Chapter 1: Management Information Systems and Data Analytics

Chapter 1 covers the following Learning Outcomes.

A. Management Information Systems and Data Analytics 1. Managing information systems a) Explain the role of information systems in organisations. b) Discuss the costs and benefits of information systems. c) Explain the uses of the internet, intranet, wireless technology and networks. d) Identify the accounting information requirements and describe the different types of information systems used for strategic planning, management control and operational control and decision-making. e) Define and discuss the main characteristics of transaction processing systems; management information systems; executive information systems; enterprise resource planning systems and customer relationship management systems. 2. Uses and control of information a) Demonstrate how principal sources of management information might be used for control purposes. b) Discuss the principal controls required in generating and distributing internal information. c) Discuss the controls and procedures which may be necessary to ensure the security of highly confidential information that is not for external consumption. d) Discuss the importance of data visualisation in the presentation of management information. 3. Big data and data analytics a) Describe the characteristics (volume, velocity, variety, veracity and value) of big data. b) Explain the purpose of the big data pyramid (data, information, knowledge, wisdom). c) Explain the uses and benefits of big data, data mining and data analytics e.g. predictive analytics for planning, costing, decision-making and performance management. d) Discuss the challenges and risks of implementing and using big data and data analytics in an organisation.

1.1 Information Systems

Information systems - consist of computer hardware and software, and communication networks to collect, store, process and communicate information. An information system is more than a computerised application. Information Technology (IT) is widespread in modern information systems, and IT can support all levels of management. Information systems provide the information required to assist management in the following areas:

. Planning: setting the organisation's long-term strategic direction and planning for the medium and short term.

. Control of the organisation: management needs to monitor how the organisation is performing against the plan and take actions to correct any significant deviations from the plan.

· Decision-making: managers need to make decisions at many different levels. The information systems should provide them with the information to do this.

1.1.1 Strategic Planning

This is the highest level of management in an organisation, and it is usually carried out by the board of directors or an equivalent body. This management level concerns with setting goals and objectives for the organisation over the long term (typically 5-15 years). Strategic planning may include the following:

· Deciding which products or markets to be in. · Investment decisions.

· Planning for environmental changes.

· Identifying the competitive advantage of the organisation.

1.1.2 Tactical Management Tactical management, or management control, usually is carried out by a middle level of management. It involves taking the strategic plan and making it happen. The time for planning usually is one year. Tactical management includes the following tasks:
· Ensuring that resources are obtained and used effectively and efficiently in accomplishing the objectives of the organisation;
· Implementing strategic decisions, often by way of a long-term plan; · Preparing annual budgets, and comparing actual results with budgets monthly; and
· Recruiting staff.

1.1.3 Operational Management Operational management focuses on the day-to-day running of the business, and operational managers will be responsible for departments within an organisation. Operational managers are involved in the following:
· Routine planning such as staff rotas (rosters; schedules).
· Programmed decisions based on internal, transaction-based information (e.g. ordering inventory when inventory levels fall to the reorder levels). These are usually actions undertaken when certain criteria or rules are met-for example, ordering inventory when inventory levels fall to the reorder level.

Quiz: Planning and Control
Vacation Lodge runs a chain of three-star hotels throughout the world. The company's head office is in New York, where the executive and non-executive directors are based. Each hotel has a management team headed by a general manager. The other management team members are the financial controller, the rooms division manager, the food and beverage manager, the sales and marketing manager, and the head of security. Each hotel has a restaurant manager, who manages the restaurant staff including the kitchen chefs.

Required: Describe the types of plans prepared by the directors, the management teams and the restaurant manager. For each plan, describe control measures that can be used to see how well the plan is being achieved.

The following is not an exhaustive list of the plans and controls - any other reasonable plans and controls are also relevant.

	Plans	Controls
Board of directors	Five-year financial plan New hotel openings	Actual profits vs. plan monitoring progress
Management team	Annual budget Staff head count	Compare actual against budget Occupancy rates Actual v plan
Restaurant manager	Menus Staff rotas	Food wasted Staff attendance

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1.1.4 Costs
Costs of information systems include:

· Pre-implementation/development costs analysing current business processes and how they will be automated in a new system.
· Initial set-up costs - hardware, software licensing (e.g. based on the number of users) and installation costs.
· Data conversion of historical information (e.g. from paper documents and spreadsheets).
· Staff and user training and IT support.
· Modifications and system upgrades.
· Communication charges (e.g. for internet access).

1.1.5 Benefits
The main benefit of an information system is the ability to provide users with the information they need to do their work efficiently. Other benefits will depend on the specifics of the information provided. For example:
· Strategic information provides strategic management with an overview of the entire business.
· The ability to extract customised information saves time and clerical expense. Many business decisions can be delegated to a lower level of the business.
· A system is more efficient because data is easier to use. The same data may be presented in customised formats (e.g. lists, tables, graphs and charts) for different users (see s.4).
· Information provided in real-time can drive improvements (e.g. in meeting customers needs).

1.2 Information Technology
1.2.1 Internet The term Internet describes the global network of computers and devices connected with an Internet Protocol (IP) address. It is a valuable source of information for businesses, for example:
· Competitors' websites.
· Online newspapers with access to back copies.
· Online databases containing names and contact details of potential customers.

1.2.2 Intranet Intranet refers to a subset of the internet that is an organisation's private network that only authorised users can access. It allows the sharing of information, typically to employees throughout the organisation. However, controls should exist to ensure that employees only have access to information that is relevant to their function. It would be inappropriate, for example, if all employees had access to the human resources files. Intranets facilitate collaboration and document sharing, which provides for remote working. For example, many institutions, such as universities, have a portal accessible only to registered lecturers and other employees.

1.2.3 Wireless Technology Wireless technology is a communications technology used to transmit and receive data between two devices without a physical connection. Communication technologies use radio frequency, infrared, satellite, etc. It is used increasingly for data transmission.
· Wi-Fi allows tablets, laptops, printers and smartphones to communicate with the Internet.
· Mobile phone (cell) networks allow electronic devices to communicate over long distances.

· Bluetooth exchanges data over short distances (e.g. between fitness trackers and smartphones).
· Radio Frequency ID (RFID) tags digitally store data that radio waves can read. It has many applications in industry, such as inventory management, asset tracking and controlling access to restricted areas.

1.2.4 Network Technology A computing network is a group of two or more devices that communicate by physical or wireless connections. Networking technologies connect multiple computers and devices and share information. For example:
· Local Area Network (LAN) - a group of computers connected across short distances (e.g. using a router).
· Wide Area Network (WAN) - for example, the Internet, connects computers worldwide.
· Storage-Area Network (SAN) - a dedicated high-speed and high-performance network that connects shared pools of storage devices to several servers.
· Virtual Private Network (VPN) - users access a private network across the internet to send and receive data as if their devices were connected to the private network.

1.3 Principal Controls
1.3.1 Purpose of Controls Controls and procedures over the distribution and generation of internal information need to be in place to ensure that:
· Reports are only prepared when the benefits of the report exceed the cost of producing it.
· Reports should only be sent to relevant managers. There is a danger of "information overload" if certain managers are copied on every report, they will not read any of them.
· Information is not duplicated.
· Only relevant information is included in the report.

1.3.2 Types of Control The principal controls over the distribution and generation of internal information are:
· The format of the reports to be generated should be agreed upon in advance.
· Distribution lists should be provided for all reports.

1.4.1 Security
Information security - protects the interests of those relying on information (and the information systems and communications that deliver the information) from harm resulting from hacking, operational error, sabotage and other threats.
Security - protection of the system from harm.
Privacy - restriction of knowledge to authorised persons.
Security and privacy are very closely related, and it is often difficult to determine whether a particular risk relates to security or privacy. What is clear, however, is that security relates to the whole system whereas privacy refers only to the data held within the system.

1.4.2 General Security Controls Training all staff in computer security procedures is essential in creating:

· An appropriate attitude of mind (e.g. integrity, carefulness, security-aware); and
· Strong security culture within the organisation.

Staffing arrangements should include the following:

· Authorisation for access and change routines to programs.
· Segregation of duties For example, programmers in charge of developing features on corporate systems should not have access to make changes to the code of "live" programs, nor be able to view sensitive real-time data and processes without authorisation. Any changes to live programmes should be vetted and authorised by personnel of appropriate authority before being released.
· Thorough vetting of job applicants before being employed.
· Application of appropriate procedures for cleansing of security access for staff that have been terminated, such as the disabling of access to accounts, company data, and premises and removal from any authorisation workflows.
· Risk analysis on sensitive staff (e.g. to identify low morale, poor motivation, and potential "grudge" bearers).

1.4.3 Physical Access Controls Physical access controls that prevent unauthorised people from accessing computer systems include:

· Security guards and cameras;
· Time controls (e.g. only allowed access between certain times);
· Electronic door locks (PIN, card or bio-data entry).

1.4.4 Logical Access Controls Once someone has gained physical access to a computer system, the next level of security would be logical access controls. The logical access system aims to protect data or software from the potential threats of unauthorised access. Controls may include:

· System passwords (see s.1.4.5); and
· Usage logs (usually computer generated).

Call-back security (dial-back security) is used to authenticate users who access systems remotely. For example, a user logging into a system over a telephone line enters a user name and password, and the system calls the user back on a pre-agreed phone number.

1.4.5 Passwords

Password - a sequence of characters known only to the user; its input allows access to a computer system (or part thereof). Password characters should be alpha, numeric, upper and lower case, and, preferably, the password should be non-sensible (i.e. not an everyday word) but not too difficult so as to make it impossible to remember (hence the conundrum). In some very secure systems, passwords must have a special character (*, &, #, @, etc.).

· Passwords should be changed regularly and not connected with the user (e.g. birthday, address) or written down (e.g. on a post-it note).
· Passwords for access to different functions should not be the same (e.g. a password for general admission to the system should not be the same for admission to the payroll).

· Each access level of a password-protected program should be protected with a different password.
· Attributes for each password should be established (e.g. read-only, read and write, valid for x number of entries, valid until a given date or event, etc.).
· Minimum format requirements for each password should be specified (e.g. a minimum number of characters and include at least one upper case letter/number/symbol).
· Passwords should never be divulged or readable from the screen as entered (i.e. an asterisk or dot should be visible rather than the actual character typed).
· The company policy on passwords should be documented and made available to all staff members.
· The number of password attempts should be limited for high-risk systems. For example, only three attempts are allowed at ATMs, after which the cash card is retained by the system and not returned.

1.4.6 Hacking
Hacking - deliberate unauthorised access to a system and the data within that system.
Hacking originally described unauthorised activity by individuals who saw systems security as a challenge and wished to show they could breach the security in place. The term now describes stealing (also includes reading) or changing data, or any other aspect of a system (e.g. changing programs, adding additional routines). Most people consider hacking an external threat (e.g. via the Internet). However, the majority of hacking is carried out internally by employees. Hacking usually takes one of two forms: 1. Authorisation attack - password cracking using computer programs that work through dictionaries and other sources to generate passwords for repeated sending to the system until the correct password is found. 2. Trapdoor/backdoor attacks - utilising existing weaknesses within the program code of the system. Sometimes, these are deliberately programmed into the system by the programmer, who, for example, can bypass the password system later.
Measures to combat hacking include:
· Physical security;
· Logical security;
· System logs and audit trails;
· Sentinels ("watchdog" programs which check for unusual activity);
· Data encryption (s.1.4.7);
· Strong quality control and risk analysis procedures in developing programs and websites.

1.4.7 Encryption The principle of encryption is to make any intelligible data unintelligible, which can then be read-only using the decryption key. It prevents unauthorised access to, or understanding of, for example, the data being transmitted or stored.
· It involves an algorithm (the operation itself) and a key (a secret numerical code usually consisting of many letters, numbers and symbols).
· To be read, the message must be unscrambled (decrypted) using a matching key.
· Helps protect critical information (e.g. credit card details) and addresses the problems of authentication and integrity (once the credit card details have been unscrambled by the receiver, however, they may be subject to hacking).

1.4.8 Software Audit Trail

Audit trail - a record of important data about each transaction. A software audit trail could include, for example, user and terminal identifications, the time and date of the transaction, transaction type (e.g. despatch), quantities and values, and cross-references to related transactions (e.g. invoice). The software audit trail records information about online transactions so the transaction and its path (both backward and forward) can be inspected and verified by third parties (e.g. internal auditors and system analysts).

1.4.9 Testing Systems Security It is of no use to have security systems in place unless they work and are known to operate effectively. Using in-house staff to test the system may be one option, but they may have a vested interest in it. Many external organisations (e.g. large accountancy practices and consultancies) offer "attack and penetration" services to their clients. They attempt to access the computer system:

· Physically, for example, attempted access to the surroundings of the computer system and into the computer room.

· Logically, by attempting to penetrate the system directly through dial-up connections, tapping external data lines and gaining access codes and other information (often simply by asking).

2.1.1 Internal The principal internal sources of management information from within the organisation are:

· Accounting system - provides information on costs and revenues, and can provide sophisticated outputs such as product cost using activity-based costing.

· Inventory system - contains information about movements in and out of inventory and quantities held.

· Payroll system - contains information about employee costs by department.

· Purchase processing system - contains information about suppliers (invoices, addresses, key personnel, costs and invoices received).

· Sales processing system - often contains detailed information about all customers' purchases and preferences. In retail businesses, many customers use loyalty cards, so whenever they buy from the company, the sales system records information about who is buying what.

· Qualitative information systems (e.g. customer satisfaction) - aggregate customer surveys or other qualitative data.

Although these systems have a primary purpose, their information could be interrogated and used to provide other useful management information. For example, information in the sales processing system could be used to analyse sales by customer or product for marketing purposes.

2.1.2 External

External information is likely to be used for strategic purposes. As indicated previously, this includes information about competitors, markets, and the economy.

Primary information is tailored information that is provided to meet an organisation's needs, such as:

· market research into new products; or

· obtaining information about prices charged by competitors.

Secondary information is data produced for general use rather than specific to an organisation's needs. Examples include:

· Government statistics;

· Country reports produced by consulting firms;

· Business directories of detailed information about the activities of other organisations;

· Trade magazines or other similar publications may provide useful information about external factors affecting a business.

2.2 Use of Information in Control The different levels of management have several uses for management information for control purposes: · Strategic managers are more involved in long-term planning and control of the organisation. Control concerns high-level information (e.g. actual profits for a period by division, market share, etc.).

· Strategic managers compare this information with the long-term plan and take action if the objective is not achieved.

· Tactical managers are interested in running the organisation efficiently. Therefore, they will be interested in more detailed, usually internal, information. Comparison of actual costs and revenues against budget will be important information for control. Monitoring quality also will be necessary.

· Operational managers would be interested in detailed transactional information from all the sub-systems (e.g. the inventory system).

3.1 Accounting Information Requirements

3.1.1 Strategic Planning and Control Information Information for strategic planning typically:

· Addresses objectives at a high level, not detailed (e.g. a summarised statement of profit or loss for the entire organisation).

· Includes much external information.

· Addresses ad hoc information needed one time only for special projects rather than regularly.

· Will contain forecasts covering a longer time horizon.

Examples of information for strategic planning include the following:

· Economic and market forecasts;

· Analysis of competitors.

