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Paper F5

PERFORMANCE MANAGEMENT

JUNE 2012 EXAMINATIONS

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P2 Corporate Reporting

P3 Business Analysis

P4 Advanced Financial Management

P5 Advanced Performance Management

P6 Advanced Taxation (UK)

P7 Advanced Audit & Assurance

Paper F5

CONTENTS

FORMULAE

Learning curve

$Y = ax^b$

Where Y = cumulative average time per unit to produce x units
a = the time taken for the first unit of output
x = the cumulative number of units
b = the index of learning (log LR/log 2)
LR = the learning rate as a decimal

Regression analysis

$y=a+bx$

$$b=\frac{n\sum xy-\sum x\sum y}{n\sum x^2-(\sum x)^2}$$

$$a=\frac{\sum y}{n}-\frac{b\sum x}{n}$$

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

Demand curve

$P = a - bQ$

$$b = \frac{\text{change in price}}{\text{change in quantity}}$$

a = price when Q = 0

$MR = a - 2bQ$

Chapter 1

ACTIVITY BASED COSTING

1 Introduction

The traditional method of dealing with overheads is to split them between variable overheads and fixed overheads. If we are using absorption costing we then decide on a suitable basis for absorption (e.g. labour hours) and absorb the overheads on that basis.

Activity Based Costing (ABC) attempts to absorb overheads in a more accurate (and therefore more useful) way.

2 The steps to be followed are as follows:

- identify the major activities that give rise to overheads (e.g. machining; despatching of orders)
- determine what causes the cost of each activity – the **cost driver** (e.g. machine hours; number of despatch orders)
- calculate the total cost for each activity – the **cost pool** (e.g. total machining costs; total costs of despatch department)
- calculate an absorption rate for each cost driver
- calculate the total overhead cost for each product manufactured
- calculate the overhead cost per unit for each product

Example 1

Una manufactures three products: A, B, and C.

Data for the period just ended is as follows:

	A	*B*	*C*
Production (units)	20,000	25,000	2,000
Sales price (per unit)	$20	$20	$20
Material cost (per unit)	$5	$10	$10
Labour hours (per unit)	2 hours	1 hour	1 hour

(Labour is paid at the rate of $5 per hour)

Overheads for the period were as follows:

Set-up costs	90,000
Receiving	30,000
Despatch	15,000
Machining	55,000
	$190,000

Cost driver data:

	A	*B*	*C*
Machine hours per unit	2	2	2
Number of set-ups	10	13	2
Number of deliveries received	10	10	2
Number of orders despatched	20	20	20

(a) Calculate the cost (and hence profit) per unit, absorbing all the overheads on the basis of labour hours.

(b) Calculate the cost (and hence profit) per unit absorbing the overheads using an Activity Based Costing approach.

3 Advantages of, and problems with, activity based costing.

Chapter 2

TARGET COSTING

1 Introduction

An important reason for calculating the cost of the product or service is in order to decide on a selling price. There is a chapter later in these notes that covers pricing decisions in detail, but traditionally a very common approach to determining a selling price has been to take the cost and then add on a profit percentage.

One problem with this approach is that it can clearly result in a price that is unacceptable to customers and at the same time provides no direct incentive to cut costs.

Target costing is a more modern and more market driven approach.

2 Target costing

2.1 The steps involved are:

- From research of the market determine a selling price at which the company expects to achieve the desired market share (the target selling price)
- Determine the profit required (e.g. a required profit margin, or a required return on investment)
- Calculate the maximum cost p.u. in order to achieve the required profit (the target cost)
- Compare the estimated actual costs with the target cost. If the actual cost is higher than the target cost then look for ways of reducing costs. If no way can be found of meeting the target cost then the product should not be produced.

Example 1

Packard plc are considering whether or not to launch a new product. The sales department have determined that a realistic selling price will be $20 per unit.

Packard have a requirement that all products generate a gross profit of 40% of selling price.

Calculate the target cost.

Example 2

Hewlett plc is about to launch a new product on which it requires a pre-tax ROI of 30% p.a..

Buildings and equipment needed for production will cost $5,000,000.

The expected sales are 40,000 units p.a. at a selling price of $67.50 p.u..

Calculate the target cost.

3 The use of the target cost

Once the target cost has been determined, it will be compared with the estimated actual cost of production. The excess of the actual cost over the target cost is known as the target cost gap, and the company will then be looking for ways of closing this gap.

4 Possible ways of attempting to close the target cost gap

5 Target costing in service industries

It is much more difficult to use target costing in service industries due to the characteristics of service businesses.

5.1 The five major characteristics that distinguish services from manufacturing are:

Intangibility

Inseparability / Simultaneity

Variability / heterogeneity

Perishability

No transfer of ownership

Chapter 3

LIFE-CYCLE COSTING

1 Introduction

The costs involved in making a product, and the sales revenues generated, are likely to be different at different stages in the life of a product. For example, during the initial development of the product the costs are likely to be high and the revenue minimal – i.e. the product is likely to be loss-making.

If costings (and decision based on the costings) were only to be ever done over the short term it could easily lead to bad decisions.

Life-cycle costing identifies the phases in the life-cycle and attempts to accumulate the costs over the entire life of the product.

2 The product life cycle

2.1 The product life cycle may be divided into five phases:

Development

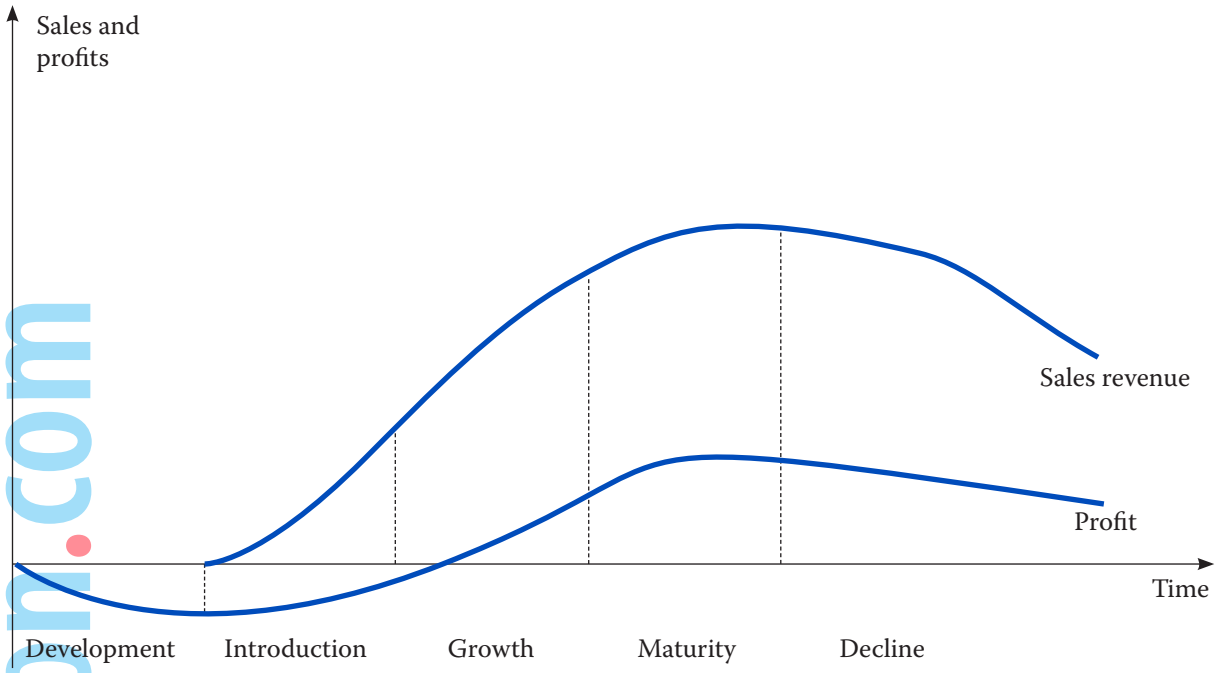
Introduction

Growth

Maturity

Decline

The effect of these can be illustrated diagrammatically as follows:



2.2 Maximising the return over the product life cycle

Design costs out of products

Minimise the time to market

Minimise breakeven time

Maximise the length of the life span

Example 1

A company is planning a new product. Market research suggests that demand for the product would last for 5 years. At a selling price of $10.50 per unit they expect to sell 2,000 units in the first year and 12,000 units in each of the other four years.

The company wishes to achieve a mark up of 50% on cost.

It is estimated that the lifetime costs of the product will be as follows:

1. Manufacturing costs - $6.00 per unit
2. Design and development costs - $60,000
3. End of life costs - $30,000

You are required to:

(a) Calculate the target cost for the product.

(b) Calculate the lifecycle cost per unit and determine whether or not the product is worth making.

It has been further estimated that if the company were to spend an additional $20,000 on design, then the manufacturing costs per unit could be reduced.

(c) If the additional amount on design were to be spent, calculate the maximum manufacturing cost per unit that could be allowed if the company is to achieve the required mark-up.

Chapter 4

ENVIRONMENTAL MANAGEMENT ACCOUNTING

1 Introduction

Environmental management accounting (EMA) focuses on the efficient use of resources, and the disposal of waste and effluent.

In this chapter we will discuss the types of costs faced by businesses, and describe the different methods a business may use to account for these costs.

2 The importance of considering environmental costs

If a company is wasteful in its use of resources, or alternatively causes pollution, then this impacts in three ways:

(a) there is the direct cost to the company of spending more than is needed on resources, or having to spend money cleaning up the pollution

(b) there is the damage to the reputation of the company – consumers are becoming more and more environmentally aware

(c) there are possible fines or penalties as a result of breaking environmental regulations.

For all of the above reasons it is important for the company to attempt to identify and to manage the various costs involved.

3 Typical environmental costs

The cost that comes to the mind of most people immediately are those relating to dealing with waste. However there are many other costs that are likely to be just as important.

For example:

The amount of raw materials used in production. A publisher should consider ways of using less paper (or recyclable paper) as a way of saving costs for themselves as well as helping the environment.

Transport costs. Consideration of alternative ways of delivering goods could perhaps reduce costs and reduce the impact on the environment.

Water and energy consumption. EMA may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings.

4 Different methods of accounting for environmental costs

Although you cannot be required to perform any calculations for this section of the syllabus, you should be able to explain briefly four methods that have been suggested as ways of accounting for environmental costs.

(a) Inflow / Outflow analysis

This approach balances the quantity of resources that is input with the quantity that is output either as production or as waste. Measuring these in physical quantities and in monetary terms forces the business to focus on environmental costs.

(Resources includes not simply raw materials but also energy and water. i.e. all resources)

(b) Flow cost accounting

This is really inflow/outflow analysis (as described above) but instead of applying simply to the business as a whole, it takes into account the organisational structure. Resources input into the business are divided into three categories:

Material: the resources used in storing raw materials and in production

System: the resources used in (for example) storing production and quality control

Delivery and disposal: resources used in delivering to the customer and in disposing of any waste.

As in (a), the aim is to reduce the quantities of resources used, which saves costs for the company and leads to increased ecological efficiency.

(c) Lifecycle costing

This has been discussed in an earlier chapter. The relevance to EMA is that it is important to include environmentally driven costs such as the costs of disposal of waste. It may be possible to design-out these costs before the product is launched.

(d) Environmental Activity Based Costing

Activity Based Costing has been discussed in an earlier chapter. Its application to environmental costs is that those costs that are environment-related (e.g. costs related to a sewage plant) are attributed to joint environmental cost centres.

As with ABC in general, this focusses more attention on these costs and potentially leads to greater efficiency and cost reduction.

Chapter 5

THROUGHPUT ACCOUNTING

1 Introduction

You should previously have studied **limited factor** (or **key factor**) **analysis**. This deals with the situation where several products are being made but where there are limited resources available.

In this chapter we will quickly revise limited factor analysis and then explain how this may be adapted in a modern environment to perhaps a more meaningful approach known as **throughput accounting**.

2 Key Factor Analysis

In a situation where we are manufacturing several products, all of which use the same limited resource, then we need to decide on how best to use the limited resource in production.

The standard key factor approach is to rank the products on the basis of the contribution earned per unit of the limited resources.

Example 1

Pi plc manufactures 2 products, A and B.

The cost cards are as follows:

	A	*B*
Selling price	25	28
Materials	8	20
Labour	5	2
Other variable costs	7	2
Fixed costs	3	2
	23	26
Profit	$2	$2
Machine hours p.u.	2 hrs	1 hr
Maximum demand	20,000 units	10,000 units

The total hours available are 48,000.

Calculate the optimum production plan and the maximum profit using conventional key factor analysis

3 Throughput Accounting

The key factor approach described in the previous section is very sensible, and the throughput approach is effectively the same. However, there are two main concepts of throughput accounting which result in us amending the approach.

3.1 The main concepts of throughput accounting are:

- in the short run, all costs in the factory are likely to be fixed with the exception of materials costs
- in a JIT environment then we should be attempting to eliminate inventories. Use of a limited resource in production of inventories should be avoided and therefore any work-in-progress should be valued at only the material cost

4 Definitions:

- Throughput = sales revenue – material cost
- Total factory costs = all production costs except materials
- Return per factory hour = $\frac{\text{Throughput}}{\text{Time on key resource}}$
- Cost per factory hour = $\frac{\text{Total factory cost}}{\text{Total time available on key resource}}$
- Throughput accounting ratio = $\frac{\text{Return per factory hour}}{\text{Cost per factory hour}}$

4.1 Target for decision making:

The TA ratio should be greater than 1 if a product is to be viable. Priority should be given to those products which generate the highest TA ratios.

Example 2

Pi plc manufactures 2 products, A and B.

The cost cards are as follows:

	A	*B*
Selling price	25	28
Materials	8	20
Labour	5	2
Other variable costs	7	2
Fixed costs	3	2
	23	26
Profit	$2	$2
Machine hours p.u.	2 hrs	1 hr
Maximum demand	20,000units	10,000units

The total hours available are 48,000.

(a) Calculate the optimum production plan and the maximum profit, on the assumption that in the short-term only material costs are variable i.e. using a throughput accounting approach

(b) Calculate the Throughput Accounting ratios

Chapter 6

LIMITING FACTORS

1 Introduction

We have already looked at how to deal with one limited resource – key factor analysis and throughput accounting.

In this chapter we will look at the situation where there is more than one limited resource, and a technique known as linear programming.

You should have studied linear programming before, and so most of this chapter is revision. One extra topic is the calculation of shadow prices – this will be explained later in this chapter.

2 Linear Programming

If there are two or more scarce resources then we are unable to use the Key Factor approach. Instead, we must use Linear Programming.

2.1 The steps are as follows:

(1) Define the unknowns in terms of symbols

(2) Formulate equations for the constraints

(3) Formulate an equation for the objective

(4) Graph the constraints and the objective

(5) Find the optimum solution

Example 1

Peter makes two types of chair – the 'Executive' and the 'Standard'.

The data relating to each as follows:

	Standard	*Executive*
Materials	2 kg	4 kg
Labour	5 hours	6 hours
Contribution	$6	$9

There is a maximum of 80 kg of material available each week and 180 labour hours per week. Demand for 'Standard' chairs is unlimited, but maximum weekly demand for 'Executive' chairs is 10.

Find the optimal production plan and the maximum contribution that this will generate.

3 Spare capacity

In the previous example, there were limits on the resources available. However, there was no requirement to use all of the resources – only that we could not use more than the maximum available.

If the optimum solution results in using less that the maximum available of a particular resource, then we have spare capacity of that resource or slack.

Example 2

Using the information from example 1, calculate the slack for each of the constraints i.e. for materials, for labour, and for demand for 'Executive' chairs.

4 Shadow prices

In real life there are unlikely to be any truly limited resources – it will almost always be possible to get more, but we are likely to have to pay a premium for it. For example, the supply of labour may be limited by the length of the normal working week, but we can get more hours if we are prepared to pay overtime.

The **shadow price** (also known as the **dual price**) of a limited resource is the most extra that we would be prepared to pay for one extra unit of the limited resource. We calculate it by calculating the extra profit that would result if we have one extra unit of the limited resource.

Example 3

Using the information from example 1, calculate the shadow price of each of the contraints i.e. for materials, for labour, and for demand for 'Executive' chairs.

Chapter 7

PRICING

1 Introduction

An important decision for the management accountant is that of fixing a selling price.

In this chapter we will consider the practical considerations that are likely to apply, and also some theoretical calculations that you need to know.

2 Factors influencing selling price

Many factors are relevant when considering what price to charge.

2.1 The main areas to be considered are the following:

- **costs**
- **competitors**
- **customers**

3 Cost plus pricing

Using cost-plus pricing, the selling price is calculated by estimating the cost per unit of a product and adding an appropriate percentage mark-up.

A primary consideration will be as to what is to be regarded as the cost – full cost, marginal cost, or opportunity cost.

3.1 Full cost plus

Full cost includes a share of overheads and also often includes non-production costs.

- **advantages**

- **disadvantages**

3.2 Marginal cost plus

The price of the product is determined by calculating the marginal (or incremental) cost of producing a unit and adding a mark-up.

- **advantages**

- **disadvantages**

3.3 Opportunity cost plus

This is a marginal cost approach but also includes within the cost any opportunities foregone. It is a relevant costing approach.

Example 1

A new product is being launched, and the following costs have been estimated:

Materials	$10 per unit
Labour	$8 per unit
Variable overheads	$5 per unit

Fixed overheads have been estimated to be $50,000 per year, and the budgeted production is 10,000 units per year.

Calculate the selling price based on:

(a) full cost plus 20%

(b) marginal cost plus 40%

4 Optimal pricing – tabular approach

One major disadvantage of a cost plus approach to pricing is that it completely ignores the possible effect of the selling price on the level of demand.

For many products (but not all) it is the case that a higher selling price will result in lower demand, and vice versa.

It could therefore be worthwhile to reduce the selling price and sell more – provided of course that this resulted in a higher total profit.

Example 2

Kennedy plc has established that the price demand relationship is as follows:

S.P. p.u.	*Demand*
16	100
15.5	200
15	300
14.5	400
14	500
13.5	600
13	700

They have also established that the cost per unit for production of jars of coffee is as follows:

Quantity	*Cost p.u.*
100	14.0
200	13.9
300	13.8
400	13.7
500	13.6
600	13.5
700	13.4
800	13.3
900	13.2

Determine the optimal selling price in order to maximise profit

S.P. p.u.	*Demand*	*Cost p.u.*	*Total Revenue*	*Total cost*	*Total profit*	*Marginal Revenue*	*Marginal Cost*

Whichever way you choose to calculate the optimum selling price in the above example, do be aware that it occurs at the point where marginal revenue = marginal cost. You could be specifically asked to use this fact in the examination.

5 Price elasticity of demand

In the previous example, a reduction in the selling price results in an increase in demand (vice versa). This is true of many products, but the effect of selling price on demand will be different for different products. The effect of selling price on demand is also likely to be different for the same product at different levels of selling price.

A measure of the size of the effect on demand of a change in selling price is called the price elasticity of demand.

$$\text{Price elasticity of demand (PED)} = \frac{\%\text{ change in demand}}{\%\text{ change in price}}$$

A high PED means that the demand is very sensitive to changes in price, or **elastic**.

A low PED means that the demand is not very sensitive to changes in price, or **inelastic**.

Example 3

Using the figures from example 2, calculate the price elasticity of demand

if the current selling price is $16 per unit

if the current selling price is $15 per unit

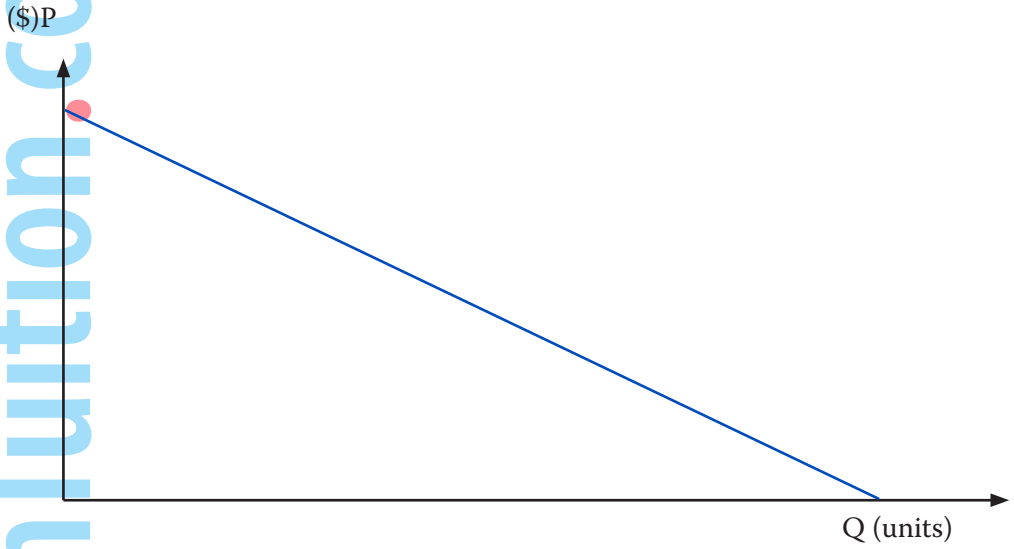
6 Optimal pricing – equations

In section 4, we were presented with the price/demand relationship as a table, and used these figures to calculate the optimum level of selling price from those available.

In principle, it would be possible to have an equation relating the selling price to the demand, and to then solve the problem algebraically.

6.1 Price/demand equation

In the exam you could be asked to derive the price/demand equation yourself from information given, or alternatively you could be given the equation. If you were asked to derive the equation yourself, then it would always be on the basis that the relationship was linear (as is the case in example 2, from inspection).



The equation would therefore be of the form:

P = a – bQ

where P = selling price

Q = quantity demanded at that price

a = theoretical maximum price (if the price is set at 'a' or above, then the demand will be zero)

b = the change in price required to change demand by 1 unit (the gradient of the line)

Example 4

A company sells an article at $12 per unit and has a demand of 16,000 units at this price.

If the selling price were to be increased by $1 per unit, it is estimated that demand will fall by 2,500 units.

On the assumption that the price/demand relationship is linear, derive the equation relating the selling price to the demand.

6.2 Optimal selling price

Having identified the price/demand relationship, it is easy to derive the equation for the revenue at any level – the total revenue will be equal to PQ.

We could then show on a graph the total revenue and total costs for any level of demand. It would be of this sort of shape:

Our objective is to maximise profit. We can do this by calculating the Marginal Revenue and Marginal Cost, and using the fact that the profit is maximised when the two are equal.

Example 5

A company currently has a demand for one of its products of 2000 units at a selling price of $30 per unit.

It has been determined that a reduction in selling price of $1 will result in additional sales of 100 units.

The costs of production are $1000 (fixed) together with a variable cost of $20 per unit.

(Note: see the note at the top of the next page)

Calculate the selling price p.u. at which the profit will be maximised.

Note: **you cannot be required to differentiate in the examination, and therefore the formula for the marginal revenue is given on the formula sheet: MR = a – 2bQ**

Example 6

At a selling price of $100 p.u. the company will sell 20,000 units p.a..

For every $2 change in the selling price, the demand will change by 2,000 units.

The costs comprise a fixed cost of $100,000, together with a variable cost of $5 p.u..

Calculate the selling price p.u. that will result in maximum profit p.a., and the amount of that profit.

7 Pricing strategies

In particular circumstances, for particular reasons, the company may decide on a special strategy with regard to its pricing policy.

You should be aware of the following common strategies, and be able to give examples of circumstances where they may be considered.

- Penetration pricing
- Price skimming
- Product-line pricing / complementary product
- Price discrimination
- Volume discounting

Chapter 8

COST VOLUME PROFIT ANALYSIS

1 Introduction

Cost-volume-profit analysis considers how costs and profits change with changes in the volume or level of activity.

The first part of this chapter should be revision of previous studies. We will then continue to examine the situation where there are several products.

