and his team could require more supervision as they would work for a daily wage rate, and the possibility that additional tools may have to be purchased should be considered before a final decision is taken. (6)

(d) The making and erection of trusses for 12 roofs does not represent a cumulative doubling. A cumulative doubling is a consecutive doubling of units, that is, 1; 2; 4; 8; 16; 32; 64 etc. (1)

[28]

QUESTION 3 (23 marks; 28 minutes)

IPM (Pty) Limited manufactures luxury sports cars. The company recently started manufacturing a new model of which two units have been completed and sold to date. The manufacturing costs for these two units were as follows:

	R
Material	200 000
Direct labour	80 000
Overhead	120 000

The overheads are 40% fixed, 60% of which relates to manufacturing overheads. Fixed manufacturing overheads are allocated to production on the basis of direct labour costs. Organisational overheads are allocated to production departments on the basis of sales values.

The variable overheads consist of manufacturing overheads only. Forty per cent (40%) of the overheads are variable to material costs and 60% are variable to direct labour costs.

The direct labour hours taken for the manufacturing of the first two sports cars were as follows:

- First car : 160 hours
- Second car : 144 hours

This trend is similar to that experienced in the manufacturing of similar sports cars. Experience has shown that the trend will last for the manufacturing of the first 32 sports cars.

An order for another six of these sports cars has been received. The price of material and labour has increased by the following percentages since the manufacturing of the first two sports cars:

- Material : 10%
- Direct labour : 15%

REQUIRED

Determine the selling price of each of the six sports cars if the company wants to recover only directly related manufacturing costs and earn a total profit of R500 000. (23)
Calculations must be rounded off to four decimals. Final figures (hours or rands), must be rounded off to the nearest whole number. **[23]**

SUGGESTED SOLUTION

IPM (PTY) LIMITED

Selling price per sports car

		R
Material	$\left(\frac{R200\ 000}{2} \times 6 \times 1{,}1\right)$	660 000
Direct labour	$\left(\frac{R80\ 000}{304②} \times 793 \times 1{,}15\right)$	239 987
Variable overheads variable to:		
- Material	(R120 000 x 60% x 40% x $\frac{6}{2}$ x 1,1)	95 040
- Direct labour	(R120 000 x 60% x 60% x $\frac{793②}{304}$ x 1,15)	129 593
Fixed manufacturing overheads	(R239 987 x 36%③)	86 395
Total direct manufacturing costs		1 211 015
Profit		500 000
Sales		1 711 015
Selling price per sports car	(R1 711 015 ÷ 6)	285 169

(14)

Calculations:

① *Learning curve*

$$\text{Learning curve} = \frac{\text{Cumulative average time per unit}}{\text{Previous cumulative average time per unit}} \times \frac{100}{1}$$

$$= \frac{(160 + 144) \div 2}{60} \times \frac{100}{1}$$

$$= 95\% \qquad (3)$$

② *Labour hours required for next six sports cars*

Total time for eight cars

Cumulative average = $0{,}95^3 \times 160$ hours

= 137,18 hours

		Hours
Total time for eight sports cars (137,18 x 8)	=	1 097,44
	≈	1 097
Less: Time for first two sports cars (160 + 144)		304
Time for next six sports cars		793

(6)

③ *Fixed manufacturing overheads*

$$= \frac{\text{R120 000 x 40\% x 60\%}}{\text{R80 000}} \times \frac{100}{1}$$

$$= \frac{\text{R28 800}}{\text{R80 000}} \times \frac{100}{1}$$

$$= 36\% \qquad \textbf{[23]}$$

CHAPTER

8

Optimisation

When a company produces more than one product, management must decide how much of each output to produce. Owing to various constraints, such as material, labour and machine time, companies can only produce a limited amount of outputs. Optimisation is used to determine the optimal product mix.

Carefully study chapter 8 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter.

This module does not require you to be able to solve problems graphically. You need to be able to solve problems with the application of marginal costing techniques, as well as problems requiring the application of linear programming in situations where two actual, and any number of potential constraints, exist.

Additional questions and solutions have been included to help you gain the necessary proficiency in the application of the technique. You will benefit the most if you work through these as suggested in the manner set out in chapter 5 of this study guide.

QUESTION 1 (21 marks; 25 minutes)

Super Sport Products Limited is a manufacturer of sport equipment. In order to compile the budget of the section that manufactures children's cricket bats for the next financial year, a decision must be taken regarding the optimal product mix.

Two models of children's cricket bats are being manufactured:

- the Hansie bat for older children, and
- the Johnty bat for younger children.

The standard per unit for each of the models are as follows:

	Hansie bat	Johnty bat
	R	R
Material	12,95	10,50
Direct labour (@ R6 per hour)	18,00	6,00
Manufacturing overheads (@ R3,50 per machine hour)	10,50	5,25
Selling price	45,00	25,00

Additional information:

1. Both bats are made from the same material, of which only 35 500 kilograms, at a total cost of R248 500, will be available during the next financial year.

2. The following is an extract of the budget for manufacturing overheads:

Capacity utilisation	Number of machine hours	Total manufacturing overheads
		R
100%	50 000	158 075
90%	45 000	151 575

3. It is estimated that 11 000 Hansie bats and 14 500 Johnty bats could be sold annually.

4. Selling and administrative expenses are fixed and amount to R15 000 per annum.

REQUIRED

Determine the product mix which will maximise the net profit of the section for the next financial year. (21)

[21]

SUGGESTED SOLUTION

SUPER SPORT PRODUCTS LIMITED

Product mix to maximise net profit

1. *Optimal product mix*
   Maximise 10,15 H + 6,55 J
   Where: H = Hansie bats and J = Johnty bats

2. *Marginal income per unit*

	Hansie	Johnty
	R	R
Selling price	45,00	25,00
Less: Variable costs	34,85	18,45
Material	12,95	10,50
Labour	18,00	6,00
Overhead	3,90 ①	1,95 ①
Marginal income per unit	10,15	6,55

(4)

3. *Constraints*

Product	Units	Material		Material		Machine hours	
		Per unit R	Total R	Kg per unit ②	Total kg	Hours per unit ③	Total hours
Hansie	11 000	12,95	142 450	1,85	20 350	3,00	33 000
Johnty	14 500	10,50	152 250	1,50	21 750	1,50	21 750
Required			294 700		42 100		54 750
Available			248 500		35 500		50 000
Shortage			46 200		6 600		4 750

Material and machine hours are constraints. (5)

!! Remark:

Only one constraint exists with regard to material. The material constraint could be calculated in terms of rand or kilogram. This solution has included both options, it should be seen as two alternative ways of determining the material constraint.

4. *Marginal income per constraint*

Product	Marginal income per unit R	Material			Material			Machine hours		
		Per unit R	Marginal income per R	Ran-king	Kg per unit ②	Marginal income per kg	Ran-king	Hours per unit ③	Marginal income per hour	Ran-king
Hansie	10,15	12,95	0,78	1	1,85	5,49	1	3,00	3,38	2
Johnty	6,55	10,50	0,62	2	1,50	4,37	2	1,50	4,37	1

The ranking in terms of the constraints does not favour the same product, therefore linear programming will have to be applied to determine the optimal product mix. (5)

5. *Equations*

Let Hansie bats = H and
Johnty bats = J

	12,95 H + 10,50 J	≤	248 500	(1)
	3,00 H + 1,50 J	≤	50 000	(2)
(2) x 7:	21,00 H + 10,50 J	≤	350 000	
(1) :	12,95 H + 10,50 J	≤	248 500	
(2) - (1):	8,05 H	≤	101 500	
	H	≤	12 608,70	
	H	≈	12 609	

Limited to the market ∴ 11 000 Hansie bats

Material available for Johnty bats	**R**
Available	248 500
Utilised for Hansie bats (11 000 x 12,95)	142 450
Available for Johnty	106 050

Production of Johnty (106 050 / 10,5) = 10 100 bats

Machine available for Johnty bats	**R**
Available	50 000
Utilised for Hansie bats (11 000 x 3)	33 000
Available for Johnty	17 000

Production of Johnty (17 000 / 1,5) = 11 333 bats

The optimal product mix is 11 000 Hansie bats and 10 100 Johnty bats.**!!** (7)

!! Remark:

There are sufficient machine hours to manufacture 11 333 Johnty bats. There are, however, material for only 10 100 Johnty bats. Only 10 100 Johnty bats can therefore be manufactured.

Calculations:

① *Machine hours*

	Hours	R
Total costs	50 000	158 075
Total costs	45 000	151 575
	5 000	6 500

Variable manufacturing overhead cost per hour = (R6 500 / 5 000)
= R1,30

Variable manufacturing overhead cost per unit:
Hansie = R1,30 x (R10,50 ÷ 3,50)
= R3,90

Johnty = R1,30 x (R5,25 ÷ 3,50)
= R1,95

② *Kilograms per unit*

Cost per kilogram = R248 500 ÷ 35 500
= R7,00

Hansie = R12,95 ÷ R7,00
= 1,85 kg

Johnty = R10,50 ÷ R7,00
= 1,50 kg

③ *Machine hours per unit*

Hansie = R10,50 ÷ R3,50
= 3,00 hours

Johnty = R5,25 ÷ R3,50
= 1,50 hours **[21]**

QUESTION 2 (29 marks; 35 minutes)

Wheely (Pty) Limited manufactures tyres for cars and bakkies. Speedy tyres are manufactured for cars and Bumpy tyres for bakkies.

Mr Screech, the managing director, has provided you with the following information:

1. The results of a market survey show that 50 000 Speedy and 40 000 Bumpy tyres can be sold at prices of R200 and R240 per tyre respectively.

2. A shortage of material exists, resulting in only R4 620 000 of material being available annually.

3. The flexible budget, at capacity levels of 90% and 100%, indicates that total overheads will amount to R7 984 000 and R8 200 000 for 24 300 and 27 000 machine hours respectively.

4. The prime costs per tyre is as follows:

	Speedy	**Bumpy**
	R	**R**
Material	50	55
Direct labour (at R50 per hour)	30	35
	80	90

5. The machining of a Speedy tyre takes 15 minutes and that of a Bumpy tyre 22,5 minutes.

REQUIRED

(a) Determine the product mix which will maximise the income of the company, assuming a capacity utilisation of 100% in terms of machine hours. (24)

(b) Calculate the net contribution to profit resulting from the product mix determined in (a) above. (5)

[29]

SUGGESTED SOLUTION

WHEELY (PTY) LIMITED

(a) Product mix

Marginal income per unit

	Speedy	Bumpy
	R	**R**
Selling price	200	240
Less: Variable costs	100	120
Material	50	55
Direct labour	30	35
Variable overhead	20 ①	30 ①
Marginal income	100	120

(6)

Calculations:

① *Variable overhead*

Capacity	**Hours**	**R**
100%	27 000	8 200 000
90%	24 300	7 984 000
	2 700	216 000

Variable overhead per hour = R216 000 ÷ 2 700
= R80

Variable overhead per unit:

- Speedy = 15 /60 x R80
= R20

- Bumpy = 22,5 /60 x R80 **!!**
= R30

!! Remark:

Students often ask us why we divide by 60. Variable overheads are calculated per hour, while machine time is given per minute. You have to convert the minutes into hours and therefore divide by 60, as there are 60 minutes in an hour.

Constraints (limiting factors)

Product	Material			Machine capacity		
	Units	**R per unit**	**Total rands**	**Units**	**Hours per unit**	**Total hours**
Speedy	50 000	50,00	2 500 000	50 000	15 /60	12 500
Bumpy	40 000	55,00	2 200 000	40 000	22,5 /60	15 000
Required			4 700 000			27 500
Available			4 620 000			27 000
Shortage			80 000			500

∴ Material and machine capacity are both constraints. (6)

Marginal income per constraint

	Material				Machine capacity			
Product	**Marginal income**	**R per unit**	**Marginal income per rand**	**Ran-king**	**Marginal income**	**Time (hours)**	**Marginal income per hour**	**Ran-king**
			R				**R**	
Speedy	100	50	2,00	2	100	15 /60	400	1
Bumpy	120	55	2,18	1	120	22,5 /60	320	2

As the ranking does not favour one product, linear programming will have to be applied. (4)

!! Remark:

Some students find it difficult to calculate marginal income per constraint when there are fractions involved and are in doubt whether to divide or multiply to get to an answer!. Marginal income should be **divided** by the amount of the constraint. When you divide by a fraction, you need to know some of the basics of mathematics. When you deal with fractions, you simplify it by multiplying by its inverse. Therefore, $100 / \frac{15}{60}$ will be the same as $100 \times \frac{60}{15}$.