Examples of strategic control information are:

· Profits by business segment;

· External factors influencing the organisation;

· Present and potential market studies;

· Investment appraisal.

3.1.2 Tactical Planning and Control Information Information to support tactical planning, on the other hand, will:

· Contain more detailed information (e.g. detailed statements of profit or loss analysing revenue and costs by division or product).

· Be mainly internal, although some external information may be used.
· Be provided regularly (e.g. monthly analysis of revenues compared with budgets and variance analysis).
· Contain forecasts over periods up to 12 months. The most obvious example of information used for tactical planning is the annual budget.
Examples of tactical control measures include:
· Analysis of sales by product/customer/geographical location.
· Inventory levels.
· Cash flow projections.

3.1.3 Operational Planning and Control Information Operational planning typically requires transaction-based data. This is almost entirely internal, covering short-term periods. Examples of operational control measures include:
· Variances (e.g. materials and labour);
· Receivables/payable levels;
· Payroll details;
· Customer complaints;
· Output records.

3.2 Information Systems
The four main types of information systems that support the different levels of an organisation may be summarised as follows:
STRATEGIC: EIS Executive Information System
TACTICAL: DSS Decision Support System, MIS Management Information System
OPERATIONAL: TPS Transaction Processing System

3.2.1 Transaction Processing System (TPS)
Transaction Processing System - systems used by operational staff to capture data and make processes more efficient, improving the accuracy and timeliness of information.
Transaction Processing System (TPS) data is primarily high-frequency and short-term.
Transaction processing is automated, with limited human input. A TPS collects and stores data about transactions and may include controls. A transaction takes place when goods or services are exchanged for some form of payment. For example:
· Purchasing an airline ticket from an airline's website.
· Buying groceries from a supermarket. The transaction is recorded when the cashier records the sale in the cash register, typically using a barcode reader. Payment is also taken at this point.
· Withdrawing cash from a bank ATM.
· Receiving inventory in the warehouse of a factory.
Transaction processing systems use one of two approaches to process the data: 1. Batch processing - individual transactions of the same type are collected (into "batches") and stored for later (periodic) input to the computer. Processing proceeds in discrete "runs". Payroll transactions are often processed using batch processing: - information about new joiners, leavers, hours worked, etc is collected during a particular period; - payroll calculations are made at the end of the period (e.g. a week or a month). Batch processing is easier to control as data

can be checked and validated before processing. 2. Real-time systems processing - transactions are processed immediately as they occur. This has the apparent advantage that information in the system is always up-to-date. The disadvantage is that it can be challenging to control, and the risk of errors is greater.

A TPS will include controls to ensure that the information entered into the system is valid and that the processes are accurate. This is important; otherwise, the information generated by the system will not be reliable.

Example: EPOS

The TPS in a supermarket may include an electronic point of sale (EPOS) system, where the goods are scanned by the cashier using a bar-code reader when the customer is checking out. It may also use an electronic data interchange (EDI) system that enables the supermarket's system to communicate with the suppliers' systems. The following transactions cycle occurs: 1. Customer proceeds to checkout, and the cashier scans the bar code on the products to calculate the amount payable. 2. The inventory database is updated to reflect the sale of goods. 3. Customer presents credit or debit card - this is scanned, and the payment is transferred from the customer account to the supermarket's bank account. Alternatively, the customer pays in cash, and the system records a cash receipt. 4. At the end of the work shift, the cashier counts the cash in the cash register and compares this to the system's record of how much cash there should be. 5. Re-order level is reached for an item of inventory. 6. EDI is used to automatically place an order with suppliers. 7. When an order is ready, the supplier informs the retailer that goods have been sent (also through EDI). 8. Bar codes on goods can be used to track them during delivery. 9. When received, bar codes are read, and the retailer's systems are updated (e.g. inventory control, purchases and payables). Suppliers may also be informed that the goods have been received (through EDI). 10. Supplier sends purchase invoice to the retailer (through EDI). 11. Invoice details checked by the retailer's system and agreed to information already on the database. 12. Payment authorised and then made by EDI authorising the retailer's bank to allow a transfer of funds to the supplier's bank. 13. Retailer's database updated to record payment and settlement of the liability.

3.2.2 Management Information System (MIS)

Management information system - systems that convert data from internal and external sources into information used by management at all levels and across all functions to make timely and effective decisions.

An MIS is, therefore, any system for:

· obtaining data;

· processing it to produce useful information; and

· distributing this to the relevant managers or members of staff.

Information from an information system is used for three purposes: 1. Planning - deciding what the organisation (or that part of the organisation under the control of a particular manager) will do. 2. Controlling - ensuring that the organisation stays on course to meet its plan. 3. Decision-making - deciding between different courses of action (e.g. whether or not to develop a new product).

Quiz: Suggest examples of information that would be required from an information system for each of the following:
a. A market trader working in a fruit market; and
b. Materials purchasing department in a factory.
Answer:
Market Trader
The market trader will need to have some forecasts of demand for each type of fruit on a particular day. This will probably be based on experience and "gut feeling" rather than on any formal information. The trader will also need to know what prices customers are willing to pay and what prices competitors are charging. How much cash has been taken each day. This will be ascertained by counting it. The information systems used by a market trader are informal, based on observation.
Materials Purchasing Department
The materials purchasing department will need to know the following information:
· Existing quantities of all materials in the warehouse.
· Expected use during the forthcoming period. This will be based on production schedules and bills of materials for each product that is made.
· Information about economic order quantities to ensure that purchasing decisions minimise the costs of holding and ordering inventory.

Information systems come in many different shapes and sizes. For example: . In a small, owner-managed organisation, the MIS will be informal; the owner will obtain most of the information that he needs: - from discussions with the staff; and - by observing what is happening. · In larger organisations, specially designed information systems will be needed. The growth of IT has led to organisations taking a more formal approach to developing the information systems they need. Especially in larger organisations, care should be taken to plan the needs of an information system before it is developed to avoid the risk of the following problems:
· Poor communication of information to appropriate personnel.
· Bad decisions are being made because of inaccurate data.
· Information is provided late.

3.2.3 Decision Support System (DSS)
Decision Support System - a computer-based information system that supports managers in decision- making, often utilising analytical modelling techniques. Decision support systems assist in complex decision-making. DSS analyse large amounts of data and provide information about the likely outcome of decisions based on rules and assumptions programmed into the system. Variables can be changed to reflect the conditions that might affect the decision. A simple example of a decision support system is a financial model in a spreadsheet, which calculates a potential investment's net present value. Users can change variables in the model and perform what-if analysis to help decide whether to invest.

Example: Decision Support System

Larga is an original equipment manufacturer that employs many employees across multiple shifts. These employees have contracts varying from full-time to part-time that have committed to being available at specific hours on certain days of the week. Larga uses a decision support system (DSS) to create its weekly duty roster. The DSS extracts the necessary information from the HR system, such as available employees and their hours, employee leave, and specific functions of the employees (for example, an employee is specialised in a particular area of manufacturing) and solves a duty roster that ensures optimum staffing for each production line throughout the week. Suppose the DSS is unable to suggest staffing for any specific section of the production line; in that case, it flags the shortage as an error so that the production and human resource managers have time to arrange alternate staffing arrangements or adjust production line loading.

Decision support systems do not have to be complex. For example, a forecasting model on a spreadsheet, whereby variables such as economic growth can be changed, would also be described as a decision support system.

3.2.4 Executive Information System (EIS)
Executive information system - a system designed to assist the decision-making of senior management by providing summarised information from internal and external sources relevant to the organisation's strategic goals. It is a specific type of decision support system. An EIS typically provides senior management with high-level information about the company's performance. This information may be extracted from a central database, using reporting tools. The systems may also be linked to external data sources (e.g. financial information from Internet sites). Charts, tables and other graphical tools often accompany numerical data in a "dashboard" that helps managers visualise performance, with "drill down" facilities to provide more detail. An EIS often allows users to customise their view to focus on information most relevant to them. This overcomes the problem experienced in many information systems whereby senior managers receive standard monthly reports irrelevant to their concerns.

3.2.5 Enterprise Resource Planning System (ERP)
Enterprise resource planning system - a software system which provides a seamless flow of information across an entire organisation using a shared database. Before ERP systems, different departments (e.g. warehouse and finance) would have separate systems. These systems were not linked, so traditional communication methods were used for inter-departmental information sharing. The same information was often entered into two or more systems, so time-consuming reconciliations had to be carried out. An ERP system is designed to integrate the main functional areas of business processes into a unified "enterprise-wide" approach and to serve the whole organisation.

The "modules" which may be found in an ERP system typically include the following:
· Accounting and financial;
· Inventory control;
· Supply chain management;
· Material requirement planning;

· Customer relationship management (see s.3.2.6).

Implications of the introduction of an ERP system for the management accountant include:
· A reduction in gathering and processing routine information. In a supermarket, for example, sales are recorded when barcodes are scanned at the checkouts.
· A change in the work of the management accountant, who can now spend more time as a business advisor because the system automates many routine tasks he once performed.

3.2.6 Customer Relationship Management System (CRM)
Customer relationship management system (CRM) - a CRM system used to manage customer interactions and data, to improve customer service, retain customers and drive sales growth. At a basic level, CRM software consolidates customer information and documents (e.g. purchasing history, demographics and returns) for easy access and management. CRM captures, analyses and distributes all relevant data from customer and prospective customer interactions to everyone in the organisation. This distribution of information helps an organisation better meet customer, product and service needs. For example, data can be used to create target customer profiles to find opportunities to upsell and reward them for their loyalty. Characteristics of a sound CRM system include:
· Easy import of data from existing databases.
· Ease of use (e.g. an intuitive interface and good user support).
· Adaptability (as the business should grow).
· Improved customer satisfaction.
· Easy reporting and tracking features.

3.3.1 Characteristics
Big data - vast data sets that may be analysed to reveal patterns, trends and associations, especially relating to human behaviour and interactions.
Structured data - data stored within defined fields within a defined record, along with similar data, according to the specifications laid down in a data model. The data model limits the data collected and how it can be processed.
Unstructured data - information gathered in various forms and ways, not in accordance with any data model, and thus may be difficult to store or analyse.
The following have been adopted as essential characteristics of big data:
Volume: a tremendous amount; more than can be easily handled by a single computer; for example, retailers have details of all customer purchases and enquiries.
Variety: non-uniform, from internal and external sources, some structured, but primarily unstructured; examples would include customer demand, complaints, reviews on websites, and tweets about the business.
Velocity: fast and continuous; it has to be processed quickly to yield useful results.
Veracity: is the data valid, and can its accuracy be relied upon? Assessment of veracity involves considering the reliability of the data itself and the source providing the data. Machine-generated data may be more reliable than data from human sources, which may be easy to manipulate. In addition, veracity links to velocity in that if data is changing rapidly, there is a risk of using out-of-date data.

Value: Big data analysis could be costly in terms of facilities needed and staff time spent. Data specialists may have to be employed. The organisation must, therefore, consider the value that the analysis of big data could create.

3.3.2 Data Analytics
The processing of big data is generally known as data analytics and includes the following:

Data testing: testing models or hypotheses on existing data.

Data mining: analysing data to identify patterns, relationships and correlations. Note that data mining refers to the analysis process, not the finding of the items themselves. There are a number of aspects of data mining:

· Finding relationships between variables;

· Applying known structures to new data;

· Identifying groups and structures within the data that have similarities other than those connected by known structures (clustering);

· Spotting unusual items (outliers) or items that appear to be in error;

· Finding a function that expresses the relationship between the data with as little error as possible (covered in Chapter 10);

· Providing the results in a user-friendly, easy-to-see, form.

Predictive analytics: a type of data mining that often uses statistical or machine learning techniques to predict future events (e.g. the likelihood that a customer may be persuaded to buy a more expensive product).

Text analytics: scanning emails and word documents to extract useful information (e.g. keywords that indicate an interest in a product). Similarly, voice analytics (but with audio).

Statistical analytics: used to identify trends, correlations and changes in behaviour.

3.3.3 The Big Data (DIKW) Pyramid
The big data pyramid originated in the work of Ackoff and was developed further by Jennifer Rowley. It is designed to show the stages of the transformation of the initial unstructured data obtained into material that can be used for reliable decision-making and accurate forecasting. Wisdom Knowledge Information Data Guidelines to produce tables:

· Has a suitable title; Each column has a heading;

· Each row has a heading;

· Totals are shown in bold.

Level	Description	Example
Data	Facts and figures. Data may be provided from several sources, ideally in a format that enables links to be made between different items.	For an airline undertaking "overbooking" (airlines sell more tickets than seats on the plane to ensure planes are used at maximum capacity). Data might include: . Ticket prices and purchase date relative to flight date. . passenger check-in or "no-show", and impact on plan capacity utilization . Season and/or time of year . Overbooking compensation offered . Passenger demographics . Compensation acceptance rates . Forced overbooking removal rates

| Information | Identifying data relationships. The initial analysis aims to find the meaning of the data and establish what links and relationships there are between the data. If these are established, the data becomes information.| The following relationships might exist: · Passengers who purchased tickets earlier accept lower compensation. . Passenger no-show rates are higher at certain times of the year. . Compensation acceptance rates and amounts correlated to the ticket price.

| Knowledge | Understanding data relationships. Further analysis provides more detail about the context of how and why the links between the data might arise and what the specific connections and patterns are. Establishing these things means that the data becomes knowledge. | The following understanding could be ascertained: . 90% probability of accepting compensation is at 80% of ticket price. · Compensation rejection rates higher and no-show lower during major holiday seasons. . Persons travelling alone have higher compensation acceptance rates.
z
| Wisdom | Improved decision-making from the understanding of data relationships. Ensuring the knowledge can be used to make an informed decision and correct predictions means that it becomes wisdom. | Design of ticketing and overbooking policy and processes, with adjustments to compensation amounts, alternative flight dates, and compensation offers made based on prevailing conditions at the time.

3.3.4 Benefits Analytical findings can provide information to enhance decision-making and performance management. For example:
· Marketing - gaining insights about customer preferences through browsing histories of pages visited and purchases made; "Customers who viewed this item also bought
· Customer service - through the collation of feedback from various sources (including social media).
· Competitive strength - through using the information to identify and respond to changes in customer preferences earlier than competitors.
· Customer loyalty - data gathered through loyalty cards to make personalised offers to customers (e.g. discount vouchers).
· Operational efficiency - for example, better forecasting of sales volumes will improve inventory management and reduce wastage (e.g. of perishable goods).
· Performance measurement - through the ability to access a variety of insights into how the organisation is doing, avoiding over-focus on information that is most readily available.

3.3.5 Challenges and risks Despite the examples of the use of big data in commerce, particularly for marketing and Customer Relationship Management (CRM), there are some potential dangers and drawbacks.
· Cost: It is expensive to establish the hardware and analytical software needed, though these costs are continually falling.
· Time and staff resources: Analysing which data is essential for the organisation and its impact may be time-consuming.

· Regulation: Some countries and cultures worry about the amount of information being collected and have passed laws governing its collection, storage and use. Breaking the law can have serious reputational and punitive consequences.

· Loss and theft of data: Apart from the consequences arising from regulatory breaches, as mentioned above, companies might find themselves open to civil legal action if data were stolen and individuals suffered as a consequence.

· Incorrect data (veracity): If data held is incorrect or out of date, erroneous conclusions are likely.