2 Breakeven

Breakeven is the level of activity which gives rise to zero profit. Since profit is the difference between total contribution and fixed costs, breakeven is where the total contribution equals total fixed costs.

$$\text{Breakeven volume} = \frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

Example 1

Product X has variable costs of $2 per unit, and selling price of $6 per unit.
The fixed costs are $1,000 per year

(a) If budgeted sales and production are 300 units, what is the budgeted profit (or loss) for the year?

(b) What is the breakeven point (in units)?

(c) What is the breakeven revenue?

(d) How many units need to be sold to achieve a target profit of $300 per year?

3 Margin of safety

The Margin of Safety measures the %age fall in budgeted sales that can be allowed before breakeven is reached.

$$\text{Margin of safety} = \frac{\text{Budgeted sales - breakeven}}{\text{Budgeted sales}} \times 100\%$$

It is useful in identifying how big a problem any inaccuracy in the budgeted sales is likely to be.

Example 2

Calculate the margin of safety for example 1

4 Contribution to sales ratio

The contribution to sales ratio (or C/S ratio) is calculated as follows:

$$\text{C/S ratio} = \frac{\text{Contribution in \$}}{\text{Sales in \$}}$$

Since the contribution and the sales revenue both vary linearly with the volume, the C/S ratio will remain constant.

[Note: the C/S ratio is sometimes called the profit to volume (or P/V ratio)].

Example 3

Calculate the C/S ratio for example 1

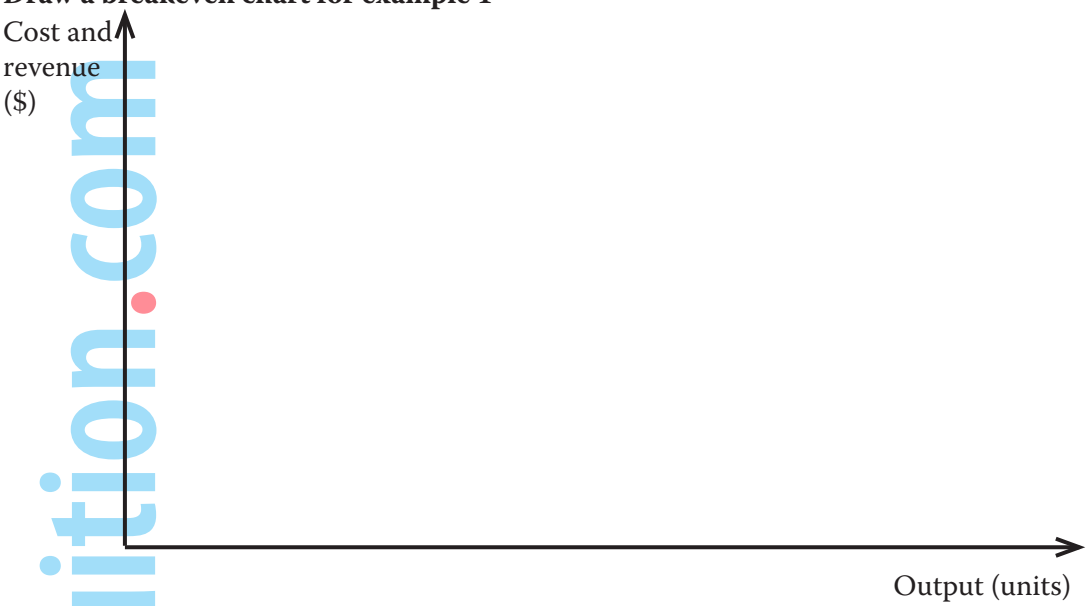
What sales revenue is needed to generate a target profit of $320?

5 Breakeven chart

The breakeven chart plots total costs and total revenues at different levels of volume, and shows the activity level at which breakeven is achieved.

Example 4

Draw a breakeven chart for example 1

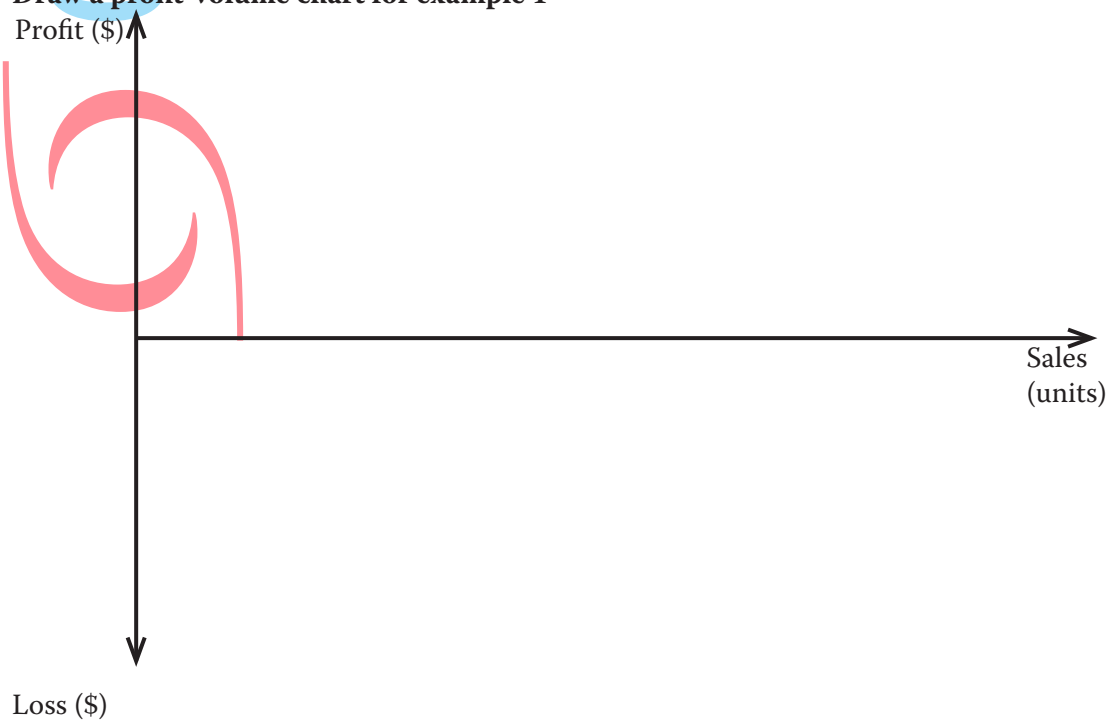


6 Profit-volume chart

The profit volume chart shows the net profit or loss at any level of activity

Example 5

Draw a profit-volume chart for example 1



7 Multi-product CVP analysis

In practice a company is likely to make several products, each with different CS ratios.

They are still likely to be interested in the break-even sales revenue (in order to cover the fixed overheads), but the existence of several products makes it less certain and all we can really do is calculate breakeven on the assumption that the mix of products remains as per the budgeted mix – even if total sales are lower.

However, as will be illustrated in the following example, the company could reach the breakeven position sooner if it were to sell the product with the highest CS ratio first.

Example 6

A company produces and sells three products: C, V and P.
The budget information for the coming year is as follows:

	C	*V*	*P*
Sales (units)	4,800	4,800	12,000
Selling price (p.u.)	$5	$6	$7
Variable cost (p.u.)	$3.75	$5.25	$4.35
Contribution (p.u.)	$1.25	$0.75	$2.65

The total budgeted fixed overheads for the year are $8,000

(a) Calculate the CS ratio for each product individually

(b) Calculate the average CS ratio (assuming that the budget mix of production remains unchanged)

(c) Calculate the breakeven revenue (assuming that the budget mix of production remains unchanged)

(d) Construct a PV chart (assuming that the budget mix of production remains unchanged)

Assuming that the products are produced in order of their CS ratios, contruct a table showing the cumulative revenue and cumulative profits

Calculate the breakeven sales revenue on this basis

Add the information to the P/V chart already produced for Example 6

8 Limitations of CVP analysis

- The selling price per unit is assumed to remain constant at all levels of activity
- The variable cost per unit is assumed to remain constant at all levels of activity
- It is assumed that the total fixed costs remain constant
- It is assumed that the level of production is equal to the level of sales (i.e. that there are no changes in the levels of inventory)

Chapter 9

SHORT-TERM DECISION MAKING

1 Introduction

This chapter looks at various techniques for the making of decision in the short-term. You should be already familiar with them from your previous studies. First we will revise the terminology and then revise the techniques by way of examples.

2 Terminology

2.1 Variable costs

These are costs where the total will vary with the volume. In the case of production costs, the total will vary with the level of production, whereas in the case of selling costs the total will vary with the level of sales.

Normally, the variable cost per unit will be constant, although this is not always the case. In the case of materials cost, it may be that the cost per unit falls with higher quantities due to discounts being received. In the case of labour, again the cost per unit may fall with higher production due to the learning effect (covered in a later chapter).

The total of the variable production costs is also called the marginal cost of production.

2.2 Fixed costs

These are costs where the total will not vary with volume. An example perhaps is factory rent, where the same total rent is payable whether we produce 1 unit or 1,000 units.

2.3 Contribution

The contribution per unit is the difference between the selling price and all variable costs per unit. (Or, alternatively, the profit before charging any fixed costs).

The contribution is of fundamental importance in decision making, because it is this element of profit that will vary with volume – the fixed costs, by definition, staying fixed.

2.4 Avoidable (or discretionary) fixed costs

These are the specific fixed costs of an activity or sector of a business which would be avoided if that activity or sector did not exist. These costs are usually associated with decisions as to whether or not to shut down a sector. If we were to shut down a sector, then any contribution from that area would be lost, but any avoidable fixed costs of that area would be saved.

Note that not all fixed costs are avoidable by shutting down an area. For example, there may be head office fixed costs that remain payable in full even if one sector of the business were to be closed.

2.5 Sunk costs

These are costs that have already been incurred. They are irrelevant for decision making. The reason for this is that in any decision we will be concerned with whether or not the future benefits from the decision will outweigh the future costs. Any costs already incurred will remain payable whatever decision we make.

2.6 Relevant costs

A relevant cost is simply a cost that is relevant to the decision being made. A sunk cost is not a relevant cost for the reasons stated above.

2.7 Opportunity cost

This is the value of a benefit sacrificed when one course of action is taken in preference to an alternative.

For instance, one factor that might be involved in deciding whether or not to launch a new product could be that sales of another existing product may fall. If, as a result we would lose (say) $20,000 of existing contribution, then for the purpose of making the decision about the new product we would consider the $20,000 as being a cost of the new product. (The new product will only be worthwhile if the revenue from it covers not only any direct costs of production but also the $20,000 that we would be losing.)

2.8 Incremental costs

Incremental means extra, or additional. These are any extra costs which would be incurred as a result of the decision and will therefore be relevant to the decision.

3 Shutdown problems

This sort of question is asking for a decision as to whether or not to close part of the business.

EXAMPLE 1

(a) A company manufactures three products, Pawns, Rooks and Bishops. The present net annual income from these is as follows:

	Pawns	*Rooks*	*Bishops*	*Total*
	$	*$*	*$*	*$*
Sales	50,000	40,000	60,000	150,000
Less variable costs	30,000	25,000	35,000	90,000
Contribution	20,000	15,000	25,000	60,000
Less fixed costs	17,000	18,000	20,000	55,000
Profit/loss	3,000	(3,000)	5,000	5,000

The company is considering whether or not to cease selling Rooks. It is felt that selling prices cannot be raised or lowered without adversely affecting net income. $5,000 of the fixed costs of Rooks are direct fixed costs which would be saved if production ceased. All other fixed costs would remain the same.

(b) Suppose, however, that it were possible to use the resources released by stopping production of Rooks to produce a new item, Crowners, which would sell for $50,000 and incur variable costs of $30,000 and extra direct fixed costs of $6,000.

Consider whether the company should cease production and sale of Rooks under each of the scenarios in (a) and (b) above.

4 Relevant costing

This sort of question is really testing that you can determine what information in the question is relevant to the decision, and what information (for example, sunk costs) is irrelevant.

This is not a topic for which you can really learn rules. The main thing is to understand the thought process involved and then to read questions very carefully and to state the assumptions you have made where relavant.

EXAMPLE 2

The managing director of Parser Ltd, a small business, is considering undertaking a one-off contract and has asked her inexperienced accountant to advise on what costs are likely to be incurred so that she can price at a profit. The following schedule has been prepared:

Costs for special order:

	Notes	*$*
Direct wages	1	28,500
Supervisor costs	2	11,500
General overheads	3	4,000
Machine depreciation	4	2,300
Machine overheads	5	18,000
Materials	6	34,000
		98,300

Notes:

1. Direct wages comprise the wages of two employees, particularly skilled in the labour process for this job, who could be transferred from another department to undertake work on the special order. They are fully occupied in their usual department and sub-contracting staff would have to be bought-in to

undertake the work left behind. Subcontracting costs would be $32,000 for the period of the work. Different subcontractors who are skilled in the special order techniques are available to work on the special order and their costs would amount to $31,300.

2. A supervisor would have to work on the special order. The cost of $11,500 is comprised of $8,000 normal payments plus $3,500 additional bonus for working on the special order. Normal payments refer to the fixed salary of the supervisor. In addition, the supervisor would lose incentive payments in his normal work amounting to $2,500. It is not anticipated that any replacement costs relating to the supervisor's work on other jobs would arise.
3. General overheads comprise an apportionment of $3,000 plus an estimate of $1,000 incremental overheads.
4. Machine depreciation represents the normal period cost based on the duration of the contract. It is anticipated that $500 will be incurred in additional machine maintenance costs.
5. Machine overheads (for running costs such as electricity) are charged at $3 per hour. It is estimated that 6000 hours will be needed for the special order. The machine has 4000 hours available capacity. The further 2000 hours required will mean an existing job is taken off the machine resulting in a lost contribution of $2 per hour.
6. Materials represent the purchase costs of 7,500 kg bought some time ago. The materials are no longer used and are unlikely to be wanted in the future except on the special order. The complete inventory of materials (amounting to 10,000 kg), or part thereof, could be sold for $4.20 per kg. The replacement cost of material used would be $33,375.

Because the business does not have adequate funds to finance the special order, a bank overdraft amounting to $20,000 would be required for the project duration of three months. The overdraft would be repaid at the end of the period. The bank's overdraft rate is 18%.

The managing director has heard that, for special orders such as this, relevant costing should be used that also incorporates opportunity costs. She has approached you to create a revised costing schedule based on relevant costing principles.

Adjust the schedule prepared by the accountant to a relevant cost basis, incorporating appropriate opportunity costs.

5 Make or Buy decisions

In order to overcome problems of limited resources, a firm may buy in a product instead of making it itself.

Where incremental costs of manufacture are less than those of buying in, the firm should make – assuming that there are not limited resources.

Where resources are limited, the firm should concentrate on making those products which give the greatest saving (over buying in) per unit of the scarce resource.

To decide which products should be made and which should be bought, we calculate the saving per unit of scarce resource from making the product rather than buying it in.

Example 3

The availability of Material B is limited to 8,000 kg

Product	*X*	*Y*	*Z*
Demand (units)	2,000	2,500	4,000
Variable cost to make ($ per unit)	10	12	14
Buy-in price ($ per unit)	13	17	16
Kg of B required per unit (included in variable cost)	3	2	1

Which products should the company make and which should it buy?

Chapter 10

RISK AND UNCERTAINTY

1 Introduction

Decision making involves making decisions now which will affect future outcomes which are unlikely to be known with certainty.

Risk exists where a decision maker has knowledge that several possible outcomes are possible – usually due to past experience. This past experience enables the decision maker to estimate the probability or the likely occurrence of each potential future outcome.

Uncertainty exists when the future is unknown and the decision maker has no past experience on which to base predictions.

Whatever the reasons for the uncertainty, the fact that it exists means that there is no 'rule' as to how to make decisions. For the examination you are expected to be aware of, and to apply, several different approaches that might be useful.

2 Risk preference

As will be illustrated by an example, the approach taken to make the decision will depend on the decision-makers attitude to risk.

A risk seeker will be interested in the best possible outcome, no matter how small the change that they may occur.

Someone who is risk neutral will be concerned with the most likely or 'average' outcome.

A risk avoider makes decisions on the basis of the worst possible outcomes that may occur.

Example 1

John has a factory capacity of 1,200 units per month.

Units cost him $6 each to make and his normal selling price is $11 each. However, the demand per month is uncertain and is as follows:

Demand	*Probability*
400	0.2
500	0.3
700	0.4
900	0.1

He has been approached by a customer who is prepared to contract to a fixed quantity per month at a price of $9 per unit. The customer is prepared to sign a contract to purchase 300, 500, 700 or 800 units per month.

The company can vary production levels during the month up to the maximum capacity, but cannot carry forward any unsold units in inventory.

(a) Calculate all possible profits that could result

(b) Determine for what quantity John should sign the contract, under each of the following criteria:

i) expected value
ii) maximin
iii) maximax
iv) minimax regret

(c) What is the most that John would be prepared to pay in order to obtain perfect knowledge as to the level of demand?

3 The limitations of expected values.

Although we say that someone who is risk neutral would take an expected value approach to decision making, there are two serious limitations of this approach:

4 Decision Trees

A decision tree is a diagrammatical representation of the various alternatives and outcomes. It is relevant when using an expected value approach and where there are several decisions to be made – it makes the approach more understandable.

Example 2

Combi plc are having problems with one of their offices and have decided that there are three courses of action available to them:

(a) shut down the office, raising proceeds of $5 million
(b) have an expensive refurbishment of the office costing $4,000,000
(c) have a cheaper refurbishment of the office at a cost of $2,000,000

If they do the expensive refurbishment, then a good result will yield a return of $13,500,000 whereas a poor result will yield a present value of only $6,500,000.

If they alternatively decide to do the cheaper refurbishment, then a good result will yield a return of $8,500,000 whereas a poor result will yield $4,000,000.

In either case, the probability of the refurbishment achieving a good result has been estimated to be 2/3.

An independent company has offered to undertake market research for them in order to identify in advance whether the result of refurbishment is likely to be good or poor. The research will cost $200,000 and there is a 68% probability that it will indicate a good result.

Unfortunately, the research cannot be guaranteed to be accurate. However, if the research indicates a good result, then the probability of the actual result being good is 91%.
If the survey indicates a poor result, then the probability of the actual result being good is 13%.

Combi have already decided that if they do have market research, and if the research indicates a poor result, then they will only be prepared to consider the cheaper refurbishment.

Use a decision tree to recommend what actions should be taken.

Note: In this example, the market research is not guaranteed to be accurate. This is likely to be the case in real life and is an example of **imperfect knowledge**

Chapter 11

BUDGETING

1 Introduction

Budgeting is an essential tool for the management accounting in both planning and controlling future activity. In this chapter we will discuss the benefits of budgeting, the types of budget, and the preparation of budgets.

2 Benefits of budgeting

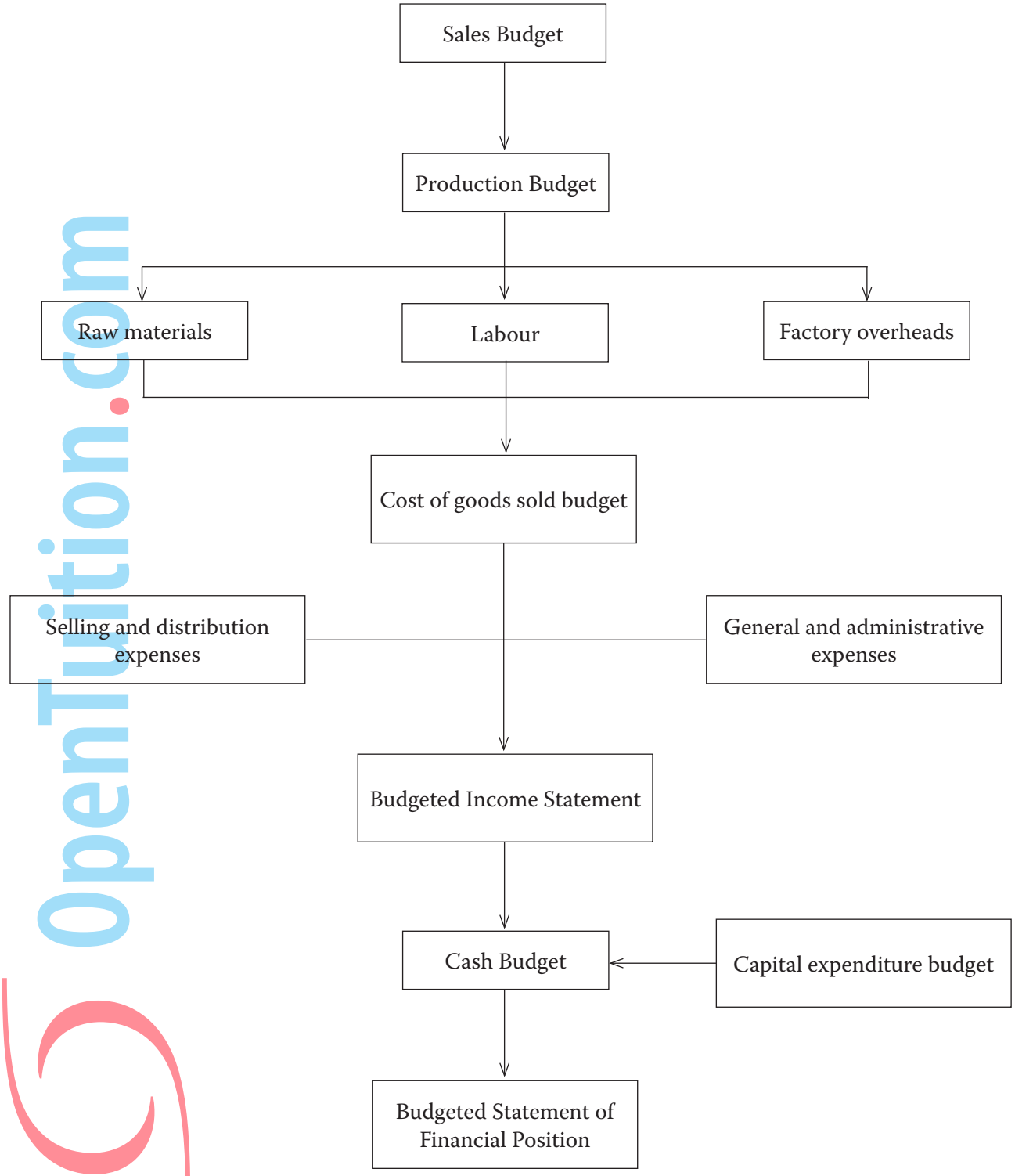
- Planning
- Co-ordination
- Control
- Authorising and delegating
- Evaluation of performance
- Communicating and motivating

3 Principal budget factor

The principal budget factor is the factor that limits the activity for the budget period. Normally this is the level of sales and therefore the sales budget is usually the first budget to be prepared and this leads to the others.

However, it could be (for example) a limit on the availability of raw materials that limits activity. In this case Raw Materials would be the principal budget factor, and this would the first budget to be prepared.

4 The preparation of budgets



Example 1

The XYZ company produces three products, X, Y, and Z. For the coming accounting period budgets are to be prepared using the following information:

Budgeted sales

Product X 2000 units at $100 each

Product Y 4000 units at $130 each

Product Z 3000 units at $150 each

Standard usage of raw material

	Wood (kg per unit)	*Varnish (litres per unit)*
Product X	5	2
Product Y	3	2
Product Z	2	1
Standard cost of raw material	$8	$4

Inventories of finished goods

	X	*Y*	*Z*
Opening	500u	800u	700u
Closing	600u	1000u	800u

Inventories of raw materials

	Wood	*Varnish*
Opening	21,000	10,000
Closing	18,000	9,000

Labour

	X	*Y*	*Z*
Standard hours per unit	4	6	8

Labour is paid at the rate of $3 per hour

Prepare the following budgets:

(a) Sales budget (quantity and value)

(b) Production budget (units)

(c) Material usage budget (quantities)

(d) Material purchases budget (quantities and value)

(e) Labour budget (hours and value)

5 Types of budget

Fixed budget

Flexed budget

Rolling budget

Example 2

A company has prepared the following fixed budget for the coming year.