Equations:

Let S = Speedy tyres, and
B = Bumpy tyres

$S \leq 50\,000$ and ≥ 0
$B \leq 40\,000$ and ≥ 0

Material : $50S + 55B \leq 4\,620\,000$ (1)

Machine hours : $\frac{15S}{60} + \frac{22{,}5B}{60} \leq 27\,000$ (2)

(2) x 200 : $50S + 75B \leq 5\,400\,000$ (3)

(1) : $50S + 55B \leq 4\,620\,000$
(3) - (1) : $20B \leq 780\,000$
$B \leq 39\,000$

Substitute $B = 39\,000$ in (1)

$50S + 55(39\,000) \leq 4\,620\,000$
$50S \leq 4\,620\,000 - 2\,145\,000$
$S \leq \frac{2\,475\,000}{50}$
$S \leq 49\,500$

The optimal product mix is 49 500 Speedy tyres and 39 000 Bumpy tyres, with no production factors remaining. (8)

(b) *Net contribution to profit*

		R
Marginal income -	Speedy (R100 x 49 500)	4 950 000
-	Bumpy (R120 x 39 000)	4 680 000
		9 630 000
Less: Fixed overheads		6 040 000①
Net contribution to profit		3 590 000

Calculations:

① *Fixed overheads*

	R
Total overheads at 100% capacity	8 200 000
Less: Total variable overheads (R80 x 27 000 hours)	2 160 000
Fixed overheads	6 040 000

(5)

[29]

QUESTION 3 (30 marks; 36 minutes)

Importers Limited manufactures two products, Abbo and Babbo, from a raw material called Zapo. The raw material is imported at a cost of R15 per kilogram from Japa Limited, a foreign company. A fire has destroyed the warehouse of the supplier, and as a result, the 20.1 import of Zapo will be limited to 80% of the quantity imported in 20.0.

Following the restrictions on raw material imports, it is estimated that labour hours will reduce by 10 000 hours in comparison to those worked in 20.0. The management of the company has decided to maintain a minimum wage rate of R6 per hour.

The following is an extract from the budget for the 20.1 financial year, based on 95% of the available machine hours:

	Abbo	Babbo
Sales volume (in units)	12 000	16 000
Sales volume (in rands)	R348 000	R512 000

Standards per unit	R	R
Raw material - Zapo	12,00	7,50
Labour	4,50	3,00
Overheads	3,00	5,00

The budgeted fixed manufacturing overheads for the year amount to R63 800. Overheads are allocated to production at a rate of R4 per machine hour.

The actual raw material usage during 20.0 amounted to 20 000 kilograms. Twenty-six thousand (26 000) labour hours were clocked during 20.0.

REQUIRED

(a) Determine the optimal product mix for 20.1. (27)

(b) Calculate the expected net profit for 20.1, based on the optimal product mix determined in (a) above. (3)

[30]

SUGGESTED SOLUTION

IMPORTERS LIMITED

(a) *Optimal product mix*

1. *Objective function*

Maximise 11,15 A + 19,25 B

Where A = Abbo
B = Babbo

2. *Marginal income*

	Abbo	**Babbo**
	R	**R**
Selling price (R348 000/ 12 000) ; (R512 000/ 16 000)	29,00	32,00
Less: Variable costs	17,85	12,75
Raw material (Zapo)	12,00	7,50
Labour	4,50	3,00
Variable overheads	1,35 ①	2,25 ①
Marginal income	11,15	19,25

Calculations:

① *Variable overheads per unit*

	R
Total overheads [(12 000 x R3) + (16 000 x R5)]	116 000
Less: Fixed overheads	63 800
Variable overheads	52 200

Total machine hours: = (116 000 ÷ 4)
= 29 000 machine hours

Variable overheads per hour = (R52 200 ÷ 29 000)
= R1,80 per hour

Variable overheads per unit:
- Abbo 3/4 x R1,80 = R1,35 per unit
- Babbo 5/4 x R1,80 = R2,25 per unit

3. *Constraints*

Product	Raw material			Labour		
	Units	**Kg per unit**	**Total kg**	**Units**	**Hours per unit**	**Total hours**
Abbo	12 000	12/15	9 600	12 000	4,5/6	9 000
Babbo	16 000	7,5/15	8 000	16 000	3/6	8 000
Required			17 600			17 000
Available			16 000②			16 000③
Shortage			(1 600)			(1 000)

Raw material and labour are therefore both constraints.

Calculations:

② 80% x 20 000 = 16 000

③ 26 000 - 10 000 = 16 000

!! Remark:

Please note that machine hours will not be a constraint because the budget is based on 95% of the available machine hours. Unless machine hours are reserved for unforseen events, or a special order is received, machine hours will not be a constraint if the budget is based on less than full capacity, and need not to be tested.

4. *Marginal income per constraint*

Product	Raw material				Labour			
	Marginal income per unit	**Kg per unit**	**Marginal income per kg**	**Ran-king**	**Marginal income per unit**	**Hours per unit**	**Marginal income per hour**	**Ran-king**
Abbo	11,15	12/15	13,94	2	11,15	4,5/6	14,87	2
Babbo	19,25	7,5/15	38,50	1	19,25	3/6	38,50	1

Babbo is more profitable than Abbo in respect of both constraints. The maximum number of Babbo that can be sold should therefore be manufactured and the remainder of the resources should be utilised for the manufacture of Abbo.

5. *Optimal product mix*

	Raw material	**Labour**
	Kg	**Hours**
Available (per 3 above)	16 000	16 000
Less: Required for Babbo (per 3 above)	8 000	8 000
Available for Abbo	8 000	8 000
Number of units of Abbo $\left(\frac{8\,000}{12 \div 15} ; \frac{8\,000}{4{,}5 \div 6}\right)$	10 000	10 666,66

The manufacture of Abbo will therefore be limited to 10 000 units.

The optimal product mix will therefore be 16 000 units Babbo and 10 000 units Abbo. (27)

(b) *Expected net profit for 20.1*

	R
Marginal income	419 500
- Abbo (10 000 x R11,15)	111 500
- Babbo (16 000 x R19,25)	308 000
Less: Fixed overheads	63 800
Budgeted net profit	355 700

(3)

[30]

!! Remark:

To comply with the ethical aspects as discussed in the introduction, the management accountant should be aware that the decision to reduce labour hours drastically, has implications for the workers. Make sure that the trade unions were involved in the decision-making process. You should also consider whether the company conforms to the requirements of the Basic Conditions of Employment Act regarding minimum wages.

CHAPTER

9

The relevance approach to nonroutine profit-related decisions (decision making cost)

The management accountant's role in decision-making is to provide information relevant to a decision. Managers use this information in preparing a quantitative analysis of the problem under review. Qualitative factors should also be considered before a final decision is taken.

The various decisions that are discussed in the textbook, includes the following:

- outsourcing versus manufacturing (example 9.4)
- deletion of a market segment
- expansion of a product range
- acceptance of once-off sales opportunities at discounted selling prices (example 9.5)
- further processing of a product (examples 9.6 & 9.7)
- acceptance of special orders requiring the use of optimisation (see chapter 8).

Carefully study chapter 9 of the prescribed textbook, "*Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter.

Additional questions and solutions have been included to help you gain the necessary proficiency in the application of the technique. You will benefit most if you work through these as suggested in chapter 5 of this study guide.

QUESTION 1 (27 marks; 32 minutes)

Safesit (Pty) Limited has five different departments that manufacture various products. Department 1 manufactures vehicle safety seats for babies.

Currently, two products, namely a budget baby seat and a standard baby seat, are manufactured.

Management is concerned about the sudden decline in the sales of the standard baby seat. Despite attempts to reduce the number of employees on the production line, as well as a recent productivity drive aimed at higher productivity and less wastage of resources, the department is operating at a loss.

The following budget has been compiled at 60% of the available capacity, based on labour hours, for the year ending 28 February 20.1:

		Budget baby seat	**Standard baby seat**
		R	**R**
Sales		1 358 000	1 620 000
Less:	Expenses	1 281 000	2 004 000
	Direct material	357 000	684 000
	Direct labour	210 000	300 000
	Overheads	714 000	1 020 000
Net income/(loss)		77 000	(384 000)
Production and sales (units)		7 000	6 000

Additional information:

1. Overheads are allocated to production based on direct labour hours.
2. An amount of R1 387 200 in respect of fixed overheads is included in overheads.
3. Organisational overheads relating to head office costs are allocated to departments. These overheads amount to 30% of the fixed overheads stated above. The remainder of the fixed overheads specifically relate to Department 1.
4. Sixty percent (60%) of the fixed overheads of Department 1 are discretionary.
5. All production line workers earn the same hourly rate.
6. The demand for the budget baby seat will not be affected if the manufacturing of the standard baby seat is discontinued.

REQUIRED

(a) Advise the management of Safesit (Pty) Limited on the decision of whether the manufacture of the standard baby seat should be discontinued or not, in the long-term as well as the short- to medium-term. Motivate your reasoning in respect of cost items not taken into account. (21)

(b) Briefly motivate possible long-term steps that could be taken to solve the problem experienced in Department 1. (6)

[27]

SUGGESTED SOLUTION

SAFESIT (PTY) LIMITED

(a) *Decision on whether the manufacture of standard baby seats should be discontinued in the long-term as well as the short- to medium-term*

Long-term	R
Relevant income	1 620 000
Less: Relevant expenses	1 759 200
Direct materials	684 000
Direct labour	300 000
Variable overheads	204 000①
Fixed overheads	
- Department 1	571 200②
- Organisational overheads	- ③
Relevant net loss	(139 200)

Short- to medium-term	
Relevant net loss above	(139 200)
Add: Committed portion of fixed overheads of Department 1	228 480④
Relevant net income	89 280

The manufacture of the standard baby seats should therefore be discontinued in the long-term. In the short- to medium-term the manufacture of the standard baby seats should be continued.

Calculations and notes:

① *Variable overheads*

	R
Total overheads (714 000 + 1 020 000)	1 734 000
Less: Fixed overheads	1 387 200
Variable overheads	346 800
- Budget seat ($^{210}/_{510}$ x R346 800) **!!**	142 800
- Standard baby seat ($^{300}/_{510}$ x R346 800) **!!**	204 000

!! Remark:

Overheads should be allocated based on labour hours, but labour hours are not available. The question states that all production line workers are paid at the same rate, therefore the allocation can be based on labour costs.

② *Fixed overheads*

	R
Fixed overheads	1 387 200
Less: Organisational overheads 30%	416 160
Fixed overheads - Department 1	971 040
- Budget seat ($^{210}/_{510}$ x R971 040)	399 840
- Standard baby seat ($^{300}/_{510}$ x R971 040)	571 200

③ *Organisational overheads*

Organisational overheads are allocated to departments at a specified rate. Whether or not Department 1 is going to manufacture the standard baby seat is not going to change these overheads, therefore they are irrelevant to this decision, in the long-term as well as the short- to medium-term.

④ *Committed portion of fixed overheads of Department 1*

Committed portion (40% x R571 200②) = R228 480
The committed portion of the fixed overheads relating to the standard baby seat, namely 40% (100% - 60%), is irrelevant to the short- to medium term decision and is therefore added back. (21)

(b) *Possible long-term steps to solve the problem*

(i) Determine why the demand for the standard baby seat has declined. Do the following:
- Launch a market survey to determine the needs of consumers. These needs may have changed while the product remained unchanged.
- Investigate the strengths and weaknesses of the standard baby seat manufactured by the company and compare it to competitors' products.
  Compare the selling price of the standard baby seat with the prices of competitors' products.

(ii) Analyse the detailed product costs to determine where savings could be made:
- Determine whether the recent productivity drive has achieved its aim of higher productivity and less wastage of resources.
- Concentrate efforts on reducing fixed overheads, both in Department 1 and in the rest of the company.
- Consider alternative production methods or new machinery that could reduce the total manufacturing costs of the standard baby seat.

(iii) Launch a new product to replace the standard baby seat, or add another product to the range manufactured by Department 1, in an attempt to recapture the market share lost and to result in a better utilisation of available capacity.

One and a half mark per relevant point, limited to (6)

[27]

QUESTION 2 (28 marks; 34 minutes)

Ready-Truss (Pty) Limited manufactures wooden roof trusses and sells them to construction firms and building supply stores.

The business is conducted from two branches, one in Babelegi and the other in Midrand.

Owing to current poor economic conditions and the resultant decline in construction activity, the turnover of both branches has dropped considerably.