· Overfitting: the risk of finding patterns in the data which are not there or which cannot be used on other data or used to predict the future.

3.3.6 Uses The uses of big data and data analytics can be illustrated by some of the biggest companies in their industry. Netflix began as a DVD mailing service and developed algorithms to help it predict viewers' preferences and habits. Now, it delivers films over the internet and can easily collect information about when movies are watched, how often films might be stopped and restarted, where they might be abandoned and how users rate films. This allows Netflix to predict which films will be popular with which customers and produce its TV series with much greater assurance that they will succeed. Amazon is the world's leading e-retailer. It collects vast amounts of information about customers' preferences and habits to use in personalised marketing. For example, to make recommendations to customers based on previous purchases. British Airways, an airline, knows where, when and how often each customer has flown, in which class and their preferred seating. Its "create a trip" booking system knows how often customers search for a flight before booking, how susceptible they are to price reductions, and whether they are returning with them but did not fly out with them. It also knows whether car hire was purchased and what hotels are booked. As a result, it can plan for routes that are growing in popularity and seasonal destinations. Knowing the profitability of each customer means that, for example, if a flight is cancelled, the most valuable customers can be given priority. Target is the second largest discount retailer in the USA. A headline in the article "How Target Figured Out A Teen Girl Was Pregnant Before Her Father Did" caused a media storm in 2012. With the aid of a statistician the company identified 25 products that, when purchased together, indicate that, a woman is likely to be pregnant. This helped Target offer discount coupons on baby-related products to expectant mothers.

4.1 Importance of Data Visualisation
Data visualisation is the display of information graphically, using various forms such as charts, graphs, and maps. Data visualisation aims to present data to users in a form that is easy to understand and analyse, summarising big data in a way that even non-technical users may understand. It should facilitate the identification of trends, patterns, outliers, anomalies, and comparisons between items on various bases and allow for further insights, such as changes of perspective from general to specific or from past to future (forecasts). What matters is that the visualisation tells the user what they need to know compellingly, with an attractive form fulfilling the function of communicating what the data is supposed to say. There are many different visualisations, and they are used according to what is most appropriate to display the data and inform users. Once the data has been "cleaned" (i.e. errors, mistakes and irrelevant

data removed) and arranged meaningfully, it can be presented and communicated to the person(s) who will be using it in a way that they will find easy to understand.

4.2 Tables Tables should always be set up so they fit on one page. This makes them much more user-friendly so that all of the information can be seen at the same time. If data or information used to prepare a table has been taken from a specific source, this should be noted somewhere on the table. Guidelines to produce tables:
· Has a suitable title;
· Each column has a heading;
· Each row has a heading;
· Totals are shown in bold.
Example: Tabulate of Budgeted Profits
Cost and revenues of different sales levels at Winston's Football Factory

Sales volume (number of footballs)	4,800	4,900	5,000	5,100	5,200	5,300
	$	$	$	$	$	$
Sales revenue	168,000	171,500	175,000	178,500	182,000	185,500
Materials cost	14,400	14,700	15,000	15,300	15,600	15,900
Labour cost	7,500	58,800	60,000	61,200	62,400	63,600
Variable production overhead	57,600	9,800	10,000	10,200	10,400	10,600
Fixed production overhead	19,200	19,600	20,000	20,400	20,400	21,200
Non-production overhead	36,600	36,600	36,600	36,600	36,600	36,600
Budgeted profit	30,600	32,000	33,400	34,800	36,200	37,600

4.3 Charts and Graphs Charts and graphs tables are helpful ways of quickly highlighting relationships and trends within data. Type Example Description Line chart Line charts are useful for showing trends over time, such as sales revenue growth. Bar chart Bar charts help show comparisons. For example, comparing budget revenue per month against actual results. Pie chart Pie charts can show a relative comparison to a whole, such as sales in different regions. Scatter diagram A scatter diagram ("scattergraph") is used to plot pairs of numerical data, with one variable on each axis, to look for a relationship between them. If the variables are correlated, the points will fall along a line or curve (see Chapter 9).

Type	Example	Description
Line chart	Line Chart picture	Line charts are useful for showing trends over time, such as sales revenue growth.
Bar chart	Bar Chart picture	Bar charts help show comparisons. For example, comparing budget revenue per month against actual results.
Pie chart	Pie chart picture	Pie charts can show a relative comparison to a whole, such as sales in different regions.

| Scatter diagram | Scatter diagram | A scatter diagram ("scattergraph") is used to plot pairs of numerical data, with one variable on each axis, to look for a relationship between them. If the variables are correlated, the points will fall along a line or curve (see Chapter 9). |

Key Point The following elements are crucial for effective charts:
Chart title - Name of the chart, describing its contents and purpose.
Labelled axes - Define the axes of the chart.
Legend (key) - Provides context data points displayed on the chart.
Gridlines - Lines on the chart to assist the user in comparing data points to axes.
You will not be required to present charts, graphs or any other diagrams in the exam. However, you need to understand their construction in order to interpret them.

Quiz: Data Visualisation
Select the most appropriate format in which to present the information given in each scenario:
| Information
| Format (Line chart, bar chart, pie chart, scatter chart or table) |
| A production manager wants to understand how production costs respond to changes in activity. | |
| Management has just received the final figures for actual material price costs last year and wants to compare them to the original budget estimates. |
|
| A sales director wants to know which product segment contributes the most revenue relative to total revenue for the period. |
|
| Management wants to present the results of a detailed survey of inventory costs for different products, showing the current month, prior month, prior year and % changes. |
|
| A factory supervisor wants to compare recorded employee time spent on producing each unit of a product and its final quality score to determine if there is any link. |
|

Answer:
| Information
| Format (Line chart, bar chart, pie chart, scatter chart or table) |
| A production manager wants to understand how production costs respond to changes in activity. | Line chart |
| Management has just received the final figures for actual material price costs last year and wants to compare them to the original budget estimates. | Bar chart
|
| A sales director wants to know which product segment contributes the most revenue relative to total revenue for the period. | Pie chart
|

| Management wants to present the results of a detailed survey of inventory costs for different products, showing the current month, prior month, prior year and % changes. | Table |
| A factory supervisor wants to compare recorded employee time spent on producing each unit of a product and its final quality score to determine if there is any link. | Scatter diagram |

4.4 Bar Charts Bar charts are drawn with two axes: the independent variable on the x-axis and the dependent variable on the y-axis. Bar charts must be drawn from the origin (where the x- and y-axes are both zero) to reduce misinterpretation. Bar charts are best used for comparison between two data series. For observing a trend, a line chart may be superior. Data presented in a bar chart can take many forms.

4.4.1 Simple Bar Chart A simple bar chart is typically used to present a single data series over several periods.

Quiz: Simple Bar Chart
Present the following information as a simple bar chart:

	Franklyn's Football Factory
Year	Sales $000
1	21.00
2	52.00
3	24.00

Answer:
Draw a bar chart titled "Franklyn's Football Factory: Simple bar chart showing sales in Years 1-3" presents the sales data in thousands of dollars ($'000s) over three years.
- Year 1: Sales were $20,000.
- Year 2: Sales increased significantly to $50,000.
- Year 3: Sales decreased to $25,000.
The vertical axis represents sales in thousands of dollars, ranging from $0 to $60,000. The horizontal axis represents the years, labeled 1, 2, and 3. Each bar's height corresponds to the sales value for that particular year.

4.4.2 Compound Bar Chart
A compound ("clustered") bar chart is used to present multiple data series over multiple periods (also called a "multiple" bar chart).
Example: Two Data Series over Multiple Periods
This example shows two data series: Total sales and Total costs. The legend (key) is essential in differentiating the data series. Total sales are blue and Total costs are red.
Draw a compound bar chart titled "Total Sales and Total Costs" presents the total sales and total costs in thousands of dollars ($'000s) over five years, from 20W9 to 20X3.
- For the year 20W9:

- Total sales were $500,000.
  - Total costs were $400,000.
- For the year 20X0:
  - Total sales were $550,000.
  - Total costs were $450,000.
- For the year 20X1:
  - Total sales were $600,000.
  - Total costs were $500,000.
- For the year 20X2:
  - Total sales were $650,000.
  - Total costs were $550,000.
- For the year 20X3:
  - Total sales were $675,000.
  - Total costs were $650,000.

The vertical axis represents the values in thousands of dollars, ranging from $0 to $700,000. The horizontal axis represents the years. The blue bars represent total sales, and the red bars represent total costs. Each pair of bars shows the comparison between total sales and total costs for each year.

Some observations are: Sales have exceeded costs every year, indicating profit (the blue bar is higher than the red bar); Both sales and costs have increased over the years; Costs have increased faster than sales (the gap between red and blue bars has narrowed over the years); Sales in 20X3 have exceeded $600,000 (blue bar exceeds $600,000 gridline); There was a significant increase in sales and costs from 20W9 to 20X0 (wide gaps between the bars of 20W9 compared to 20X0).

Example: Compound Bar Chart
Draw a compound bar chart titled "Sales by Division" presents the sales data in thousands of dollars ($'000s) across four divisions (North, South, East, and West) over five years, from 20W9 to 20X3.
For the year 20W9:
- North: $200,000
- South: $150,000
- East: $100,000
- West: $50,000
For the year 20X0:
- North: $220,000
- South: $170,000
- East: $200,000
- West: $50,000
For the year 20X1:
- North: $200,000
- South: $190,000

- East: $180,000
- West: $50,000
For the year 20X2:
- North: $210,000
- South: $180,000
- East: $190,000
- West: $60,000
For the year 20X3:
- North: $230,000
- South: $200,000
- East: $180,000
- West: $50,000
The vertical axis represents sales in thousands of dollars, ranging from $0 to $250,000. The horizontal axis represents the years from 20W9 to 20X3. Each group of four bars for each year shows the sales in the North, South, East, and West divisions. The blue bars represent the North division, the red bars represent the South division, the green bars represent the East division, and the purple bars represent the West division.

Some observations are: South has overtaken North as having the highest sales in 20X3 (the blue bar is the tallest for all years except 20X3); West has been experiencing declining sales (the purple bar getting shorter over time); Sales in the North have been consistent (not much change in the blue bar over time).

Key Point
Compound bar charts do not show the proportion of a data series to the total. There is also a risk of overloading the chart with data, diluting its meaning.

4.4.3 Component Bar Chart
A component ("stacked") bar chart presents the numerical amounts of data series that make up a total.
Component can also be converted to proportions of a total (similar to a pie chart). This loses the numerical amounts.

4.5 Line Charts Line charts are drawn with two axes, usually with the independent variable on the x-axis and the dependent variable on the y-axis. Care must be taken during the production and interpretation of the chart if the axes of a line chart are not drawn from the origin (i.e. the point where the x and y axes intercept at x = 0 and y = 0). A line chart is best suited to observe trends over time.
4.5.1 Simple Line Chart
Example of Simple Line Charts: Give an example that shows a gentle increase in the sales trend over five years. By contrast, give another example of simple line chart that shows a more significant rate of change in total sales.

4.5.2 Multiple Line chart

Example of Multiple Line Chart: draw a multiple line chart with two lines: one is for the Total sales, and the other for the Total costs. The Total sales is in blue color, and the Total costs in red color. The y-axis is not from the origin. The smaller scale means that the rate of change in the lines appears more significant. The gap between the lines is profit. The narrowing of the gap in 20X2 and 20X3 means that profit is shrinking. It is easy to see the sales and cost trends and how they compare.

4.6 Pie Charts

Pie charts are most suitable for showing the proportions of multiple data series at a single period or point. The entire "pie" is 100%, with each data series representing a proportion of it. For example, 25% would be a quarter of the pie.

4.7 Scatter Diagram

Scatter diagrams plot data points on a chart with two variables for each axis.

Example of Scatter Diagram

The total monthly costs and outputs for a process are as follows:

Month Output (units)	Total costs ($)
Jan 100	2,500
Feb 110	2,600
Mar 90	2,200
Apr 100	2,600
May 100	2,550
Jun 130	3,000
Jul 110	2,650
Aug 90	2,300
Sep 120	2,800
Oct 130	2,900
Nov 140	2,950
Dec 100	2,400

Plotting the pairs of data gives the following scatter diagram:
Draw a scatter diagram based on the above table's data.
There appears to be a relationship between output units and total costs (more output, higher cost), although some cost variations occur at some of the output levels. Where there appears to be a linear relationship between two variables, a trend can be estimated using a "line of best fit".

4.8 Inappropriate Use of Data Visualisation

It is essential to use the proper visualisation to convey the appropriate meaning to the user. The wrong type of chart will be misleading and may lead to dysfunctional decision-making.

Chapter Summary:

· An information system is an integrated set of components that collect, store, process and communicate information.
· Control procedures to ensure the security of confidential data typically include physical and logical access controls, passwords, encryption, systems logs and audit trails.
· Sources of information are: Internal (e.g. transaction processing systems); and External, which may be primary (e.g. market research) or secondary (e.g. government statistics).
· An MIS converts data from internal and external sources into information used by management for planning, control and decision-making.
· Systems include: EIS – provides high-level information to senior management and typically includes reporting tools and drill-down facilities; ERP – can be used by all functions within the organisation and include a central shared database; CRM – used to manage customer interactions and data, improve customer service, retain customers and drive sales growth.
· The "Vs" of big data are volume, variety, velocity, veracity and value.
· Data analytics refers to the analysis of big data to reveal patterns, trends and associations, especially relating to human behaviour and interactions, which may help a business improve its performance.
· Data analytics includes: Data testing; Data mining; Predictive analytics; Text analytics; and Statistical analytics.
· The purpose of data visualisation is to present data to users in a form that is easy to understand and analyse, summarising big data in a way that even non-technical users may understand.

Chapter 2: Cost and Management Accounting
This chapter covers the following Learning Outcomes. B. Specialist Cost and Management Accounting Techniques 1. Activity-based costing a) Identify appropriate cost drivers under ABC. b) Calculate costs per driver and per unit using ABC. c) Compare ABC and traditional methods of overhead absorption based on production units, labour hours or machine hours.

1.1 Management Accounting and Financial Accounting
Management accounting is concerned with preparing and presenting accounting information to management to help them plan, control and make decisions about business operations.
Financial accounting is concerned with preparing and presenting accounting information on the performance and financial position of the business.
1.2 Comparison

	Management Accounting	Financial Accounting
Users of information	Management	Shareholders, banks, lenders and suppliers, potential investors, tax authorities and governments
Format of information	Can take any form	Presentation regulated by law and by profession through Accounting Standards (e.g. IFRS)

| Purpose of information | Useful to plan, control and make decisions | Stewardship and investment decisions |
| Bases of valuation | Relevant costs | Historical costs |

1.3 Planning, Control and Decision Making

Key Point Planning, control, and decision-making encompass establishing objectives and evaluating policies and actions required to achieve them.

1.3.1 Planning Planning is the setting of goals and the selection of the means of achieving these goals. As businesses become large, these procedures need to be formalised.

· Short-term plans, such as an annual budget, detail the intended results for the forthcoming year.

· Long-term plans, also called "strategic" plans, are usually documents showing the long-term objectives of a business.

1.3.2 Control Control means checking that an organisation is on track to meet its long- and shortterm objectives and taking action to correct any deviations from these.