Sales	10,000 units
Production	10,000 units

	$
Direct materials	50,000
Direct labour	25,000
Variable overheads	12,500
Fixed overheads	10,000
	$97,500

Budgeted selling price $10 per unit.

At the end of the year, the following costs had been incurred for the actual production of 12,000 units.

	$
Direct materials	60,000
Direct labour	28,500
Variable overheads	15,000
Fixed overheads	11,000
	$114,500

The actual sales were 12,000 units for $122,000

(a) Prepare a flexed budget for the actual activity for the year

(b) Calculate the variances between actual and flexed budget, and summarise in a form suitable for management. (Use a marginal costing approach)

6 Methods of budgeting

6.1 Incremental budgeting

This approach is to take the previous years results and then to adjust them by an amount to cover inflation and any other known changes.

It is the most common approach, is a reasonably quick approach, and for stable companies it tends to be fairly accurate.

However, one large potential problem is that it can encourage the continuation of previous problems and inefficiencies.

The reason for this is that the budget is a plan for the coming year – not simply a financial forecast.

If we require a wages budget, we will probably ask the wages department to produce it and they (using an incremental approach) will assume that our workers will continue to operate as before. They will therefore simply adjust by any expected wage increases.

As a result, the 'plan' for our workers stays the same as before. Nobody has been encouraged to consider different ways of operating that may be more efficient. It is at budget time that we perhaps should be considering different ways of operating.

6.2 Zero-based budgeting

With zero-based budgeting we do not consider the previous period. Instead, we consider each activity on its own merits and draw up the costs and benefits of the different ways of performing it (and indeed whether or not the activity should continue).

We then decide on the most effective way of performing each activity.

Clearly any changes to the way an activity is performed may require funding, and there may not be sufficient funding available for all changes proposed, and therefore they are ranked to decide which changes are made.

Although this approach is in principle a much better approach to budgeting, it is time-consuming and also requires much more expertise than incremental budgeting. For this reason, it is often restricted just to a few activities each year in order that training and help may be given to the people involved. Other activities are budgeted using the incremental approach.

7 Behavioural aspects

7.1 Participation

If the budget process is not handled properly, it can easily cause dysfunctional activity. It is therefore necessary to give thought to the behavioural aspects.

- **Top-down budgeting**

  This is where budgets are imposed by top management without the participation of the people who will actually be involved for implementing it.

- **Bottom-up budgeting**

  Here the budget-holders do participate in the setting of their own budgets.

- **Advantages and disadvantages**

7.2 Target setting and motivation

Targets can assist motivation and appraisal if they are set at the right level.

- if they are too difficult then they will demotivate
- if they are too easy then managers are less likely to strive for optimal performance
- ideally they should be slightly above the anticipated performance level

Good targets should be:

- agreed in advance
- dependant on factors controllable by the individual
- measurable
- linked to appropriate rewards and penalties
- chosen carefully to ensure goal congruence

7.3 Responsibility accounting

A system of accounting that separates revenues and costs into areas of separate responsibility, which can then be assigned to specific managers

7.4 Management by objectives

A system of management incorporating clearly established objectives at every level of the organisation.

Here there is less emphasis on monetary budgets and more emphasis on taking action which helps the business to achieve its objectives.

Chapter 12

QUANTITATIVE ANALYSIS IN BUDGETING

1 Introduction

In this chapter we will look at numerical techniques that can be useful in the preparation of budgets.

The first two you should have studied before, but the other techniques are new.

2 Cost estimation

We assume always that there are two types of costs – variable costs and fixed costs.

In practice, there are many costs which are semi-variable, i.e. part of the cost is fixed and part variable.

For budgeting purposes it is important to identify the variable and the fixed elements.

You need to be aware of two approaches – the **high-low method**, and **regression analysis**.

3 High-low method

The high-low method is a very quick and simple approach to identifying the variable and fixed elements of costs.

This approach assumed that there is a linear relationship and uses just the highest and lowest observation for calculating the costs.

Example 1

The following table shows the number of units produced each month and the total cost incurred:

	Units	*Cost ($)*
January	100	40,000
February	400	65,000
March	200	45,000
April	700	85,000
May	600	70,000
June	500	70,000
July	300	50,000

Estimate the variable cost per unit, and the fixed cost per month

This approach is very simplistic. It assumes that the relationship is perfectly linear.

4 Regression analysis

A problem with the high-low approach is that unless the relationship is perfectly linear, the result is at best a rough approximation – it can be distorted greatly by the high or the low observation being unusual.

Regression analysis still assumes that the basic relationship is approximately linear, but arrives at a best estimate of the relationship by considering all of the observations.

4.1 Regression

If there is a reasonable degree of linear correlation between two variables, we can use regression analysis to calculate the equation of the best fit for the data.

This is known as **least squares linear regression**.

If the equation relating two variable, x and y, is

$y = a + bx$

then the values of a and b may be calculated using the following formulae (which are given in the examination)

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2}$$

$$a = \frac{\sum y}{n} - \frac{b\sum x}{n}$$

Example 2

The following table shows the number of units produced each month and the total cost incurred:

	Units	*Cost ($)*
January	100	40,000
February	400	65,000
March	200	45,000
April	700	85,000
May	600	70,000
June	500	70,000
July	300	50,000

Calculate the regression line, y = a + bx

4.2 Problems with regression analysis

4.3 The correlation coefficient.

Pearson's correlation coefficient is a measure of how linear the relationship between variables is.

A correlation coefficient of +1 indicates perfect positive linear correlation, whereas -1 indicates perfect negative linear correlation.

The further away from + or – 1, the less linear correlation exists.

The correlation coefficient may be calculated using the following formula (which is given to you in the examination)

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

EXAMPLE 3

Using the data in example 2, calculate the correlation coefficient.

4.4 Coefficient of determination

The **coefficient of determination** is the square of the coefficient of correlation (r2).

It is a measure of how much of the variation in the dependent variable is 'explained' by the variation of the independent variable.

5 Time series analysis

Managers often wish to look at the trend of costs or sales over time as a basis for forecasting the future. It is unlikely in practice that past results will follow a smooth pattern, for various reasons.

Of particular interest to us are seasonal variations which we can attempt to identify.

5.1 Definitions

Time series: A set of observations taken at equal intervals of time e.g. monthly

Variations in observations:

Trend: The underlying pattern of a time series when the short term fluctuations have been smoothed out.

Cyclical Variations: The wave-like appearance of a number of time series graph when taken over a number of years. Generally this correspondents to the influence of booms and slumps in the industry.

Seasonal variations: The regular rise and fall over shorter periods of time. For example, umbrella sales are likely to be higher than average every winter and lower than average every summer.

Random (residual) variations: These are other, unpredictable variations.

5.2 Moving averages

In order to estimate the trend and the seasonal variations, we use the method of moving averages.

Example 4

Set out below are the sales per quarter (in 000's of units) of a company over the last 3 years.

	Quarter			
	1	2	3	4
2000	80	87	82	90
2001	90	95	93	102
2002	105	112	103	116

Identify the trend and calculate the average seasonal variation.

5.3 The multiplicative model

In the previous example we calculated the seasonal variations in terms of units.

However, if the trend is increasing it would perhaps be more sensible to accept an increasing seasonal variation.

The multiplicative model deals with this by measuring the seasonal variation as actual as a percentage of trend.

EXAMPLE 5

Using the data from example 2 together with the trend already calculated, calculate the average seasonal variation using the multiplicative model.

6 Learning curves

Both of the two previous techniques assume that the total variable cost is reasonably linear – that the variable cost per unit is fixed.

In the case of labour, this is very often not the case in the early stages of a new product. If we were intending to start production of a new product, then the obvious thing to do would be to produce a prototype in order to assess how long it would take to produce each unit. However, this would be dangerous because as we were to produce more and more units it is likely that the time taken for each unit would reduce as the workers gained experience. This reduction in time per unit is known as the learning effect.

6.1 Conditions

The theory of learning curves will only hold if the following conditions apply:

(a) There is a significant manual element in the task being considered.

(b) The task must be repetitive.

(c) Production must be at an early stage so that there is room for improvement.

(d) There must be consistency in the workforce.

(e) There must not be extensive breaks in production, or workers will 'forget' the skill.

(f) Workforce is motivated.

6.2 Theory

As cumulative output doubles, the cumulative average time per unit falls to a given percentage of the previous average time per unit.

Example 6

The time taken to produce the first unit is 100 hours.

There is a learning rate of 75%.

How long will it take to produce an additional 7 units?

6.3 Steady State

Eventually, the time per unit will reach a steady state where no further improvement can be made.

6.4 Cessation of learning effect

Practical reasons for the learning effect to cease are:

(a) When machine efficiency restricts any further improvement

(b) The workforce reach their physical limits

(c) If there is a 'go-slow' agreement among the workforce

6.5 Formula

$y = ax^b$

where y = cumulative average time per unit

x = cumulative output

a = time taken for 1st

b = a learning factor which is given by the formula $\frac{\log r}{\log 2}$

r = learning rate expressed as a %.

EXAMPLE 7

Flogel Ltd has just produced the first full batch of a new product taking 200 hours.

Flogel has a learning curve effect of 85%.

(a) How long will it take to produce the next 15 batches?

(b) Flogel expects that after the 30th batch has been produced, the learning effect will cease.

From the 31st batch onwards, each batch will take the same time as the 30th batch. What time per batch should be budgeted?

Chapter 13

STANDARD COSTING AND BASIC VARIANCE ANALYSIS

1 Introduction

In an earlier chapter we stated that one important use that is made of budgets is that of controlling. As the company progresses through the year, the budget gives us something to which we can compare the actual results in order to help identify any problems. Having identified problems we can then investigate as to whether or not these problems can be controlled in the future.

In this chapter we will look at the setting of standard costs for these purposes and also revise from your earlier studies the calculations of variances (or differences) between actual and budgeted results.

2 Standard costs

Standard costing is a system of accounting based on pre-determined costs and revenue per unit which are used as a benchmark to assess actual performance and therefore provide useful feedback information to management.

Illustration 1

Standard cost card for Product X

		$ per unit
Sales price		100
Materials	(2 kg @ $20/kg)	40
Labour	(1.5 hrs @ $2/hr)	3
Variable o/h	(1.5 hrs @ $6/hr)	9
Fixed o/h	(1.5 hrs @ $10/hr)	15
Standard cost of production		67
Standard profit per unit		33

2.1 Uses of standard costing

- inventory valuation (for internal and/or external use)
- as a basis for pricing decisions
- for budget preparation
- for budgetary control
- for performance measurement
- for motivating staff using standards as targets

2.2 Limitations of standard costing

- accurate preparation of standards can be difficult
- it may be necessary to use different standards for different purposes (see next section)
- less useful if not mass production of standard units
- traditional standards are based on companys own costs – a more modern approach is benchmarking, where the practices of other organisations are taken into account
- the use of standard costing can lead to an over-emphasis on quantitative measures of performance at the expense of qualitative measures (e.g. customer satisfaction; employee morale)

2.3 Types of standards

Ideal standard

Calculated assuming that perfect conditions apply.

E.g. 100% efficiency from men and from machines.

Could form the basis for long-term aims, but not useful for variance analysis because unattainable.

Basic standard

This is a long-run underlying average standard.

It is only really of use in very stable situations where there are unlikely to be fluctuations in prices, rates etc..

Expected standard

This is a standard expected to apply to a specific budget period and is based on normal efficient operating conditions.

This is used for variance analysis routine reporting. However, it may be too 'easy' to be used as a target.

Current standard

This is the current attainable standard which reflects conditions actually applying in the period under review.

This should be used for performance appraisal, but the calculation of a 'fair' current standard can be complicated and time-consuming.

3 Variance analysis

In the chapter on budgeting, we looked at the comparison between the actual results for a period and the flexed budget. The differences between the two are know as the variances.

In this section we will repeat the exercise, and then analyse them into their different components. If we are to investigate variances properly and use them for control, then it is important that we should analyse the reasons for their occurrence.

3.1 Total variances

Example 1

A company has prepared the following standard cost card:

	$ per unit
Materials (4 kg at $4.50 per kg)	18
Labour (5 hrs at $5 per hr)	25
Variable overheads (5 hrs at $2 per hr)	10
Fixed overheads (5 hrs at $3 per hr)	15
	$68

Budgeted selling price $75 per unit.

Budgeted production	8,700 units
Budgeted sales	8,000 units

There is no opening inventory

The actual results are as follows:

Sales:	8,400 units for $613,200
Production:	8,900 units with the following costs:

Materials (35,464 kg)	163,455
Labour (45,400 hrs paid, 44,100 hrs worked)	224,515
Variable overheads	87,348
Fixed overheads	134,074

Prepare a flexed budget and calculate the total variances

3.2 Analysis of variances

The total variance that we have calculated for materials indicates that the actual expenditure on materials was not $18 per unit. However, this could be either because we used the wrong amount of materials (which should have been 4 kg per unit) or that we paid the wrong price (which should have been $4.50 per kg). More likely of course, it would be a combination of the two.

We will therefore analyse this and the other variances in as much detail as possible.

EXAMPLE 2

Using the data from example 1, analyse the variances and use them to produce on Operating Statement reconciling the budgeted profit with the actual profit.

3.3 Marginal costing

In the previous example, the company had been using absorption costing. They could alternatively have used marginal costing. The variances will be calculated in very much the same way, but when using marginal costing the focus is on contribution (rather than profit) and the fact that we will not be absorbing fixed overheads means that any fixed overhead volume variance is not relevant.

Example 3

Using data from example 1

(a) prepare the original fixed budgets using marginal costing

(b) prepare an Operating Statement using a marginal costing approach

3.4 Interpretation of variances

Example 4

In the previous example there was a materials price variance.

Suggest possible reasons for its occurrence.

Chapter 14

MORE VARIANCE ANALYSIS

1 Introduction

In this chapter we will look more at variances and three ways of making them more useful to management.

Planning and Operational variances involve further analysis of the variances to assist management in deciding where more investigation should be focussed; whereas Mix and Yield variances looks at a specific situation where conventional variances might be misleading; and finally we will take another look at labour idle time variables.

2 Planning and Operational variances

We discussed in the previous chapter that the purpose of variance analysis is to assist management in exercising control by identifying areas where perhaps there are operational problems.

We also discussed possible reasons for variances. Although these included factors such as inefficiency of the workforce – a factor that perhaps may be controlled for the future – they also included factors such as an increase in raw material prices and an incorrect standard having been used in the budgets. These last two are examples of factors that certainly can not be controlled and where it would be silly to waste time re-investigating each month. It would make more sense to compare actual results with a standard that reflects any changed conditions and is therefore realistic.

2.1 Planning variance (or revision variance)

This is a classification of variances calculated by comparing the original budget (or ex **ante budget**) to a budget revised for any permanent changes to a more realistic budget (**ex post** budget).

Operational variance

This is a classification of variances calculated by comparing actual performance with a revised (or ex post) budget. These variances are worth investigating more as they are variances caused by operating factors that potentially might be controllable.

Example 1

Letia plc manufacture and sell a single product, The company uses a standard marginal costing system, and the standard cost per unit is as follows:

	$
Materials (1 litre @ $1 per litre)	1.00
Labour (2 hours @ $2.50 per hour)	5.00
Variable overheads	1.40
Standard cost	7.40
Standard contribution	8.60
Standard selling price	16.00

Budgeted production and sales for 2002 were 5,000 units. The budgeted fixed overhead was $20,000.

During 2002 the actual production was 5,200 units, and 5,100 units were sold for $81,000.

Actual production costs were:

Materials (5,150 litres)	$5,120
Labour (10,200 hours)	$27,400
Variable overheads	$7,000
Fixed overheads	$19,500

During 2002 the following was ascertained:

(a) material usage should have been budgeted at 1.2 litres per unit at a price of $0.95 per litre

(b) the labour rate of pay was increased at the start of the year to $2.60 per hour

(c) in the industry as a whole, sales of Letia's product were 10% lower than forecast

You are required to produce an operating statement, analysing variances between planning variances and operational variances.

Example 2

Original Budget:
Standard cost of materials:
8kg at $4 per kg = **$32** per unit
Budget production: 20,000 units

Actual results:
Production 24,000 units
Materials: 190,000kg for $769,500

Since preparation of the budget, the price per kg had increased to $4.10 and the usage had been revised to 7.5 kg per unit.

Calculate the planning and operational variances, and analyse each into expenditure and usage variances

3 Mix and Yield variances

3.1 It is quite common in practice for one product to use several different materials.

For example, a desk may use wood for the top and metal for the legs.

For each of the materials we can calculate price and usage variances in the normal way, and usually this is sufficient for our purpose.

However, suppose we were manufacturing a mixed fruit juice that contained a mixture of strawberry juice and banana juice. To calculate usage variances for each material separately would be of little use – if we used less strawberry juice than budgeted, we would automatically use more banana juice. We would therefore end up with one variance favourable and one adverse, and yet the overall effect on costs could be either favourable or adverse depending on which juice was the most expensive.

In this situation, when the materials may be substituted for each other (or are **substitutable**) then we look at all the materials together and analyse the usage variance into the following variances:

- **mix variance**

  this shows the effect of changing the proportions of the mix of materials input into the process

- **yield variance**

  this shows the difference between the actual and expected output or yield from the process

Example 3

The standard material cost per unit of a product is as follows:

		$
Material X	2 kg @ $3 per kg	6
Material Y	1 kg @ $2 per kg	2
		8

The actual production during the period was 5,000 units and the materials used were:

Material X	9,900 kg costing $27,000
Material Y	5,300 kg costing $11,000

Calculate the total materials cost variance; the materials price variance; the materials usage variance; the mix variance; and the yield variance.

3.2 Other mix variances

Although the calculation of mix variances most commonly relates to materials, exactly the same sort of situation could be relevant for labour if there were more than one grade (paid at different rates) that were substitutable.

The approach would be exactly the same as for materials.

Slightly less obvious (although essentially the same approach) is the situation where sales are 'substitutable'.

For example, suppose a company sold two types of desk which although similar had different profit margins. Clearly the company would hope for higher sales, but they would also be interested in the mix of sales – it would be better if customers bought more of the desks giving higher profit p.u., even if it were to mean selling fewer of the desks that gave lower profit p.u..

Again, in this situation, the approach used for materials may be useful.

Example 4

Olga plc sells three products – A, B and C.

The following table shows the budget and actual results for these products:

	A	*B*	*C*
Budget:			
Sales (units)	200	100	100
Price (p.u.)	$20	$25	$30
Cost (p.u.)	$17	$21	$24
Actual:			
Sales (units)	180	150	170
Price (p.u.)	$22	$22	$26
Cost (p.u.)	$16	$18	$25

Calculate the total sales margin variance, and analyse into the sales price variance; the sales mix variance; and the sales quantity variance.

4 Advanced Idle Time variances

When we looked at labour variances in the previous chapter, we said that any difference between the hours paid and the hours worked was Idle Time.

However, since there is likely to be some idle time in almost every business, it would be more sensible to build some idle time into the budget and then an idle time variance would only occur if the actual idle time were more or less than budgeted.

We will look at the 'rules' with an example.

Example 5

A company budgets that each unit will take 7.6 hours to make.
It budgets on paying workers at the rate of $5.70 per hour, and that 5% of the hours paid for will be idle.
The actual results (for production of 1000 units) are:

Hours paid:	8,200 hours at a cost of $50,020
Hours worked:	7,740 hours

You are required to:
(a) Calculate what will appear on the standard cost card as the labour cost per unit
(b) calculate the effective standard cost per hour worked
(c) calculate the total labour variance
(d) Analyse the total variance into rate of pay, idle time, and efficiency variances.

Chapter 15

FINANCIAL PERFORMANCE MEASUREMENT

1 Introduction

Financial statements are prepared to assist users in making decisions. They therefore need interpreting, and the calculation of various ratios makes it easier to compare the state of a company with previous years and with other companies.

In this chapter we will look at the various ratios that you should learn for the examinations.

2 The main areas

When attempting to analyse the financial statements of a company, there are several main areas that should be looked at:

Profitability

Liquidity

Gearing

The importance of each area depends on whose behalf that we are analysing the statements.

We will work through an example to illustrate the various ratios that you should learn under each heading.

3 Worked example

EXAMPLE 1

Statements of Financial Position as at 31 December

	2007		*2006*	
	$	*$*	*$*	*$*
ASSETS				
Non-current assets				
Tangible assets		1,341		826
Current assets				
Inventory	1,006		871	
Trade receivables	948		708	
Cash	360		100	
		2,314		1,679
TOTAL ASSETS		3,655		2,505
LIABILITIES AND CAPITAL				
Capital and reserves				
$1 ordinary shares	1,200		720	
Retained profit	990		681	
		2,190		1,401
Non-current liabilities				
10% loan 2015		500		400
Current liabilities				
Trade payables	653		516	
Tax payable	228		140	
Dividends payable	84		48	
		965		704
TOTAL LIABILITIES AND CAPITAL		3,655		2,505

Income statement for the year ended 31 December

	2007	*2006*
	$	*$*
Revenue	7,180	5,435
Cost of sales	5,385	4,212
Gross profit	1,795	1,223
Distribution costs	335	254
Administrative expenses	670	507
Profit from operations	790	462
Finance costs	50	52
Profit before taxation	740	410
Company tax expense	262	144
Profit after taxation	478	266
Dividends	169	95
Retained profit for the period	309	171

You are required to calculate the profitability, liquidity and gearing ratios.

Profitability

$$\text{Net profit margin} = \frac{\text{Profit before interest and tax}}{\text{Revenue}}$$

$$\text{Gross profit margin} = \frac{\text{Gross profit}}{\text{Revenue}}$$

$$\text{Return on capital employed} = \frac{\text{Profit before interest and tax}}{\text{Total long term capital}}$$

(= capital + reserves + long-term liabilities)

$$\text{Asset turnover} = \frac{\text{Revenue}}{\text{Total long term capital}}$$

NB: ROCE = asset turnover × net profit margin

Liquidity

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick ratio (or acid test)} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

$$\text{Inventory days} = \frac{\text{Inventory}}{\text{Cost of sales}} \times 365 \text{ days}$$

$$\text{Average collection period (receivables days)} = \frac{\text{Trade receivables}}{\text{Revenue}} \times 365 \text{ days}$$

$$\text{Average payment period (payables days)} = \frac{\text{Trade payables}}{\text{Purchases}} \times 365 \text{ days}$$

Gearing

$$\text{Gearing} = \frac{\text{Long term liabilities}}{\text{Shareholders' funds}} \%$$

4 Limitations of ratio analysis

You must learn the various ratios, however, it is important that you are able to discuss briefly the relevance of the various ratios, and also their limitations.

Very few of the ratios mean much on their own – most are only useful when compared with the ratios for previous years or for similar companies.

Many of the ratios use figures from the Statement of Financial Position. These only represent the position at one point in time, which could be misleading. For example, the level of receivables could be unusually high at the year end, simply because a lot of invoicing was done just before the year end. Perhaps more sensible in that sort of case would be to use the average for the year. Normally in the examination you will be expected simply to use Statement of Financial Position figures at the end of the year, but do be prepared to state the problem if relevant.

Chapter 16

NON-FINANCIAL PERFORMANCE MEASUREMENT

1 Introduction

We have looked separately at measures of financial performance. However, it is important to have a range of performance measures considering non-financial as well as financial matters. This is particularly important in the case of service industries where such things as quality are of vital importance if the business is to grow in the long-term.

In this chapter we will consider the various areas where performance measures are likely to be needed.

Various authors have summarized the areas in different ways – the two that you are expected to be aware of are Fitzgerald and Moons building blocks; and Kaplan and Nortons Balanced Scorecard.

2 Fitzgerald and Moon

Fitzgerald and Moon focussed on performance measurement in service businesses. They suggested the following areas needing measures of performance:

- **Financial performance**
- **Competitive performance**
- **Quality**
- **Flexibility**
- **Resource utilisation**
- **Innovation**

3 Kaplan and Norton's Balanced Scorecard

The balanced scorecard (developed by Kaplan and Norton 1992) views the business from four perspectives and aims to establish goals for each together with measures which can be used to evaluate whether these goals have been achieved.