The Babelegi branch has an even greater problem because the wage and rental subsidies previously granted by the government have been abolished permanently. These subsidies were the sole reason why this branch had been profitable in the past.

You are a management consultant and have been approached for advice concerning the possible closure of the Babelegi branch.

You have been supplied with the following information with regard to the Babelegi branch for the year ended 28 February 20.0:

		R
Sales		1 350 000
Less:	Cost of sales	1 300 000
	Direct material	800 000
	Direct labour	100 000
	Manufacturing overheads	400 000
Gross profit		50 000
Less:	Expenses	174 000
	Administrative expenses	80 000
	Selling expenses	94 000
Net loss		(124 000)

Additional information:

1. Seventy five per cent (75%) of the manufacturing overheads are fixed, 60% of which are committed fixed costs.

2. Administrative expenses consist of the salary of the Babelegi receptionist (R2 000 per month) and head office administrative costs allocated to the Babelegi branch. The latter cost will not cease to exist if the Babelegi branch is closed.

3. Head office selling expenses, allocated to the branch on the basis of turnover, amount to R40 000. The remainder of the above selling expenses figure relates to sales commission paid to a salesman and is calculated as a percentage of turnover.

4. The following are the changes foreseen with regard to the year ending 28 February 20.1:
   - The volume of turnover is expected to increase by 10% as a result of an intensive marketing campaign.
   - The cost of direct materials will increase by 5% in terms of a notification by the sawmill.
   - An 8% increase in the cost of direct labour was agreed upon during recent negotiations with trade unions.

5. Should the Babelegi branch be closed, vehicles, machinery and equipment would be sold at prices exceeding their book values to enable the company to cover all closing-down costs, and the required retrenchment packages to employees, including the receptionist.

6. The activities of the Babelegi branch could be relocated to the Midrand branch, which is currently operating well below full capacity. In such a case, additional fixed costs of R100 000 per annum would have to be incurred by the Midrand branch.

Should the activities of the Babelegi branch be relocated to the Midrand branch, only 80% of the year 20.1 volume of turnover of the Babelegi branch would be retained.

The variable manufacturing cost structure of the Midrand branch is similar to that of the Babelegi branch. The variable cost structure of the Babelegi branch for the year 20.1 should be used as basis for its relocated activities during the year 20.1 at the Midrand branch, except for the commission of the salesman, which will increase by 2% to compensate for the additional travelling costs which will have to be incurred by him.

REQUIRED

Advise the management of Ready-Truss (Pty) Limited whether the activities of the Babelegi branch should be relocated to the Midrand branch in the long-term, as well as in the short- to medium-term. Motivate your reasoning in respect of cost items not taken into account. **[28]**

SUGGESTED SOLUTION

READY-TRUSS (PTY) LIMITED

Continue manufacturing at Babelegi branch

Long-term	R
Relevant income (R1 350 000 x 1,10)	1 485 000
Less: Relevant variable costs	1 212 200
Direct material (R800 000 x 1,10 x 1,05)	924 000
Direct labour (R100 000 x 1,10 x 1,08)	118 800
Variable manufacturing overheads (25% x R400 000 x 1,10)	110 000
Variable selling expenses [(R94 000 - R40 000) x 1,10]	59 400
Relevant marginal income	272 800
Less: Relevant fixed costs	324 000
Fixed manufacturing overheads (75% x R400 000)	300 000
Administrative expenses	
- Babelegi branch (R2 000 x 12)	24 000
- Head office expenses allocated	- ①
Fixed selling expenses	
- Allocated from head office	- ①
Relevant net loss	(51 200)

(17)

Short- to medium-term	R
Relevant net loss above	(51 200)
Add: Committed portion of fixed manufacturing overheads (60% x R300 000)	180 000
Relevant net income	128 800

(3)

Explanation:

① A predetermined figure for head office costs relating to certain administrative and selling expenses are allocated to the Babelegi branch. Whether or not the branch continues manufacturing is not going to change these expenses, therefore they are irrelevant to this decision in the long-term as well as in the short-to medium-term.

Relocate to Midrand branch

Short- to medium-term and long-term

	R
Relevant income [80% x (R272 800 + R59 400)]	265 760
Less: Variable selling expenses [(0,04① + 0,02) x R1 188 000)]②	71 280
Relevant marginal income	194 480
Less: Additional fixed costs	100 000
Relevant net income	94 480

Calculations:

① R59 400/ R1 485 000 = 0,04

② R1 485 000 x 0,80 = R1 188 000 (5)

Conclusion:

In the long-term, Ready-Truss (Pty) Limited should close the Babelegi branch and relocate to the Midrand branch. In the short- to medium term, the Babelegi branch should continue manufacturing the roof trusses. (3)

[28]

QUESTION 3 (27 marks; 32 minutes)

Excel Limited is a manufacturer of high quality tools. The company produces 120 000 units of a certain spare part per annum. This spare part is frequently used in the manufacture of various tools. One hundred thousand (100 000) of these spare parts are used internally in the manufacture of tools, and 20 000 are sold to external manufacturers at a price of R15 per unit. The profit made on the sale of the 20 000 units is used to reduce the cost of the 100 000 units.

The company has been approached by a sales representative of another manufacturing company, offering to provide the company with these spare parts at a price of R13 per unit, provided that at least 100 000 units are purchased per annum.

The following information regarding the section manufacturing this spare part has been extracted from the budget for the year ending 28 February 20.0:

	R
Material (@ R1,50 per unit)	180 000
Labour (@ R30 per hour)	720 000
Overheads	1 200 000
Total costs (@ R17,50 per unit)	2 100 000

Overheads consist of the following:

- Sectional overheads: R900 000
  Sectional overheads are 60% fixed, 50% of which are committed fixed costs.

- Overheads of the enterprise: R300 000
  Overheads of the enterprise comprise fixed managerial and administrative costs, which are allocated to the various sections on the basis of labour hours.

This particular production section manufactures only the abovementioned spare part.

REQUIRED

(a) Determine whether Excel Limited should continue selling 20 000 units of the spare part to external manufacturers annually if:
  (i) the spare part is manufactured
  (ii) the spare part is purchased (6)

(b) Determine whether the company should purchase or manufacture the spare part:
  (i) in the long-term (9)
  (ii) in the short-term (8)

(c) Name two considerations that should be taken into account before a final decision is taken. (4)

[27]

SUGGESTED SOLUTION

EXCEL LIMITED

(a) *Profitability of the sale of 20 000 units*

(i) *If spare part is manufactured*	**R**
Selling price	15,00
Less: Variable costs	10,50
Material	1,50
Labour (R720 000 ÷ 120 000)	6,00
Variable overheads (900 000 x 40% ÷ 120 000)	3,00
Marginal income per unit	4,50

(ii) *If spare part is purchased*	**R**
Selling price	15,00
Less: Variable costs	
- Purchase cost	13,00
Marginal income per unit	2,00

By selling 20 000 units to external manufacturers, additional marginal income is earned. This practice should therefore be continued. (6)

(b) (i) *Long-term evaluation*

Relevant cost of manufacturing spare part:	**R**
Material	180 000
Labour	720 000
Divisional overheads	900 000
	1 800 000
Less: Proceeds from sale of 20 000 units (20 000 x R15)	300 000
Net relevant cost to manufacture spare part in the long-term	1 500 000

Relevant cost of purchasing spare part	
Purchase costs (120 000 x R13)	1 560 000
Less: Proceeds from sale of 20 000 units (20 000 x R15)	300 000
Net relevant cost to purchase spare parts	1 260 000

Conclusion:
Based on monetary considerations only, the company should purchase rather than manufacture the spare part on the long term. (9)

(b) (ii) *Short-term evaluation*

Relevant cost of manufacturing spare part:	**R**
Relevant manufacturing costs in the long-term	1 500 000
Less: Committed fixed costs of section (R900 000 x 60% x 50%)	270 000
Relevant manufacturing costs in the short-term	1 230 000

Relevant cost of purchasing spare part	
Cost of purchasing from another manufacturer	R1 260 000

Conclusion:

In the short term the company should manufacture the spare part internally, rather than buying it from another manufacturer. (8)

(c) *Other considerations:*

- the reliability of the supplier in terms of timeous delivery of goods
- the quality of the product
- the expected price increases
- the possibilities of exploitation of the outside market (4)

[27]

CHAPTER

10

Decision-making under circumstances of risk and uncertainty

As all decision problems have a definable structure containing certain basic elements, it is possible to develop a decision-making model. A decision-making model includes the following steps:

- identify objectives
- search for possible courses of action
- identify events
- list possible alternatives
- measure payoffs
- select a course of action.

The elements of the decision-making model and the hypothetical possible outcomes of each event is called a "decision tree".

A decision tree is a useful tool for analysing alternatives, especially where there are many possible outcomes for various alternatives, and where some outcomes depend on previous outcomes.

Carefully study chapter 10 of the prescribed textbook, "*Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter.

Please study example 7.1 carefully. This example illustrates the difference between an event node and a decision node.

Additional questions and solutions have been included to help you gain the necessary proficiency in the application of the technique. You will benefit most if you work through these as suggested in chapter 5 of this study guide.

QUESTION 1 (30 marks; 36 minutes)

SECTION A

Harrison Investors (Pty) Limited has purchased 35 hectares of land. A large variety of indigenous plants and trees grow on the property and there is also a large dam. It is situated 60 kilometres south-west of one of the main entrances to the Kruger National Park.

The purchase price of the land amounted to R150 000, which included all transfer costs.

The directors of the company have identified various alternatives for the possible development of the land, but most of these alternatives have been ruled out for different reasons.

The development alternatives that are still being considered are:

- to develop a caravan park, or
- to develop a conference centre.

The following information regarding these two investment alternatives is available:

1. *Development of a caravan park*

   A caravan park, large enough to accommodate 150 caravans, could be developed at an estimated cost of R350 000. If an additional amount of R80 000 could be spent, water sports facilities could be included in this development.

   Caravan bays will be rented out at a rate of R50 per day, irrespective of whether water sports facilities are provided.

   If water sports facilities are not provided, it is estimated that there is a 75% chance that the park will be fully booked equivalently for 40 days per annum, and a 25% chance that it will be fully booked equivalently for 30 days per annum.

   If water sports facilities are provided, it is estimated that there is a 90% chance that the park will be fully booked equivalently for 45 days per annum, and a 10% chance that it will be fully booked equivalently for 35 days per annum.

   The annual maintenance costs of the caravan park is estimated at fixed amounts of R30 000 if water sports facilities are not provided, and R40 000 if these facilities are provided.

2. *Development of conference centre*

   A conference centre, offering a broad spectrum of facilities, including seminar rooms, a restaurant, swimming pool and sports courts, could be developed at a cost of R850 000.

   Once it has been decided to develop the conference centre, an advertising campaign in order to introduce the centre to businessmen will be considered. Should it prove worthwhile to launch the campaign, similar campaigns will be launched annually at similar costs in order to maintain the goodwill created in this way.

The advertising campaign can be launched country-wide, or limited to Gauteng only, at a cost of R100 000 or R60 000 respectively.

After all relevant costs (including the cost of the campaign, where applicable), have been taken into account, the net income before taxation is estimated as follows:

- If advertising is done country-wide, chances are 70% of earning a net income of R530 000, otherwise R370 000 will be earned.
- If advertising is done in Gauteng only, chances are 90% of earning a net income of R500 000, otherwise R300 000 will be earned.
- If no advertising campaign is launched, chances are 60% of earning a net income of R300 000, otherwise R200 000 will be earned.

REQUIRED

Determine by using a decision tree which alternative would render the highest net income. (24)

SECTION B

One of the most important considerations of the directors in the final evaluation of any project, is the extent to which the estimated return on a project complies with the minimum return. The minimum return required is determined by applying the fair rate of return for a particular project to the required capital outlay of the project.

The fair rate of return for developing the caravan park has been set at 40% before taxation.

The fair rate of return for developing the conference centre has been set at 50% before taxation.