· Long-term control includes strategic performance evaluation, which measures an organisation's performance against its strategic objectives.

· Short-term control focuses on comparing the budgeted results with actual results.

· This usually takes the form of an operating statement, which breaks down the difference into parts (variances).

1.3.3 Decision Making Decision-making usually involves using the information provided by the costing system to make decisions. For example, when an organisation decides the appropriate price to charge for a contract, they are tendering for or whether it would make financial sense to outsource the production of an essential component.

2.0 Introduction

2.1 Marginal Costing Under marginal costing:

· Fixed overheads are not included in unit costs but are treated as a period cost (i.e. written off in full in the statement of profit or loss in the period they occur).

· Inventory valuation includes only the variable costs of production.

2.2 Absorption Costing Under absorption costing, fixed production overhead costs must be allocated, apportioned and absorbed.

2.2.1 Allocation As overhead costs are incurred, they must be allocated to the cost centres to which they belong. Costs related to a single cost centre are allocated to that cost centre.

Cost centre - a location, function or item of equipment in respect of which costs may be ascertained and related to cost units for control purposes.

2.2.2 Apportionment Apportionment is necessary when an overhead is common to multiple cost centres. Such overheads must be shared between the relevant cost centres using an appropriate method of apportionment.

Example: Apportionment

Cost	Basis of apportionment
Rent, rates, heat	- Floor are
Supervision, canteen costs	- Number of employees.
Depreciation, plant insurance	- Carrying value of plant

2.2.3 Re-apportionment Overheads apportioned to service cost centres must be re-apportioned to production cost centres. This is achieved by selecting an appropriate re-apportionment basis, that would reflect how service departments support production departments. Common basis used include:
· Direct labour hours
· Machine hours
· Parts movements
· Variable overheads utilised All fixed costs apportioned to service cost centres will be re-apportioned to production cost centres for absorption into cost units.

2.2.4 Absorption The total overheads in each production department must now be absorbed into the production units. This is achieved using one of the following methods:
· direct labour hour rate;
· direct material cost rate;
· direct labour cost rate;
· prime cost percentage rate;
· machine hour rate; or
· unit of output rate.

Quiz: Overhead Absorption
X Co estimates that its factory costs for the coming year will be as follows:

	S
Direct material	40,000
Direct wages	60,000
Prime cost	100,000
Factory overhead	30,000
Total factory cost	130,000

During the year, 10,000 direct labour hours and 5,000 machine hours are available, and 20,000 units will be produced.
Required: (a) Calculate the overhead absorption rate using each of the following bases: i. direct labour hours; ii. direct materials cost; iii. direct labour cost; iv. prime cost; v. machine hours; vi. units of output. (b) Management has decided that the absorption rate per machine hour is the most appropriate method of absorbing overheads. One of the products manufactured by X Co is the Smidget. Each Smidget costs $5 per unit in materials and $10 per unit of direct labour. Making a Smidget requires half an hour of machine time. Calculate the full absorption cost of one unit of Smidget.

Answer:
a. Overhead absorption rates
i. Direct labour hour rate = $30,000/10,000 hrs = $3
ii. Direct material cost rate = $30,000/$40,000 = 75%
iii. Direct labour cost rate = = $30,000/$60,000 = 50%
iv. Prime cost percentage rate = $30,000/$100,000 = 30%
v. Machine hour rate = $30,000/5,000 hrs = $6
vi. Unit of output rate = $30,000/20,000 units =$1.50

b. Full absorption cost

	$
Materials	5
Direct labour	10
Prime cost	15
Overhead absorbed (0.5 machine hours x $6)	3
Absorption cost	18

3.1 Introduction

Activity-based costing (ABC) - an approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources are assigned to activities and activities to cost objects. The latter use cost drivers to attach activity costs to outputs. - Chartered Institute of Management Accountants (CIMA) Official Terminology 2005

Traditional absorption costing uses one method of apportioning all overhead costs between products, typically labour hours or machine hours. This "blanket rate" means that product costs may not accurately reflect the true product overhead costs. When overhead costs accounted for only a small portion of total factory costs, this inaccuracy was not significant. However, in modern factories and service industries, due to the reduction in the amount of labour used and the increase in the amount of high technology, overhead costs are often a significant portion of overall product costs. The inaccuracy of absorption costing is no longer insignificant. Activity-based costing aims to identify the activities that cause overhead costs to be incurred and to apportion the overhead costs to each product based on the use of the activities by each product. ABC recognises that traditional ideas of fixed and variable cost categorisations may not be appropriate and that, as the proportion of overhead costs in manufacturing has increased, there is a need for a more accurate method of absorbing these costs into cost units. It looks for a clearer picture of cost behaviour and a better understanding of what determines the level of costs (i.e. "cost drivers").

3.2 Cost Drivers

Cost driver - a factor which can cause a change in the cost of an activity.
In absorption costing, it is assumed that the volume of output is the factor which determines costs. However, ABC recognises that the amount of cost may be determined by factors other

than the output volume. These factors are called cost drivers. For example, the number of purchase orders processed could be the cost driver for a procurement department. An activity could give rise to multiple cost drivers as it consumes different types of overheads. For example, cost drivers associated with a production activity may be:
· Machine operator(s) hours for apportionment of human resource costs;
· Floor space occupied for apportionment of the cost of premises;
· Power consumed as direct overheads; and
· Quantity of waste and rejected output for apportionment of recycling and quality costs.

Therefore, different overhead cost types are absorbed into production units using more appropriate rates based on cost drivers rather than a single absorption rate. For example, for a particular production department, the following rates may be suitable:
· A warehousing cost/kg of material used;
· Electricity cost/machine hour;
· Production scheduling cost/production order, etc.
These can then be applied and aggregated to calculate an overhead cost per unit, as in Step 5 of the following section.

3.3 Steps
To find total product costs, overheads are traced to individual production departments, as usual, with common costs being apportioned using suitable bases. Then, the following steps are applied:

Step 1 Identify major activities within each department which create cost. Examples:(1) Production scheduling (2) Machining (3) Dispatching of orders (4) Inspections
Step 2 Create a cost centre/cost pool for each activity-the "activity cost pool". Examples: Cost pool for: (1) all production scheduling costs (2) all machining costs (3) all dispatching costs (4) all inspection costs
Step 3 Determine what causes the cost of each activity- the "cost driver". Examples: (1) Number of batch set-ups for production scheduling (2) Machine hours for machining (3) Number of dispatch orders for dispatching (4) Number of inspections Cost per unit of driver
Step 4 Calculate an absorption rate for each "cost driver". Examples: Cost per unit of driver: (1) batch set-up (2) machine hour (3) dispatch order (4) inspection
Step 5 Calculate the total overhead cost for manufacturing each product. e.g. Product Z (1) No. of batch set-ups for Product Z * Cost per batch set-up = x1 (2) No. of machine hours for Product Z * Cost per machine hour = x2 (3) No. of dispatch orders for Product Z * Cost per dispatch order = x3 (4) No. of inspections for Product Z * Cost per inspection = x4; y = x1 + x2 + x3+ x4.
Step 6 Calculate the overhead cost per unit. e.g. Product Z Overhead cost per unit = y / No. of Zs produced

Identifying the cost drivers in a business enables management to better understand cost behaviour.

Example of Activity-Based Cost

A company assembles two product models in batches: Basic in 2,000 units and Deluxe in 100 units. Each Basic model has 20 components, and each Deluxe model has 30 components. It takes 5 hours to assemble a Basic model and 6 hours to assemble a Deluxe model. 20,000 units of the Basic model and 2,000 units of the Deluxe model are budgeted for the next period. The total fixed overhead budget of $224,000 has been analysed into three activities and cost drivers identified as follows:

Activities /cost pools:	Cost driver:	
	$	
1. Batch set-ups	90,000	Number of set-ups
2. Stores/material handling	92,000	Number of components
3. Other (rent, etc.)	42,000	Labour hours
Total overheads	224,000	

Number of units of cost drivers (Step 3)
1. Number of set-ups required: 30 calculated as:
Basic: 20,000/2,000 = 10
Deluxe: 2,000/100 = 20
2. Number of components required: 460,000 calculated as:
Basic: (20,000 x 20) = 400,000
Deluxe: (2,000 x 30) = 60,000 Total components = 460,000
3. Number of labour hours required: 112,000 calculated as:
Basic: (20,000 × 5) = 100,000
Deluxe: (2,000 × 6) = 12,000
Cost per unit of cost driver (Step 4)
1. Batch set-ups ($90,000/30) $3,000 per set up
2. Stores/material handling ($92,000/460,000) $0.20 per component
3. Other overheads ($42,000/112,000) $0.375/labour hour
Total overhead for each product (Step 5)

	Basic	Deluxe	Cost	Basic	Deluxe
	No.	No.	(Step 4)	$	$
1. Batch set-ups	10	20	$3,000	30,000	60,000
2. Stores/material handling	400,000	60,000	$0.20	80,000	12,000
3. Other (rent, etc.)	100,000	12,000	$0.375	37,500	4,500
Total overheads				147,500	76,500

Overhead cost per unit of product (Step 6)

Number of products	20,000	2,000
Overhead cost per unit	$7.375	$38.25

Under traditional absorption costing, using labour hours, the overhead cost of the Deluxe model would be only 20% more than a Basic model. However, the ABC approach substantially increases the cost of making a Deluxe unit; the set-up costs for each batch are spread over far fewer units. The effort and cost incurred in producing small batches are now reflected in the

higher cost per unit. Deluxe units should have a higher selling price to justify the higher costs incurred.

Quiz: Activity-Based Costing v Absorption Costing The total budgeted fixed overheads for a company are $712,000. These have traditionally been absorbed on a machine-hour basis. The company makes two products, A and B.

	A	B
Direct material cost	$20	$60
Direct labour cost	$50	$40
Machine time	3 hrs	4 hrs
Annual output	6,000	40,000

The company is considering changing to an ABC system and has analysed the overhead cost into three activities:

Activities /cost pools:	$	Cost driver:
Machine related	178,000	Machine hours
Set-up related	230,000	Set-ups
Purchasing related	304,000	Purchase orders
Total overheads	712,000	

	Machine hours/unit	Annual output	Total machine hours	Number of set-ups	Number of purchase orders
Product A	3	6,000	18,000	16	52
Product B	4	40,000	160,000	30	100
		46,000	178,000	46	152

Required:
a. Calculate the total cost for each product, assuming that the company continues to absorb overheads on a machine-hour basis.
b. Calculate the cost per unit using the ABC system.
c. Compare the cost per unit of each product using ABC with the cost per unit using absorption costing, and identify the main reasons for the difference.

Answer:
(a) Traditional
Total overhead =$712,000
Total machine hours=178,000
Rate per hour = $712,000/178,000 = $4/hour

	A	B
	$	$
Direct material	20	60
Direct labour	50	40
Fixed overhead		

3 hrs @ $4	12	
4 hrs @ $4		16
Total	82	116

(b) ABC

Activities	Machine related	Set-up related	Purchasing related
Overheads	$178,000	$230,000	$304,000
Consumption of activities (cost drivers)	178,000 hrs	46 set-ups	152 orders
Cost per unit of driver	$1 per hour	$5,000 per set-up	$2,000 per order
Cost traced to products			
A	$18,000	$80,000	$104,000
B	$160,000	$150,000	$200,000
Overhead cost per unit			

A (18,000 + 80,000 + 104,000)/6,000 = $33.67
B (160,000 + 150,000 + 200,000)/40,000 = $12.75

	A $	B $
Direct material	20.00	60.00
Direct labour	50.00	40.00
Fixed overhead	33.67	12.75
Total	103.67	112.75

(c) Comparison of costs under ABC and absorption costing

There is a significant difference in the cost per unit of Product A when using ABC compared to traditional absorption costing. Under absorption costing, the cost per unit was calculated as $82; under ABC, the cost rose to $103.67, an increase of 26%. The difference in the cost per unit of Product B is less significant. It falls to $112.75 under ABC, compared to $116 under absorption costing, a drop of 3%.

The cost of Product A is significantly understated when absorption costing is used. A significant factor in this is set-up costs. The total set-up costs apportioned to Product A were $80,000, equivalent to $13.33 per unit. Product B, by contrast, has total set-up costs of $150,000, equivalent to $3.75 per unit. Product A used 16 set-ups to produce 6,000 units, which is 375

units per set-up, and Product B used 30 set-ups to make 40,000 units, achieving an output of 1,333.33 per set-up.

Similarly, in product-related costs, the cost per unit of Product A was $17.33 ($104,000/6,000 units), and the cost per unit of Product B was $5 per unit ($200,000/40,000). This is because, on average, one purchase order was used for 115 units of Product A (6,000/52) and one for 400 units of Product B (40,000/100). These differences in the use of the activities are disguised when absorption costing is used, and all costs are absorbed on a machine-hour basis.

3.4 Analysis of ABC

3.4.1 Advantages The main advantage of ABC is that the costs per unit are more accurate, as overhead costs are apportioned to products based on their use of the cost drivers rather than using some arbitrary "blanket rate" as used for absorption costing. This leads to the following benefits:

· Better decision-making. Companies will have a more accurate knowledge of cost and profit per unit. They can evaluate whether to stop producing loss-making products.

· Where cost-plus pricing is used, applying ABC means that the price will be more likely to achieve the desired margins.

· There is a better understanding of what causes costs resulting from identifying the cost driver. This enables managers to make more informed decisions on actions to reduce costs.

· Control of overheads is more straightforward, as responsibility for incoming costs must be established before ABC can be implemented.

· More accurate performance measurement leads to better performance management.

3.4.2 Disadvantages

Although ABC provides a more accurate treatment of overheads, it is not without disadvantages:

· ABC is still based on budgeted overheads in the current period, which may be unsuitable for future strategic decisions;

· It is more complex, and the selection of cost drivers may not be straightforward: - There may be more than one possible cost driver for a particular overhead, so some judgment is required in selecting an appropriate driver. - As not all costs will be easily identified with particular cost pools, some allocations will be arbitrary.

· Additional time and cost will be incurred to set up and administer the system.

3.5 Comparison of ABC and Traditional Methods

The differences between traditional methods of absorbing overheads and ABC methods can be summarised as follows:

Traditional Absorption Costing :

· Initial allocation and apportionment of overheads is to cost centres.

· Absorption of overheads of each cost centre is based on the volume of output (e.g. number of units or labour hours). As costs may not depend on volume, some allocations may be inappropriate.

· Many different cost types for a particular cost centre are included in that department's blanket overhead absorption rate.

· Since costs are assumed to depend on output volume, limited information is provided to management about ways to reduce costs.
· Absorption costing is relatively straightforward.

Activity-Based Costing:
· Initial allocation and apportionment of overheads is to cost pools. Each cost pool represents a particular activity.
· Absorption of overheads of each cost pool is based on the "driver" that causes the costs to vary. Product costs reflect more accurately the activities that cause them.
· Costs for a particular activity will include only the costs of performing that activity.
· Identification of cost drivers allows management to understand better the causes of costs and to find more appropriate ways to control them.
· ABC requires a large project to identify activities and drivers. The accounting system may have to be amended or replaced to provide the information needed.