3.1 Possible Measures

Perspective	*Question*	*Possible Measures*
Customer Perspective	What do existing and potential customers value from us?	◆ % Sales from new customers ◆ % On time deliveries ◆ % Orders from enquiries ◆ Customers survey analysis
Internal Business Perspective	What process must we excel at to achieve our customer and financial objectives?	◆ Unit cost analysis ◆ Process/cycle time ◆ Value analysis ◆ Efficiency
Learning and Growth Perspective	How can we continue to improve and create future value?	◆ Number of new products introduced ◆ Time to market for new products
Financial Perspective	How do we create value for our shareholders?	◆ Profitability ◆ Sales growth ◆ ROI ◆ Cash flow/liquidity

Chapter 17

DIVISIONAL PERFORMANCE MEASUREMENT

1 Introduction

In this chapter we will consider the situation where an organisation is divisonalised (or decentralised) and the importance of proper performance measurement in this situation.

We will also consider the possible problems that can result from the use of certain standard performance measures.

2 The meaning of divisionalisation

Divisionalisation is the situation where managers of business areas are given a degree of autonomy over decision making i.e. they are given the authority to make decision without reference to senior management. In effect they are allowed to run their part of the business almost as though it were their own company.

2.1 Advantages of divisionalisation:

2.2 Problems with divisionalisation:

3 The use of performance measures to control divisional managers

If managers are to be given autonomy in their decision making, it becomes impossible for senior management to 'watch over' them on a day-to-day basis – this would remove the whole benefit of having divisionalised!

The way to control their performance is to establish in advance a set of measures that will be used to evaluate their performance at (normally) the end of each year.

These measures provide a way of determining whether or not they are managing their division well, and also communicate to the managers how they are expected to perform.

It is of critical importance that the performance measures are designed well.

For example, suppose a manager was simply given one performance measure – to increase profits. This may seem sensible, in that in any normal situation the company will want the division to become more profitable. However, if the manager expects to be rewarded on the basis of how well he achieves the measure, all his actions will be focussed on increasing profit to the exclusion of everything else. This would not however be beneficial to the company if the manager were to achieve it by taking actions that reduced the quality of the output from the division. (In the long-term it may not be beneficial for the manager either, but managers tend to focus more on the short-term achievement of their performance measures.)

It is therefore necessary to have a series of performance measures for each division manager. Maybe one measure will relate to profitability, but at the same time have another measure relating to quality. The manager will be assessed on the basis of how well he has achieved all of his measures.

We wish the performance measures to be goal congruent, that is to encourage the manager to make decisions that are not only good for him but end up being good for the company as a whole also.

In this chapter we will consider only financial performance. However, non-financial performance is just as important and we will consider that in the next chapter.

4 Controllable profits

The most important financial performance measure is profitability.

However, if the measure is to be used to assess the performance of the divisional manager it is important that any costs outside his control should be excluded.

For example, it might be decided that pay increases in all division should be fixed centrally by Head Office. In this case it would be unfair to penalise (or reward) the manager for any effect on the division's profits in respect of this cost. For these purposes therefore an income statement would be prepared ignoring wages and it would be on the resulting controllable profit that the manager would be assessed.

5 Investment Centres and the problem with measuring profitability.

As stated earlier, divisionalisation implies that the divisional manager has some degree of autonomy.

In the case of an investment centre, the manager is given decision making authority not only over costs and revenues, but additionally over capital investment decision.

In this situation it is important that any measure of profitability is related to the level of capital expenditure. Simply to assess on the absolute level of profits would be dangerous – the manager might increase profits by $10,000 and be rewarded for it, but this would hardly be beneficial to the company if it had required capital investment of $1,000,000 to achieve!!

The most common way of relating profitability to capital investment is to use Return on Investment as a measure. However, as we will see, this can lead to a loss of goal congruence and a measure know as Residual Income is theoretically better.

6 Return on Investment (ROI)

ROI is defined as: Controllable division profit expressed as a percentage of divisional investment

It is equivalent to Return on Capital Employed and this is one of the reasons that it is very popular in practice as a divisional performance measure.

Example 1

Arcania plc has divisions throughout the Baltic States.
The Ventspils division is currently making a profit of $82,000 p.a. on investment of $500,000.
Arcania has a target return of 15%

The manager of Ventspils is considering a new investment which will require additional investment of $100,000 and will generate additional profit of $17,000 p.a..

(a) Calculate whether or not the new investment is attractive to the company as a whole.

(b) Calculate the ROI of the division, with and without the new investment and hence determine whether or not the manager would decide to accept the new investment.

In the above example, the manager is motivated to accept an investment that is attractive to the company as a whole. He has been motivated to make a goal congruent decision.

Note that in this illustration we have used the opening Statement of Financial Position value for capital invested. In practice it may be more likely that we would use closing Statement of Financial Position value (which would be lower because of depreciation). There is no rule about this – in practice we could do whichever we thought more suitable. However, in examinations always use opening Statement of Financial Position value unless, of course, you are told to do differently.

However, there can be problems with a ROI approach as is illustrated by the following example:

Example 2

The circumstances are the same as in example 1, except that this time the manager of the Ventspils division is considering an investment that has a cost of $100, 000 and will give additional profit of $16,000 p.a.

(a) Calculate whether or not the new investment is attractive to the company as a whole.

(b) Calculate the ROI of the division, with and without the new investment and hence determine whether or not the manager would decide to accept the new investment.

In this example the manager is not motivated to make a goal congruent decision. For this reason, a better approach is to assess the managers performance on Residual Income.

7 Residual Income (RI)

Instead of using a percentage measure, as with ROI, the Residual Income approach assesses the manager on absolute profit. However, in order to take account of the capital investment, notional (or imputed, or 'pretend') interest is deducted from the P&L profit figure. The balance remaining is known as the Residual Income.

(Note that the interest charge is only notional, and is only made for performance measurement purposed).

Example 3

Repeat examples 1 and 2, but in each case assume that the manager is assessed on his Residual Income, and that therefore it is this that determines how he makes decisions.

Note that in both cases the manager is motivated to make goal congruent decisions.

8 ROI vs RI

In practice, ROI is more popular than RI, despite the fact that RI is technically superior.

8.1 Reasons for using ROI:

8.2 Reasons for using RI:

Chapter 18

TRANSFER PRICING

1 Introduction

In a previous chapter we looked at divisionalisation. When a company is divisionalised it is very common to have the situation where one division supplies goods or services to another division.

If we are measuring the performance of each division separately then it becomes important that divisions are able to charge each other for goods or services supplied.

In this chapter we will explain the importance of this, and also the importance of divisions charging each other 'sensible' transfer prices.

2 What is a transfer price?

The transfer price is the price that one division charges another division of the same company for goods or services supplied from one to the other. It is an internal charge – the 'sale' of one division is the 'purchase' of the other. Although it will be reflected in the results for each division individually, there is no effect in the accounts of the company as a whole.

Example 1

Division A produces goods and transfers them to Division B which packs and sells them to outside customers.

Division A has costs of $10 per unit, and Division B has additional costs of $4 p.u.. Division B sells the goods to external customers at a price of $20 p.u.

Assuming a transfer price between the divisions of $12 p.u., calculate:

(a) the total profit p.u. made by the company overall

(b) the profit p.u. made by each division

3 Why have a transfer price?

The reason for having a transfer price is to be able to make each division profit accountable. If, in the previous example, there was no transfer price and goods were transferred 'free of charge' between the division, then the overall profit for the company would be unchanged. However, Division A would only be reporting costs, and Division B would be reporting an enormous profit. The problem would be compounded if Division A was selling the same product externally as well as transferring to Division B.

4 Cost-plus transfer pricing

A very common way in practice of determining a transfer price is for the company to have a policy that all goods are transferred at the cost to the supplying division plus a fixed percentage.

EXAMPLE 2

Division A has costs of \$15 p.u., and transfer goods to Division B which has additional costs of \$5 p.u.. Division B sells externally at \$30 p.u.

The company has a policy of setting transfer prices at cost + 20%.

Calculate:

(a) the transfer price

(b) the profit made by the company overall

(c) the profit reported by each division separately

5 Goal congruence

If we are properly divisionalised, then each divisional manager will have autonomy over decision making. It will be therefore the decision of each manager which products are worth producing in their division (for these purposes we assume that each division has many products and therefore stopping production of one product will not be a problem).

A cost-plus approach, which easy to apply can lead to problems with goal congruence in that in some situations a manager may be motivated not to produce a product which is in fact to the benefit of the company as a whole.

Example 3

Division A has costs of $20 p.u., and transfer goods to Division B which has additional costs of $8 p.u.. Division B sells externally at $30 p.u.

The company has a policy of setting transfer prices at cost + 20%.

Calculate:

(a) the transfer price

(b) the profit made by the company overall

(c) the profit reported by each division separately

Determine the decisions that will be made by the managers and comment on whether or not goal congruent decisions will be made.

6 "Sensible" transfer pricing to achieve goal congruence.

The previous example illustrates that unless care is taken to set the transfer price sensibly, decisions may be made that are not goal congruent.

In the examination you can be asked to suggest sensible transfer prices. (As we will illustrate, you will normally be asked to state a range rather than one specific price.)

There is a 'rule' that may be applied. However, it is dangerous to simply learn a rule without fully understanding the logic. We will therefore build up the rule using a series of small examples, and then state the rule at the end.

Example 4

Division A has costs of $20 p.u., and transfer goods to Division B which has additional costs of $8 p.u.. Division B sells externally at $30 p.u.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 5

Division A has costs of $15 p.u., and transfers goods to Division B which has additional costs of $10 p.u.. Division B sells externally at $35 p.u.

A can sell part-finished units externally for $20 p.u.. There is limited demand externally from A, and A has unlimited production capacity.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 6

Division A has costs of $15 p.u., and transfers goods to Division B which has additional costs of $10 p.u.. Division B sells externally at $35 p.u.

A can sell part-finished units externally for $20 p.u.. There is unlimited external demand from A, and A has limited production capacity.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 7

Division A has costs of $8 p.u., and transfers goods to Division B which has additional costs of $4 p.u.. Division B sells externally at $20 p.u.

Determine a sensible range for the transfer price in order to achieve goal congruence, if Divison B can buy part-finished goods externally for:

(a) $14 p.u.

(b) $18 p.u.

7 The 'rule' for sensible transfer pricing

The following rule summarises the results from the previous examples:

7.1 Minimum transfer price:

7.2 Maximum transfer price:

(Note: we always assume that both divisions are manufacturing many products and that discontinuing one product will have no effect on the fixed costs. It is therefore only the marginal costs that we are interested in when applying the above rules.)

8 Capacity limitations

In one of the previous examples there was a limit on production in one of the divisions. This problem can be made a little more interesting, although the same rule as summarised in Section 7 still applies.

Example 8

A is capable of making two products, X and Y.
A can sell both products externally as follows:

	X	Y
External selling price	80	100
Variable costs	60	70
Contribution p.u.	20	30

A has limited labour available. The labour hours required for each product are X: 5 hours p.u., Y: 10 hours p.u.
A has unlimited external demand for both products.
Division B requires product Y from Division A.

Calculate the minimum transfer price that should be charged by A for supply of Product Y to Division B.

Chapter 19

PERFORMANCE IN THE NOT-FOR-PROFIT SECTOR

1 Introduction

Non-profit seeking organisations are those whose prime goal cannot be assessed by economic means. Examples would include charities and state bodies such as the police and the health service.

For this sort of organisation, it is not possible or desirable to use standard profit measures. Instead (in for example the case of the health service) the objective is to ensure that the best service is provided at the best cost.

In this chapter we will consider the problems of performance measures and suggestions as to how to approach it.

2 Problems with performance measurement

2.1 Multiple objectives

Even if all objectives can be clearly identified, it may be impossible to identify an over-riding objective or to choose between competing objectives

2.2 The difficulty of measuring outputs

An objective of the health service is obviously to make ill people better. However, how can we in practice measure how much better they are?

2.3 Financial constraints

Public sector organisations have limited control over the level of funding that they receive and the objectives that they can achieve.

2.4 Political, social and legal considerations

The public have higher expectations from public sector organisations than from commercial ones, and such organisations are subject to greater scrutiny and more onerous legal requirements.

2.5 Little market competition and no profit motive.

3 Value for money

Non-profit organisations, such as the health service, are expected to provide value for money.

This can be defined as providing a service in a way which is economical, efficient and effective.

3.1 Performance should be assessed under each of these '3 E's '

- **Economy**

  Attaining the appropriate quantity and quality of inputs at the lowest cost

- **Efficiency**

  Maximising the output for a given input (or, for a given output achieving the minimum input).

- **Effectiveness**

  Determining how well the organisation has achieved its desired objectives.

Paper F5

ANSWERS TO EXAMPLES

Chapter 1

Answer to Example 1

(a) Total overheads $190,000

Total labour hours

A	20,000	× 2 =	40,000
B	25,000	× 1 =	25,000
C	2,000	× 1 =	2,000
			67,000 hours

O.A.R. = $\frac{190,000}{67,000}$ = $2.836 per hour

Cost cards:

	A	B	C
Materials	5	10	10
Labour	10	5	5
Overheads (at $2.84 per hr)	5.68	2.84	2.84
	20.68	17.84	17.84
Selling price	20	20	20
Profit / Loss	$(0.68)	$2.16	$2.16

(b)

	Total	A	B	C
Set-up costs				
(Cost per set up = $\frac{90,000}{25}$ = 3,600)	90,000	36,000	46,800	7,200
Receiving				
(Cost per delivery = $\frac{30,000}{22}$ = 1,364)	30,000	13,636	13,636	2,728
Despatch				
(Cost per order = $\frac{15,000}{60}$ = 250)	15,000	5,000	5,000	5.000
Machining				
(Cost per machine hour: $\frac{55,000}{94,000}$ = 0.585)	55,000	23,404	29,256	2,340
	190,000	78,040	94,692	17,268
Number of units		20,000	25,000	2,000
Overheads p.u.		$3.90	$3.79	$8.63

Costings:

	A	B	C
Materials	5	10	10
Labour	10	5	5
Overheads	3.90	3.79	8.63
	18.90	18.79	23.63
Selling price	20	20	20
Profit / Loss	$1.10	$1.21	$(3.63)

Chapter 2

Answer to Example 1

Selling price = $20 p.u.
Target return = 40% of selling price
Target Cost = **$12 p.u.**

Answer to Example 2

Target return = 30% × 5M = $1.5M p.u.
Expected revenue = 40,000 × $67.50 = $2.7M

$$\text{Target cost} = \frac{2.7\text{M} - 1.5}{40{,}000} = \textbf{£30 p.u.}$$

Chapter 3

Answer to Example 1

(a)	Cost	(100%)	7.00
plus:	Mark-up	(50%)	3.50
equals:	Selling price	(150%)	10.50

The target cost is **$7.00 per unit**

(b) Estimated total sales = 2,000 + (4 x 12,000) = 50,000 units
Total lifecycle cost = (50,000 x 6) + 60,000 + 30,000 = $390,000
Lifecycle cost per unit = 390,000 / 50,000 = **$7.80**
This is above the target cost per unit, and therefore it would not be worthwhile making the product.

(c) The maximum lifecycle cost per unit = the target cost = $7.00
The part caused by the design and end of life costs :
(60,000 + 20,000 + 30,000) / 50,000 = $2.20
Therefore, the maximum manufacturing cost per unit would have to fall from $6.00 to ($7.00 - $2.20) = **$4.80 per unit**

Chapter 4

No Examples

Chapter 5

Answer to Example 1

	A	*B*
Selling price	25	28
Materials	8	20
Other variable	12	4
	20	24
Contribution p.u.	5	4
Machine hrs p.u.	2	1
Contribution per hour	$2.50	$4
	②	①

Production

	units	*hours*	
B:	10,000 × 1 hr =	10,000	
A:	19,000 × 2hrs =	38,000	
		48,000	hours

ANSWERS TO EXAMPLES

Profit

		$
A:	19,000 × $5	95,000
B:	10,000 × $4	40,000
		135,000
less	Fixed costs:	
	[A: 20,000 × $3	
	B: 10,000 × $2]	80,000
	Profit	$55,000

Answer to Example 2

	A	B
Selling price	25	28
Materials	8	20
Throughput p.u.	$17	$8
Machine hrs p.u.	2	1
Contribution per hour	$8.50	$8
	①	②

Production

	units	hours	
A:	20,000 × 2hrs =	40,000	
B:	8,000 × 1hr =	8,000	
		48,000	hours

Profit

		$
A:	20,000 × $17	340,000
B:	8,000 × $8	64,000
		404,000
less	"fixed" costs:	
	[A: 20,000 × $15	
	B: 10,000 × $6]	360,000
	Profit	$44,000

Cost per factory hour = $\frac{360,000}{\$48,000}$ = **$7.50**

Throughput accounting ratios:

A: $\frac{8.50}{7.50}$ = **1.13**

B: $\frac{8}{7.50}$ = **1.07**

Chapter 6

Answer to Example 1

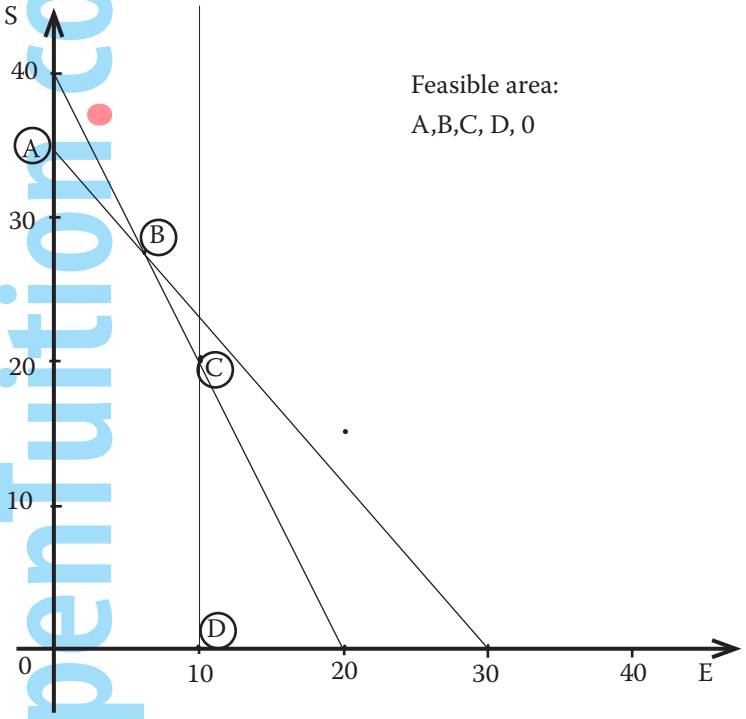
Let S = number of standard chairs produced per week
E = number of executive chairs produced per week

Constraints:

Materials:	$2S + 4E \leq 80$
Labour:	$5S + 6E \leq 180$
Demand:	$E \leq 10$
Non-negativity:	$S \geq 0; E \geq 0$

Objective:

Maximise $C = 6S + 9E$



Feasible area:
A,B,C, D, 0

Maximum contribution occurs at point **B** (using the objective function).

At B, $2S + 4E = 80$ (1)
$5S + 6E = 180$ (2)
(1) × 2.5: $5S + 10E = 200$ (3)
(3) – (2): $4E = 20$
$\mathbf{E = 5}$
In (1): $2S + 20 = 80$
$2S = 60$
$\mathbf{S = 30}$
$C = 6S + 9E$
$= 180 + 45$
$= \mathbf{\$225}$

Produce 5 Executive chairs and 30 standard chairs per week.
Maximum contribution is $225 per week.

Answer to Example 2

There is **no** spare material or labour
The spare demand for executive chairs is 5 chairs (10 – 5)

Answer to Example 3

(a) If there was 1 more kg of material available, then the material constraint becomes:

$$2S + 4E \leq 81$$

Point B will still be the optimum solution, and therefore this will be when:

	2S + 4E	= 81	(1)
	5S + 6E	= 180	(2)
(1) × 2.5	5S + 10E	= 202.5	(3)
(3) – (2)	4E	= 22.5	
		E = 5.625	
in (1)	2S + 22.5	= 81	
	2S	= 58.5	
		C = 6S +9E	
		= 175.5 + 50.625	
		= **226.125**	

Shadow price of material = extra contribution
= 226.125 – 225
= **$1.125** per kg

(b) If there was 1 more hour of labour available, then the labour constraint becomes: 5S + 6E ≤ 181

Point B will still be the optimum solution, and therefore this will be when:

	2S + 4E	= 80	(1)
	5S + 6E	= 181	(2)
(1) × 2.5	5S + 10E	= 200	(3)
(3) – (2)	4E	= 19	
		E = 4.75	
in (1)	2S + 19	= 80	
	2S	= 61	
		S = 30.5	
	C	= 6S +9E	
		= 183 + 42.75	
		= **225.75**	

Shadow price of labour = 225.75 – 225
= $0.75 per hour

The shadow price of demand for executive chairs is $0, because there is already spare demand

Chapter 7

Answer to Example 1

(a)

Materials	10
Labour	8
Variable o/h	5
Fixed o/h (50,000 ÷ 10,000)	5
Full cost	28
Profit	5.60
Selling price	$33.60

(b)

Materials	10
Labour	8
Variable o/h	5
Marginal cost	23
Profit	9.20
Selling price	$32.20

Answer to Example 2

S.P. p.u.	*Demand*	*Cost p.u.*	*Total Revenue*	*Total cost*	*Total profit*	*Marginal Revenue*	*Marginal cost*
16	100	14.0	1,600	1,400	200	1,600	1,400
15.5	200	13.9	3,100	2,780	320	1,500	1,380
15	300	13.8	4,500	4,140	360	1,400	1,360
14.5	400	13.7	5,800	5,480	320	1,300	1,340
14	500	13.6	7,000	6,800	200	1,200	1,320
13.5	600	13.5	8,100	8,100	-	1,100	1,300
13	700	13.4	9,100	9,380	(280)	1,000	1,280

Optimum selling price is $15 per unit

Answer to Example 3

(a)
$$PED = \frac{\frac{200-100}{100}}{\frac{15.5-16}{16}} = \mathbf{32}$$

(b)
$$PED = \frac{\frac{400-300}{300}}{\frac{14.5-15}{15}} = \mathbf{10}$$

Answer to Example 4

Minimum price is $£12 + \frac{16,000}{2,500} \times £1 = \mathbf{£18.40}$

$$P = 18.40 - \frac{1}{2,500}Q$$

(or $P = 18.40 - 0.0004Q$)

Answer to Example 5

$P = 50 - \frac{1}{100}Q$ $\qquad$ $P = 50 - 0.01Q$

$R = PQ = 50Q - 0.01Q^2$

$$\text{Marginal revenue} = \frac{dR}{dQ} = \mathbf{50 - 0.02Q}$$

$$\text{Total cost} = \frac{dC}{dQ} = \mathbf{20}$$

For maximum profit, MR = MC

$50 - 0.02Q = 20$

$Q = 1,500$

When $Q = 1,500$

$P = 50 - 0.01Q = \$35$ p.u.