REQUIRED

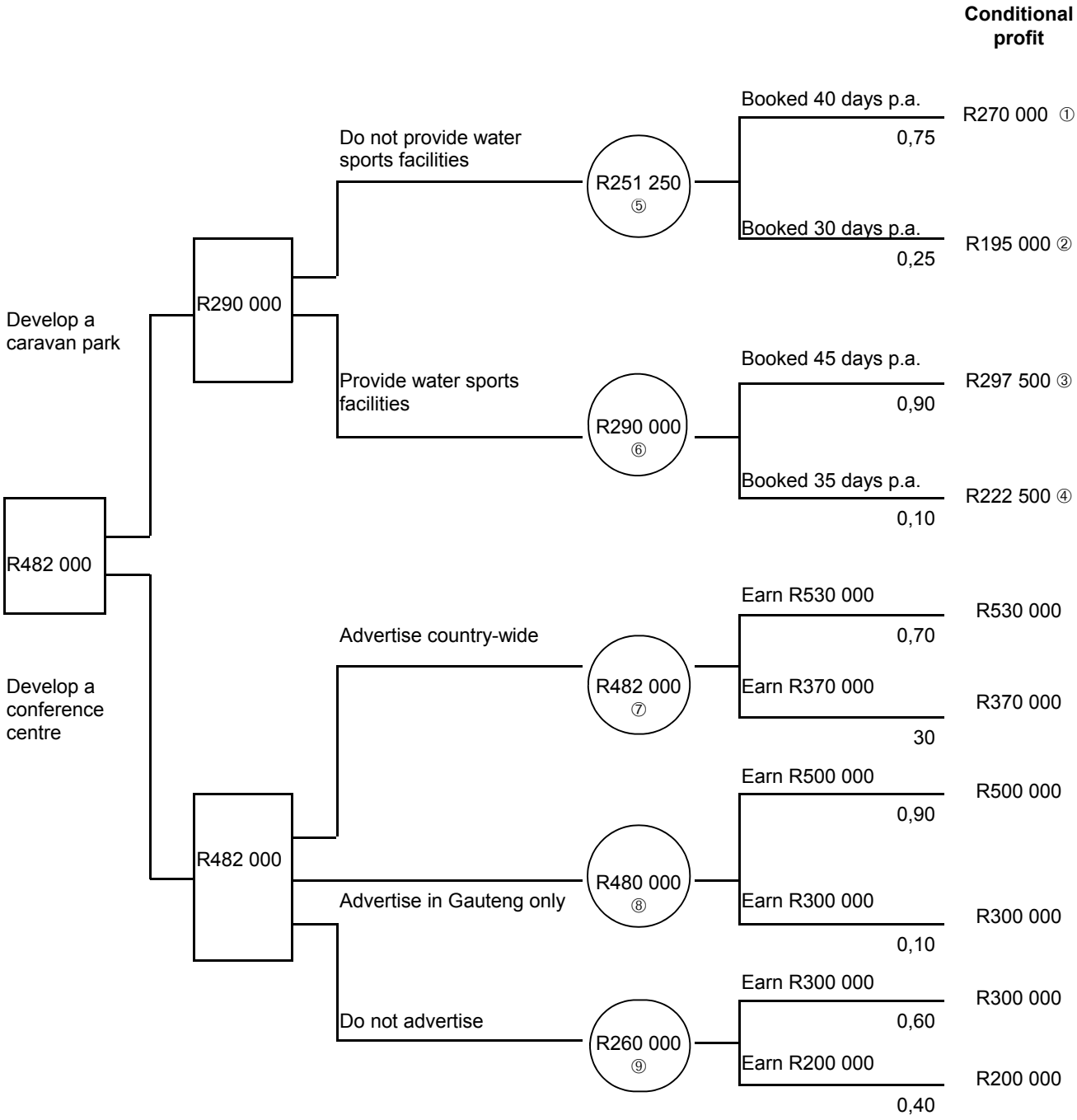
Determine which of the two development alternatives in section A above will render an estimated return in excess of that required in terms of their respective fair rates of return. (6)

[30]

HARRISON INVESTORS (PTY) LIMITED

SECTION A

Decision tree



Conclusion:

The alternative in terms of which a conference centre is developed and advertised country-wide will render the highest estimated net income. (24)

Calculations:

①	(40 x 150 x R50) - R30 000	=	R270 000
②	(30 x 150 x R50) - R30 000	=	R195 000
③	(45 x 150 x R50) - R40 000	=	R297 500
④	(35 x 150 x R50) - R40 000	=	R222 500
⑤	[(270 000 x 0,75) + (195 000 x 0,25)]	=	R251 250
⑥	[(297 500 x 0,90) + (222 500 x 0,10)]	=	R290 000
⑦	[(530 000 x 0,70) + (370 000 x 0,30)]	=	R482 000
⑧	[(500 000 x 0,90) + (300 000 x 0,10)]	=	R480 000
⑨	[(300 000 x 0,60) + (200 000 x 0,40)]	=	R260 000

SECTION B

Alternative 1: Development of caravan park

Estimated capital outlay for project = R(150 000 + 350 000 + 80 000)
= R580 000

Minimum return required = R580 000 x 40%
= R232 000

Estimated return = R290 000

Alternative 2: Development of conference centre

Estimated capital outlay for project = R(150 000 + 850 000)
= R 1 000 000

Minimum return required = R1 000 000 x 50%
= R500 000

Estimated return = R482 000

Conclusion:

Only alternative 1, namely the development of a caravan park, will render an estimated return in excess of that required in terms of its fair rate of return. (6)

[30]

QUESTION 2 (27 marks; 32 minutes)

TV Services CC was approached by a large hotel group for a quotation on the maintenance of 1 000 colour television sets for one year.

The manager of the close corporation estimated the expected number of calls per annum, based on experience, as follows:

Number of calls	Probability
100	0,5
150	0,2
200	0,2
250	0,1

The close corporation can fulfil its obligations in terms of the maintenance contract by any of the following means:

1. *By making use of own labour and spares*
   The average direct cost per call is estimated at R150, which excludes normal labour costs. Normal labour costs are considered irrelevant as the close corporation does not operate at full capacity.

2. *By making use of subcontractor A*
   This subcontractor would charge the close corporation R23 000 per annum, irrespective of the actual number of calls.

3. *By making use of subcontractor B*
   This subcontractor would charge the close corporation R20 000 per annum for the first 150 calls and R100 per cal for each call thereafter.

Subcontractors provide their own spares.

REQUIRED

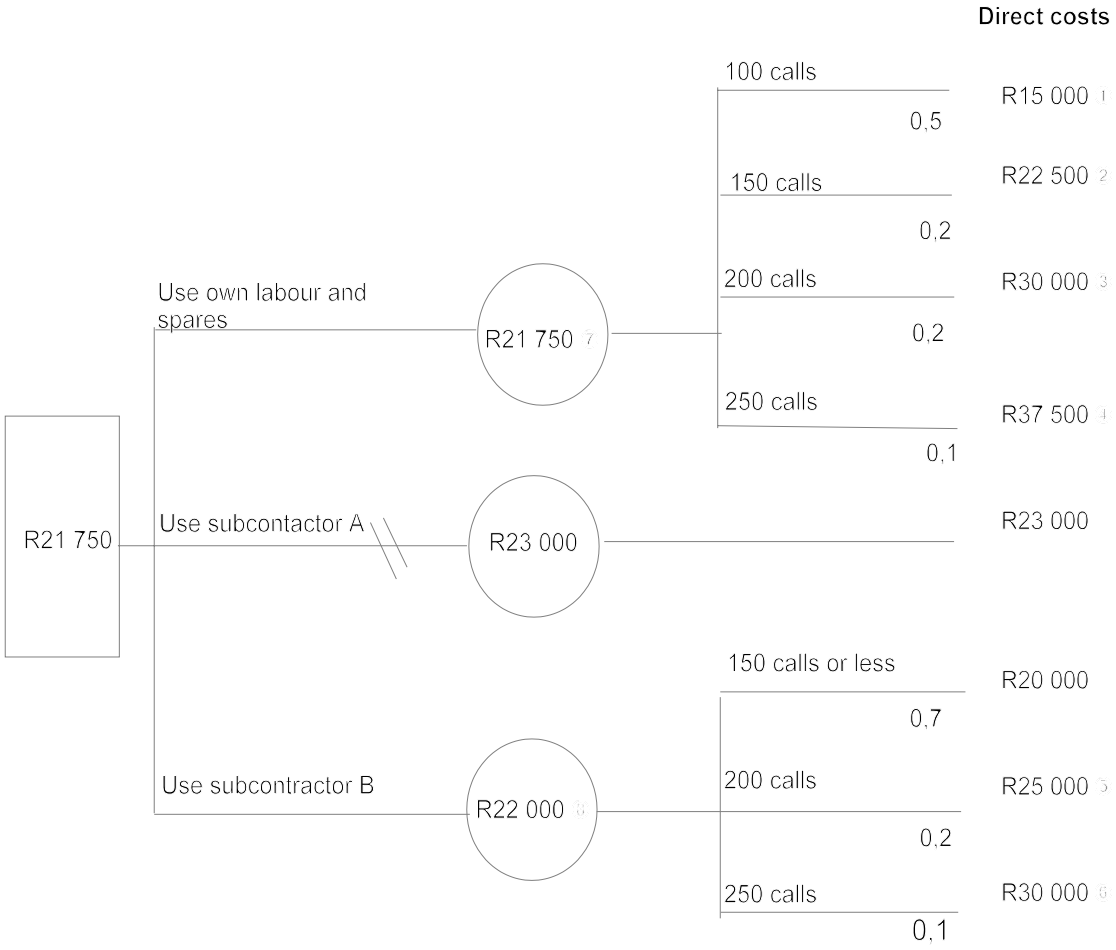
(a) Determine by making use of a decision tree, by which means the obligations of the above-mentioned service contract could be fulfilled in the most economical manner. (24)

(b) State a reason why TV Services CC may consider making use of subcontractor A in any case to fulfil its obligations in terms of the service contract, should the contract be obtained. (3)

[27]

TV SERVICES CC

(a) *Decision tree*



Calculations:

① 100 x R150 = R15 000
② 150 x R150 = R22 500
③ 200 x R150 = R30 000
④ 250 x R150 = R37 500
⑤ R20 000 + (50 x R100) = R25 000
⑥ R20 000 + (100 x R100) = R30 000
⑦ (0,5 x R15 000) + (0,2 x R22 500) + (0,2 x R30 000) + (0,1 x R37 500) = R21 750
⑧ (0,7 x R20 000) + (0,2 x R25 000) + (0,1 x R30 000) = R22 000

Conclusion:

The obligations in terms of the service contract could be fulfilled in the most economical manner by making use of own labour and spares. (24)

(b) *Why subcontractor A could be used*

Subcontractor A could be used because it would minimise the risk. Should own labour and spares be used, there is a probability of 0,3 (0,2 + 0,1 for 200 and 250 calls respectively) that the actual expenses would exceed R23 000, which would be the cost if subcontractor A were used. This excess might vary by between R7 000 (R30 000 - R23 000) and R14 500 (R37 500 - R23 000). Likewise, as far as subcontractor B is concerned, the risk that the actual expenses exceed R23 000 by up to R7 000 (R30 000 - R23 000) is also 0,3 (0,2 + 0,1).

The close corporation's attitude towards risk, as well as the nature of the remainder of its business activities in terms of risk, will finally determine which option is exercised. (3)

[27]

QUESTION 3 (23 marks; 28 minutes)

Podgy Potato, a fast-food outlet, sells baked potatoes with different fillings.

As the baked potatoes cannot be kept overnight, all baked potatoes that are not sold on a specific day have to be thrown or given away.

On the other hand, enough potatoes must be baked to maintain goodwill. The fillings for the potatoes can be prepared in a microwave oven in 8 minutes, and do therefore not present a wastage problem.

The manager has approached you with the following figures in respect of previous years:

Sales per day (potatoes)	Number of days that quantity was sold
100	70
200	175
300	105
Total trading days	350

The average selling price per potato with a filling is R15,00. The average cost of a baked potato is R2,00, and that of the fillings R6,00.