3.6 Use of ABC in the Public Sector
In many countries, governments are making greater use of management accounting techniques to:
· allocate government funds more efficiently to areas where they provide the most benefits;
· reduce the amount of overall government spending;
· provide greater transparency so that taxpayers can see where their money is being spent, and
· encourage public sector bodies to become more responsive to their customers.
ABC is useful in helping public sector bodies assess their services' costs more accurately. However, ABC's disadvantages also apply to public sector organisations. Critics also argue that public sector resources would be better spent improving "front line" services than developing sophisticated accounting techniques such as ABC.

Example of Hospital Operating Theatre
A hospital needs to monitor the costs per patient; part of this is the cost of surgery. Under traditional methods, the operating theatre might be treated as a cost centre. An absorption cost per minute could be calculated by dividing the total costs of the theatre by the total number of minutes budgeted to be available. The cost of an operation would then be calculated by multiplying the number of minutes the procedure takes by this absorption rate. The problem with this approach is that it is unrealistic to assume that the cost per minute of all operations is the same. Some operations may require several surgeons and medical staff; others may require just one or two. Different equipment and different quantities of consumable materials will be used. Examples of activities that could be used for an ABC approach to calculating the cost of an operation include:

Activity	Driver
. Preparing the operating theatre	. Number of operations - the cost of preparing the theatre does not vary significantly between different types of operations.
. Activity of anaesthetist	. Number of operations - calculated separately for those requiring a general anaesthetic and those requiring only local anaesthetics.

. Anaesthetic drugs	. Time taken from entering the anaesthetic room until entering the recovery room.
. Activity of the physician	. Time taken from initial incision to closure of incision on completion of surgery.
· Consumable items during surgery	. Itemised list of consumables used during surgery, captured by a bar- coding device.
· Overhead activity	· A charge for management administration and staff training.

Summary:
· Management accounting is concerned with preparing and presenting accounting information to assist management in planning, controlling and making decisions.
· Costing involves calculating the unit cost of a product or service. Traditional methods are absorption costing and marginal costing.
· Under absorption costing, a share of fixed production overheads is included in the unit cost. The steps used in absorption costing are: Allocation and apportionment to cost centres; Re-apportionment of service centre costs to production cost centres; Absorption of the total cost of each production cost centre into the unit cost using an appropriate basis (e.g. labour or machine hours);
· Activity-based costing (ABC) aims to provide a more meaningful product cost by linking costs to the activities that drive them.
· Steps in ABC: 1. Identify the activities that cause costs to be incurred. 2. Allocate and apportion costs between "activity cost pools". 3. Identify the cost drivers for each activity. 4. Calculate the absorption rate per unit of driver (divide costs in (2) by quantities in (3)). 5. Calculate the total overhead for the product (multiply (4) by the number of activities for each product). 6. Calculate the overhead cost per unit of product (divide (5) by the number of units for each product).
· The main advantage of ABC is that it focuses on the activities that cause costs rather than products.
· The main disadvantage is its complexity (and implementation cost), making it inappropriate for many organisations.

Chapter 3: Advances in Management Accounting
This chapter covers the following Learning Outcomes. B. Specialist Cost and Management Accounting Techniques 2. Target costing a) Derive a target cost in manufacturing and service industries. b) Explain the difficulties of using target costing in service industries.> c) Suggest how a target cost gap might be closed. 3. Life-cycle costing a) Identify the costs involved at different stages of the life-cycle. b) Derive a life-cycle cost or profit in manufacturing and service industries. c) Identify the benefits of life-cycle costing. 4. Throughput accounting a) Discuss and apply the theory of constraints. b) Calculate and interpret a throughput accounting ratio (TPAR). c) Suggest how a TPAR could be improved. d) Apply throughput accounting to a multi-product decision-making problem. 5. Accounting for environmental and sustainability factors a) Discuss the issues organisations face in the management of environmental costs. b) Describe the

different methods an organisation may use to account for its environmental costs. c) Discuss the issues organisations face in accounting for environmental and sustainability factors. d) Discuss the role of the management accountant in supporting the business to develop sustainable practices.

1.1 Traditional Management Accounting Traditional management accounting is inward-looking, focusing on controlling costs. The most important techniques are:
· costing systems (marginal and absorption costing);
· budgeting systems; · standard costing and variance analysis; and
· working capital management.

1.2 Business Environment Changes
During the 1950s and 1960s, the Western industrialised nations enjoyed strong positions in international markets. There was little competition either on price or quality. Businesses could continue to be successful by doing what they had always done. During the 1970s, however, this stable business world began to disappear:
· Less protection in home markets and increased globalisation led to increased competition from newly emerging industrialised nations (particularly Japan).
· The introduction of computerised manufacturing systems led to the opportunity to reduce manufacturing costs while increasing the quality of products.
· Products' lifecycles began to shorten, so there was increased demand for new products from consumers.
· The growth of service industries. · Business combinations resulted in larger multinational organisations with diverse operations.
· Change in the business structure with more decentralised decision-making.

1.3 Growth of Services Industries
Many of the traditional management accounting practices were aimed at manufacturing businesses. However, many "post-industrial" economies have developed that include a significant proportion of service industries. Service industries can be distinguished from manufacturing by the following characteristics, which can be memorised on with the mnemonic SHIP:
· Simultaneity (also called inseparability): The service is consumed simultaneously as it is performed, so there is usually more emphasis on getting it right the first time, as there may be no second chances.
· Heterogeneity (also called variability): The standard of services will vary from service to service. For example, hairdressers in a salon will usually have different talents, and each haircut and styling could be unique to each client. This characteristic makes it more challenging to ensure that all services are of a consistently high standard.
· Intangibility: Tangible products have a physical aspect; customers can point to the specific features/ physical characteristics they value. On the other hand, a service does not have physical characteristics, making it more challenging to identify what aspects of the service customers value.

· Perishability: Services cannot be stored. Businesses, therefore, need to strike a careful balance between the need for sufficient resources to meet demand at peak times and the need for efficiency.
· Non-transferability of ownership: Often, there is no transfer of ownership when a service is provided. For example, a hotel guest only has the right to access their room for the duration of their stay.

1.4 Adding Value and Avoiding Waste

The modern business environment emphasises the removal of activities that do not add value and the elimination of waste. A non-value adding activity is one that any that does not enhance a product or service for the customer. In this context, two developments are worth specific mention: 1. Total Quality Management; and 2. Just-in-Time manufacturing.

1.4.1 Total Quality Management (TQM)

TQM is a philosophy of "getting it right the first time". It recognises that the costs of bad quality may exceed the costs of good quality.
Total Quality Management consists of continuous improvement in activities involving everyone in the organisation, managers and workers, in an integrated effort towards improving performance at every level.

1.4.2 JIT Manufacturing

The traditional Western approach to manufacturing was to produce to maximum capacity. Production was driven by internal plans rather than external demand. This led to a variety of weaknesses:
· Excessive holding of inventory with the associated costs of storage and obsolescence;
· Delays between the customer ordering products and the delivery of the products;
· Bottlenecks in the production process not being identified;
· A lack of flexibility in meeting changes in customer requirements.

The demand for finished products drives a just-in-time (JIT) production system, so each component on a production line is only produced when needed for the next stage.
· A "pull through philosophy" - customer demand drives production.
· Requires careful planning of demand and production requirements.

JIT purchasing means that raw materials are received when needed for production, so raw material inventory is reduced to near-zero levels.
· Smaller, more frequent deliveries are required at short notice.
· A few dedicated suppliers deliver defect-free components just in time when the parts are demanded on the production line.

Key Point Inventory holding costs are low, but ordering costs are high.

1.5 Response of Management Accountants

Several new management accounting techniques evolved in response to the changing business environment. The methods included in the syllabus for the Performance Management exam are:

· Activity-based costing (see Chapter 2);
· Target costing;
· Life-cycle costing;
· Throughput accounting;
· Environmental accounting.

2.1 Aim and Use In traditional cost-plus pricing models, the cost of a product is the starting point for calculating the price. Having determined the unit cost of a product, a profit margin is then added to calculate the price. This approach is flawed in a competitive world; the estimated price may be too high for the market to accept. In a competitive market, the price of a product may be determined by the market. Companies, therefore, have to accept the market price. Target costing is a marketing approach to costing. It attempts to achieve an acceptable margin in a situation where the price of a product is determined externally by the market. This margin is achieved by identifying ways to reduce the product's costs.

Target costing - subtracting a desired profit margin from a competitive market price to determine the maximum acceptable cost.
Target costing is most appropriately used during the design phase of a product (where cost savings can be identified by changing the design of the product to avoid unnecessary costs from being designed into the product);

2.2 Steps in Target Costing
1. Determine the price the market will accept for the product based on market research. This may take into account the market share required.
2. Deduct a required profit margin from this price - this gives the target cost.
3. Estimate the actual cost of the product. If it is a new product, this will be an estimate.
4. Identify ways to narrow the gap between the actual cost of the product and the target cost.

Summary on how the target price and profit may be determined:
· The starting point is to define the product specification. This involves designing the product and determining, in detail, which features will be included.
· The sales volume is defined, and the target price is set. This price will be based on the organisation's pricing strategy and market research, which will help determine the price at which the required output volume can be sold that meets profit objectives.
· The required profit may be based on the investment required to produce the product and the needed return on investment.
· The target profit is then divided by the number of units to obtain the required profit per unit, which is deducted from the target price to give the target cost.

Quiz: Target Costing
Exclusive Motors is designing a new version of its luxury car, the Z123 series. The vehicle will be launched next year. It is expected to have a lifecycle of 10 years. The production of the car will require an investment of $3 billion. The company needs a profit of 20% a year on this

investment. The marketing department believes that the car could be sold for a price of $40,000 each. 100,000 cars would be manufactured and sold each year.

Required: Calculate the target cost of one Z123.

Answer:

	$million
Expected revenue (100,000 × $40,000)	4,000
Required profit (20% × $3 billion)	600
Total target cost	3,400
	$
Target cost per car ($3,400 million / 100,000)	34,000

2.3 Application to Service Industries
Target costing is likely most appropriate in manufacturing industries, where a volume of standard products is to be made. Although it can also be used in service industries, there may be additional challenges:
· In many service industries, the "products" are non-standard and customised. It is difficult to define a target cost when there is no standard product.
· A higher portion of the expenses in service industries are indirect (overheads). It is harder to reduce these on a product-by-product basis.
· Reducing costs in a service industry may be at the expense of customer service or quality. In manufacturing industries, it may be possible to identify cost savings that remove product parts that customers do not value.

Example of Target Costing for Services
Gates & Jobs Co is a tax advisory business. There is much competition for tax services in the market where Gates & Jobs is located, and one competitor has recently started to advertise that it will do tax returns for a flat rate of $100 per return. Gates & Jobs Co has decided to match this price for a basic tax return, provided the client has no capital gains tax to pay. Gates & Jobs currently aims to make a profit of 20% of all fees charged to clients. The target cost of the tax return is, therefore:
Standard fee $100
Less: Required margin $20
Target cost $80
Based on observation and discussions with the management accountant, the actual cost of a "typical" tax return is as follows:
Direct costs Time of senior adviser (1 hour at $15 per hour) $15
Time of partner review (15 minutes at $100 per hour) $25
Total direct costs $40
Overheads apportioned at 150% of labour time $60
Actual cost $100

There is, therefore, a cost gap of $20. Although it can be argued that the price of the tax return of $100 does cover all direct costs, and therefore increases contribution, the partners are keen that all services should contribute to the business's overheads at a 150% rate.

Methods which might be used to reduce the cost gap include: · Reduce the time the senior takes (e.g. using a software package). · Reduce partner time (e.g. the partner might not review basic returns). · Reduce the overheads of the business (e.g. using ABC methods to identify more accurately the drivers of overheads) and find ways to economise.

2.4 Narrowing the Target Cost Gap

Target costing relies on multi-disciplinary teams discussing ways to reduce the gap between the actual (expected) and target costs. There are various methods to reduce product cost; an important consideration when using these techniques is to ensure that the perceived value of the final product/service is not reduced (which would lead to lower effective selling prices). Some methods which may be used are:

· Reconsider the design to eliminate non-value-added elements. For example, snap-together fasteners and automated glue dispensing may be used instead of screws (which require high labour manipulation)

· Reduce the number of components or standardise components. For example, multiple separate components that need to be welded together in car assembly may be cast as a single piece, reducing welding costs and improving structural integrity.

· Use less expensive materials. Using cheaper materials may reduce overall unit cost, but there is a significant risk of reducing perceived value.

· Employ a lower grade of staff on production. Using a lower staff grade may reduce labour costs. However, management must closely monitor quality costs. It might be suitable if the production process does not require specialist skills.

· Invest in new technology. This usually involves a significant upfront cost to acquire the technology, and its value may be related to how effectively the new technology is utilised. Lifecycle costing may be used to have better insight into the actual cost of the investment Outsource elements of the production or support activities.

· Outsourcing activities is a common cost reduction action; however, care must be taken to ensure outsourced components and services are of the required quality and that crucial value drivers and capabilities are not lost in the outsourcing process.

· Reduce manning levels or redesign the workflow. Redesigning workflows and processes (using Kaizen, for example) helps reduce production costs. Ensure dysfunctional shortcuts disguised as cost-cutting measures are not built into the redesigned workflow. For example, removing supposedly non-value-adding activities such as precision measurement and quality tests might lead to deterioration in the consistency of quality.

The following techniques may assist such methods:

"Tear down analysis" (also called "reverse engineering") - involves examining a competitor's product to identify possible improvements or cost reductions.

Value engineering - involves investigating the factors that affect the cost of a product or service. The aim is to improve the design of a product so the same functions can be provided for a lower cost or save cost by eliminating those the customer does not value.

Some writers distinguish between four elements of value: 1. Utility or use value - how useful the product is to the owner. 2. Esteem value - how the product increases the owner's well-being. 3. Scarcity value - the high value of diamonds results from their scarcity. 4. Exchange value - the amount the owner sells the product for.

Key Point
The value engineering technique is applied to new products/services at the beginning of the development process during the design stage (i.e. before production starts). Value analysis evaluates the value of an existing product or service.

Functional analysis - involves identifying the attributes/ functions of a product that customers value. The price the customer is prepared to pay for each function is then determined. The function should be dropped (abandoned) if the cost of providing it exceeds the value (marginal revenue) it generates. Businesses should ensure that any steps taken to reduce product costs do not lead to a lower perceived (or actual) quality, as this may reduce the price the product could sell for. This would then reduce rather than increase the margin from selling the product. Increasing the sales price is not a viable method of reducing the gap.
· The whole purpose of target costing is to achieve a reasonable margin when the market determines the competitive price.
· Charging a higher price would lead to a significant fall in demand for the product.

Key Point
Target costs can be driven down by directing attention to any costs related to any part of a product's lifecycle (see next).