Answer to Example 6

$P = 120 - 0.001Q$

$MR = 120 - 0.002Q$ (given)

MC = variable cost = $5

For maximum profit, MR = MC

$120 - 0.002Q = 5$

$0.002Q = 115$

$Q = 57500$ units

ANSWERS TO EXAMPLES

$$P = 120 - 0.001Q = 120 - (0.001 \times 57{,}500)$$
$$= 120 - 57.5$$
$$= \textbf{\$62.50} \text{ per unit}$$

Total contribution =	57,500 × (62.50 – 5) =	3,306,250
Less: Fixed costs		(100,000)
Maximum profit		$3,206,250

Chapter 8

Answer to Example 1

	$
Selling price	6
Variable costs	2
Contribution	4

(a)

	$
Total contribution (300u × $4)	1,200
Fixed costs	(1,000)
Profit	$200

(b) $\text{Breakeven} = \dfrac{\text{Fixed costs}}{\text{Contribution p.u}} = \dfrac{1{,}000}{4} = 250 \text{ units}$

(c) Breakeven revenue = 250 u × $6p.u. = **$1,500**

(d)

	$
Target profit	300
Fixed costs	1,000
Target contribution	$1,300

$$\text{Number of units} = \frac{\text{Target contribution}}{\text{Contribution p.u}} = \frac{1{,}300}{4} = 325 \text{ units}$$

Answer to Example 2

Budgeted sales = 300 units
Breakeven = 250 units

$$\text{Margin of safety} = \frac{300 - 250}{300} \times 100 = \textbf{16.67\%}$$

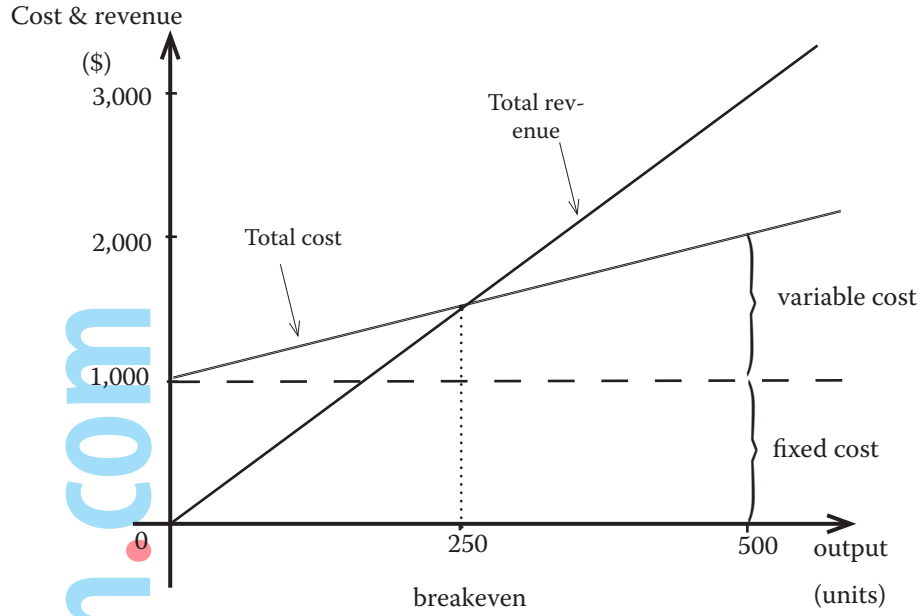
Answer to Example 3

$$\text{C/S ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{4}{6} = \textbf{0.67}$$

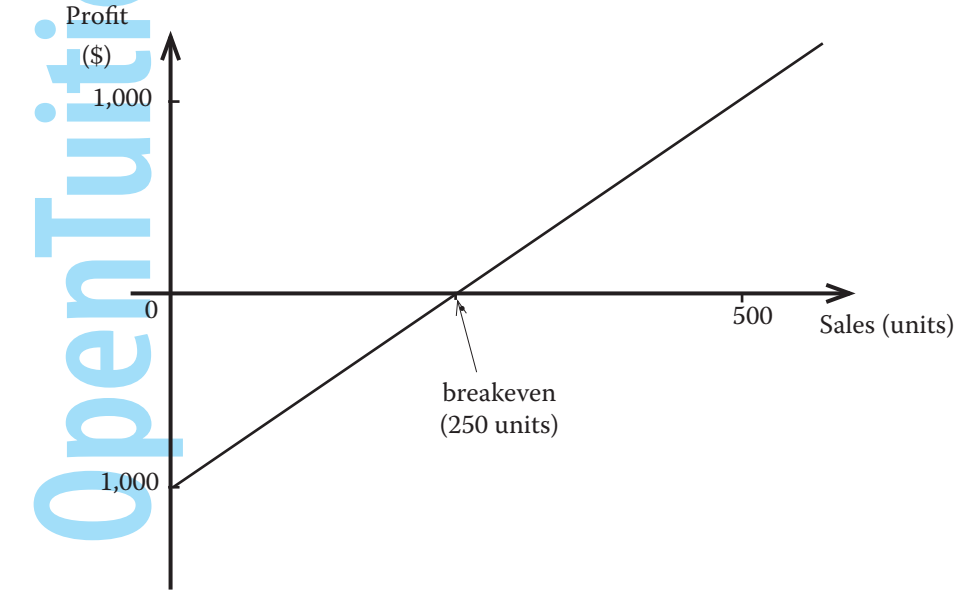
	$
Target profit	320
Fixed overheads	1,000
Target contribution	$1,320

Sales revenue required = Target contribution ÷ C/S ratio = 1320 ÷ 4/6 = **$1,980**

Answer to Example 4



Answer to Example 5



Answer to Example 6

(a) CS ratios:

C = 1.25 / 5.00 = 0.25 (or 25%)

V = 0.75 / 6.00 = 0.125 (or 12.5%)

P = 2.65 / 6.00 = 0.379 (or 37.9%)

(b) Average CS ratio:

Based on budget sales,

Total revenue = (4800 x 5) + (4800 x 6) + (12000 x 7)
= $136,800

Total contribution= (4800 x 1.25) + (4800 x 0.75) + (12000 x 2.65)
= $41,400

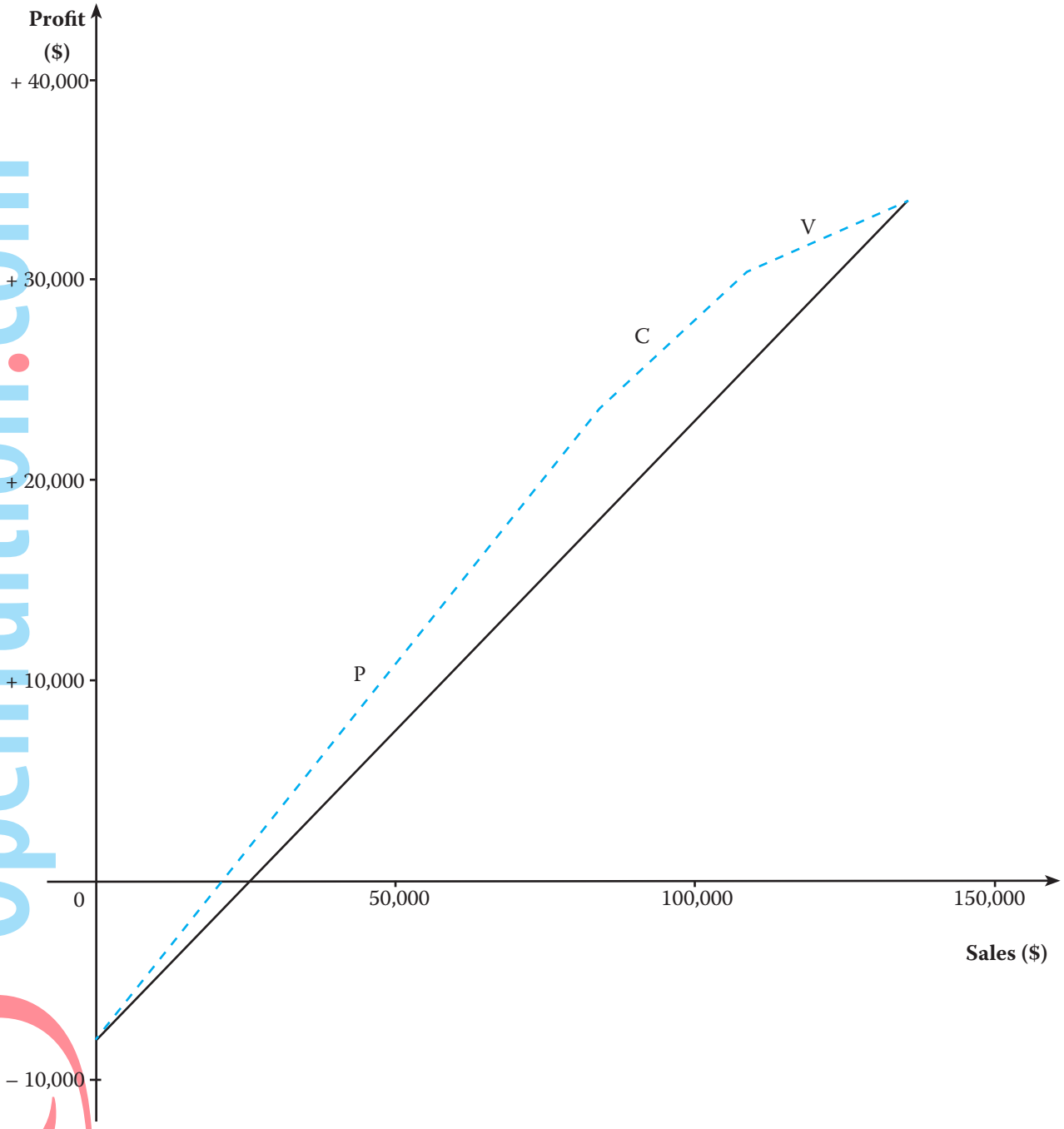
Average CS ratio = 41400/136800 = 0.303 (or 30.3%)

(Alternatively, the average CS ratio may be calculated by taking the weighted average of the individual CS ratios, weighting by the budgeted sales revenues.)

ANSWERS TO EXAMPLES

(c) Breakeven sales revenue = fixed overheads / CS ratio
= 8000/0.303
= $26,400

(d) See graph below



(e) P has the highest CS ratio, followed by C, followed by V.

		Cumulative Sales		*Cumulative Profit*
P	(12,000 × 7 =)	84,000	((12,000 × 2.65) – 8000)	23,800
C	(4,800 × 5 = 24,000)	108,000	(4,800 × 1.25 = 6000)	29,800
V	(4,800 × 6 = 28,800)	136,800	(4,800 × 0.75 = 3600)	33,400

(f) Breakeven sales for P are 8000/0.379 = $21,108

Chapter 9

Answer to Example 1

(a)	Lost contribution from Rooks	(15,000)
	Save fixed overheads	5,000
	Net loss from ceasing Rooks	10,000

Therefore, should continue production of Rooks.

(b)	Lost contribution from Rooks	(15,000)
	Save fixed overheads	5,000
	Extra contribution from Crowners	20,000
	Extra fixed costs of Crowthers	(6,000)
	Net gain from ceasing Rooks	4,000

Therefore, should cease production of Rooks and produce Crowners instead.

Answer to Example 2

Revised costs for special order:

	Notes	$
Subcontractor costs	1	31,300
Supervisor costs	2	1,000
General overheads	3	1,000
Machine maintenance	4	500
Machine overheads	5	22,000
Materials	6	31,500
Interest costs	7	900
		88,200

Notes:

1. The choice lies between the two subcontractor costs that have to be employed because of the shortage of existing labour. The minimum cost is to have subcontractors employed who are skilled in the special process.
2. Only the difference between the bonus and the incentive payment represents an additional cost that arises due to the special order. Fixed salary costs do not change.
3. Only incremental costs are relevant.
4. Depreciation is a period cost and is not related to the special order. Additional maintenance costs are relevant.
5. The relevant costs are the variable overheads ($3 × 6000 hours) that will be incurred, plus the displacement costs of $2 × 2000 hours making a total of $22,000.
6. Since the materials are no longer used the replacement cost is irrelevant. The historic cost of $34,000 is a sunk cost. The relevant cost is the lost sale value of the inventory used in the special order which is: 7,500 kg × $4.20 per kg = $31,500.
7. Full opportunity costing will also allow for imputed interest costs on the incremental loan. The correct interest rate is the overdraft rate since this represents the incremental cost the company will pay. Simple interest charges for three months are therefore: (3/12) × $20,000 × 18% = $900.

Answer to Example 3

	X	Y	Z
Buy-in price	13	17	16
Cost to make	10	12	14
Saving (p.u.)	$3	$5	$2
Kg of B	3	2	1
Saving per kg	$1	$2.50	$2
RANKING	③	①	②

ANSWERS TO EXAMPLES

		Units	Material B (kg)
Y	MAKE	2,500	5,000
Z	MAKE	3,000	3,000
			8,000kg
Z	BUY	1,000	
X	BUY	2,000	

Chapter 10

Answer to Example 1

(a)

Contract size \ Demand	400u	500u	700u	900u
300u	2,900	3,400	4,400	5,400
500u	3,500	4,000	5,000	5,000
700u	4,100	4,600	4,600	4,600
800u	4,400	4,400	4,400	4,400

(b) (i) Expected value if contract size =
300 units = (0.2 ×2,900) + (0.3 × 3,400) + (0.4 × 4,400) + (0.1 × 5,400) = **$3,900**
500 units = (0.2 × 3,500) + (0.3 × 4,000) + (0.5 × 5,000) = **$4,400**
700 units = (0.2 × 4,100) + (0.8 × 4,600) = **$4,500**
900 units = **$4,400**
Sign contract for **700 units**

(ii) maximin
Worst outcome from:
300 units = **$2,900**
500 units = **$3,500**
700 units = **$4,100**
800 units = **$4,400**
Sign contract for **800 units**

(iii) Best outcome from
300 units = **$5,400**
500 units = **$5,000**
700 units = **$4,600**
800 units = **$4,400**
Sign contract for **300 units**

(iv) Regret table:

Contract size \ Demand	400u	500u	700u	900u
300u	1,500	1,200	600	0
500u	900	600	0	400
700u	300	0	400	800
800u	0	200	600	1,000

Worst regret for
300 units = **$1,500**
500 units = **$900**
700 units = **$800**
800 units = **$1,000**
Sign contract for **700 units**

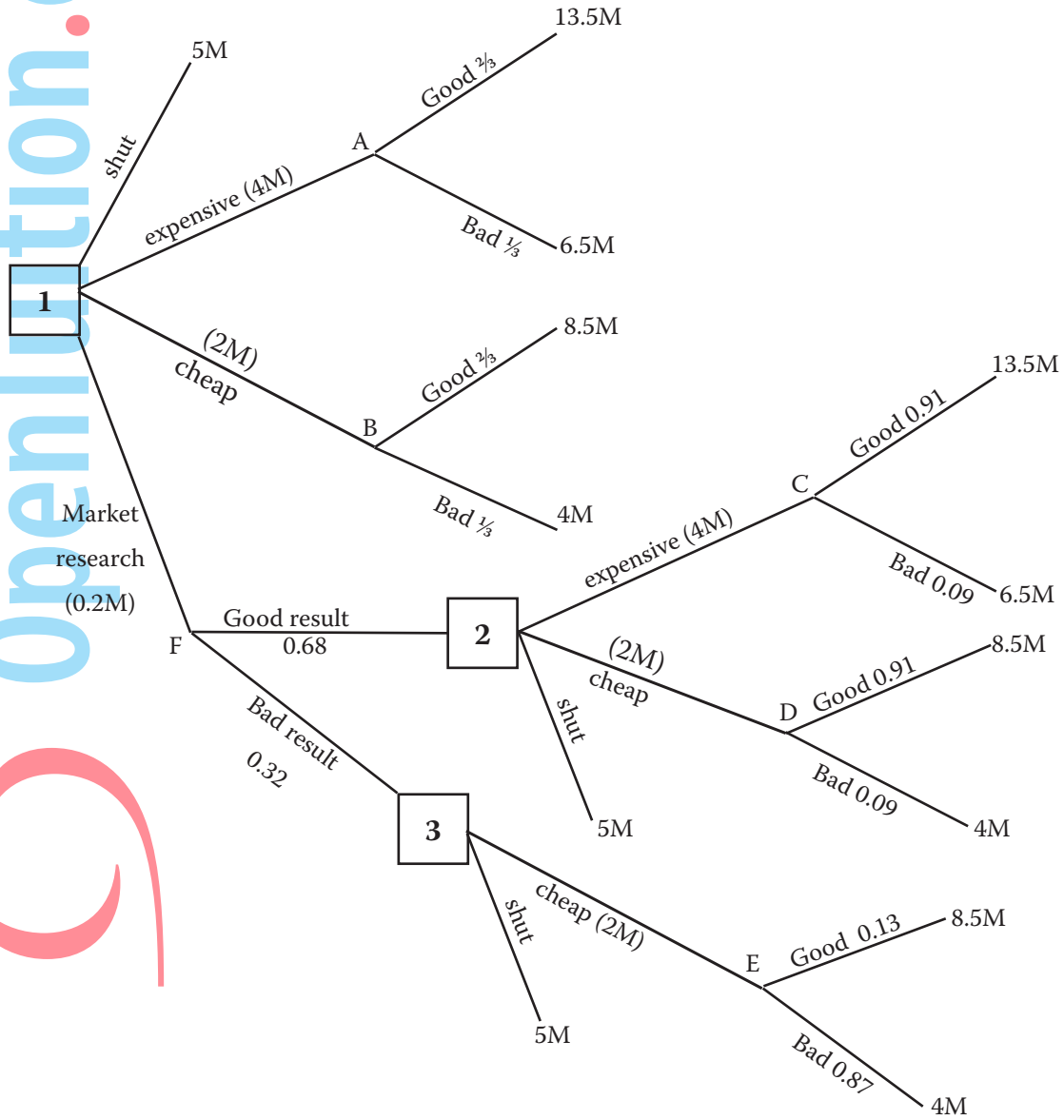
(c) With perfect knowledge of the level of demand, the payoffs would be as follows:

Result of perf. know.	*Decision Contract*	*Payoff $*
400	800u	4,400
500	700u	4,600
700	500u	5,000
900	300u	5,400

The expected return with perfect knowledge =
(0.2 × 4,400) + (0.3 × 4,600) + (0.4 × 5,000) + (0.1 × 5,400) = $4,800

The expected return without perfect knowledge (from (b)(i) is $4,400
So the most to pay for perfect knowledge
= 4,800 – 4,400
= $400

Answer to Example 2



Expected values:

at	A	(2/3 × 13.5M)	+	(1/3 ×6.5M)	= 11.17M
	B	(2/3 ×8.5M)	+	(1/3 × 4M)	= 7M
	C	(0.91 × 13.5M)	+	(0.09 × 6.5M)	= 12.87M
	D	(0.91 × 8.5M)	+	(0.09 × 4M)	= 8.095M
	E	(0.13 × 8.5M)	+	(0.87 × 4M)	= 4.585M

Decisions
at 2: choose expensive, 8.87M (12.87 – 4)
at 3: choose shut, 5M

Expected value at F, (0.68 × 8.87M) + (0.32 × 5M) = 7.63M
Decision at 1: choose market research, 7.43M (7.63 – 0.2)

Chapter 11

Answer to Example 1

(a) Sales budget

				$
X	2,000u	× $100	=	200,000
Y	4,000u	× $130	=	520,000
Z	3,000u	× $150	=	450,000
				$1,170,000

(b) Production budget

	X	*Y*	*Z*
Sales	2,000	4,000	3,000
Opening inventory	(500)	(800)	(700)
Closing inventory	600	1,000	800
Production	2,100 u	4,200 u	3,100 u

(c) Material usage budget

			Wood		*Varnish*
X	2,100u	× 5 =	10,500	× 2	4,200
Y	4,200u	× 3 =	12,600	× 2	8,400
Z	3,100u	× 2 =	6,200	× 1	3,100
			29,300 kg		15,700 litres

(d) Materials purchases budget

	Wood	*Varnish*
Usage	29,300	15,700
Opening inventory	(21,000)	(10,000)
Closing inventory	18,000	9,000
	26,300 kg	14,700 litres
	× $8	× $4
	$210,400	$58,800

(e) Labour budget

			hours
X	2,100u × 4	=	8,400
Y	4,200u × 6	=	25,200
Z	3,100u × 8	=	24,800
			58,400 hours
			×$3
			$175,200

Answer to Example 2

	Flexed	*Actual*	*Variances*	
Sales	12,000u	12,000 u		
Production	12,000u	12,000 u		
Sales	120,000	122,000	2,000	(F)
Materials	60,000	60,000	–	
Labour	30,000	28,500	1,500	(F)
Variable o/h	15,000	15,000	–	
	105,000	103,500		
Contribution	15,000	18,500		
Fixed o/h	10,000	11,000	1,000	(A)
Profit	$5,000	$7,500	$2,500	(F)

Statement

			$	
Original budget contribution	(10,000u × $1.25)		12,500	
Sales volume variance	(2,000 × $1.25)		2,500	(F)
			15,000	
Sales price variance			2,000	(F)
Labour variance			1,500	(F)
Actual contribution			18,500	
Fixed overheads				
Budget		10,000		
Variance		1,000 (A)	11,000	
Actual profit			$7,500	

Chapter 12

Answer to Example 1

	u	$
High	700	85,000
Low	100	40,000
	600u	$45,000

$$\text{Variable cost} = \frac{45{,}000}{600} = \mathbf{\$75}$$

For high:

Total cost =	85,000
Variable cost (700u @ $75)	52,500
Fixed cost	$32,500

Answer to Example 2

x	y	xy	x^2	y^2
1	40	40	1	1,600
4	65	260	16	4,225
2	45	90	4	2,025
7	85	595	49	7,225
6	70	420	36	4,900
5	70	350	25	4,900
3	50	150	9	2,500
28	425	1,905	140	27,375
Σx	Σy	Σxy	Σx^2	Σy^2

ANSWERS TO EXAMPLES

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2}$$

$$= \frac{7 \times 1{,}905 - 28 \times 425}{7 \times 140 - 28^2}$$

$$= \frac{1{,}435}{196} = \mathbf{7.321}$$

$$a = \frac{\sum y}{n} - \frac{b\sum x}{n}$$

$$= \frac{425}{7} - \frac{7.321 \times 28}{7} = \mathbf{31.430}$$

$y = 31.430 + 73.21x$

Answer to Example 3

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

$$= \frac{\left(7 \times 1{,}905\right) - \left(28 \times 425\right)}{\sqrt{\left(\left(7 \times 140\right) - \left(28\right)^2\right)\left(\left(7 \times 27{,}375\right) - \left(425\right)^2\right)}}$$

$$= \frac{1{,}435}{\sqrt{196 \times 11{,}00}} = \mathbf{0.977}$$

Answer to Example 4

			Moving Average	*Trend*	*Seasonal Variation*	*% variation*
2000	1	80				
	2	87	84.75			
	3	82	87.25	86	- 4	95.3
	4	90	89.25	88.25	+ 1.75	102.0
2001	1	90	92	90.62	- 0.62	99.3
	2	95	95	93.5	+1.5	101.6
	3	93	98.75	96.87	- 3.87	96.0
	4	102	103	100.87	+1.13	101.1
2002	1	105	105.5	104.25	+0.75	100.7
	2	112	109	107.25	+4.75	104.4
	3	103				
	4	116				

	1	*2*	*3*	*4*
2000	-	-	- 4	+ 1.75
2001	- 0.62	+ 1.5	- 3.87	+ 1.13
2002	+ 0.95	+ 4.75	-	-
Total	+ 0.13	+ 6.25	- 7.87	+ 2.88
Averages	+ 0.06	+ 3.12	- 3.93	+ 1.44

Answer to Example 5

	1	*2*	*3*	*4*
2000	-	-	95.3	102.0
2001	99.3	101.6	96.0	101.1
2002	100.7	104.4	-	-
Total	200	206	191.3	203.1
Averages	100%	103%	95.6%	101.5%

Answer to Example 6

units	*Average time*	*Total time*
1	100	100
2	75	150
4	56.25	225
8	42.1875	337.5

	hours	
Time for 8	337.5	
Time for first	100	
Time for additional 7	237.5	hours

Answer to Example 7

(a) $b = \frac{\log 0.85}{\log 2} = -0.2345$

$y = ax^b$

for 16 batches $y = 200 \times 16^{-02345} = 104.3912$

Total time for 16 = 16 × 104.4	=	1,670	hours
Time for first	=	200	hours
Time for next 15	=	1,470	hours