REQUIRED

(a) Calculate the probability of selling 100, 200 or 300 potatoes per day. (3)

(b) Construct a decision tree for the enterprise and advise management on the course of action to be taken to maximise profit. (20)

[23]

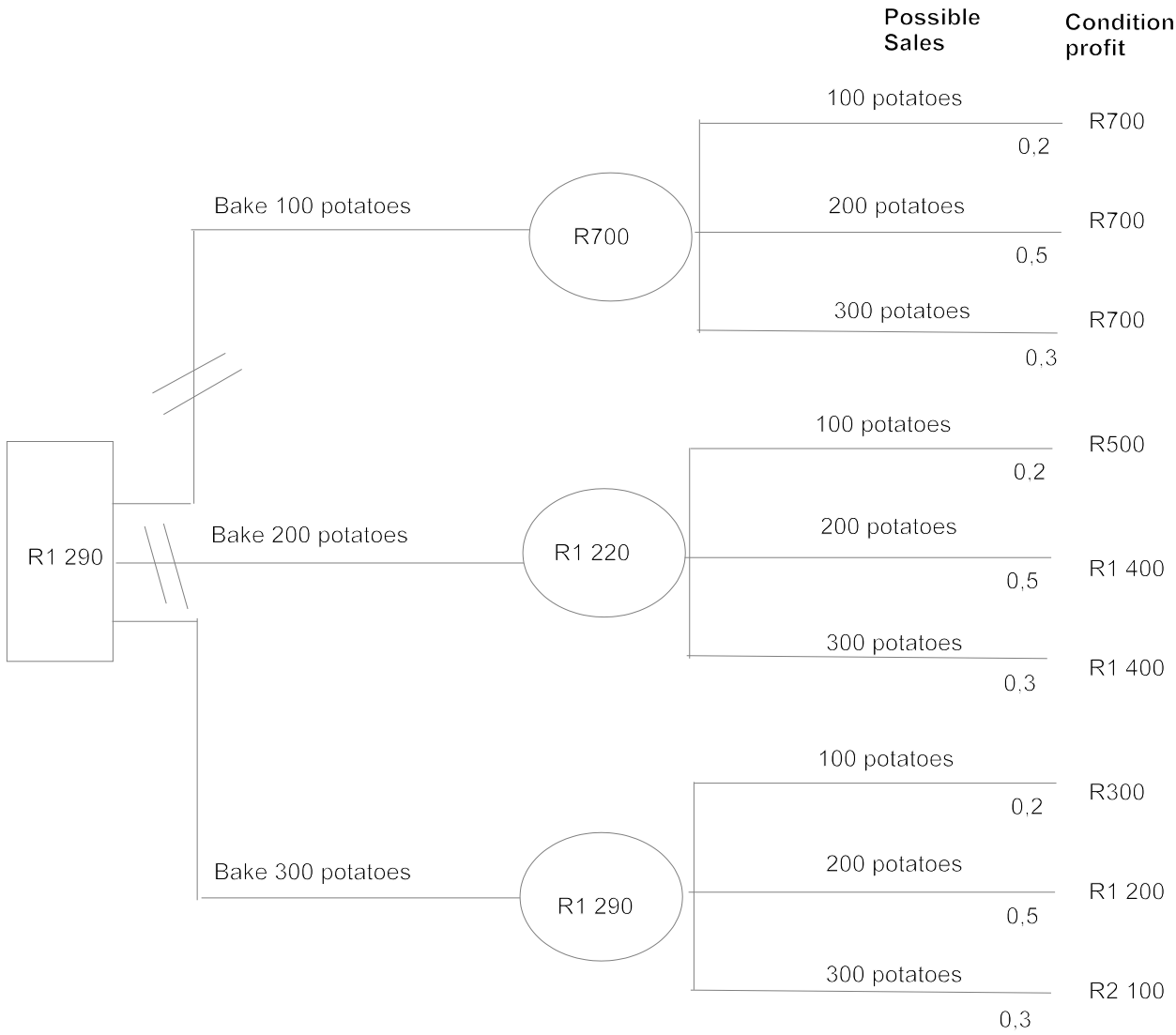
PODGY POTATO

(a)

Sales per day	Number of business days		Probability
100	70	(70/350)	0,2
200	175	(175/350)	0,5
300	105	(105/350)	0,3
	350		10

(3)

(b) *Decision tree*



Conclusion:

Bake 300 potatoes to realise an estimated profit of R1 290 per day.

Calculation of conditional profit:

Number baked	Cost of potatoes	Filling	Cost of fillings	Possible sales	Sales	Conditional profit
Units	**R**	**Units**	**R**	**Units**	**R**	**R**
100	(200)	100	(600)	100 **!!**	1500	700
200	(400)	100	(600)	100	1500	500
200	(400)	200	(1200)	200 **!!**	3000	1400
300	(600)	100	(600)	100	1500	300
300	(600)	200	(1200)	200	3000	1200
300	(600)	300	(1800)	300	4500	2100

(20)

[23]

!!Remark:

Only 100 potatoes were baked therefore only 100 potatoes can be sold. If a demand for 200 or 300 potatoes exist, only 100 can be sold. Podgy Potato would therefore not be able to meet the demand on those specific days. In the decision tree you should however indicate the probability that there could be a demand for 200 or 300 potatoes respectively. The conditional profit would therefore be R700 for all the probabilities.
The principle will be the same if 200 potatoes were baked but a demand for 300 exists.

QUESTION 4 (32 marks; 38 minutes)

At the monthly meeting of the directors of Windsey Limited, the following was noted in the minutes:

1. As a result of the recent upswing in the economy, turnover has increased considerably. In the process, surplus cash funds of R1 million have accumulated, which are now available for investment purposes.

2. The following investment alternatives have been identified:

2.1 Investment in a portfolio managed by the company's brokers.

2.1.1 *High-risk investment*
This investment has a 40% chance of being a success, in which case it will render a return of 60% on capital. If the investment is a failure, the loss will amount to 10% on capital.

2.1.2 *Medium-risk investment*
This investment has a 75% chance of rendering a return of 25% on capital. If it does not meet these expectations, it will still render a return of 18% on capital.

2.2 Expansion of current product range

Designs for two new products have recently been completed. Each product requires a capital outlay of R1 million, which also makes provision for an increase in the working capital with regard to the new product.

3. Market research has been done on both products, and the following is an extract of the final report:

Profits and/or losses are estimated as follows:

Product	Demand good	Demand average
	R	R
Antrix	300 000	(150 000)
Beva	350 000	(120 000)

The probability that the demand for the products will be good is estimated as follows:
Product Antrix : 0,75
Product Beva : 0,65

4. Regression analysis has been applied to determine the effect of advertising on turnover. Based on this calculation, it is possible to increase the estimated net profit of product Antrix by R100 000 if an amount of R50 000 is spent on advertising. Likewise, the net profit in respect of product Beva can be increased by R90 000, should the same amount be spent on advertising. This information was not taken into account in the estimates under point 3 above.

REQUIRED

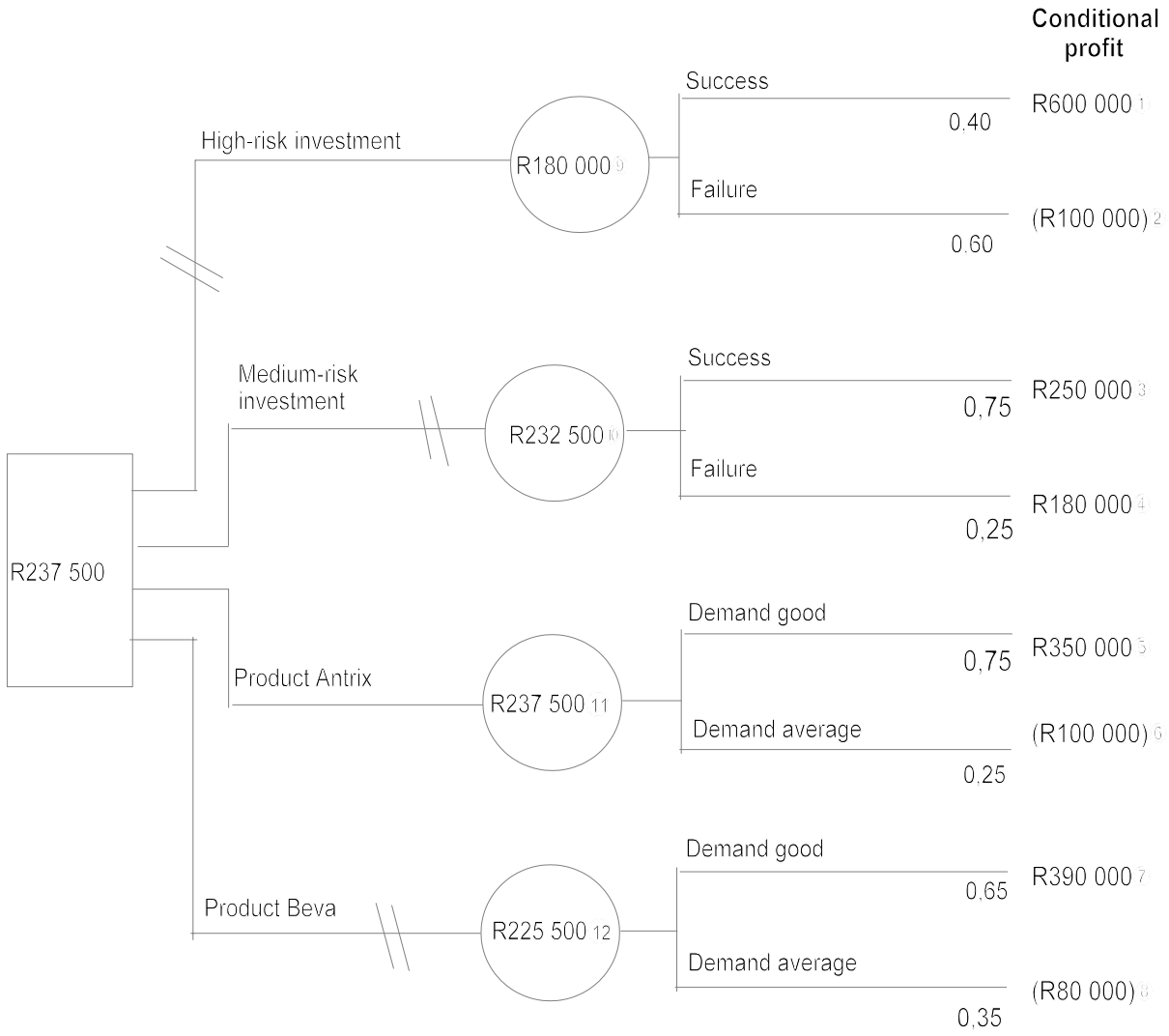
(a) Determine whether the amount of R50 000 should be spent on advertising. (3)
(b) Construct a decision tree in order to determine which is the most profitable investment alternative. Your answer in (a) above should be taken into account in your calculations. The expected monetary values relating to each alternative must be clearly indicated. (25)
(c) State a very obvious consideration which should be taken into account before the final decision can be taken. (4)
[32]

WINDSEY LIMITED

(a) *Determination of whether an additional amount should be spent on advertising*

	Antrix	Beva
	R	R
Additional profit that can be earned	100 000	90 000
Less: Additional amount to be spent on advertising	50 000	50 000
Amount by which profits can increase	50 000	40 000

∴ The amount should be spent as it would lead to an increase in profits. (3)



(b) *Decision tree*

Calculations:

① 60% x R1 000 000 = R600 000
② (10%) x R1 000 000 = (R100 000)
③ 25% x R1 000 000 = R250 000
④ 18% x R1 000 000 = R180 000
⑤ R300 000 + R50 000 = R350 000
⑥ (R150 000) + R50 000 = (R100 000)
⑦ R350 000 + R40 000 = R390 000
⑧ (R120 000) + R40 000 = (R80 000)
⑨ [0,40 x R600 000] + [0,60 x (R100 000)] = R180 000
⑩ [0,75 x R250 000] + [0,25 x R180 000] = R232 500
⑪ [0,75 x R350 000] + [0,25 x (R100 000)] = R237 500
⑫ [0,65 x R390 000] + [0,35 x (R80 000)] = R225 500 (25)

(c) *Obvious consideration before a decision is taken*

There is a very small difference in the expected return of the medium-risk investment and the manufacturing of Antrix. Even though the probability of a "failure" is exactly the same in both cases, namely 25%, the possible monetary loss if Antrix fails amounts to R100 000, in comparison to an investment which will render at least R180 000 - a significant difference in risk.
This fact should be taken into account before the final decision is taken. (4)

[32]

!! Remark:

Do you think that an investment with a return of 60% on capital is too good to be true? Remember, the higher the return, the higher the risk. When you are confronted with such a situation in practice, beware of pyramid schemes and other illegal schemes.

CHAPTER

11

Project management by making use of network analysis

As a result of rapid technological development projects are becoming larger and more complex. Project costs and time control is becoming more and more necessary and at the same time more difficult.

Traditional budgetary control methods are used in most projects, but they have a number of weaknesses, including the following:

- Budgets are compiled from a departmental point of view or function, and not from the point of view of a project.
- Cost control and information about physical progress cause difficulties because the initial budget has been prepared independently of the physical programme.
- Expenditure to date is often only compared with a total budget figure at a certain stage of completion, when it is normally too late to take corrective action.
- Where physical progress is linked to cost control, it is often based on the proportion of allowed time or budgeted expenses.
- Budgetary control relies on the activity being repetitive. Action can be taken on a variance shown in one period to correct it in the next.