3.0 Introduction
Target costing emphasises cost control through good product design and production planning, but those up- front activities also cause costs. There might also be costs incurred after a product is sold, such as warranty costs and plant decommissioning. Therefore, to profit from a product, its total revenue must exceed its total cost, whether these costs are incurred before, during or after the product is produced. This is the concept of life-cycle costing.
Life-cycle costing - a system that tracks and accumulates the actual costs and revenues attributable to each product from development through to abandonment.
3.1 Product Lifecycle The product lifecycle describes how demand conditions for a product, a brand and whole markets change with time.
1. Development stage (planning and design stage) - The product is designed and developed during this stage. Prototypes may be produced. Manufacturing processes will also be created, including any special machinery required to make the product. Cash flow will be negative at this stage, as no revenue is generated. 2. Introduction phase/launch - Special pricing strategies may be used during the launch of a new product, such as market skimming or market penetration. Companies must also consider that the pricing strategy used at the introductory stage may affect demand in later years. For example, setting a low price initially may discourage competitors from entering the market. This will allow the company to enjoy higher demand later in the product lifecycle. 3. Growth - Competition may rise due to new suppliers entering

the market. This may force lower prices. 4. Maturity - Most profits are made during this phase. Prices may be stable. The company's price strategy during this phase is more likely to focus on maximising short-term profits, unlike in the introduction phase. 5. Decline - Prices may fall with demand unless a niche market can be found. In the modern manufacturing environment, many of a product's costs will be incurred at the early stages of its lifecycle (e.g. development, design and set-up costs). Revenues only arise, however, when the product is being manufactured and sold. Traditional financial and management accounting systems focus only on costs and revenues incurred during the manufacturing stage of the product's life. They therefore, ignore the following: · costs incurred in developing and designing the product; and . any abandonment and disposal costs at the end of the product's life. Life-cycle costing estimates and accumulates costs over a product's entire lifecycle to determine whether the profits earned during the manufacturing stage will cover the costs incurred pre- and post-manufacturing. It traces individual products' development, design and set-up costs over their lifecycles.

Example of Life-Cycle Costing

Zany developed a new computer game during the year 20X2 for $200,000. The game will be launched in the year 20X3. Budgeted revenues and costs of the game over its lifecycle (life-cycle costing) are presented below:

	20X2	20X3	20X4	20X5
Sales (units)	0	16,000	34,000	12,000
	$000	$000	$000	$000
Revenue	0	160	340	120
Variable costs	0	30	65	20
Contribution	0	130	275	100
Marketing costs	40	30	0	0
Development costs	200	0	0	0
Annual profit	(240)	100	275	100
Cumulative profit	(240)	(140)	135	235
Life-cycle cost per unit:	$000			
Total variable costs	115 (30 + 65 + 20)			
Marketing costs	70 (40 + 30)			
Development costs	200			
Total life-cycle costs	385			
Total output (000 units)	62			
Life-cycle cost per unit	$6.21			

Since the selling price is $10 per unit, life-cycle profit per unit = $3.79 ($10-$6.21). Managers can now see the expected profit of the product over its entire life rather than simply on a year-by-year basis. Actual revenues and costs would be presented on a comparable basis. The life-cycle cost per unit includes all costs, not just manufacturing-related.

3.2 Costs Involved

For life-cycle costing, three stages can be identified in the product's lifecycle:

· Planning and design stage;
· Manufacturing (or production and sales) stage;
· Service and abandonment stage.

3.2.1 Committed Costs During the planning and design phase, many decisions about the product's design will determine the costs that will be incurred in the future. These are committed costs. Although not incurred during the design phase, the company is committed to incurring future expenditures (mainly during manufacturing). Tools such as target costing (see previous) may be used to reduce such committed costs, if they exceed what is acceptable. The pattern of expenditure will vary from industry to industry. It is common for committed costs during the planning and design phase to reach 80% of the total costs over the product's life.

3.2.2 Cost Behaviour in the Product Lifecycle The actual costs incurred during the product lifecycle typically include the following:

Stage	Fixed Costs	Variable Costs
Planning and design	· Product design · Building prototypes · Market research	
Manufacturing and sales	· Marketing and advertising · Fixed production and sales overheads · Design updating	· Materials and components · Direct labour · Variable production and non- production overheads. · Sales commissions
Service and abandonment	· Decommissioning factories · Disposal of products · Servicing (may be outsourced)	

During the manufacturing and design phase, costs are likely to change as follows:
· Marketing and advertising costs will initially be high when the product is first launched and for some time after this, in which the manufacturer will want to raise market awareness. Later, the costs of marketing and advertising will fall.
· Fixed production costs may also be higher in the initial manufacturing stages. Later, the manufacturing experience gained may enable cost savings to be made. However, some fixed costs may be stepped costs and increase if production increases through expanding production facilities.

· Total variable costs will, by definition, increase as output increases. The output will be expected to grow at least during the start of the sales and manufacturing phase as demand for the product increases.
· Unit manufacturing costs calculated using traditional absorption costing will decrease as output increases, due to two factors: 1. The fixed costs will be spread over a more significant number of units, leading to a lower fixed cost per unit; and 2. The variable cost per unit may fall as output increases due to economies of scale and the learning effect.

3.2.3 Strategies to Extend Product Maturity The life-cycle cost per unit can be reduced by extending the maturity of the product. The following strategies can be used for this:
· Issuing updated versions of the product, which include new features. The costs of developing updates for an existing product are likely considerably less than the cost of creating an entirely new product.
· Repackaging the product to give it a new image. This way, established products can be relaunched as if they were new.
· Selling the product in new markets. This could be new geographical markets or aiming the product at new market segments (e.g. by discounting the price).

3.3 Benefits
Life-cycle costing encourages management to plan the pricing strategy for the whole product life rather than on a short-term basis. (Pricing and the effect of the product lifecycle on pricing decisions are discussed later in Chapter 7.)
Identifying the costs incurred throughout the product's life means that management understands them better, enabling management to control them better.
By monitoring a product's revenues and costs on a cumulative basis over its life, management is provided with more meaningful information for control than it would have by monitoring costs and revenues period by period.
It is much easier to "design out costs" during the design phase of a product than to "control out costs" later in a product's lifecycle. By considering the whole lifecycle of the product at the design phase, management is more likely to achieve a reasonable cost base and, therefore, reasonable profits. Decisions about whether to continue developing and manufacturing products will be based on complete information when the product lifecycle is considered. Where costs and revenues are monitored on a period-by-period basis, there is a risk that products in the development phase will be scrapped because they do not bring in revenues.

3.4 Relevance to Service Industries
Life-cycle costing is relevant to services that require significant upfront research and development. An example is the software industry, where considerable research and development are invested in a new application or operating system. The cost of this development must be recovered before the software becomes obsolete. Life-cycle costing can also be performed concerning customers. The costs of providing goods or services to customers may vary over their "life" as customers. Some businesses incur high costs in setting up a new customer. However, having attracted new business, the cost of maintaining a customer relationship is likely to be much lower. An effort is therefore directed to ensuring customer

loyalty. For example, the following one-off costs might be incurred by a retail bank at the start of a new customer's life:

· Financial incentives (e.g. below-market-rate interest on borrowings for 12 months).
· Initial registration, including validation of personal details and identification documents.
· Creditworthiness checks if loans are to be provided.
· Setting up bank account access. · Issuing user IDs and passwords for Internet banking.

Once the customer's accounts have been set up, many of the costs above will not need to be incurred again. The bank must ensure that the expenses incurred at the start are recovered over the customer's life.

4.1 The Theory of Constraints During the 1980s, many factories in Western Europe and the US became heavily automated. At that time, there was a general belief that automation would reduce costs (by reducing labour) and higher profits. Management accountants, therefore, focused on performance measures of efficiency. However, many businesses did not enjoy increased profits despite improved efficiency. Instead, they discovered the following problems:

· They failed to meet customer orders on time, leading to customer frustration.
· The volume of work-in-progress and finished goods grew significantly, leading to high inventory obsolescence costs and a lack of storage space in factories.

Goldratt and Cox, in their book, "The Goal", pointed out that the cause of the apparent paradox between increased efficiency and reduced profits was production bottlenecks. Bottlenecks are slower processes than those that precede and succeed them. They slow down the whole production process.

Example of Bottleneck

A factory makes three products, all of which pass through three machines. The time spent on each machine is the same for all three products. Demand for the company's products exceeds the amount that the company can produce. The maximum daily output of the three machines is as follows:

Machine 1 200 units -> Machine 2 180 units -> Machine 3 210 units

Machine 2 is the bottleneck, which has the lowest output volume.

Goldratt and Cox pointed out the following:

· If the non-bottleneck processes operate at maximum efficiency, work-in-progress will build up before the bottleneck process. In this example, if Machine 1 continues to produce 200 units a day, 20 incomplete units a day will accumulate in front of Machine 2, which can only deal with 180 units daily.

· The bottlenecks restrict the input quantity to the "downstream" processes. In this example, Machine 3 can only process 180 units a day, as this is all it receives as input from Machine 2.

Bottlenecks reduce the rate at which finished goods are produced. The problem was worse because factories would set up machines for large production runs. After producing a large batch of one product, the machines must be set up for a different product. It was thought that large batches would reduce costs further by reducing set-up costs. However, it compounded the problems of a build-up of work-inprogress and the delays in meeting customer order deadlines. Goldratt and Cox concluded that organisations should focus on "throughput" (i.e. producing for sale, not work-in-progress) instead of focusing on efficiency. Throughput is the rate at which the

system generates money through sales. Goldratt and Cox proposed the following process ("the five focusing steps") to maximise profit when faced with bottlenecks: 1. Identify the system's bottlenecks. This will be more complex in the real world than the simplified example here. 2. Decide how to exploit the bottlenecks identified in (1) (i.e. which products to make, given the bottlenecks). Ensuring the bottleneck resource is actively used requires limiting factor analysis using the time spent on the bottleneck as the limiting factor. By definition, the non-bottleneck resources will not be used at full capacity and, therefore, must sit idle for some time. 3. Subordinate everything else to the decisions made in (2) (i.e. ensure that other resources do not produce at a higher rate than the bottleneck). In this example, if Machine 1 were to operate at its maximum capacity of 200 units per day, Machine 2 would only be able to take 180 units, so 20 units of work-in- progress would build up. In this case, Machine 1 should be subordinated to the speed of Machine 2, and its production speed should be limited to 180 units. 4. Elevate the system's bottlenecks (i.e. elevate production capacity). This can be done, for example, by buying additional machines (capital investment), training the machine operators or reducing the time spent on the bottleneck resource. It may be possible to redeploy available idle time hours from a subordinated resource from step (3) to help alleviate the bottleneck. 5. If a new constraint is broken in (4), return to (1). Once the bottleneck has been removed, another resource becomes the bottleneck (as long as there is market demand). For example, if the capacity of Machine 2 were increased to 240 units per day, Machine 1 would become the bottleneck. Steps 1-4 are repeated. Therefore, this is a process of continuous improvement.

The ideas above conflict with traditional management accounting:

· The idea that Machine A should not operate at full capacity would lead to the idle time of the operators of Machine A. Goldratt and Cox argue that idle time must be accepted as the cost of idle time is less than the cost of the work-in-progress which would build up if Machine A were to operate at full capacity.

· Under traditional management accounting, the build-up of work-in-progress would not affect the business's profits (since closing work-in-progress is part of closing inventory and deducted in determining the cost of sales). Goldratt and Cox argue that this is wrong because the build-up of work-in-progress in front of a bottleneck is a cost to the company if the volume of work-in-progress continually increases.

4.2 Throughput Contribution

Throughput contribution - sales revenue less direct material costs.

Goldratt and Cox introduced the idea of "throughput contribution" as the measure of performance. They argue that all other costs, traditionally treated as variable, are fixed in the short run (e.g. labour). When using limiting factor analysis (see also Chapter 6) to determine which products to produce, given a bottleneck, they would advocate prioritising the production of those products that generate maximum throughput contribution per bottleneck hour.

Key Point

The fixed elements in this technique include overheads and labour, which may collectively termed "conversion costs".

Quiz: Limiting Factor Analysis

Beta Co produces three products, E, F and G, all in the same factory, details of which are shown below:

	E	F	G
Selling price per unit ($)	120	110	130
Direct material cost per unit ($)	60	70	85
Maximum demand (units)	30,000	25,000	40,000
Time required on the bottleneck resource (hours per unit)	5	4	3

There are 320,000 bottleneck hours available each month.
Required: Calculate the optimum product mix each month.

Answer:
Step 1: Calculate the throughput per unit for each product.
Step 2: Calculate the throughput return per hour of bottleneck resource.
Step 3: Rank products in order of production priority (i.e. highest return per hour first).

	E	F	G
1. Throughput per unit = Selling price - direct material cost ($)	60	40	45
Time required on the bottleneck resource (hours per unit)	5	4	3
2. Return per factory hour ($)	12	10	15
3. Rank	2	3	1

Note: Product E has the highest throughput per unit, while product G has the highest per hour. Therefore, the bottleneck must be exploited by prioritising G before E.
Step 4: Calculate the optimum production plan (i.e., allocating the bottleneck resource to each product in order, not exceeding their maximum demand).

Product	Units	Hours	Total	Throughput per hour	Total throughput
Total hours available			320,000		
G	40,000	3	(120,000)	$15	$1,800,000
E	30,000	5	(150,000)	$12	$1,800,000
F	12,500	4	(50,000)	$10	$500,000
					$4,100,000

320,000 hours is sufficient to produce 40,000 units (maximum demand) of G (first) and E (second), leaving only 50,000 hours for making 12,500 units of F.

Quiz: Throughput Contribution
A factory produces two products, A and B. Both products pass through three processes: Process 1, Process 2 and Process 3. Process 2 has been identified as the bottleneck. There are 10 hours of Process 2 time available per day. Information relating to the two products is as follows:

	A	B
	$	$
Selling price per unit	100	80
Direct materials per unit	70	60
Direct labour per unit	5	10

Traditional contribution per unit	25	10
Maximum demand per day	8	14
Time on Process 2 per unit (hours)	1	0.5

Required: Determine the daily production plan that would maximise throughput contribution.

Answer:

	A	B
	$	$
Selling price per unit	100	80
Direct materials per unit	70	60
Throughput contribution per unit	30	20
Time on Process 2 per unit (hours)	1	0.5
Throughput return per hour of Process 2	30	40
Ranking	2	1

	Units produced	Hours used
B:	14	7
A:	3	3
		10
Total throughput contribution: (14 × 20) + (3 × 30)		370

Note: There are only three Process 2 hours remaining after prioritising production of Product B, which is sufficient for making three units of Product A (which requires one Process 2 hour per unit).

4.3 Throughput Accounting Ratio ("TPAR")

4.3.1 Calculation Based on the ideas of the theory of constraints, Galloway and Waldron developed the throughput accounting ratio ("TPAR") as a performance measure to evaluate factory managers. This aims to motivate factory managers to focus on maximising throughput. The ratio is calculated as follows:

TPAR = Return per factory hour /Cost per factory hour

Return per factory hour= Throughput per unit/Hours of bottleneck resource used per unit

Cost per factory hour = Other factory costs/Bottleneck resource hours available

Other factory costs mean all costs incurred in the factory besides materials; since materials are considered the only truly variable costs, all other costs are fixed. Return per factory hour is throughput contribution per unit divided by time spent on the bottleneck, where materials are the only variable cost. The TPAR, therefore, shows: Contribution per hour/Fixed cost per hour

4.3.2 Interpreting TPAR

TPAR is interpreted as follows:

· If TPAR > 1, the product is profitable, as the throughput contribution exceeds the fixed costs.

· If TPAR = 1, the product breaks even.

· If TPAR < 1, the product is loss-making. The throughput contribution generated does not cover the fixed costs required to make it.