(b) Average time for 30 = $200 \times 30^{-0.2345} = 90.08$

Total time for 30 = 30 × 90.08 = 2,703 hours

Average time for 29 = $200 \times 29^{-0.2345} = 90.80$

Total time for 29 = 29 × 90.80 = 2,633 hours

Time for 30th = 2,703 – 2,633 = 70 hours

Chapter 13

Answer to Example 1

	Original Fixed Budget	*Flexed Budget*	*Actual*	*Variances*	
	$	$	$		
Sales (units)	8,000	8,400	8,400		
Production (units)	8,700	8,900	8,900		
Sales	600,000	630,000	613,200	16,800	(A)
Materials	156,600	160,200	163,455	3,255	(A)
Labour	217,500	222,500	224,515	2,015	(A)
Variable o/h	87,000	89,000	87,348	1,652	(F)
Fixed o/h	130,500	133,500	134,074	574	(A)
	591,600	605,200	609,392		
Closing inventory	(47,600)	(34,000)	(34,000)		
	544,000	571,200	575,392		
Profit	$56,000	$58,800	$37,808	20,992	(A)

ANSWERS TO EXAMPLES

Answer to Example 2

Materials

Expense variance

Actual purchases 35,464kg	at actual cost	163,455
	at standard cost ($4.50)	159,588
		$3,867 (A)

Usage variance

	kg
Actual usage	35,464
Standard usage for actual production (8,900 u × 4kg)	35,600
	136kg

at a standard cost ($4.50) = **$612** (F)

Labour

Rate of Pay variance

Actual hours paid at actual cost	224,515
45,400 hours at standard cost ($5)	227,000
	$2,485 (F)

Idle Time Variance

Actual hours paid	45,400
Actual hours worked	44,100
	1,300 hrs

at a standard cost ($5) = **$6,500** (A)

Efficiency variance

Actual hours worked	44,100
Standard hours for actual production (8,900 u × 5hrs)	44,500
	400 hrs

at a standard cost ($5) = **$2,000** (F)

Variable overheads

Expenditure variance

Actual hours worked	at actual cost	87,348
44,100	at standard cost	88,200
		$852 (F)

Efficiency variance

Actual hours worked	44,100
Standard hours for actual production (8,900u × 5hrs)	44,500
	400 hrs

at a standard cost ($2) = $800 (F)

Fixed overheads

Expenditure variance

Actual total	134,074	
Original budget total	130,500	
	$3,574	(A)

Capacity variance

Actual hours worked	44,100	
Budget hours (8,700u × 5hrs)	43,500	
	600	hrs

at a standard cost ($3) = **$1,800** (F)

Efficiency variance

Actual hours worked	44,100	
Standard hours for actual production (8,900u × 5hrs)	44,500	
	400	hrs

at a standard cost ($3) = **$1,200** (F)

Operating Statement

		$	
Original budget profit		56,000	
Sales	– volume variance	2,800	(F)
		58,800	
Sales	– price variance	(16,800)	(A)
Materials	– expense variance	(3,867)	(A)
	– usage variance	612	(F)
Labour	– rate of pay variance	2,485	(F)
	– idle time variance	(6,500)	(A)
	– efficiency variance	2,000	(F)
Variable o/hs	– expense variance	852	(F)
	– efficiency variance	800	(F)
Fixed o/hs	– expense variance	(3,574)	(A)
	– capacity variance	1,800	(F)
	– efficiency variance	1,200	(F)
Actual profit		$37,808	

Answer to Example 3

No Answer

Answer to Example 4

No Answer

ANSWERS TO EXAMPLES

Chapter 14

Answer to Example 1

Cost cards:

	Original		Revised
	$p.u.		$p.u.
Materials (1 litre @ $1 per litre)	1.00	(1.2 litres @$0.95 per litre)	1.14
Labour (2hrs @ $2.50 per hr)	5.00	(2 hrs @$2.60 per hr)	5.20
Variable overheads	1.40		1.40
	7.40		7.74
Selling price	16.00		16.00
Standard contribution	8.60		8.26

Operating statement

Original budget contribution (5,000u × $8.60)	43,000
Planning Variance (balancing figure)	5,830(A)
Revised budget contribution (4,500u × $8.26)	37,170
Operational variances	
Sales volume variance ((5,100u – 4,500u) × $8.26)	4,956(F)
	42,126
Sales price variance (81,000 – (5,100 × 16))	600(A)
Materials expense variance (5,120 – (5150 × 0.95))	227.5(A)
Materials usage variance (5,150 – (5,200 × 1.2)) × 0.95	1035.5(F)
Labour rate variance (27,400 – (10,200 × 2.60)	880(A)
Labour efficiency variance (10,200 – (5,200 × 2)) × 2.60	520(F)
Variable overhead variance (7,000 – (5,200 × 1.40))	280(F)
Actual contribution	42,254
Less: Fixed overheads	
Budget 20,000	
Variance 500(F)	19,500
Actual profit	$22,754

Answer to Example 2

Flexed original budget (for 24,000 units produced):

24,000 units x $32 = $768,000

Revised budget (for 24,000 units produced):

Planning $30,000 (F)

24,000 units x $30.75 = $738,000

Actual results (for 24,000 units produced):

Operational $31,500 (A)

$769,500

Analysis

Planning variances

Expenditure

24,000u x 7.5 kg =	180,000 kg x $4.10 =	738,000	
	180,000 kg x $4 =	720,000	
		$18,000	(A)

Usage:

	kg		
Revised	180,000		
Flexed budget (24,000u x 8 kg	192,000		
	12,000 x $4 =	$48,000	(F)

Operational variances

Expenditure

Actual	190,000 kg	769,500	
Revised	190,000 kg x $4.10 =	779,000	
		$9,500	(F)

Usage:

	kg		
Actual	190,000		
Revised (24,000 x 7.5 kg)	180,000		
	10,000 x $4.10 =	$41,000	(A)

Answer to Example 3

Total materials cost variance

Actual total cost (27,000 + 11,000)	38,000
Standard total cost (5,000 × $8)	40,000
Total cost variance	$2,000(F)

Materials price variance

	Actual purchases kg	*Actual cost* $	*Actual purchases* kg	*Standard cost* $
X	9,900	27,000	9,900	29,700
Y	5,300	11,000	5,300	10,600
		38,000		40,300

Price variable = 38,000 – 40,300 = $2,300 (F)

Mix variance

	Actual purchases kg	*Standard cost $*		*Standard mix kg*	*Standard cost $*
X	9,900	29,700	(⅔)	10,133	30,399
Y	5,300	10,600	(⅓)	5,067	10,134
	15,200kg	40,300		15,200kg	40,533

Mix variance = 40,300 – 40,533 = 233 (F)

Yield variance

	Standard mix (actual total) kg	*Standard cost $*	*Standard mix kg*	*Standard cost $*
X	10,133	30,399	10,000	30,000
Y	5,067	10,134	5,000	10,000
	15,200kg	40,533	15,000kg	40,000

Yield variance = 40,533 – 40,000 = 533 (A)

(Usage variance = Yield variance + Mix variance = 533 (A) + 233 (F) = **300 (A)**)

ANSWERS TO EXAMPLES

Answer to Example 4

Note: throughout this answer we use standard **costs** because cost variances are calculated separately in the usual way

Total sales margin variance

Budget profit:

A	200u	×	(20 – 17)		600
B	100u	×	(25 – 21)	=	400
C	100u	×	(30 – 24)	=	600
					1,600

Actual profit (using standard costs):

A	180u	×	(22 – 17)		900
B	150u	×	(22 – 21)	=	150
C	107u	×	(26 – 24)	=	340
					1,390

Total variance = 1,390 – 1,600 = $210 (A)

Sales price variance

	Actual sales units		$	Actual sales units	Standard selling price	$
A	180	× 22 =	3,960	180	× 20 =	3,600
B	150	× 22 =	3,300	150	× 25 =	3,750
C	170	× 26 =	4,420	170	× 30 =	5,100
			$11,680			$12,450

Sales price variance = 11,680 – 12,450 = $770 (A)

Sales mix variance

	Actual total sales units	Actual selling price	$		Actual total sales units	Standard profit p.u.	$
A	180	× $3 =	540	(2/4)	250	× $3 =	750
B	150	× $4 =	600	(1/4)	125	× $4 =	500
C	170	× $6 =	1,020	(1/4)	125	× $6 =	750
	500		$2,160		500		$2,000

Mix variance = 2,160 – 2,000 = $160 (F)

Sales quantity variance

	Actual total sales standard mix units	Standard Profit	$	Budget sales units	Standard profit	$
A	250	× $3 =	750	200	× $3 =	600
B	125	× $4 =	500	100	× $4 =	400
C	125	× $6 =	750	100	× $6 =	600
	500		$2,000	400		$1,600

Quantity variance = 20,000 – 1,600 = $400 (F)

Answer to Example 5

(a) Each unit takes 7.6 hours to make, and therefore the company expects to need to pay for 7.6/.95 = 8 hours of labour.

8 hours at the rate of $5.70 per hour gives a standard cost of $45.60 per unit

(b) Each unit should take 7.6 hours to produce, and should cost $45.60 for labour. Therefore, the effective standard cost per hour worked is 45.60 / 7.6 = $6.00

c) Total labour variance:

Actual cost of production:	50,020	
Standard cost of actual production (1,000 units at $45.60)	45,600	
Total variance	**4,420**	**(A)**

d) Rate of pay variance:

Actual amount paid	50,020	
Standard cost of actual hours paid (8,200 hours at $5.70)	46,740	
Total variance	**3,280**	**(A)**

Idle time variance:

Actual idle hours (8,200 – 7,740)	460	hours
Standard idle time (8,200 × 5%)	410	hours
Excess idle time	50	hours
Idle time variance: 50 hours at $6.00 =	**$300**	**(A)**

Efficiency variance:

Actual hours worked	7,740	hours
Standard hours worked for actual Production: 1000 units × 7.6 hours =	7,600	hours
Idle time variance: 50 hours at $6.00 =	140	hours
Efficiency variance: 140 hours × $6 =	**$840**	**(A)**

(Check:

Rate of pay	3,280	(A)
Excess idle time	300	(A)
Efficiency	840	(A)
Total	**$4,420**	

Chapter 15

Answer to Example 1

		2007	2006
Net profit margin	$(\frac{790}{7,180})$	11%	8.5%
Gross profit margin	$(\frac{1,795}{7,180})$	25%	22.5%
Return on capital	$(\frac{790}{2,690})$	29.4%	25.7%
Asset turnover	$(\frac{7,180}{2,690})$	2.67	3.02
Current ratio	$(\frac{2,314}{965})$	2.4	2.4
Quick ratio (or acid test)	$(\frac{1,308}{965})$	1.36	1.15

Inventory turnover	$(\frac{1,006}{5,385} \times 365)$	68.2 days	75.5 days
Receivables days	$(\frac{948}{7,180} \times 365)$	48.2 days	47.5 days
Payables days	$(\frac{653}{5,385} \times 365)$	44.3 days	44.7 days
Gearing ratio	$(\frac{500}{2,190})$	22.8%	28.6%

Chapter 16

No Examples

Chapter 17

Answer to Example 1

Return from new project = $\frac{17,000}{100,000}$ = **17%**

(a) For company:
17% > 15% (target)
Therefore company wants to accept

(b) For division

ROI (without project) $\frac{82,000}{500,000}$ = 16.4%

ROI (with project) $\frac{82,000 + 17,000}{500,000 + 100,000}$ = 16.5%

ROI of division increases therefore divisional manager motivated to accept.

Answer to Example 2

Return from new project = $\frac{16,000}{100,000}$ = 16%

(a) For company: 16% > 15%
Company wants to accept

(b) For division:

ROI (without project) =16.4%

ROI (with project) $\frac{82,000 + 16,000}{500,000 + 100,000}$ = 16.3%

Answer to Example 3

(1) RI (without project)

Profit	82,000
Less: Interest	
15% × 500,000	(75,000)
	$7,000

RI (with project)

Profit	99,000

Less: Interest	
15% × 600,000	90,000
	$9,000

$9,000 > $7,000 manager motivated to accept

(2) RI (without project) $7,000

ROI (with project)	
Profit	98,000
Less: Interest	
15% × 600,000	90,000
	$8,000

$8,000 > $7,000 manager motivated to accept

In both cases the decisions are goal congruent

Chapter 18

Answer to Example 1

(a)

Selling price			20
Costs:	A	10	
	B	4	14
Profit			$6

(b)

	A		B	
Total Profit	12	Selling price		20
Cost	10	Total Profit	12	
Profit	$2	Costs	4	16
		Profit		$4

Answer to Example 2

(a) Transfer price = 15 × 1.2 = $18 p.u.

(b)

Selling price			30
Costs:	A	15	
	B	5	20
Profit			$10

(c)

	A		B	
Total Profit	18	Selling price		30
Cost	15	Total Profit	18	
Profit	$3	Costs	5	23
		Profit		$7

Answer to Example 3

(a) Transfer price = 20 × 1.2 = $24 p.u.

(b)

Selling price			30
Costs:	A	20	
	B	8	28
Profit			$2

(c)

	A			B
Total Profit	24	Selling price		30
Cost	20	Total Profit	24	
Profit	$4	Costs	8	32
		Profit		$(2)

Answer to Example 4

For A: T.P. > 20
For B: T.P. < 30 - 8
< 22
Sensible T.P. between $20 and $22 p.u.

Answer to Example 5

For A: T.P. > 15
For B: T.P. < 35 - 10
< 25
Sensible range between $15 and $25 p.u.

Answer to Example 6

For A: T.P. > 20
For B: T.P. < 25 (as in previous example)

Sensible range between $20 and $25 p.u.

Answer to Example 7

(a) For A: T.P. > 8
For B: T.P. < 14

Sensible range between $8 and $14 p.u.

(b) For A: T.P. > 8
For B: T.P. < 20 – 4
< 16
Sensible range between $8 and $16 p.u.

Answer to Example 8

	X	Y
Contribution	$20	$30
Hours	5	10
Contribution per hour	$4	$3

Therefore, if no transfers to B then A would sell exactly and generate $4 per hour contribution.
To make transfers of Y worthwhile, A need to charge at least 70 + (10 × 4) = **$110 p.u.**

Chapter 19

No Examples

Paper F5

PRACTICE QUESTIONS

1 Melns

Melns Limited currently uses traditional absorption costing, absorbing overheads on a machine hour basis. They are now considering using Activity Based Costing.

Details of the four products and relevant information are given below for one period.

Product	*P*	*Q*	*R*	*S*
Output in units	120	100	80	120
Costs per unit:	*$*	*$*	*$*	*$*
Direct material	40	50	30	60
Direct labour	28	21	14	21
Machine hours (per unit)	4	3	2	3

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

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

	$
Machine department costs	10,430
Set up costs	5,250
Stores receiving	3,600
Inspection/quality control	2,100
Materials handling and despatch	4,620

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

Cost	*Cost driver*
Set up costs	Number of production runs
Stores receiving	Requisitions raised
Inspection/quality control	Number of production runs
Materials handling and despatch	Orders executed

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

Requirements

(a) Calculate the cost per unit for each product if all overhead costs are absorbed on a machine hour basis.

(b) Calculate the total costs for each product, using activity based costing.

2 Edward

Edward Co assembles and sells many types of radio. It is considering extending its product range to include digital radios. These radios produce a better sound quality than traditional radios and have a large number of potential additional features not possible with the previous technologies (station scanning, more choice, one touch tuning, station identification text and song identification text etc).

A radio is produced by assembly workers assembling a variety of components. Production overheads are currently absorbed into product costs on an assembly labour hour basis.

Edward Co is considering a target costing approach for its new digital radio product.

Required:

(a) Briefly describe the target costing process that Edward Co should undertake.

(b) Explain the benefits to Edward Co of adopting a target costing approach at such an early stage in the product development process.

(c) Assuming a cost gap was identified in the process, outline possible steps Edward Co could take to reduce this gap.

A selling price of $44 has been set in order to compete with a similar radio on the market that has comparable features to Edward Co's intended product. The board have agreed that the acceptable margin (after allowing for all production costs) should be 20%.

Cost information for the new radio is as follows:

Component 1 (Circuit board) – these are bought in and cost $4·10 each. They are bought in batches of 4,000 and additional delivery costs are $2,400 per batch.

Component 2 (Wiring) – in an ideal situation 25 cm of wiring is needed for each completed radio. However, there is some waste involved in the process as wire is occasionally cut to the wrong length or is damaged in the assembly process. Edward Co estimates that 2% of the purchased wire is lost in the assembly process. Wire costs $0·50 per metre to buy.

Other material – other materials cost $8·10 per radio.

Assembly labour – these are skilled people who are difficult to recruit and retain. Edward Co has more staff of this type than needed but is prepared to carry this extra cost in return for the security it gives the business. It takes 30 minutes to assemble a radio and the assembly workers are paid $12·60 per hour. It is estimated that 10% of hours paid to the assembly workers is for idle time.

Production Overheads – recent historic cost analysis has revealed the following production overhead data:

	Total production overhead	*Total assembly labour hours*
	$	
Month 1	620,000	19,000
Month 2	700,000	23,000

Fixed production overheads are absorbed on an assembly hour basis based on normal annual activity levels. In a typical year 240,000 assembly hours will be worked by Edward Co.

Required:

(d) Calculate the expected cost per unit for the radio and identify any cost gap that might exist.

3 Genesis

(a) Genesis plc make and sell two products R and S, each of which passes through the same production operations. The following estimated information is available for period 1:

(i) Product unit data:

	R	*S*
Direct material cost ($)	2	40
Variable production overhead cost ($)	28	4
Overall time per unit (minutes)	15	9

(ii) Production/sales of products R and S are 120,000 units and 45,000 units respectively. The selling prices per unit for R and S are $60 and $70 respectively.

(iii) Maximum demand R and S are 144,000 and 54,000 respectively.

(iv) Total fixed production overhead cost is $1,470,000. This is absorbed by products R and S at an average rate per hour based on the estimated production levels.

Required:

Using net profit as the decision measure, show why the management of Genesis plc argues that it is indifferent on financial grounds as to the mix of products R and S which should be produced and sold, and calculate the total net profit for period 1.

(b) One of the production operations has a maximum capacity of 3,075 hours which has been identified as a bottleneck which limits the overall production/sales of products R and S. The bottleneck time required per unit for products R and S are 1.2 and 0.9 minutes respectively.

All other information detailed in (a) still applies.

Required:

Calculate the mix (units) of products R and S which will maximise net profit and the value ($) of the maximum net profit, using a marginal costing approach.

(c) The bottleneck situation detailed in (b) still applies. Genesis plc has decided to determine the profit maximising mix of products R and S based on the Throughput Accounting principle of maximising the throughput return per production hour of the bottleneck resource. This may be measured as: Throughput return per production hour = (selling price – material cost)/bottleneck hours per unit.

All other information detailed in (a) and (b) still applies, except that the variable overhead cost as per (a) is now considered to be fixed for the short/intermediate term, based on the value ($) which applied to the product mix in (a).

Required:

(i) Calculate the mix (units) of products R and S which will maximise net profit and the value of that net profit.

(ii) Calculate the throughput accounting ratio for product S which is calculated as: throughput return per hour of bottleneck resource for product S/overall total overhead cost per hour of bottleneck resource.

4 Cameron

George Cameron, a self employed builder, has been asked to provide a fixed price quotation for some building work required by a customer. Cameron's accountant has compiled the following figures, together with some notes as a basis for a quotation.

		$	
Direct materials			
Bricks	200,000 at $240 per thousand	48,000	note 1
	200,000 at $288 per thousand	57,600	
Other materials		12,000	note 2
Skilled	7,680 hours at $12 per hour	92,160	note 3
Unskilled	4,800 hours at $6 per hour	28,800	note 4
Other costs			
Machine hire		8,400	note 5
Depreciation of own machinery		4,800	note 6
General overheads 12,480 hours at $1 per hour		12,480	note 7
Plans		4,800	note 8
Total cost		269,040	
Profit		67,260	note 9
Suggested price		$336,300	

Notes

(1) The contract requires 400,000 bricks, 200,000 are already in inventory and 200,000 will have to be bought in. This is a standard type of brick regularly used by Cameron. The 200,000 in inventory were purchased earlier in the year at $240 per 1,000. The current replacement cost of this type of brick is $288 per 1,000. If the bricks in inventory are not used on this job George is confident that he will be able to use them later in the year.

(2) Other materials will be bought in as required; this figure represents the purchase price.

(3) Cameron will need to be on site whilst the building work is performed. He therefore intends to do 1,920 hours of the skilled work himself. The remainder will be hired on an hourly basis. The current cost of skilled workers is $12 per hour. If George Cameron does not undertake the building work for this customer he can either work as a skilled worker for other builders at a rate of $12 per hour or spend the 1,920 hours completing urgently needed repairs to his own house. He has recently had a quotation of $28,000 for labour to repair his home.

(4) George employs several unskilled workers on contract guaranteeing them a 40 hours week at $6 per hour. These unskilled labourers are currently idle and would have sufficient spare time to complete the proposal under consideration.

(5) This is the estimated cost of hiring a machine.

(6) George estimates that the project will take 20 weeks to complete. This represents 20 weeks' straight line depreciation on the equipment used. If the equipment is not used on this job it will stand idle for the 20 week period. In either case its value at the end of the 20 week period will be identical.

(7) This represents the rental cost of George's store yard. If he does not undertake the above job he can rent the space out to a competitor who will pay him rent of $1,200 per week for the 20 week period.

(8) This is the cost of the plans that George has already had drawn for the project.

(9) George attempts to earn a mark up of 25% on cost on all work undertaken.

George is surprised at the suggested price and considers it rather high. He knows that there will be a lot of competition for the work.

Required

(a) Explain how each item in the accountant's estimate should be treated

(b) Using relevant costing principles, calculate the lowest price that George could quote for the customer's building work.

(c) Discuss the advantages and disadvantages of full cost-plus pricing.

5 Pricing

A company produces a single product and operates in a market where it has to lower the selling price of all units if it wishes to sell more.

The costing and marketing departments have provided the following information:

The current demand is 1,000 units per month, at a selling price of $10 per unit.

It is estimated that for every $1 change the in the selling price, the demand will change by 100 units.

The variable costs of production are $0.60 per unit, and the fixed costs are $5,000 per month.

Required:

(a) Derive the price/demand equation

(b) Calculate the optimal selling price per unit to achieve maximum profit, and the amount of that profit.

(Note: The marginal revenue is given by 20 – 0.02Q where Q is demand.

6 Joker

Joker Club specialises in the provision of exercise and dietary advice to clients. The service is provided on a residential basis and clients stay for whatever number of days suits their needs.

Budgeted estimates for the year ending 31 December 2010 are as follows:

(i) The maximum capacity of the centre is 50 clients per day for 350 days in the year.

(ii) Clients will be invoiced at a fee per day. The budgeted occupancy level will vary with the client fee level per day and is estimated at different percentages of maximum capacity as follows:

Client fee per day	*Occupancy level*	*Occupancy as percentage of maximum capacity*
$180	High	90%
$200	Medium	75%
$220	Low	60%

(iii) Variable costs are also estimated at one of three levels per client day. The high, most likely and low levels per client day are $95, $85 and $70 respectively.

The range of cost levels reflects only the possible effect of the purchase prices of goods and services.

Required:

(a) Prepare a summary which shows the budgeted contribution earned by Joker Club for the year ended 31 December 2010 for each of nine possible outcomes.

(b) State the client fee strategy for the year to 31 December 2010 which will result from the use of each of the following decision rules: (i) maximax; (ii) maximin; (iii) minimax regret.

Your answer should explain the basis of operation of each rule. Use the information from your answer to (a) as relevant and show any additional working calculations as necessary.

(c) The probabilities of variable cost levels occurring at the high, most likely and low levels provided in the question are estimated as 0·1, 0·6 and 0·3 respectively.

Using the information available, determine the client fee strategy which will be chosen where maximisation of expected value of contribution is used as the decision basis.