Network analysis is an extension of budgetary control methods and overcomes some of the above weaknesses. It provides a method of controlling both costs and physical progress.

Carefully study chapter 11 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter.

Additional questions and solutions have been included to help you gain the necessary proficiency in the application of the technique. You will benefit the most if you work through these as suggested in chapter 5 of this study guide.

QUESTION 1 (21 marks; 25 minutes)

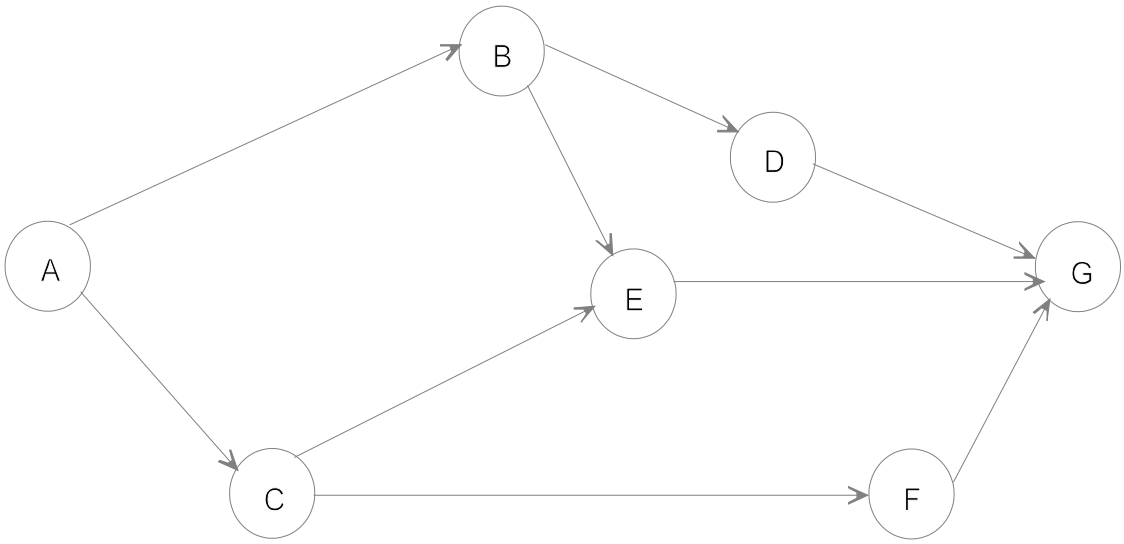
Tarsem (Pty) Limited is a company involved in civil construction. The company has tendered unsuccessfully for the construction of a bridge over the Limpopo River.

The directors of the company have appointed you as management accountant. The company has been unable to obtain any contracts in the last six months, and your first assignment is to determine why no tender has been successful.

You have decided to use the Limpopo River project as the basis of your report to the directors.

You have studied the working papers of the project and have determined the following important facts:

1. The network diagram of the project is as follows:



2. The company applies a profit margin of 33⅓% on cost.

3. The cost of the tender was based on the normal cost of the normal duration of the project.

4. The project details were as follows:

Activity	Variable costs		Duration (weeks)		Cost slope
	Normal	Accelerated	Normal	Accelerated	
	R	R			R
Ⓐ➜ Ⓑ	150 000	210 000	12	10	30 000
Ⓐ ➜ Ⓒ	180 000	220 000	14	10	10 000
Ⓑ ➜ Ⓓ	200 000	245 000	10	9	45 000
Ⓑ ➜ Ⓔ	120 000	192 000	12	9	24 000
Ⓒ ➜ Ⓔ	150 000	199 000	14	7	7 000
Ⓒ ➜ Ⓕ	160 000	200 000	12	7	8 000
Ⓓ ➜ Ⓖ	240 000	312 000	15	7	9 000
Ⓔ ➜ Ⓖ	180 000	222 000	16	9	6 000
Ⓕ ➜ Ⓖ	120 000	170 000	14	12	25 000

In addition to the above variable costs, fixed costs, which are not regarded as committed costs, amount to R20 000 per week.

REQUIRED

Calculate the following:

(a) The normal duration of each route. (3)

(b) The amount tendered for the project. (6)

(c) The amount that could have been tendered if the cost of the project had been minimised. (12)

[21]

SUGGESTED SOLUTION

TARSEM (PTY) LIMITED

(a) *Normal duration of each route*

Ⓐ ➜ Ⓑ ➜ Ⓓ ➜ Ⓖ : 12 +10 + 15 = 37 weeks

Ⓐ ➜ Ⓑ ➜ Ⓔ ➜ Ⓖ : 12 + 12 + 16 = 40 weeks

Ⓐ ➜ Ⓒ ➜ Ⓔ ➜ Ⓖ : 14 + 14 + 16 = 44 weeks ➜ critical path

Ⓐ ➜ Ⓒ ➜ Ⓕ ➜ Ⓖ : 14 + 12 + 14 = 40 weeks (3)

(b) *Amount tendered for the project*

	R
Direct costs	1 500 000
Fixed overhead (R20 000 x 44)	880 000
	2 380 000
Profit (33⅓% x R2 380 000)	793 333
Tender amount based on normal time	3 173 333

(6)

(c) *Tender amount at minimum cost*

Acceleration

	Routes				Additional direct costs R	Saving in fixed costs R	Net saving R
	Ⓐ →Ⓑ → Ⓓ →Ⓖ weeks	Ⓐ →Ⓑ → Ⓔ →Ⓖ weeks	Ⓐ →Ⓒ → Ⓔ →Ⓖ weeks	Ⓐ →Ⓒ → Ⓕ →Ⓖ weeks			
Normal time	37	40	44	40			
Accelerate: Ⓔ →Ⓖ by 4 weeks		(4)	(4)		R6 000 x 4 = R24 000	R20 000 x 4 = R80 000	64 000
	37	36	40	40			
Ⓐ →Ⓒ by 3 weeks			(3)	(3)	R10 000 x 3 = R30 000	R20 000 x 3 = R60 000	30 000
	37	36	37	37			
Ⓐ →Ⓒ by 1 week			(1)	(1)	R10 000		
Ⓓ →Ⓖ by 1 week	(1)				R9 000	R20 000	1 000
	36	36	36	36			
Ⓓ →Ⓖ by 1 week	(1)				R9 000		
Ⓔ →Ⓖ by 1 week		(1)	(1)		R6 000	R20 000	(3 000)
Ⓒ →Ⓕ by 1 week				(1)	R8 000		
	35	35	35	35			92 000

(9)

Minimum tender price

	R	
Original cost	2 380 000	
Less: Net saving	95 000	
	2 285 000	
Profit (33⅓% x R2 285 000)	761 667	
Minimum tender price	3 046 667	(3)

[21]

!! Remark:

Many students have difficulty with the acceleration process. There are three steps to follow:

1. You start accelerating on the critical path,
2. the activity with the lowest cost slope
3. to the route with the second highest duration.

In this example the critical path is 44 weeks. Activity Ⓔ → Ⓖ has the lowest cost slope and can be accelerated by 7 days (difference between normal and accelerated times :16 - 9 = 7).

Activity Ⓔ → Ⓖ also lies on route Ⓐ → Ⓑ → Ⓔ →Ⓖ and it will decrease the duration thereof as well. The route with the second highest duration is Ⓐ → Ⓒ → Ⓕ →Ⓖ(40 weeks). No time will be saved by accelerating activity Ⓔ → Ⓖ by more than 4 weeks. Route Ⓐ → Ⓒ → Ⓕ →Ⓖ will still take 40 weeks to complete. Therefore, you accelerate by 4 weeks.

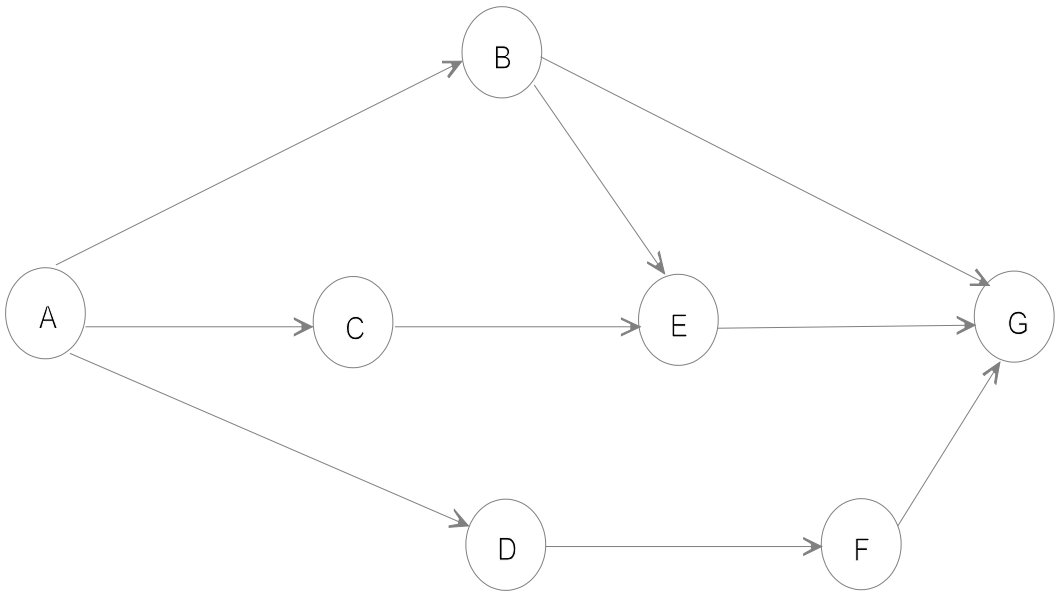
There are now two critical paths, both on 40 weeks. Both routes have to be accelerated simultaneously, using the option with the lowest cost slope.

On Ⓐ → Ⓒ → Ⓔ →Ⓖ, activity Ⓔ → Ⓖ has the lowest cost slope (R6 000) and on Ⓐ → Ⓒ → Ⓕ →Ⓖ, Ⓒ → Ⓕ is the cheapest (R8 000). The total cost is, therefore, R14 000. It will however be cheaper to accelerate activity Ⓐ → Ⓒ, at a cost of R10 000, as it lies on both routes. Activity Ⓐ → Ⓒ can be accelerated by 4 weeks, but will be accelerated to the next highest route, namely 37 weeks. Therefore we only accelerate by 3 weeks (40-37).

You follow the same principle until you start making a loss, that is, when the additional variable costs exceed the saving in fixed costs. The most cost effective point will therefore be the last acceleration before a loss is made.

QUESTION 2 (23 marks; 28 minutes)

A contract for the erection of prefabricated classrooms has been awarded to Vinnigrig CC. You are the cost accountant of the firm and have identified the activities involved, and the sequence thereof, as follows:



The duration of the various activities in normal and accelerated circumstances, and the relevant cost slopes, are as follows:

Activity	Duration (days)		Cost slope
	Normal	Accelerated	R
Ⓐ ➜ Ⓑ	10	9	1 800
Ⓐ ➜ Ⓒ	10	6	2 800
Ⓐ ➜ Ⓓ	8	7	1 200
Ⓑ ➜ Ⓔ	7	4	4 700
Ⓑ ➜ Ⓖ	9	8	4 000
Ⓒ ➜ Ⓔ	8	6	800
Ⓓ ➜ Ⓕ	4	3	1 500
Ⓔ ➜ Ⓖ	5	2	1 200
Ⓕ ➜ Ⓖ	8	6	1 700

The fixed costs amount to R4 500 per day. They are not regarded as committed fixed costs.