4.3.3 Ways to Improve the TPAR TPAR is a performance measurement tool that may be used in evaluating managers' performance. It is hoped that managers will take the following actions to increase their measured performance:
· Eliminate bottlenecks or reduce the time spent on bottleneck resources.
· Reduce other factory costs.
Mathematically, the ratio could also be improved by increasing selling prices or reducing material costs. However, increasing selling prices may not be feasible in a competitive environment. Reducing material costs may affect quality, so this may not be desirable.

5.1 Introduction
In recent decades environmental issues have become more prominent. Environmental groups and many scientists point to evidence of human activity causing global warming and warn of the dire consequences of climate change. The most pressing issues are:
· Global warming, caused by greenhouse gas emissions (measured by the "carbon footprint").
· The global reserves of scarce natural resources are being depleted. In particular, energy and water will become scarce over the next 50 years.
· Pollution and rising sea levels causing loss of habitats for many species.

5.2 Importance of the Environment for Business
5.2.1 Environmental Behaviour and Performance One of the pioneering articles on environmental management accounting was "The Green Bottom Line: Management Accounting for Environmental Improvement and Business Benefit", published by Martin Bennett and Peter James in 1998. This identified several ways in which a company can improve its performance by becoming more aware of the impact on the environment:
· Poor environmental behaviour can harm an organisation's image, which may lead to a loss of sales as customers boycott the organisation's products.
· Many governments may impose heavy fines on companies which harm the environment. Companies also may have to pay hefty amounts to clean up any pollution for which they are responsible.
· Increasing government regulations on environmental issues such as pollution has increased business compliance costs.
· Improving environmental behaviour can reduce costs. For example, increasing energy efficiency will reduce energy costs and the depletion of natural resources for the companies concerned.
· Businesses as corporate citizens have a moral duty to play their part in helping to reduce the harm they do to the environment.
Example
The Deepwater Horizon oil spill in April 2010 was one of the world's worst environmental disasters. An exploratory oil rig exploded in the Gulf of Mexico, leading to a partially capped oil well a mile below the water's surface. Experts estimate that 35,000 to 60,000 barrels of oil

leaked from this well daily, depending on weather conditions. It took approximately three months to re-seal the oil well and stop the leak. BP was the majority owner of the oilfield. Although the rig was operated by a sub-contractor on behalf of BP, the US government stated that it held BP primarily responsible for the leak. BP recognised a pre-tax cost of $40.9 billion in its 2010 financial statements relating to the oil spill (compared with a profit for the year 2009 of $16.6. billion). This included a fund of $20 billion, which was set up to compensate the local community for damages caused and costs incurred on cleaning up the spill.

5.2.2 Achieving Environmental Benefits Bennett and James suggested six ways in which business and environmental benefits could be obtained through environmental management accounting: 1. Taking account of environmental effects in making capital expenditure decisions. 2. Better understanding of environmental costs otherwise hidden in other overheads that management is unaware of. 3. Reducing waste and saving energy. 4. Understanding environmental effects on life-cycle costs, many of which are incurred at the end of a product's life (e.g. to dispose of electronic goods following local laws on recycling). 5. Measuring environmental performance as stakeholders become more interested in organisations' environmental impact. 6. Involving management accountants in longer-term strategic planning for environmental-related issues.

5.3 Environmental Management Accounting Traditional management accounting systems do not provide any analysis of environmental costs. Management is often unaware of them. The implication of this is that:
· Management cannot do enough to manage environmental activities.
· Management accounts underestimate the costs of poor environmental behaviour and the benefits of good environmental behaviour.

Environmental Management Accounting (EMA) aims to overcome this.
EMA - the identification, collection, analysis and use of two types of information for internal decision- making: physical information on the use, flows and rates of energy, water and materials (including wastes); and monetary information on environment-related costs, earnings and savings. - Environmental Management Accounting Research and Information Centre (EMARIC) It is important to remember that there are two aspects to environmental management accounting:
· Physical information, which focuses on the physical use of scarce resources and how much waste occurs.
· Monetary information on environment-related costs, earnings and savings.

5.4 Defining Environmental Costs The first step in dealing with environmental costs is to define what environmental costs mean. Various definitions or categories of environmental costs have been suggested. One of these is the definitions provided by the US Environmental Protection Agency (EPA), which identified the following types of environmental costs:
· Conventional costs: environmental-related costs (e.g., buying energy and other scarce resources).
· Potentially hidden costs: those environmental costs that are recorded but included in general overheads, so management is unaware of them.

· Contingent costs: potential future costs (e.g., cleaning up damage caused by pollution). (In financial statements, contingent costs might be disclosed as contingent liabilities or recognised as provisions.) .

· Image and relationship costs: incurred producing environmental reports and promoting the company's environmental activities.

An alternative categorisation of environmental costs proposed by Hansen and Mendova is based on the costs of quality:

· Environmental prevention costs are incurred by activities undertaken to prevent waste production (e.g. spending on redesigning processes to reduce the amount of pollution released into the atmosphere).

· Environmental detection costs are incurred to ensure that the organisation complies with regulations and voluntary standards (e.g. costs of auditing the organisation's environmental activities).

· Environmental internal failure costs are incurred to clean up environmental waste and pollution before it has been released into the environment (e.g. costs of disposing of toxic waste).

· Environmental external failure costs are incurred on activities performed after discharging waste into the environment (e.g., cleaning up an ocean after spilling oil).

5.5 EMA Techniques

Having identified the various environmental costs, it is necessary to provide useful information to management to help manage and control environmental activities - to save money and reduce the harm caused by operations to the environment. Various tools have been proposed for this:

· An environmental cost report based on the costs defined by Hansen and Mendova, with each category of costs shown as a percentage of revenues.

· Environmental activity-based costing.

· Input-output analysis.

· Flow cost accounting.

· Life-cycle costing.

5.5.1 Environmental Activity-Based Costing

Environmental activity-based costing applies ABC principles to environmental costs so that the environmental costs are apportioned "correctly" to the products that use the drivers causing the costs to be incurred. Environmental costs are often hidden in general overheads and, therefore, apportioned to products using inappropriate drivers. This can mean that product costs do not truly reflect the environmental costs of making them.

Under environmental ABC:

· Environment-related costs are attributed to joint environmental cost centres such as sewage plants or incinerators.

· Environment-driven costs, on the other hand, are hidden in general overheads (although they vary with the amount of throughput) and do not relate directly to a joint environmental cost centre. Such costs are allocated to environmental activities using the activity's drivers. For example, the cost of monitoring emissions may be driven by waste emissions in kilograms. The

costs of tracking emissions can then be apportioned to products based on kilograms of emissions produced by each product.

The main methods of allocating these environment-driven costs (the allocation keys) might be the following:

· Volume of emissions or waste;

· Toxicity of emission and waste treated;

· Volume of emission treated;

· The relative costs of treating different types of emissions.

Example of Environmental ABC

ABC may be used to more accurately ascertain the costs of washing towels at a hotel. The energy used to power the washing machines is an environmental cost; the cost driver is "washing". Hotel management may drive change towards more "environmentally-friendly" use of towels by:

· Publishing its environmental policy;

· Providing fewer towels in rooms and requiring guests to contact housekeeping for additional towels;

· Promoting habit ("Reuse me again tomorrow - just like at home") rather than playing on environmental concerns.

As well as energy savings, carbon emissions and water consumption will be reduced. Also, for example, staff time to collect and return towels and operate the machines will be less, and since the towels are washed less frequently, they will need to be replaced by new ones less often. As most towels are manufactured from cotton (a crop), this will also help conserve natural resources.

5.5.2 Input-Output Analysis Management may use input-output analysis of "mass balance" to clarify how much waste their activities generate. The aim is to compare the output of a production process (in physical units) with the input on the basis that "what comes in must go out". What is not included in the output must, therefore, be waste. Process flows are often used to show these more specifically. For example:

INPUT 100% -> PROCESS -> 60% Product, 20% Scrap for recycling, 15% Disposal as waste, 5% Not accounted for

5.5.3 Flow Cost Accounting

Flow cost accounting is a more detailed version of input-output analysis. Input-output analysis considers only the physical inputs and ensures that these are accounted for as physical outputs at the end of the production process. Flow cost accounting considers the inputs and outputs for each process, to identify the waste for each process. Flow cost accounting examines the physical quantities of material and the costs and values of output and waste for each process. Input costs are calculated and apportioned between the production and waste using process costing principles. The costs used in flow cost accounting are sometimes categorised as follows:

· material costs;

· system costs - incurred within the various processes that add value to the product (e.g. wages and overheads); and

· delivery and disposal costs - are incurred in delivering goods to customers or disposing of waste.

5.5.4 Relevance of Life-Cycle Costing Life-cycle costing is particularly relevant for environmental costs because many environmental costs are not incurred during the production phase. Clean-up costs may be high but are only incurred after the production process is finished. The European Union's "End of Life Vehicles Directive" makes it compulsory for car manufacturers in the EU to collect and dispose of old cars that have reached the end of their useful life. Therefore, manufacturers should consider such costs during life-cycle costing exercises.

Example:
Xerox Corporation leases photocopying machines to clients. The machines are returned to the company at the end of their lives. One cost which had previously been ignored was the cost of packaging. Xerox would provide packaging for new machines delivered to the customer. The customer would then dispose of this packaging and have to pay to re-pack the old machine, which was being returned to Xerox. As a result of including the costs of packaging in the life-cycle costs of photocopying, the company could see how significant these costs were. The company now uses a standard reusable pack. When a machine is delivered to a customer, the package in which it is delivered is used to pack the old machine, which is being returned to Xerox. Two standard types of packing have been developed, which cover all of Xerox's machines. This led to a reduction in packaging costs and increased customer satisfaction.

6.1 Accounting for Environmental and Sustainability Factors Accountants must be able to link sustainability to the broader business agenda by highlighting elements that build resilience and develop a sustainable strategy. There is increasing demand from society that organisations be held responsible for a range of sustainability issues, which will ultimately affect their financial performance and ability to generate value over time. Accountants play a central role in helping organisations navigate these opportunities and risks.
Sustainability - meeting the needs of the present without compromising the ability of future generations to meet their own needs. - United Nations Bruntland Commission (1987)
Sustainable development requires organisations to consider the long-term consequences of their decisions. Investors increasingly use Environment, Social and Governance ("ESG") information to gauge a business's long-term value creation potential and sustainability. This is evident from the increasing number of investors signing up for ESG-dominated investment strategies and the proposition of ESG resolutions from shareholders. Organisations that successfully demonstrate their capability in deploying ESG activities, accounting and disclosures will attract such investors.

6.2 Sustainability Strategy Perspectives
A sustainability strategy means building value for shareholders while contributing to the needs of a sustainable society. Therefore, the accounting process supporting this mandate must account for the multiple perspectives required to inform the necessary decisions. This requires an integrated and externally-oriented focus on what truly drives sustainability within the organisation, with a focus on four perspectives:

· Value creation from capitals
· Stakeholder perspectives
· Megatrends affecting opportunities and threats
· Customer preferences

6.3 Role of Accountants in Developing Sustainable Practices
A report by the International Federation of Accountants (IFAC) Accounting for Sustainability lists actions that professional accountants can focus on to drive sustainability in their organisation:
· Identify and connect trends and impacts vital to the organisation and the connection to the organisation's strategy, business model and performance.
· Integrate significant natural and social capital issues into management information to formulate strategies, plans, targets and investment decisions.
· Assess the benefits of responding to environmental and social matters, for example, how they contribute to value creation, cost reduction, or revenue generation, as well as other benefits, such as making the organisation more attractive to employees or improving its reputation.
· Organise systems, processes and people to support decision-making and ensure that what matters gets measured and managed.
· Link to value creation to ensure resources are used effectively in creating value for shareholders, customers and other stakeholders.
· Drive efficiency by reducing waste and lowering costs.
· Provide credibility to data and information through effective governance and oversight.
· Communicate clearly to facilitate transparency through stakeholder communications and disclosures supported by appropriate reporting frameworks, such as integrated reporting.
These actions are centred on three main areas: Leadership and Business Strategy Management, Operations and Accounting Communications, Reporting and Disclosure

Area: Leadership and Business Strategy
Aspects: Make sustainability strategic, not just tactical Finance has the skills and ability to support the business to ensure sustainability initiatives are strategic rather than tactical:
· Identifying the business case at an organisational, project or issue level;
· Facilitate leadership and commitment;
· Engage the finance and accounting function;
· Connecting sustainability to strategy, risk and performance and identifying how decisions can be enhanced by integrating sustainability-related information into business planning, risk and performance management and investment appraisal.

Area: Management, Operations and Accounting
Aspect: Improve the process of information and data collection, analysis and reporting Finance professionals bring the rigour and discipline used in accounting to collect, analyse and report sustainability data. They need to work closely with sustainability professionals and others to understand what information needs to be captured and how it will be used:
· Generating information and analysis to support decisions;
· Reducing the sustainability impact of products, services and operations.

Area: Communications, Reporting and Disclosure
Aspect: Integrate with reporting Finance professionals are best placed to incorporate meaningful sustainability performance information into business reporting processes and disclosures and to inform stakeholders of an organisation's ability to create value over time:
· Developing a business reporting strategy and approach;
· Integrating sustainability impacts into financial reporting;
· Assuring Sustainability Disclosures and Reports.

Summary:
· The business environment within which companies operate has become more competitive. Products have shorter lifecycles, and there is an emphasis on quality.
· New management accounting techniques have evolved to meet this new environment.
· Target costing attempts to achieve an acceptable margin when the price of a product or service is determined externally by the market. It can be used during the design phase of a new product (to "design out" costs).
· Techniques that may be used in closing a target gap include: Tear down analysis ("reverse engineering"); Value engineering; and Functional analysis.
· Life-cycle costing involves tracking the cumulative costs and revenues through the states of a product from development to abandonment. It encourages management to plan the pricing strategy for a product over its life rather than the short term.
· According to the theory of constraints there is always at least one constraint (a bottleneck) that limits the achievement of a goal.
· Throughput accounting draws management's attention to bottleneck processes.
   - Throughput contribution means sales revenue less material cost.
   - Throughput accounting aims to maximise the throughput generated per hour by eliminating bottlenecks.
   - A product breaks even if its throughput accounting ratio (TPAR) is 1.
· Environmental management accounting (EMA) provides management with monetary and non-monetary (physical) information, enabling them to understand and manage the environmental impact of the organisation's activities.
· Environmental costs include: Conventional costs; Potentially hidden costs; Contingent costs; and Image and relationship costs.
· EMA techniques include input/output analysis, ABC, and life-cycle costing.
· Accountants must be able to link sustainability to the broader business agenda by highlighting elements that build resilience and develop a sustainable strategy.

Chapter 4: Relevant Cost Analysis
This chapter covers the following Learning Outcomes. C. Decision-Making Techniques 1. Relevant cost analysis a. Explain the concept of relevant costing. b. Identify and calculate relevant costs for a specific decision situation from given data. c. Explain and apply the concept of opportunity costs. 2. Make-or-buy and other short-term decisions a. Explain the issues surrounding make v buy and outsourcing decisions. b. Calculate and compare "make" costs with "buy-in" costs. c. Compare in-house costs and outsource costs of completing tasks and consider

other issues surrounding this decision. d. Apply relevant costing principles in situations involving shut down, one-off contracts and the further processing of joint products.