7 Light Plc

Light plc makes a range of equipment. When producing the budget for 2011 the company realises that its principle budget factor is sales and forecasts the following sales:

Product name:	*Bronze*	*Silver*	*Gold*
Sales	1,000	2,000	500
Selling price	$50	$75	$100

The unit direct costs of manufacturing each type of equipment are:

		Bronze	*Silver*	*Gold*
Materials				
Plastic	(@ 10c/m)	5m	6m	7m
Metal	(@ $2/kg)	1.2kg	1.3kg	1.4kg
Labour				
Unskilled	(@ $2/hr)	1/2hr	3/4 hr	1 hr
Skilled	(@ $3/hr)	1/2hr	1/2hr	1 hr

The company has inventory levels of finished goods of 200 Bronze, 200 Silver and 100 Gold and raw materials inventory of 1,000m of plastic and 500kg of metal. It feels that 2011's sales figures could well be repeated in 2012 and wishes to have sufficient inventory of finished goods to cope with 10% of this demand and raw materials to cope with 20% of this demand.

Produce the following budgets:

(a) Sales budget

(b) Production budget (in numbers of Bronze, Silver and Gold)

(c) Materials usage budgets (for plastic and metal in m or kg)

(d) Materials purchases budgets (in quantities and $'s)

(e) Labour utilisation budget.

8 Budgeting

(a) Three of the various uses of budgets are performance evaluation, resource allocation and authorisation. Demonstrate your understanding of each of these in the contexts given below, providing an example in each case:

(i) performance evaluation, in the context of a private sector manufacturing company
(ii) resource allocation, in the context of a private sector service company
(iii) authorisation, in the context of a public sector organisation.

(b) Assess what benefits may be achieved by an organisation adopting a zero-based approach in its budgetary process and what difficulties may be encountered.

9 Judi

Judi Limited manufacturing has received a special order from Windsor Ltd to produce 225 components to be incorporated into Windsor's product. The components have a high cost, due to the expertise required for their manufacture. Judi produces the components in batches of 15, and as the ones required are to be custom-made to Windsor' specifications, a "prototype" batch was manufactured with the following costs:

	$
Materials	
4 kg of A, $7.50/kg	30
2 kg of B, $15/kg	30
Labour	
20 hrs skilled, $15/hr	300
5 hrs semi-skilled, $8/hr	40
Variable Overhead	
25 labour hours, $4/hr	100
	500

Additional information with respect to the workforce is noted below:

Skilled	virtually a permanent workforce that has been employed by Judi for a long period of time. These workers have a great deal of experience in manufacturing components similar to those required by Windsor, and turnover is virtually non-existent.
Semi-Skilled	hired by Judi on an "as needed" basis. These workers would have had some prior experience, but Judi management believe the level to be relatively insignificant. Past experience shows turnover rate to be quite high, even for short employment periods.

Judi's plans are to exclude the prototype batch from Windsor' order. Management believes a 80% learning rate effect is experienced in this manufacturing process, and would like a cost estimate for the 225 components prepared on that basis.

Requirements

(a) Prepare the cost estimate, assuming an 80% learning rate is experienced, and

(b) Briefly discuss some of the factors that can limit the use of learning curve theory in practice.

10 Zatler Plc

Zatler plc produces a single product.

The standards set for the month of May were as follows:

Production and sales	16,000 units
Selling price (per unit)	$140
Materials	
Material X	6 kilos per unit at $12.25 per kilo
Material Y	3 kilos per unit at $3.20 per kilo

Labour
4.5 hours per unit at $8.40 per hour
Overheads (all fixed)
$86,400 per month, they are not absorbed into the product costs.

The actual data for the month of May, is as follows:
Produced 15,400 units which were sold at $138.25 each.
Materials
Used 98,560 kilos of material X at a total cost of $1,256,640 and used 42,350 kilos of material Y at a total cost of $ 132,979.
Labour
Paid an actual rate of $8.65 per hour to the labour force. The total amount paid out, amounted to $612,766.
Overheads (all fixed) $96,840

Required:

(a) Prepare a standard cost card, and calculate the budgeted profit.

(b) Prepare a statement of the variances which reconciles the actual with the budgeted profit.

(c) Explain briefly the possible reasons for inter-relationships between material variances and labour variances.

11 Usage Variances

Original budget:
Standard cost of materials: 10 kg at 5 per kg = $50 per unit
Budget production: 10,000 units

Actual results:
Production 11,000 units
Materials 108,900kg at $4.75 per kg

Since preparation of the budget the price per kg has changed to $4.85 and the usage to 9.5kg per unit

Calculate the planning and operational variances, and analyse each into expenditure and usage variances

12 Zohan plc

Zohan plc makes a product using two materials, A and B, in the production process. A system of standard costing and variance analysis is in operation. The standard material requirement per kg of mixed output is 60% material A at $30 per kg and 40% material B at $45 per kg, with a standard yield of 90%.

The following information has been gathered for the three months January to March:

	January	*February*	*March*
Output achieved (kg)	810	765	900
Actual material input:			
A (kg)	540	480	700
B (kg)	360	360	360
Actual material cost (A plus B) ($)	32,400	31,560	38,600

The actual price per kg of material B throughout the January to March period was $45.

Required:

(a) Prepare material variance summaries for each of January, February and March which include yield and mix variances in total plus usage and price variances for each material and in total;

(b) Prepare comments for management on each variance including variance trend.

(c) Discuss the relevance of the variances calculated above in the light of the following additional information:

The company has an agreement to purchase 360 kg of material B each month and the perishable nature of the material means that it must be used in the month of purchase and additional supplies in excess of 360 tonnes per month are not available.

13 Coffee Nation

The owners of the Coffee Nation Cafe have diversified business interests and operate in a wide range of commercial areas. Since buying the restaurant they have carefully recorded the data below.

Recorded Data for the Coffee Nation Cafe

	2007	*2008*	*2009*	*2010*
Total meals served	3,750	5,100	6,200	6,700
Regular customers attending weekly	5	11	15	26
Number of items on offer per day	4	4	7	9
Reported cases of food poisoning	4	5	7	7
Special theme evenings introduced	0	3	9	13
Annual operating hours with no customers	380	307	187	126
Proposals submitted to cater for special events	10	17	29	38
Contracts won to cater for special events	2	5	15	25
Complimentary letters from satisfied customers	0	4	3	6
Average number of customers at peak times	18	23	37	39
Average service delay at peak times (mins)	32	47	15	35
Maximum seating capacity	25	25	40	40
Weekly opening hours	36	36	40	36
Written complaints received	8	12	14	14
Idle time	570	540	465	187
New meals introduced during the year	16	8	27	11
Financial Data	*$*	*$*	*$*	*$*
Average customer spend on wine	3	4	4	7
Total Turnover	83,000	124,500	137,000	185,000
Turnover from special events	2,000	13,000	25,000	55,000
Profit	11,600	21,400	43,700	57,200
Value of food wasted in preparation	1,700	1,900	3,600	1,450
Total turnover of all restaurants in locality	895,000	1,234,000	980,000	1,056,000

Required:

Assess the overall performance of the business and submit your comments to the owners. They require your comments to be grouped into the key areas of performance such as those described by Fitzgerald and Moon.

14 New Project

A large conglomerate with diverse business activities is currently considering whether it should commence a new project and has gathered the following data:

(10) An initial investment of $108 million will be required on 1 January of year 1. The project has a three year life with a nil residual value. Depreciation is calculated on a straight line basis.
(11) The project is expected to generate annual revenue flows of $160m in year 1, $180m in year 2 and $200m in year 3. These values may vary by ±5%.
(12) The incremental costs will be $100m in year 1, $120m in year 2 and $140m in year 3. These may vary by ±10%.

Additional information:
Use the written down value of the asset at the start of each year to represent the value of the asset for the year.
The cost of money is estimated to be between 8%p.a. and 13% p.a.

Note: Ignore taxation

Required:

(a) Prepare two tables showing net profit, residual income and return on investment for each year of the project for:
(i) The BEST OUTCOME;
(ii) The WORST OUTCOME.

(b) Explain the distinctive features of Residual Income and Return on Investment in measuring financial performance. Your answer should include a mention of the strengths and weaknesses of each measure.

15 Transfer pricing

A company operates two divisions, Eezy and Peezy.
Eezy manufactures two products, X and Y. Product X is sold to external customers for $42 per unit.
The only outlet for product Y is Peezy.

Peezy supplies an external market and can obtain its semi finished supplies (product Y) from either Eezy or an external source. Peezy currently has the opportunity to purchase product Y from an external supplier for $38 per unit. The capacity of division Eezy is measured in units of output, irrespective of whether product X, Y or a combination of both are being manufactured.
The associated product costs are as follows:

	X	*Y*
Variable costs per unit	32	35
Fixed overheads per unit	5	5
Total unit costs	37	40

Required:

Using the above information, provide advice on the determination of an appropriate transfer price for the sale of product Y from division Eezy to division Peezy under the following conditions:
(i) When division Eezy has spare capacity and limited external demand for product X;
(ii) When division Eezy is operating at full capacity with unsatisfied external demand for product X.

Paper F5

PRACTICE ANSWERS

1 Melns

(a) Machine hour basis

	P *$/unit*	*Q* *$/unit*	*R* *$/unit*	*S* *$/unit*
Direct materials	40	50	30	60
Direct labour	28	21	14	21
Production overhead (W1)	80	60	40	60
Total cost per unit	148	131	84	141

(b) Activity based costing

	P *$*	*Q* *$*	*R* *$*	*S* *$*	*Total* *$*
Direct material (120 units × $40 etc)	4,800	5,000	2,400	7,200	19,400
Direct labour (120 units × $28 etc)	3,360	2,100	1,120	2,520	9,100
Production overhead (W2):					
Machine department costs (120 units × 4 hrs × $8,023 etc)	3,851	2,407	1,284	2,888	10,430
Set up costs (6:5:4:6)	1,500	1,250	1,000	1,500	5,250
Stores receiving (20:20:20:20)	900	900	900	900	3,600
Inspection/quality control (6:5:4:6)	600	500	400	600	2,100
Materials handling and despatch (12:10:8:12)	1,320	1,100	880	1,320	4,620
Total cost	16,331	13,257	7,984	16,928	54,500
Per unit (120 units etc)	136.09	132.57	99.80	141.07	

Workings

1

		hrs
Total machine hours:	A (4 hrs × 120 units)	480
	B(3hrs × 100 units)	300
	C (2 hrs × 80 units)	160
	D(3hrs × 120 units)	360
		1,300

Total production overhead per question: ($10,430 + $5,250 + $3,600 + $2,100 + $4,620) = **$26,000**
Rate per machine hour: ($26,000 /1,300) = **$20**

2 Overhead costs will be divided in the following ratios, depending upon the number of production runs, requisitions or orders per product.

	A	*B*	*C*	*D*
Production runs (20 units each) (120 units ÷ 20 etc)	6	5	4	6
Requisitions raised	20	20	20	20
Orders executed (10 units each) (120 units ÷ 10 etc)	12	10	8	12

Machine department costs can be assumed to have machine hours as a cost driver

$$\therefore \frac{\text{Costs}}{\text{Machine hours}} = \frac{\$10,430}{1,300(\text{W1})} = \textbf{\$8.023}$$

2 Edward

(a) Target costing process.

Target costing begins by specifying a product an organisation wishes to sell. This will involve extensive customer analysis,considering which features customers value and which they do not. Ideally only those features valued by customers will be included in the product design.

The price at which the product can be sold at is then considered. This will take in to account the competitor products and the market conditions expected at the time that the product will be launched. Hence a heavy emphasis is placed on external analysis before any consideration is made of the internal cost of the product.

From the above price a desired margin is deducted. This can be a gross or a net margin. This leaves the cost target. An organisation will need to meet this target if their desired margin is to be met.

Costs for the product are then calculated and compared to the cost target mentioned above.

If it appears that this cost cannot be achieved then the difference (shortfall) is called a cost gap. This gap would have to be closed, by some form of cost reduction, if the desired margin is to be achieved.

(b) Benefits of adopting target costing

- The organisation will have an early external focus to its product development. Businesses have to compete with others(competitors) and an early consideration of this will tend to make them more successful. Traditional approaches (by calculating the cost and then adding a margin to get a selling price) are often far too internally driven.
- Only those features that are of value to customers will be included in the product design. Target costing at an early stage considers carefully the product that is intended. Features that are unlikely to be valued by the customer will be excluded. This is often insufficiently considered in cost plus methodologies.
- Cost control will begin much earlier in the process. If it is clear at the design stage that a cost gap exists then more can be done to close it by the design team. Traditionally, cost control takes place at the 'cost incurring' stage, which is often far too late to make a significant impact on a product that is too expensive to make.
- Costs per unit are often lower under a target costing environment. This enhances profitability. Target costing has been shown to reduce product cost by between 20% and 40% depending on product and market conditions. In traditional cost plus systems an organisation may not be fully aware of the constraints in the external environment until after the production has started. Cost reduction at this point is much more difficult as many of the costs are 'designed in' to the product.
- It is often argued that target costing reduces the time taken to get a product to market. Under traditional methodologies there are often lengthy delays whilst a team goes 'back to the drawing board'. Target costing, because it has an early external focus, tends to help get things right first time and this reduces the time to market.

(c) Steps to reduce a cost gap

Review radio features

Remove features from the radio that add to cost but do not significantly add value to the product when viewed by the customer. This should reduce cost but not the achievable selling price. This can be referred to as value engineering or value analysis.

Team approach

Cost reduction works best when a team approach is adopted. Edward Limited should bring together members of the marketing, design, assembly and distribution teams to allow discussion of methods to reduce costs. Open discussion and brainstorming are useful approaches here.

Review the whole supplier chain

Each step in the supply chain should be reviewed, possibly with the aid of staff questionnaires, to identify areas of likely cost savings. Areas which are identified by staff as being likely cost saving areas can then be focussed on by the team. For example, the questionnaire might ask 'are there more than five potential suppliers for this component?' Clearly a 'yes' response to this question will mean that there is the potential for tendering or price competition.

Components

Edward Limited should look at the significant costs involved in components. New suppliers could be sought or different materials could be used. Care would be needed not to damage the perceived value of the product. Efficiency improvements should also be possible by reducing waste or idle time that might exist. Avoid, where possible, non-standard parts in the design.

Assembly workers

Productivity gains may be possible by changing working practices or by de-skilling the process. Automation is increasingly common in assembly and manufacturing and Edward Limited should investigate what is possible here to reduce the costs. The learning curve may ultimately help to close the cost gap by reducing labour costs per unit.

Clearly reducing the percentage of idle time will reduce product costs. Better management, smoother work flow and staff incentives could all help here. Focusing on continuous improvement in production processes may help.

Overheads

Productivity increases would also help here by spreading fixed overheads over a greater number of units. Equally Edward Limited should consider an activity based costing approach to its overhead allocation, this may reveal more favourable cost allocations for the digital radio or ideas for reducing costs in the business.

(d) Cost per unit and cost gap calculation

Component 1		$ per unit
	$4{\cdot}10 + \frac{\$2{,}400}{4{,}000 \text{ units}}$	4·70
Component 2	(25% × 0.5 × 100/98)	0·128
Material - other		8·10
Assembly Labour	(30% × $12.60/hr × 100%)	7·00
Variable production overhead	(30% × $20/hr)	10·00
Fixed production overhead	(30% × $12/hr)	6·00
Total cost		35·928
Desired cost	($44 × 0·8)	35·20
Cost gap		0·728

Working 1

Production overhead cost

Using a high low method

Extra overhead cost between month 1 and 2	$80,000
Extra assembly hours	4,000
Variable cost per hour	$20/hr
Monthly fixed production overhead $700,000 – (23,000 × $20/hr)	$240,000
Annual fixed production overhead ($240,000 × 12)	$2,880,000

FPO absorption rate $\frac{\$2{,}880{,}000}{240{,}000 \text{ units}}$ $12/hr

3 Genesis

(a) Fixed production overhead is absorbed at an average rate per hour.

Total hours = 120,000 × 0·25 + 45,000 × 0·15 = 36,750

Absorption rate per hour = $1,470,000/36,750 = $40

Net profit per product units may be calculated as:

	Product R		*Product S*
	$		*$*
Direct material cost	2		40
Variable production overhead cost	28		4
Fixed production overhead (0·25 × $40)	10	(0·15 × $40)	6
Total cost	$40		$50
Selling price	$60		$70
Net profit	$20		$20

Genesis will be indifferent on financial grounds to the mix of products R and S since net profit per unit is the same for both products.

Total net profit = 120,000 × $20 + 45,000 × $20 = $3,300,000

(b) Using the figures from (a) the contribution per product unit (selling price – variable cost) may be calculated as:

R = $60 – (2 + 28) = $30

S = $70 – (40 + 4) = $26

We have:	*R*	*S*
Contribution per unit	$30	$26
Bottleneck hours per unit	0·02	0·015
Contribution per bottleneck hour	$1,500	$1,733

Ranking the products on the basis of contribution per bottleneck hour we should produce and sell product S up to its maximum demand and then product R with the remaining capacity.

Maximum demand of product S = 54,000 units

Bottleneck hours required for S = 54,000 × 0·015 = 810 hours

Bottleneck hours available for R = 3,075 – 810 = 2,265 hours

Output of product R which is possible = 2,265/0·02 = 113,250 units

The maximum net profit may be calculated as:

		$
Contribution product R	113,250 × $30	3,397,500
Contribution product S	54,000 × $26	1,404,000
Total contribution		4,801,500
Less: Fixed overhead cost:		1,470,000
Net profit		3,331,500

(c) (i) Return per bottleneck hour

= (selling price – material cost)/ bottleneck hours per unit

Product R = (60 – 2)/0·02 = $2,900

Product S = (70 – 40)/0·015 = $2,000

Genesis should sell product R up to its maximum demand and then product S using the remaining capacity.

Maximum demand of product R = 144,000 units

Bottleneck hours required for R = 144,000 × 0·02 = 2,880 hours

Bottleneck hours available for S = 3,075 – 2,880 = 195 hours
Output of product S which is possible = 195/0·015 = 13,000 units
The maximum net profit may be calculated as:

		$
Throughput return product R 144,000 × ($60 – 2)		8,352,000
Throughput return product S 13,000 × ($70 – 40)		390,000
Total throughput return		8,742,000
Less:	Overhead cost:	
	Shown as variable in **(a)** (120,000 × $28 + 45,000 × $4)	(3,540,000)
	Fixed	(1,470,000)
Net profit		3,732,000

(ii) Throughput return per bottleneck hour for product S (as calculated above)
= (70 – 40)/0·015 = $2,000
Cost per bottleneck hour = ($3,540,000 + $1,470,000)/3,075 = $1,629·27
Throughput accounting ratio for product S = $2,000/$1,629·27 = 1·2275

4 Cameron

(a) The relevant costs which should be used for arriving at the minimum contract price are those future cash flows that will arise as a direct consequence of the decision to undertake the contract.

1. As bricks are used in the course of business, any used in this contract will need to be replaced. The relevant cost is therefore the replacement cost of $288 per 1,000.
2. Other materials are costed at their purchase price.
3. George Cameron's labour is charged at the opportunity cost, ie the benefit foregone as a result of working on the contract (or best alternative use). The best alternative use would be a saving of $28,000 by repairing his own house. The remainder of the skilled labour, after deducting George's hours, is charged at the incremental cost of $12 per hour.
4. Unskilled labour would have been incurred irrespective of the decision to undertake the project. The relevant cost is therefore nil.
5. The relevant cost is the cost of hiring the machine.
6. Depreciation is not a cash flow. The general purpose machinery is already owned by George Cameron and is not purchased specifically for this contract. Its value is unaffected by the contract.
7. The relevant cost is the best alternative use of the space.
8. The cost of the plans is a sunk cost and therefore not relevant to the pricing decision.
9. No profit is included as the price calculated is the minimum price which George can quote in a competitive environment.

(b) Minimum price to be quoted for building work

	$
Direct materials:	
Bricks (400,000 @ $288 per thousand)	115,200
Other materials (at purchase price)	12,000
Direct labour:	
George Cameron 's time	28,000
Skilled labour 5,760 @ $12 per hour	69,120
Unskilled	–
Other costs:	
Machine hire (at the incremental cost)	8,400
Depreciation of general purpose machinery	–
General overheads	–
Opportunity cost of using space	24,000
Plans	–
Total cost	256,720
Profit	–
Minimum price	256,720

A minimum price would leave the business no better or worse off than if George did not do the job. It is unlikely that a minimum price would actually be charged because if it were, it would not provide the business with any incremental profit.

(c) Advantages of full cost-plus pricing

(i) It is a quick, simple and cheap method of pricing which can be delegated to junior managers. This may be particularly important with jobbing work where many prices must be decided and quoted each day.

(ii) A price in excess of full cost should ensure that a company working at normal capacity will cover all of its costs and make a profit.

(iii) There may be no readily identifiable market for the product, for example, a jobbing engineering company makes products to customers' specific specifications. In such cases it will be difficult to determine a suitable starting point for pricing other than full cost.

Disadvantages of full cost-plus pricing

(i) It fails to recognise that since demand may be determining price, there will be a profit-maximising combination of price and demand.

(ii) There may be a need to adjust prices to market and demand conditions.

(iii) Budgeted output volume needs to be established. Output volume is a key factor in the overhead absorption rate.

(iv) A suitable basis for overhead absorption must be selected, especially where a business produces more than one product.

5 Pricing

(a) $b = \frac{\text{change in price}}{\text{change in quantity}} = \frac{1}{100} = 0.01$

a = price when Q = 0 = 10 + 0.01 × 1,000 = 20

P = 20 – 0.01Q

(b) Optimal selling price occurs when marginal revenue (MR) equals marginal cost (MC)

MC = variable cost p.u. = 0.60

MR = 20 – 0.02Q (from question)

20 – 0.02Q = 0.60

0.02Q = 19.40

Q = 19.40 / 0.02

= **970 units**

From demand of 970 units,

P = 20 – 0.01Q = 20 – 0.01 × 970

= **$10.30 per unit**

Maximum profit:

Total contribution (970 × (10.30 – 0.60))	9,409
Less: fixed costs	5,000
Maximum profit:	$4,409

6 Joker

(a) Budgeted Net Profit/Loss outcomes for year ending 31 December 2010.

Client Days	*Fee per Client day*	*Variable cost per client day*	*Contribution per client day*	*Total contribution per year*
	$	*$*	*$*	*$*
15,750	180	95	185	1,338,750
15,750	180	85	195	1,496,250
15,750	180	70	110	1,732,500
13,125	200	95	105	1,378,125
13,125	200	85	115	1,509,375
13,125	200	70	130	1,706,250
10,500	220	95	125	1,312,500
10,500	220	85	135	1,417,500
10,500	220	70	150	1,575,000

(b) The maximax rule looks for the largest contribution from all outcomes. In this case the decision maker will choose a client fee of $180 per day where there is a possibility of a contribution of $1,732,500.

The maximin rule looks for the strategy which will maximise the minimum possible contribution. In this case the decision maker will choose client fee of $200 per day where the lowest contribution is $1,378,125. This is better than the worst possible outcome from client fees per day of $180 or $220 which will provide contribution of $1,338,750 and $1,312,500 respectively.

The minimax regret rule requires the choice of the strategy which will minimise the maximum regret from making the wrong decision. Regret in this context is the opportunity lost through making the wrong decision.

Using the calculations from part (a) we may create an opportunity loss table as follows:

	Client fee per day strategy		
State of variable cost	$180	$200	$220
High	39,375	0	65,625
Most likely	13,125	0	91,875
Low	0	26,250	157,500
Maximum regret	**39,375**	**26,250**	**157,500**

Example of the workings: at the low level of variable costs, the best strategy would be a client fee of $180. The opportunity loss from using a fee of $200 or $220 per day would be $26,250 (1,732,500 – $1,706,250) or $157,500 (1,732,500 – 1,575,000) respectively.

The minimum regret strategy (client fee $200 per day) is that which minimises the maximum regret (i.e. $26,250 in the maximum regret row above).