REQUIRED

(a) Determine the critical path. (4)

(b) Determine the programme to be followed in order to complete the project at the minimum cost and indicate the saving in normal costs. (19)

[23]

SUGGESTED SOLUTION

VINNIGRIG CC

(a) *Critical path*

Ⓐ ➜ Ⓑ ➜ Ⓖ	:	10 + 9	=	19 days	
Ⓐ ➜ Ⓑ ➜ Ⓔ ➜ Ⓖ	:	10 + 7 + 5	=	22 days	
Ⓐ ➜ Ⓒ ➜ Ⓔ ➜ Ⓖ	:	10 + 8 + 5	=	23 days*	critical path
Ⓐ ➜ Ⓓ ➜ Ⓕ ➜ Ⓖ	:	8 + 4 + 8	=	20 days	(4)

(b) *Programme for minimum cost and indication of cost saving*

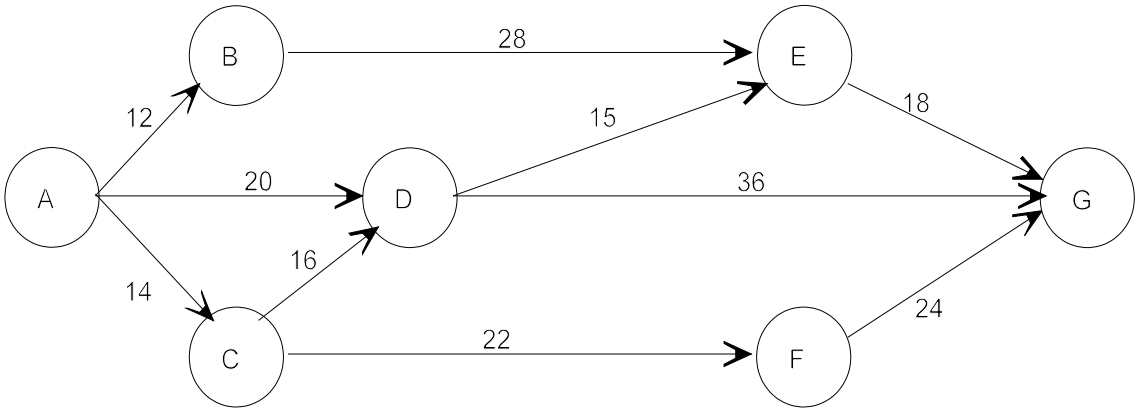
	Routes				Saving in fixed costs	Additional variable costs	Net saving
	Ⓐ ➜ Ⓑ ➜ Ⓖ	Ⓐ ➜ Ⓑ ➜ Ⓔ ➜ Ⓖ	Ⓐ ➜ Ⓒ ➜ Ⓔ ➜ Ⓖ	Ⓐ ➜ Ⓓ ➜ Ⓕ ➜ Ⓖ			
	Days	**Days**	**Days**	**Days**	**R**	**R**	**R**
Normal time	19	22	23	20			
Accelerate: Ⓒ ➜ Ⓔ by 1 day			(1)		4 500	800	3 700
	19	22	22	20			
Ⓔ ➜ Ⓖ by 2 days		(2)	(2)		4 500 x 2 = R9 000	1 200 x 2 = R2 400	6 600
	19	20	20	20			
Ⓔ ➜ Ⓖ by 1 day		(1)	(1)			1 200	
Ⓐ ➜ Ⓓ by 1 day				(1)	4 500	1 200	2 100
	19	19	19	19			
Ⓐ ➜ Ⓑ by 1 day	(1)	(1)				1 800	
Ⓒ ➜ Ⓔ by 1 day			(1)			800	
Ⓓ ➜ Ⓕ by 1 day				(1)	4 500	1 500	400
	18	18	18	18	22 500	9 700	12 800

No further acceleration is cost effective, as route Ⓐ ➜ Ⓑ ➜ Ⓔ ➜ Ⓖ can only be accelerated through activity Ⓑ ➜ Ⓔ, at a cost of R4 700 per day, therefore exceeding the possible saving in fixed costs of R4 500 per day. Therefore the project should be completed in 18 days, at a net saving of R12 800. (19)

[23]

DETERMINATION OF THE LATEST STARTING AND COMPLETION TIMES OF ACTIVITIES

We are going to discuss these concepts briefly by making use of the following example:



In principle, the earliest starting and completion times of activities are calculated by accepting that the project commences at point zero in time at milestone Ⓐ - in other words, at the planning stage of the project, the time lapse between the planning stage and the actual commencement of the project is irrelevant.

As indicated in the diagram, activity Ⓐ → Ⓑ normally takes 12 days to complete. The earliest starting time for activity Ⓐ → Ⓑ is therefore day zero, and the earliest completion time is on day 12. At the same time any activity commencing from milestone Ⓑ can only commence after day 12. Provided that there are no other routes leading to the milestone, the earliest completion time for a particular activity will be the earliest starting time for another activity commencing from that milestone.

In the example, activity Ⓑ → Ⓔ will normally take 28 days to complete. The earliest starting time for activity Ⓑ → Ⓔ will therefore be 12 days, and the earliest completion time, 40 days (0 + 12 + 28) after commencement of the project.

In most cases, however, there will be more than one route leading to a milestone, just as the case is in our example when observing milestone Ⓔ: Milestone Ⓔ has three routes leading to it, namely:

Route 1: Milestone Ⓐ to milestone Ⓑ to milestone Ⓔ
The normal duration to reach milestone Ⓔ by means of this route will be 40 days (0 + 12 + 28).

Route 2: Milestone Ⓐ to milestone Ⓓ to milestone Ⓔ
Route 2 can commence as soon as the project has started, in other words, simultaneously with route 1. The normal duration to reach milestone Ⓔ by means of this route is 35 days (0 + 20 + 15).

Route 3: Milestone Ⓐ to milestone Ⓒ to milestone Ⓓ to milestoneⒺ
The normal duration to reach milestone Ⓔ by means of this route will be 45 days (0 + 14 + 16 +15).

Please note that **no** activity can commence from milestone Ⓔ unless all routes leading to it have been completed. The earliest time at which an activity can commence from milestone Ⓔ will therefore be the duration of the **longest** route leading to that milestone. In the example under discussion it will be the longest of 40, 35 or 45 days.

It should be evident that if route 2, leading to milestone Ⓔ, takes 10 days longer than planned, it would have no effect on the estimated project time. On the other hand, if route 3 would take longer than estimated, the estimated project time will be delayed accordingly.

The calculation of the starting and completion times should be done in this manner for the whole network diagram.

For purposes of determining the earliest starting and completion times, we have started at the beginning of the network diagram at a zero point in time.

For purposes of determining the latest starting and completion times, we start at the end of the network and work backwards. The estimated duration of the project is the starting point, in other words, the duration of the critical route.

The principles applicable to the earliest starting and completion times are also applicable to the latest starting and completion times.

The latest completion time at the last milestone Ⓖ will, logically, be 66 days. The latest starting time of activity Ⓔ → Ⓖ will therefore be 48 days (the duration of the critical route, namely 66 days, minus the normal duration of activity Ⓔ → Ⓖ , which amounts to 18 days).

The difference between the earliest and latest starting times at a particular milestone represents the slack at that milestone. Slack can also be calculated by deducting the earliest completion time from the latest completion time. As the critical route determines the duration of the project, you will find that there will be no slack at the milestones on the critical route.

We trust the following simple steps will assist you in understanding how to calculate LCT, ECT, LST and EST.

Latest completion time (LCT)

LCT = critical route - longest route from the **end** of the activity to the end of the project.

If you take activity Ⓐ → Ⓒ as an example, you will find that there are three routes leading from Ⓒ, which is the end of the activity, to Ⓖ, which is the end of the project, namely

Ⓒ → Ⓓ → Ⓔ → Ⓖ : 16 + 15 + 18 = 49
Ⓒ → Ⓓ → Ⓖ : 16 + 36 = 52 (longest)
Ⓒ → Ⓕ → Ⓖ : 22 + 24 = 46

LCT = 66* - 52
= 14 days

* Critical route

Latest starting time(LST)

LST = critical route - longest route from the **beginning** of the activity to the end of the project.

There are again three routes to take into account.

Ⓐ → Ⓒ → Ⓓ → Ⓔ → Ⓖ : 14 + 16 + 15 + 18 = 63
Ⓐ → Ⓒ → Ⓓ → Ⓖ : 14 + 16 + 36 = 66 (longest)
Ⓐ → Ⓒ → Ⓕ → Ⓖ : 14 + 22 + 24 = 60

LST = 66 - 66
= 0 days

Alternatively, you can simply deduct the duration of the activity from the LCT of that activity (14 -14 = 0).

Earliest completion time (ECT)

ECT = longest route from the beginning of the project to the **end** of the activity.

The ECT for activity Ⓓ → Ⓔ will therefore be the longest of:

Ⓐ → Ⓓ → Ⓔ : 20 + 15 = 35

Ⓐ → Ⓒ → Ⓓ → Ⓔ : 14 + 16 + 15 = 45 (longest)

ECT = 45 days.

Earliest starting time (EST)

EST = the longest route from the beginning of the project to the **beginning** of the activity.

EST for Ⓓ → Ⓔ will therefore be the longest of:

Ⓐ → Ⓓ : = 20

Ⓐ → Ⓒ → Ⓓ : 14 + 16 = 30 (longest)

EST = 30 days.

Alternatively, you can deduct the duration of the activity from the ECT of that activity (45 - 15 = 30).

CHAPTER

12

Inventory and production models

It is generally expensive to hold inventory. Traditionally, enterprises held large quantities of inventory. Products were manufactured according to production capacity, with little consideration for fluctuation in the demand for the products.

Nowadays a more holistic management approach is followed. The application of inventory and production models in inventory control, can assist management in providing relevant information to optimise profitability and cashflow.

Carefully study chapter 12 of the prescribed textbook, *"Managerial Accounting", Frank W Julyan, Chalene Nel, Volume 1, second edition 2003,* in accordance with the learning objectives set out at the beginning of the chapter. Please take note of the difference between direct stockholding costs and stock carrying costs.

By working through the following questions and solutions in the manner as set out in chapter 5 of this study guide, you can ensure that you will be proficient in the application of inventory and production models as a technique contributing towards the determination of the optimal inventory policy.

INTRODUCTION

Investment in inventory represents a major asset of most organisations, and it is essential that inventory be managed efficiently. The optimum level of inventory should therefore be determined by an organisation. Our objective in this chapter is to determine the economic order quantity and level at which inventory should be replenished.

INVENTORY COSTS

The relevant costs that should be considered when determining optimal inventory levels consists of **holding or carrying costs**, **ordering costs** and **stockout costs**.

Holding or carrying costs are associated with holding the inventory, and usually consists of the following:

- Opportunity costs, i.e. the costs incurred by forfeiting possible alternative investments
- Indirect costs such as insurance and applicable levies
- Departmental clerical and administrative costs
- Salaries and wages of employees in the warehouse
- An allocation of relevant rent
- Depreciation of inventory and losses due to pilferage, breakage or spoilage as well as obsolescence
- Incremental material handling costs.

Ordering costs are costs associated with the acquisition of inventory. These costs may include the following:

- Salaries and wages of employees in the purchasing department
- Departmental clerical and administrative costs
- An allocation of the relevant rent and depreciation
- Cost of reception and inspection of orders
- Cost of processing the order.

Stockout costs are the opportunity costs of running out of inventory. These costs may include the following:

- Lost sales
- Loss of goodwill
- Additional ordering and transport costs.

Remember that the total direct costs of inventory consists of the acquisition costs plus the total ordering costs plus the total carrying costs.

THE ECONOMIC ORDER QUANTITY MODEL

The economic order quantity (EOQ) model is used to determine the order quantity that minimises the total costs (ordering costs and carrying costs).

Assumptions

An understanding of the assumptions underlying the EOQ model is necessary to avoid misapplication and wrong results. The assumptions underlying this model are:

- the demand is known and continuous
- the lead time is known and does not vary in length
- the delivery of ordered stock takes place in one batch
- the order and carrying costs are known, remain constant and are independent of the order quantity
- inventory items are considered individually in the application of the model

- orders for various inventory items are independent of one another
- quantity discounts are not relevant
- there are no restrictions as regards to storage and production capacity.

The formula for the economic order quantity is:

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering costs per order}}{\text{Carrying cost per unit per annum}}}$$

The above formula can therefore also be stated in more detail as follows:

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering costs per order}}{(\text{Opportunity cost or cost per capital per unit p.a.}) + (\text{Stockholding cost per unit p.a.})}}$$

OR

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering cost per order}}{(\text{Unit price} \times \frac{\text{Interest on capital} - \text{Inflation rate}}{100}) + (\text{Stockholding cost per unit p.a})}}$$

APPLICATION OF THE EOQ-MODEL

QUESTION 1 (5 marks; 6 minutes)

The following details in respect of Tuftleen Material are available:

Purchase price per metre	R10
Number of metres required annually	2 000
Ordering cost per order	R16
Carrying cost as a percentage of the purchase price	15% p.a.

REQUIRED

Calculate the economic order quantity. (5)
Round off your orders to the next metre.

SUGGESTED SOLUTION

TUFTLEEN MATERIAL

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering costs per order}}{\text{Carrying cost per unit per annum}}}$$

$$= \sqrt{\frac{2 \times 2\,000 \times R16}{(15\% \times R10)}}$$

$$= \sqrt{\frac{R64\,000}{R1,50}}$$

$$= 206,56$$

$$\approx 207 \text{ metres} \quad (5)$$

QUESTION 2 (8 marks; 10 minutes)

Wallop Limited sells push-carts for dolls. The annual demand is estimated at 3 000 units. The purchase price per unit is R60,00. The ordering cost is R125 per order.