(c) The expected value of variable cost

= $95 × 0·1 + $85 × 0·6 + $70 × 0·3 = $81.50

For each client fee strategy the expected value of budget contribution for the year may be calculated:

- fee of $180 : 15,750 (180 × 81·50) = $1,551,375
- fee of $200 : 13,125 (200 × 81·50) = $1,555,312·50
- fee of $220 : 10,500 (220 × 81·50) = $1,454,250

Hence choose a client fee of $200 per day to give the maximum expected value contribution of $1,555,312·50. Note that there is virtually no difference between this and the contribution where a fee of $180 per day is used.

7 Light plc

(a) Sales budget

	Bronze	*Silver*	*Gold*	*Total*
Quantities	1,000	2,000	500	3,500
Unit selling price	$50	$75	$100	
Revenue	$50,000	$150,000	$50,000	$250,000

(b) Production budget

	Bronze	*Silver*	*Gold*	*Total*
Sales	1,000	2,000	500	3,500
Closing inventory (W1)	100	200	50	350
	1,100	2,200	550	3,850
Opening inventory	(200)	(200)	(100)	(500)
Production	900	2,000	450	3,350

(c) Materials usage

	Bronze	*Silver*	*Gold*	*Total*
Plastic - (m)	4,500	12,000	3,150	19,650
Metal - (kg)	1,080	2,600	630	4,310

(d) Materials purchases

	Plastic		*Metal*	*Total*
	m	*$*	*kg*	*$*	*$*
Usage	19,650	1,965	4,310	8,620	10,585
Closing inventory (W2)	4,100	410	900	1,800	2,210
	23,750	2,375	5,210	10,420	12,795
Opening inventory	(1,000)	(100)	(500)	(1,000)	(1,100)
Purchases	22,750	2,275	4,710	9,420	11,695

(e) Labour utilisation budget

	Unskilled (hours)	*Skilled (hours)*	*Total (hours)*
Bronze (900 units)	450	450	900
Silver (2,000 units)	1,500	1,000	2,500
Gold (450 units)	450	450	900
	2,400	1,900	4,300
Hourly rate	$2	$3	
Total cost	$4800	$5,700	$10,500

Workings

(W1) Closing inventory of finished goods = 10% of 2012 demand

e.g. Bronze 10% × 1,000=100

(W2) Closing inventory of raw materials = 20% of materials required for 2012 demand

Plastic requirements for 2012 demand

Bronze: 5m × 1,000 + Silver: 6m × 2,000 + Gold: 7m × 500 = 20,500 m

Closing inventory @ 20% = 4,100m

Metal requirements for 2012 demand:

Bronze: 1.2kg × 1,000 + Silver: 1.3kg × 2,000 + Gold: 1.4kg × 500 = 4,500 kg

Closing inventory @ 20% = 900 kgs

8 Budgeting

(a) Budget uses

(i) Performance evaluation

Budgets are plans, they set targets for the organisation or sub-units of it (departments or divisions). The achievement of the budget is often delegated to managers in these departments. It is therefore possible to measure the extent to which budget targets are met by managers and in this way they are measures of the managers' performance. It must be understood that there may be dimensions of performance not captured by the budget, but it is a convenient device and it offers relative ease of measurement. However, this may result in the less easily measured dimensions of performance not being measured.

If a person is to be evaluated using budget data, it is important that they have an opportunity to influence budget content but not to bias it in their favour. A department manager of a manufacturing company will be required to achieve a certain number of units of output with a given expenditure on direct material. The variance between actual material cost and the flexible budget (based on actual output) is one way of evaluating how the department has been supervised, machines been set and material controlled, etc.

(ii) Resource allocation

Budgets enable the business to estimate the amount of physical and financial resources available over a future period. Information can also be collected on the environment in which the business operates in order to identify any strengths, opportunities etc, which may exist. It is then possible for managers of the organisation to discuss how these resources can be allocated to different parts of the business in order to create an optimal plan.

The management of a bank engage in resource allocation decisions when they decide to undertake more business by phone/mail from a regional office rather than dealing with customers in their individual branches. In their efforts to reduce costs, perhaps to improve on last year's budget, the relocation of some staff/resources into large regional offices and closure of some small branches is an example of resource allocation in this sector.

(iii) Authorisation

In some budget systems expenditure which has passed through the budget review procedure automatically becomes approved for commitment without additional formality. In other words, the identification of an expense for a particular budget centre is the formal approval that the head of the centre may go ahead and incur such an expense. No further detailed control in relation to this would occur until the actual expenditure was reported as part of the financial control system:

A public sector organisation is, for example, the departments of a local authority, social services, housing, education. When the authority meet to set their annual budget this is often based on their assessment of spending need in each area. Once the budget, and its division into each area is set, the officers of the local authority are in a position to incur expenditure in line with budget. The budget is their authorisation to spend up to that amount in providing services to the community.

(b) Benefits and difficulties of ZBB

Traditional budgeting, sometimes called incremental budgeting, takes a current level of spending almost without examination and discussion takes place on any extra expenditure. Zero-based budgeting (ZBB) is an approach which takes nothing for granted. It requires that each budget centre makes a detailed case for all of its budget allocation each year. As a result all spending is subject to scrutiny, not just incremental spending. This technique would not suit expenditure planning in line departments of a manufacturing company because clear relationships of input and output will exist and be defined by standard values. In less clearly defined areas such as service departments or service orientated industries, both private and public sector, it might have some value if selectively applied.

It is possible that economies and increased efficiency could result if departments were to justify all, not just incremental, expenditure. It is argued that if expenditure were examined on a cost/benefit basis a more rational allocation of resources would take place. Such an approach would force managers to make plans and prioritise their activities before committing themselves to the budget. It should achieve a more structured involvement of departmental management and should improve the quality of decisions and management information.

It could be expensive however, in time and effort to analyse all expenditure and difficult to establish priorities for the activities or decision packages. Managers are often reluctant to commit themselves to it because they believe they already do it. Critics have asserted that no real change in fund allocation takes place as a result of the exercise.

Any system which encourages managers to examine and communicate about their spending and performance levels must be useful providing it does not prevent individuals fulfilling their other duties and responsibilities.

9 Judi

(a) Cost estimate for 225 components is based upon the following assumptions:

(1) the first batch of 15 is excluded from the order (and total cost for first batch is likewise excluded); and

(2) the 80% learning rate only applies to the skilled workforce, (and related variable overhead) due to their high level of expertise/low turnover rate.

Cumulative Batches	*Cumulative Units*	*Total Time*	*Cumulative time/batch*
1	15	20 hr	20 hr
2	30	32 hr	16 hr
4	60	51.2hr	12.8hr
8	120	81.92hr	10.24hr
16	240	131.072hr	8.192hr

Total cost for 16 batches (240 components)

		$
Material A	$30 batch	480
Material B	$30/batch	480

Labour	Skilled 131.072 hr @ $15/hr	1,966
	Semi-skilled $40/batch	640
Variable overheads	131.072 hr @ $4/hr	524
	5 hr/batch at $4/hr	320
		4,410
Less: Cost for 1st batch (15 components)		(500)
∴cost for 225 components		3,910

(b) The limited use of learning curve theory is due to several factors:

(i) the learning curve phenomenon is not always present;

(ii) it assumes stable conditions at work (eg of the labour force and labour mix) which will enable learning to take place. This is not always practicable (eg because of labour turnover).

(iii) it must also assume a certain degree of motivation amongst employees;

(iv) extensive breaks between production of items must not be too long, or workers will 'forget' and the learning process would have to begin all over again;

(v) it is difficult to obtain enough accurate data to decide what the learning curve is;

(vi) there will be a cessation to learning eventually, once the job has been repeated often enough.

10 Zatler plc

(a) Profit statements

	Original budget		*Actual*	
	$	*$*	*$*	*$*
Sales (at $140)		2,240,000	(at $138.25)	2,129,050
Less: Costs				
Materials				
Mat. X				
(6 kilos × 16,000) = 96,000 × $12.25	1,176,000		1,256,640	
			(given)	
Mat. Y				
(3. kilos × 16,000) = 48,000 × $3.20	153,600		132,979	
			(given)	
Labour				
(4.5 hours × 16,000) = 72,000 × $8.40	604,800		612,766	
			(given)	
Fixed overheads	86,400		96,840	
	(given)		(given)	
		2,020,800		2,099,225
Profit		219,200		29,825

(b) Operating statement

				$
Original budget profit (as above)				219,200
Variance		*Favourable (+)*	*Adverse (–)*	
		$	*$*	
Sales volume (600u × $19.10)			11,460	
Sales price				
Standard - Actual				
($2,156,000 - $2,129,050)			26,950	
Materials				
Mat. X usage				
(Standard - Actual) × Standard price				
(92,400 - 98,560) × $12.25**			75,460	
Mat. Y 90 usage				
(Standard - Actual) × Standard price				
(46,200 - 42,350) × $3.20		12,320		
Mat. X Price				
(Actual quantity × Actual price)	1,256,640			
(Actual quantity × Standard price)	1,207,360			
			49,280	
Mat. X Price				
(Actual quantity × Actual price)	132,979			
(Actual quantity × Standard price)	135,520			
		2,541		
Labour				
Efficiency				
(Standard hours - Actual hours) × Standard rate				
(69,300 - 70,840) = 1,540 × $8.40			12,936	
Rate				
(Standard – Actual) × Actual hours				
($8.40 - 8.65) = $0.25 × 70,840			17,710	
Overheads				
Fixed overheads				
Standard - Actual				
($86,400 - $96,840)			10,440	
		14,861	192,776	(177,915) (A)
Actual profit				29,825

* $\frac{\$612,766}{\$8.65}$ = 70,840 hours

(c) Inter-relationships

Variances may be inter-related (eg the reason why one variance is favourable could also help explain why another variance is adverse).

Using poor quality materials could result in a favourable price variance because of paying a lower price. The poor quality material could be the cause of an adverse material usage variance and an

adverse labour efficiency variance (eg materials more difficult to work with, more rejects/spoilt work, more waste).

If a higher grade of labour was used, compared with that which was planned, there would most certainly be an adverse labour rate variance. The higher skill level employed could well be the reason for a favourable labour efficiency variance and a favourable material usage variance (eg a lower number of rejects and less waste of materials.

11 Usage Variances

Flexed original budget (for 11,000 units produced):

11,000 units x \$50 = \$550,000

Revised budget (for 11,000 units produced):

11,000 units x \$46.075 = \$506,825

Planning \$43,175 (F)

Actual results (for 11,000 units produced):

108,900 kg x \$4.75 = \$517,275

Operational \$10,450 (A)

Analysis

Planning variances

Expenditure

11,000u x 9.5 kg =	104,500 kg x \$4.85 =	506,825	
	104,500 kg x \$5 =	522,500	
		\$15,675	(F)

Usage:

	kg		
Revised	104,500		
Flexed budget (11,000 x 10kg)	110,000		
	5,500kg x \$5 =	\$27,500	(F)

Operational variances

Expenditure

Actual	108,900 kg x \$4.75 =	517,275	
Revised	108,900 kg x \$4.85 =	528,165	
		\$10,890	(F)

Usage:

	kg		
Actual	108,900		
Revised (11,000 x 9.5 kg)	104,500		
	4,400kg x \$4.85 =	\$21,340	(A)

12 Zohan

(a) Material variance summaries

Material A	60% @ $30	18	
Material B	40% @ $45	18	
	100%	36	
Standard loss	10%		
Standard yield	90%	= $36 / 90%	= $40 per kg

Price variance:	*January*	*February*	*March*
	$	*$*	*$*
Material B	Nil	Nil	Nil
Material A:			
Total material cost	32,400	31,560	38,600
Less: Cost of B 360 × $45	16,200	16,200	16,200
Actual cost of material A	16,200	15,360	22,400
Standard price @ Actual quantity:			
540 × $30	16,200		
480 × $30		14,400	
700 × $30			21,000
Price variance	Nil	960 A	1,400 A

Material variance summaries

	January			*February*			*March*		
Product:	***A***	***B***	***Total***	***A***	***B***	***Total***	***A***	***B***	***Total***
Mix variance									
Actual quantity @ Actual mix	540	360	900	480	360	840	700	360	1,060
Actual quantity @ Standard mix	540	360	900	504	336	800	636	424	1,060
Mix variance			Nil	24 @ $30 = $720 F	24@$45= $1,080A	360 A	64@$30= $1,920 A	64@$45= $2,880 F	$960 F
Yield variance									
Actual quantity @ Standard mix	540	360	900	504	336	800	636	424	1,060
Std quantity for actual production @ Standard mix	540	360	810 × 100/90 = 900	510	340	765 × 100/90 = 850	600	400	900 × 100/90 = 1,000
Yield variance			Nil	6 @ $30 =$180 F	4@$45 =$180 F	$360 F	36@$30 =$1,080 A	24@$45 =$1,080 A	$2,160 A
Usage variance									
Actual quantity @ Actual mix	540	360		480	360		700	360	
Std quantity for actual production @ Std mix	540	360		510	340		600	400	
Usage variance			$Nil	30@$30 = $900 F	20@$45= $900 A	Nil	100@$30 =$3,000 A	40@$45 = $1,800 F	$1,200 A

(b) Comments

Production in January is exactly according to standard. The price of B has remained at standard for the whole period. The price of A is \$2 $\frac{960}{480}$ and $\frac{1,400}{700}$ and in excess of standard in February and March.

If this continues the standard price of A will need to be increased. The proportion of A in the mix changed to $\frac{4,400}{840} = 57\%$ and $\frac{700}{1,060} = 66\%$ March respectively.

The cost increase in February, shown as an adverse mix variance of \$360, is caused by dearer B being used instead of cheaper A. There is an improvement in yield in February. The increased yield could be viewed as an abnormal gain of 9kg (840 × 90% = (756 – 765) × \$40 = \$360). There is also a reduction in volume produced in February.

In March the significant increase in the proportion of A (which is cheaper) used has caused a favourable mix variance and may have contributed to the large adverse yield variance. Production in March is considerably higher than for January and February - this may be a reason for the adverse yield variance.

Overall there appears to be a link between mix and yield. If the proportion of B is increased, causing adverse mix variance as B is more expensive, the yield is improved - as occurred in February; the opposite took place in March.

There could also be a link between yield and the volume of production - in February production is low and yield is high, whereas in March production is high and yield is low.

(c) Relevance of the variances

This information helps to explain the increased proportion of B used in February - if not used B would be wasted, which could involve disposal costs. It could therefore be argued that the adverse mix variance on B of \$1,080 in February is a sunk cost ie, using a greater proportion of B has not increased the purchase quantity. Using more of B has improved yield.

In March the restriction on B has resulted in adverse yield arising from the increased proportion of A needed to increase production volume - this has resulted in an overall adverse usage variance of \$1,200. This excess cost should be included in the evaluation of decisions to try to obtain more of B by, for example, paying a premium price.

It would be necessary to ascertain whether and how quality of the final product is affected by changes in mix and whether the quality is then acceptable to customers.

13 Coffee Nation

The performance can be categorised into the following key areas: Financial, Competitiveness, Resource Utilisation, Quality of Service and Innovation/Flexibility.

Financial:

- Continuous turnover growth with a 123% increase over the period.
- Annual compound growth rate
- An even faster growth in profit – approximate five fold increase
- Profits growing faster than turnover creates an increasing net profit margin from 14% in 2007 to 30·9% in 2010. This may have arisen from improved resource utilisation (see below) resulting in a gradual decrease in the ratio of fixed costs to revenues.

Competitiveness:

Concerned with market share and growing new business areas.

Market share measured by the rate of restaurant turnover to the turnover of all restaurants in the locality. This commences with 9·2% in 2007 and continually increases to 17·5% in 2010. There is also a rapid growth in the proposals submitted for new events (10 to 38), and even more significantly, is the faster growth in contracts won. The success rate increases from 20% in 2007 to 66% in 2010. The restaurant is therefore competing increasingly successfully in this developing business area. The restaurant is becoming increasingly price competitive.

Quality of service

The increasing number of regular customers would suggest that many customers are satisfied with the total package that the restaurant offers. This may be partly due to service quality or other factors such as price competitiveness. The growth in complaints, complimentary letters, reported cases of food poisoning and the service delivery data would suggest rather a mixed situation. It is difficult to provide a definitive comment regarding the quality of service over the period, especially as the number of customers nearly doubled over the period. Even additional calculations, such as those involving key service quality data per 100 customers would not provide the basis for an overall conclusive comment.

Innovation/Flexibility

The restaurant has fared quite well in this respect when we consider:

- Increase in the number of dishes on offer
- The introduction of theme evenings
- The development of the catering activities for special events

The restaurant is prepared to try new dishes although the extent of its experimentation varies considerably from year to year.

Also, the fluctuating and somewhat unsatisfactory service delays suggest that they are not managing to flex their resources adequately to meet peak demand levels.

Resource Utilisation

The business activity level continually increased over the period (meals served) with a decline in non-productive time and the hours of operation with no customers. All these suggest an improvement in resource utilisation. We do not know whether the increase in seating capacity in 2009 arose from extending the floor area available or from the provision of more seating within a constant space. Although this capacity increase permitted more customers to be fed at peak times, it did result in a fluctuation in the annual number of meals served at each seat, 150 (2007), 204 (2008), 155 (2009), 167 (2010). A brief attempt was made in 2009 to extend the opening hours and increase the hourly utilisation of the premises.

14 New Project

(a) (i) Best outcome

Year	*1*	*2*	*3*
	$m	*$m*	*$m*
Revenues	168	189	210
Less direct costs	90	108	126
= net cash flow	78	81	84
Less depreciation	36	36	36
= Profit	42	45	48
Less imputed interest (8%)	8.64	5.76	2.88
= Residual Income	33.36	39.24	45.12
NBV	108	72	36

ROI $\frac{42}{108} \times 100 = 39\%$ $\frac{45}{72} \times 100 = 62.5\%$ $\frac{48}{36} \times 100 = 133\%$

(ii) Worst outcome

Year	*1*	*2*	*3*
	$m	*$m*	*$m*
Revenues	152	171	190
Less direct costs	110	132	154
= net cash flow	42	39	36
Less depreciation	36	36	36
= Profit	6	3	0
Less imputed interest (13%)	14.08	9.36	4.68
= Residual Income	(8·04)	(6·36)	(4·68)
NBV	108	72	36

ROI $\frac{6}{108} \times 100 = 5.6\%$ $\frac{3}{72} \times 100 = 4.2\%$ $\frac{0}{36} \times 100 = 0\%$

(b) Residual Income:

This measures net income after deducting an imputed interest charge on the capital employed. It is intended to ensure that the decision making and performance assessment process incorporates the finance (interest) cost of securing funds for a project. It prompts the question – is this project a good use for scarce and costly funds?

Strengths

- Signals to project sponsors that funding of projects involves finance costs.
- Can be used to discriminate between projects that generate returns above and below the cost of capital.
- Is a flexible tool as projects carrying differing risks can have separate rates of interest imputed.

Weaknesses

- It does not facilitate comparison between projects that vary in size because it is an absolute measure of surplus.
- Many difficulties can arise in deciding an appropriate and accurate measure of the capital employed on which to base the imputed interest charge (see further comments on ROI).

Return on Investment:

It gauges the efficiency of the project to generate outputs (profits) from resources input (required investment). It can be used to assess short and long term decisions.

Strengths

- It is directly related to the standard accounting process and is widely understood.
- It appeals to investors who are interested in assessing the percentage return on an investment.
- It permits comparison to be drawn between projects that differ in their absolute size.
- It permits the performance of semi-autonomous business units to be compared with each other and with an aggregated figure.

Weaknesses

- It can be difficult to identify the appropriate value of the investment – there are problems associated with the valuation of 'assets' in relation to their earning power. What are 'assets'? Many 'costs 'are expensed, R&D for example, and do not form part of the asset base of an organisation but nevertheless make a significant contribution to the earning power of the entity. On the other hand, intangibles like brands and customer lists can be regarded as legitimate 'assets' in a Statement of Financial Position but are notoriously difficult to value.
- Both recorded profit figures and asset values are subject to unscrupulous manipulation by senior managers in an attempt to artificially enhance the ROI performance of their organisations – candidates should be given credit for referring to recent (2002) scandals within large US companies.
- It is not easy to compare the performance of investment centres if they have calculated their

depreciation in different ways or have assets that vary in their age profile.

- The ROI is likely to increase as assets depreciate and therefore this may deter necessary asset replacement if managers are assessed on short run ROI performance – short term ROI performance indicators may discourage long term optimal decisions being taken.
- Where a conglomerate sets a common ROI target that has to be achieved for all new projects, it may present problems in assessing performance fairly where:
  - » the target return makes no allowance for projects with varying risk.
  - » where the various parts of the business operate in differing business environments.

(c) Issues to consider may include:

- The anticipated project risk – is it known and can it be measured?
- Does the project represent the commencement of a much larger and longer term plan? An apparently poor performing project in the short term may proceed because of the long term prospects.
- The synergy and relationship between different projects may need to be considered – the role of the project within the corporate plan.
- The potential for an individual project to alter the overall risk of a company's business activities e.g. a single project has the potential, if combined with certain other projects, to lower overall risk, and consequently the corporate cost of capital.
- When will the project commence – now or later? Is postponement feasible? Is this project an integral element of a broader plan?

15 Transfer pricing

(a) (i) When division Eezy has spare capacity the incremental cost to the company of producing Y is $35. The cost of the external supply is $38. Therefore it is cheaper for the company if division Eezy supplies Y. The transfer price should be fixed at a price above $35, to provide an incentive for Eezy to supply and generate a contribution towards the recovery of fixed costs, and below $38 to encourage Peezy to buy. The price should be set so that both divisions, acting independently and in their own interests, choose to trade at the set price.

(ii) The situation now requires a consideration of the opportunity cost of diverting resources away from the supply of external customers. For every additional unit of Y produced and supplied to Peezy, Eezy will have to sacrifice indirectly $10 in lost contribution from external sales ($42 – $32). So the relevant cost of making a unit of Y in these circumstances is $35 plus $10 i.e. $45. $45 represents the 'real' cost of supplying division Peezy with one unit of product Y. It is therefore better for the company to purchase product Y from the external supplier for $38. We can ensure this happens by fixing the transfer price of Y above $38, to discourage Peezy from buying it from Eezy. At a price of $40, Peezy would not choose to buy from Eezy, and it would not be in the interest of Eezy to sell to the other division.

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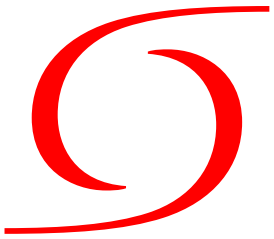

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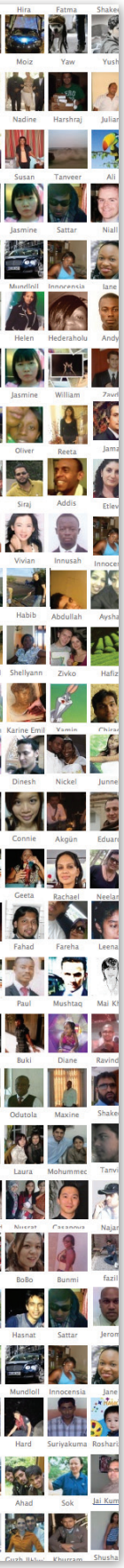

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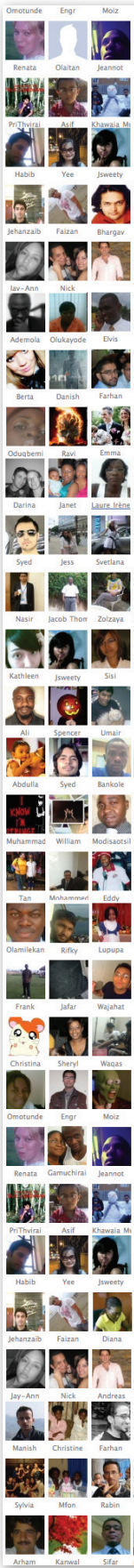

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