The company is at present investing surplus funds, and the earnings after tax on this investment is 18%. The current rate of inflation is 8%. The normal stockholding cost is 10% per annum of the purchase price per unit.

REQUIRED

(a) Determine the economic order quantity. (5)

(b) Determine the number of orders that will be placed during the year. (3)

[8]

WALLOP LIMITED

(a) *Economic order quantity*

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering cost per order}}{\left(\text{Unit price} \times \frac{\text{Interest on capital} - \text{Inflation rate}}{100}\right) + (\text{Stockholding cost per unit p.a})}}$$

$$= \sqrt{\frac{2 \times 3\,000 \times R125}{\left(R60 \times \frac{18 - 8}{100}\right) + (R60 \times 10\%)}}$$

$$= \sqrt{\frac{R750\,000}{R6 + R6}}$$

$$= \sqrt{\frac{R750\,000}{R12}}$$

$$= \sqrt{62\,500}$$

= 250 units (5)

(b) *The number of orders*

$$\text{The number of orders} = \frac{\text{Total annual demand}}{\text{Economic order quantity}}$$

$$= \frac{3\,000}{250}$$

= 12 orders (3)

[8]

VARIOUS RELATED CONCEPTS AND APPLICATIONS THEREOF

Re-order point

The re-order point is that point in time when an order must be placed. The time that will elapse between placing an order and the actual delivery is known as **lead time**. When there is no safety stock, the re-order point is calculated as follows:
Re-order point = demand per time unit x lead time in terms of time unit

If the organisation keeps safety stock, the formula will be:
Re-order point = Normal demand during lead time + safety stock

Another situation can arise where the lead time is very long, (eg. three months) and one months' demand is ordered per time. The formula will then be:
Re-order point = Normal demand during lead time + safety stock - orders placed, not yet received.

Safety stock

In practice, demand or usage of inventory is not known with certainty. In addition, there is usually a degree of uncertainty associated with the placement of an order and delivery of inventory. Safety inventory is therefore the amount of inventory that is carried in excess of the expected use during the lead time to provide a cushion against running out of inventory.

Safety stock is calculated as follows:
Safety stock = Minimum lead time x maximum demand

OR

Safety stock = the re-order point - (the normal demand x normal lead time)

QUESTION 3 (8 marks; 10 minutes)

Exeter (Pty) Limited sells electrical devices. The company operates from Mondays to Fridays, the financial year consisting of 260 days. The following information is with regard to one of its items:

Annual demand	11 960 units
Economic order quantity	200 units
Safety stock required	35 units
Lead time	4 working days

REQUIRED

Determine the re-order point for the item. (8)

SUGGESTED SOLUTION

Re-order point	=	Normal demand during lead time + safety stock
	=	(Demand per day x lead time) + safety stock
	=	(11 960 ÷ 260 x 4) + 35 units
	=	184 + 35 units
	=	219 units (8)

QUESTION 4 (20 marks; 24 minutes)

The annual demand for Sandy Limited's product is 12 000 units.

The following particulars are applicable:

Purchase price	R110 per unit
Ordering cost	R150 per order
Required pre-tax rate of return	35%
Rate of inflation	8%
Rate of taxation	30%

In addition to the required rate of return, the following stockholding costs are incurred:

Storage rental	R8,60 per unit per year
Insurance	9% of the unit cost per year

The following special offer has been received from a supplier:

Purchase price	R88,00 per unit
Number of orders per annum	6

Should the offer be accepted, additional storage space at R220 000 per annum will be needed. The present relevant costs will remain unchanged.

REQUIRED

(a) Determine the number of orders to be placed annually, without taking the special offer into account. (8)

(b) Calculate whether the special offer should be accepted or not. (12)
Show your detailed calculations. **[20]**

SUGGESTED SOLUTION

SANDY LIMITED

(a) *Calculation of the number of orders to be placed annually*

$$\text{Number of orders} = \frac{\text{Total annual demand}}{\text{EOQ}}$$

$$= \frac{12\,000}{314①}$$

$$= 38{,}22 \text{ orders}$$

$$\approx 39 \text{ orders}$$

Calculations:

① *The economic order quantity (EOQ)*

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering cost per order}}{\left(\text{Unit price} \times \frac{\text{Interest on capital} - \text{Inflation rate}}{100}\right) + (\text{Stockholding cost per unit p.a})}}$$

$$= \sqrt{\frac{2 \times 12\,000 \times R150}{\left(R110 \times \frac{[35 - (30\% \times 35) - 8]}{100}\right) + [R8{,}60 + (R110 \times 0{,}09)]}}$$

$$= \sqrt{\frac{R3\,600\,000}{\left(R110 \times \frac{16{,}5}{100}\right) + R18{,}50}}$$

$$= \sqrt{\frac{R3\,600\,000}{R(18{,}15 + 18{,}50)}}$$

= 313,41 units

≈ 314 (to the nearest unit) (8)

(b) *Calculation of the total direct costs of inventory*

	Present policy	**Special offer**
	R	**R**
Inventory unit cost		
12 000 x R110,00	1 320 000	
12 000 x R 88,00		1 056 000
Relevant cost		
Ordering cost		
R(39 x 150)	5 850	
R(6 x 150)		900
Carrying cost		
$\left[\frac{314}{2}\ !!\ \times R(18{,}15 + 18{,}50)\right]$	5 754	
$\left(\frac{2\,000}{2} \times R31{,}04②\right)$		31 040
	1 331 604	1 087 940
Add: Additional storage place per annum		220 000
	1 331 604	1 307 940

Calculation:

② *Carrying cost*

Required rate of return (as calculated in (a) above)	16,5%
New purchase price	R88

		R
∴	Return on capital ($^{16,5}/_{100}$ x R88)	14,52
	Plus: Stockholding costs	16,52
	Storage rental	8,60
	Insurance ($^{9}/_{100}$ x R88)	7,92
Carrying cost per unit per annum at adjusted purchase price		31,04

Conclusion:

Acceptance of the special offer will reduce the direct cost of stock cost by R23 664 (R1 331 604 -R1 307 940) for the current period. The offer is to be accepted, provided the additional storage space is available and conveniently obtainable (e.g. situation, access, etc.). (12)

[20]

!! Remark:

Note that in terms of the EOQ-model, 314 units are ordered and received. By the time the next order arrives, the stock will be nil. The average stock on hand at any time is therefore half of the quantity ordered.

QUESTION 5 (20 marks; 24 minutes)

Sterny (Pty) Limited assembles electrical equipment. One of the company's main products requires an electric motor. These motors are purchased from an outside contractor. The company wants to formulate a purchasing policy that will ensure minimum costs.

You are provided with the following information:

Annual production requirement	:	17 000 motors
Purchase price	:	R50 per motor
Cost of placing an order	:	R60
Lead time	:	15 days

Stockholding costs consist of the following:

Direct costs	:	R10 per motor per annum
Cost of capital	:	20% per annum after tax

The current rate of inflation is 15% per annum. The company is operative for 340 days per annum.

The supplier of the electric motors has requested the company not to place more than 20 orders per annum, in which case they are prepared to grant a discount of R0,25 per motor. The current rate of taxation is 30%.

REQUIRED

(a) Determine the following without taking the request of the contractor into account:
  (i) the economic order quantity (5)
  (ii) the re-order point. (3)

(b) Determine whether the request to place 20 orders per annum should be met. (12)
  Figures must be rounded off to the nearest rand. **[20]**

SUGGESTED SOLUTION

STERNY (PTY) LIMITED

(a) (i) *The economic order quantity*

$$EOQ = \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering cost per order}}{\text{Stockholding cost per unit per annum}}}$$

$$= \sqrt{\frac{2 \times 17\,000 \times R60}{(R50 \times \frac{20 - 15}{100}) + R10}} \text{ motors}$$

$$= \sqrt{\frac{R2\,040\,000}{R12,50}} \text{ motors}$$

$$= \sqrt{163\,000} \text{ motors}$$

$$= 403,98 \text{ motors}$$

$$\approx 404 \text{ motors} \quad (5)$$

!! Remark:

A fraction of an order is always rounded up as rounding it down could result in an inventory shortage.

(ii) *Re-order point*

Re-order point = Consumption during lead time
= 17 000/ 340 x 15 motors
= 750 motors (3)

(b) *Evaluation of request*

Number of orders per annum if EOQ is accepted = 17 000/ 404 orders
= 42,08 orders
≈ 43 orders (1½)

Order size if 20 orders are placed = 17 000/ 20 motors
= 850 motors (1½)

	Relevant cost (special request)	**Relevant cost (EOQ model)**
Average stock (850/2) ; (404/2)	425 motors	202 motors
	R	R
Ordering costs (20 x R60); (43 x R60)	1 200	2 580
Discount not allowed (17 000 x R0,25)	-	4 250
Carrying costs		
425 x [(5% x R49,75) + R10] **!!**	5 307	
202 x R12,50 [per (a)(i)]		2 525
Total relevant costs	6 507	9 355

Conclusion:

The request should be met. (9)

[20]

!! Remark:

The cost of capital after taxation less the current rate of inflation (20% – 15%) is equal to 5%. If the special request is applied, a R0,25 discount per motor will be given that is, R(50,00 –0,25) = R49,75.

QUESTION 6 (14 marks; 17 minutes)

Clothes Unlimited manufactures denim trousers from material purchased from an external supplier. To date, the management of Clothes Unlimited has maintained an order quantity of 350 metres of denim material.

The accountant of the enterprise wants to implement a new stock policy in terms of which the order size will be determined according to the economic order quantity model.

The following information has been obtained:

Ordering cost	:	R25 per order
Purchase price per metre	:	R50
Stockholding costs (excluding cost of capital)	:	20% of purchase price
Required rate of return on capital	:	20% per annum
Rate of inflation	:	8% per annum
Lead time	:	10 days

The annual demand for denim material is 20 000 metres. Clothes Unlimited is in production for 270 days per annum.

REQUIRED

(a) Calculate the cost savings if orders are placed according to the economic order quantity model. (12)

(b) Determine the re-order point in terms of the proposed policy. (2)

[14]

SUGGESTED SOLUTION

CLOTHES UNLIMITED

(a) *Cost savings*

Total relevant costs if 350 metres are ordered

Total relevant costs = Ordering costs + stockholding costs
= Ordering costs +(average stock level x total stockholding costs per unit per annum)
= R1 429 ② + (350/2 x R16 ③)
= R1 429 + 2 800
= R4 229

Total relevant costs if the economic order quantity is implemented

Total relevant costs = Ordering costs + stockholding costs
= Ordering costs + (average stock level x total stockholding costs per unit per annum)
= R2 000 ② + (250/2 x R16 ③)
= R2 000 + R2 000
= R4 000

Cost savings = R4 229 - R4 000
= R229

Conclusion:
R229 will be saved if the EOQ model is implemented. (12)

Calculations:

① EOQ $= \sqrt{\frac{2 \times \text{Annual demand} \times \text{Ordering cost per order}}{(\text{Unit price} \times \frac{\text{Interest on capital} - \text{Inflation rate}}{100}) + (\text{Stockholding cost per unit p.a})}}$

$= \sqrt{\frac{2 \times 20\,000 \times R25}{(R50 \times \frac{20 - 8}{100}) + (\frac{20}{100} \times R50)}}$

$= \sqrt{\frac{R1\,000\,000}{R6 + R10}}$ ③

$= \sqrt{\frac{R1\,000\,000}{R16}}$

= 250 metres

The economic order quantity is 250 metres.

② *Ordering costs* = $\frac{\text{Annual demand}}{\text{Order quantity}}$ x cost of placing an order

Current situation = 20 000/350 x R25 = R1 429

Economic order quantity = 20 000/250 x R25 = R2 000

③ *Stockholding costs*

Direct stockholding costs = 20/100 x R50
= R10

Stockholding costs = Unit price x [(interest on capital - inflation rate)/100]
= R50 x (20 - 8)/100
= R6

Total stockholding costs per unit per annum: (R10 + R6) = R16

(b) *Re-order point*

$$\text{Re-order point} = \frac{\text{Annual demand}}{\text{Days in production}} \times \text{Lead time}$$
= 20 000/270 x 10
= 740,74
≈ 741 metres (2)

[14]

!! Remark:

The accountant should consider whether the saving of R229 in this scenario is worth the effort of implementing the EOQ model.