1.1 Meaning

Key Point Relevant costs are those costs that are affected by a specific management decisions. Only those costs and revenues affected by a decision are "relevant". Relevant costs are:
· future costs and revenues; historical costs and revenues are not relevant, as they have already been incurred;
· incremental (i.e. the amount by which costs/revenues will change due to the decision); if a course of action is not taken, incremental costs will be saved; and
· cash flows (i.e. cash payments or receipts). Non-cash expenses and income are not relevant as they represent expenditure already made. For example, depreciation is a non-cash expense arising from the accounting treatment of an asset already acquired. A future decision does not change that acquisition. Profit or loss on disposal is similarly a non-cash item and, therefore, irrelevant. However, cash proceeds received on the disposal of an asset would be relevant if incremental to a decision. (This is detailed in s.3.4.) The following costs are relevant:
· Avoidable costs (i.e. those which would be avoided if a particular course of action were taken); and
· Controllable costs that can be influenced by the actions of the person who controls the budget or cost centre (also called "managed costs").

Variable production materials costs are incremental; if production increases, the costs of materials and labour, etc., increase. Fixed production costs that do not increase are not incremental and are therefore irrelevant.

Quiz: Incremental Costs Hide The banqueting department of the Grey Gables Hotel organises special events. Next month a wedding reception will be held in the hotel. An assistant accountant has prepared a schedule detailing the cost of the wedding as follows:

	Note	$	Solution Yes/No
Food and drinks		1,500	
Servers' wages	1	200	
Supervisor's salary	2	100	
Flowers		500	
Administration	3	300	
Cleaning of function room	4	200	
Room rental	5	200	
Central management costs	6	300	
Total costs		3,300	

Notes 1. The servers are not regular employees and work only when required for functions. They are paid $20 per day and ten servers would be needed for the wedding. 2. The supervisor is a full-time hotel employee paid a fixed salary. The charge here is a portion of his basic salary for the time he will spend supervising the event. 3. Administration costs relate to the time spent by the banqueting department organising the event. All staff members in this department are full-time employees and are paid a fixed salary. 4. An external cleaning company cleans the

function rooms before and after an event. It charges $200 per event. 5. The wedding reception will be held in Grey Gable's banqueting room. A notional rental charge for the space has been added. The hotel building is rented from a property company for a fixed annual rental. 6. When costing an event, the accounting department adds 10% to the cost of each event to cover central hotel management costs.

Required: Indicate whether or not each of the costs in the accountant's schedule is incremental.

Answer:

	Relevant?	Explanation
Food and drinks	Yes	These costs are incurred specifically for the wedding party. If there were no wedding party, these costs would not be incurred.
Servers' wages	Yes	Servers are only paid when they work, so are being paid specially for the wedding.
Supervisor's salary	No	The supervisor is on a fixed salary, which does not change as a result of the wedding party.
Flowers	Yes	They are being purchased specifically for the wedding.
Administration	No	This cost relates to the salaries of the staff in the banqueting department. These are fixed and not increased by the wedding.
Cleaning of function room	Yes	The cleaning company is paid a fee per event. If the wedding did not take place, there would be no fee.
Room rental	No	The rent of the hotel building is fixed regardless of whether the rooms are occupied or vacant.
Central management costs	No	10% has just been added to the cost of the wedding to cover central overhead costs. These would have been incurred regardless of the wedding. Some overhead costs may increase as a result of the wedding (e.g. for light and heat) but as these amounts have not been identified, it is not possible to specify a relevant amount.

1.2 Non-relevant Costs

Sunk costs- the historical cost of an asset is a past cost (money already spent) and said to be "sunk"; it is irrelevant to any decision. Examples of sunk costs include research and development costs already incurred and market research.

Committed costs (e.g. contract rental and lease payments) are similarly irrelevant - although future and cash flows, they are not incremental (even though they are future cash flows).

However, if a contract is cancellable, such payments are not committed, and any penalty costs incurred in cancelling the contract would be relevant.

Fixed costs, incurred regardless of the decision being taken, are irrelevant (but an increment "step" in a fixed cost will be relevant). Allocations and apportionments of fixed costs (and similarly shared costs) are subjective (even arbitrary) and irrelevant to decisions.

Depreciation/amortisation and carrying values are irrelevant.

Depreciation (also amortisation) is not a cash flow but a method of accounting for past capital expenditure. By the same argument, book values are not relevant as these are simply the result of historical costs and depreciation. Any realisable value of an asset (an incremental, future cash flow) would, however, be relevant (see s.3.4).

Uncontrollable ("non-controllable") costs can only be influenced indirectly by the person in charge of the budget or cost centre. Typically, these include "management charges" (i.e. reallocated non-production overheads). Similarly, notional costs (e.g. recharges of head office costs or management charges), which do not increase as a result of the decision, are irrelevant.

2.1 Definition

Opportunity cost - "The value of the benefit sacrificed when one course of action is chosen, in preference to an alternative. The opportunity cost is represented by the foregone potential benefit from the best rejected course of action." - CIMA Official Terminology (Chartered Institute of Management Accountants)

Opportunity costs apply to the use of scarce resources; where resources are not scarce, no sacrifice results from using them. For example, the contribution a key worker is moved to a new project the contribution the worker would have generated if they had not been moved is an opportunity cost relevant to the new project.

2.2 Importance

Key Point

All opportunity costs are "relevant". However, only some relevant costs are opportunity costs.

Example of Opportunity Cost

A company has been invited to tender for a contract to produce a component, R2D2. Production of R2D2 will require 100 hours of processing on Machine X. If Machine X is currently working at full capacity producing 50 units of Product Z an hour. Each unit of Product Z makes a contribution of $2. If 100 hours of Machine X time is used to fulfil the new contract the lost contribution of $10,000 (50 * $2 * 100) is an opportunity cost of producing R2D2 and should be taken into account when deciding how much to tender for the contract.

2.3 Difficulties in Using Opportunity Costs

Although the main benefit of an opportunity cost approach to decision making is that it recognises and takes into account what is given up by not selecting the next best alternative, it is not without difficulties: x How to estimate future costs/revenues and hence the benefit sacrificed.

· Identifying alternative uses to know what is the best alternative foregone.

· Lack of accounting for effects on accounting profit (i.e. accounting profits do not include opportunity costs and revenues). A course that reduces the reported accounting profit may be considered unacceptable even though it is the best decision under opportunity cost principles.
· Also, as is true for any costing method, it ignores non-financial factors (see s.3.5).

3.0 Introduction
One decision-making scenario is to decide how much to tender for a one-off contract. To make the decision, it is necessary to consider all the relevant costs of the contract to ensure that the revenue from the contract covers them. This section provides further guidance concerning materials, labour and non-current assets which may be required for such contracts.

3.1 Minimum Price The minimum price that makes a contract worthwhile is equal to the relevant cost. At this price no profit or loss would be made on the contract. There are several reasons why a business might wish to know the minimum price of a contract:
· It is useful for price negotiations to know the lowest price that can be tendered for a contract; if a price is agreed to below the relevant cost, the business will make an actual loss.
· A business may be prepared to undertake a contract at relevant cost in the hope that this may bring additional business in the future.
· If a business has under-utilised resources during low season, it may be willing to take on additional contracts at this time (provided that no loss is made) as this may build up goodwill with potential customers.

3.2 Materials
Where materials are required for a one-off contract, the following guidance, as summarised in the diagram that follows, can be used to determine the relevant cost:
· If the materials required have not already been acquired, it will be necessary to buy them for the contract. The current market price is the relevant cost. Historical costs and book values are never relevant costs of materials (as they are "sunk").
· If the materials have already been acquired, it is necessary to consider whether they are used regularly in the business: - If used regularly, any materials consumed by the one-off contract will need to be replaced, so the replacement cost (the current market price) would be the relevant cost. - - If used regularly, and replacements are not available, the relevant cost would be the opportunity cost, which would be the contribution foregone from regular production. - If not used regularly (e.g. they were acquired some time ago and there is no current use for them), the relevant cost is their opportunity cost. This is often their scrap value (i.e. disposal proceeds if the materials can be sold if not used in the contract). If there is no scrap value, the opportunity cost is $0. Or there could be an opportunity saving if the materials would otherwise have to be disposed of at a cost.
Exam advice Read exam questions carefully to identify relevant information, which would be needed for the computation, and non-relevant information, which should be either ignored or omitted. Examples of non-relevant information are sunk costs (costs historically incurred), historical purchase prices, and carrying value.

Example of Raw Materials

Crocus Co is considering making a new product that requires several types of raw material:

	Units in inventory	Units required	Additional information
Material A	0	40	Current purchase price is $7/unit.
Material B	100 cost$10/unit	150	Current purchase price is $14/unit. The material has no alternative use other than for the project under consideration. Units in inventory can be sold for $12/unit.
Material C	50 cost $20/unit	120	Current purchase price is $22/unit. The material is used regularly in current manufacturing operations.

Material A - As there is no inventory, all 40 units required must be bought at $7 per unit. This is a clear cash outflow caused by the decision to make the new product. Therefore, the relevant cost of Material A for the new product is (40 units * $7) = $280. Material B - The original purchase price ($10) is a sunk cost and so is irrelevant. The 100 units in inventory have no other internal use, so if not used on the new product, it would presumably be sold for $12/unit. If the new product is made, this cash inflow of sale proceeds will be lost. In addition, another 50 units will need to be purchased at $14/unit. The total relevant cost for Material B is therefore: (100 units * $12 (lost sale proceeds)) + (50 units * $14 (current purchase price)) = $1,200+ $700=$1,900

Material C - As this material is regularly used, any quantity in inventory diverted to the new product will need to be replenished. So, all the units required will have to be purchased; at the current purchase price of $22, this will cost $2,640 (120 units * $22). (As always, the original purchase price is not relevant.)

Quiz: Relevant Costs of Materials
Hide Bob is a carpenter who makes kitchen furniture. Recently, a customer has asked him to make a special dining room table. This will require the following materials:
1. 10 square meter of oak wood. Bob already has 20 square meter of oak in his storeroom that he bought last month for $2.50 per square meter. The current price of oak is now $2.75 per m2. Bob frequently uses oak in his work.
2. Two tins of a particular varnish. Bob does not use this type of varnish regularly, so would have to buy it in. Each tin costs $20.
3. Four hinges so that the ends of the table can be folded. Bob has four hinges in his storeroom that he acquired some years ago. Bob remembers that the hinges cost $3.00 each. The price of such hinges in a shop today would be $3.50 each. Bob said, "I'm pleased that I can finally use these. They've been in the storeroom for years and if I don't use them on this table, they will stay in the storeroom for many more years. Nobody would want to buy second-hand hinges, would they?"
Required: Explain what the relevant cost is for each of the three items above.

Answer:

1. Bob has sufficient oak in his storeroom to make the table. Since he uses oak regularly, any oak used to make the table would have to be replaced. Therefore, the relevant cost is the replacement cost (i.e. the current price of $2.75 per square meter).

2. Bob would have to buy the tins of varnish specifically for this order, so the relevant cost is the replacement cost (i.e. the current price of $20 a tin).

3. Bob already has the hinges needed for the table in the storeroom. The question is whether he would replace them if he used them for the table. The information clearly suggests not, as Bob has not used the hinges before. Any scrap value would therefore be the opportunity cost, but this would appear to be zero, as Bob has said that nobody would want to buy second-hand hinges.

3.3 Labour

One-off contracts usually require some labour. The relevant cost of labour can be determined from the following situations:

· If the organisation has spare (idle) labour time that can be used on the contract, the relevant cost is zero. This might arise, for example, where workers are being paid a fixed weekly wage and are currently underemployed.

· If additional labour time is required and can be obtained without taking workers away from other activities, the direct cost of the labour is relevant. This may be paid at a higher rate if overtime is involved.

· If there is a limit on the amount of labour available, a contract may require workers to be taken away from other profitable activities. In this case, the relevant cost of labour is the direct cost plus the lost contribution from the other activities.

Example of Labour

Magnolia Co has a new project which requires the following three types of labour:

	Hours	Additional information
Unskilled	12,000	Paid $8 per hour, and existing staff are fully utilised. New staff must be hired to meet this additional demand.
Semi- skilled	2,000	Paid $12 per hour. As these employees are difficult to recruit, Magnolia retains some permanently employed staff, even if there is no work to do. There are 800 hours of idle time currently available. Any additional hours would be fulfilled by temporary staff, who would be paid $14/hour.
Skilled	8,000	Paid $15 per hour. As there is a severe shortage of skilled employees, Magnolia would have to move skilled employees from the manufacture of Product X to undertake the project. Each unit of Product X requires 4 hours of labour and generates a contribution of $24/unit.

Relevant costs

Unskilled - the incremental cash outflow incurred in hiring the new staff necessary for the project is $96,000 (12,000 hours * $8).

Semi-skilled - Of the 2,000 hours needed, 800 are already available and already being paid for. There is no incremental cost of using spare capacity on the new project. The relevant cost is therefore only for hiring temporary staff, which is $16,800 (1,200 hours * $14).

Skilled - Consider the calculation of unit contribution for Product X:

Revenue	X :selected:
Materials	X :selected:
Labour (4 * 15)	60
Variable overheads	X :selected:
Contribution	24

For each unit of X that cannot be produced, Magnolia will lose the revenue but save material and variable overhead costs. Although revenue, material and variable overhead are not known, their net amount must be $84 a unit (60 + 24) or $21 per skilled labour hour ($84/4). This is usually calculated as $15 (current labour cost per hour) plus $6 (lost contribution per hour, $24/4). The relevant cost of skilled labour is therefore $168,000 (8,000 * ($15 + $6)).

Quiz: Relevant Costs of Labour

Hide Omega Consulting specialises in helping clients implement new accounting software packages. The company has just received a request from a new client to implement a new accounting system, urgently, next week. You have been requested to calculate the relevant cost of the labour that would be required for the project. 1. A project manager would be needed. One project manager, Bill Bates, is available next week. Bill earns a fixed salary equivalent to $1,500 a week. 2. A business consultant would be required to work 30 hours on the contract. All consultants are busy next week. One consultant, Colin Carrington, is scheduled to deliver a training course to a client. This course will generate contribution of $10,000. If the course is cancelled, Colin could work on the new client. Alternatively, the training course could be postponed to the following week, when Colin is available. The client would be charged $5,000 less if the course were delayed a week. Colin is on a fixed weekly salary of $1,000. 3. A technical consultant would be required for 10 hours to install the software and convert the data from the old system. All technical consultants are busy next week, but David Dawson, an experienced technical consultant, said he would be prepared to work overtime. He will work on the new project on Monday and Tuesday and catch up with the 10 hours missed on his existing project the following weekend. David is paid a standard hourly rate of $50 and double time (i.e. $100 an hour) for weekend work. Alternatively, a freelance technical consultant is available. Freelance consultants charge $75 an hour. 4. An analyst would be required for 10 hours to document the new client's system. All analysts are busy next week, but a small project on which Edward Eaves was due to work can be cancelled, which would enable Edward to work on the documentation for the new client. If the other contract is cancelled, contribution of $1,000 would be lost. Edward is paid an hourly rate of $50.

Required: Explain the relevant cost for each of the four items above.

Answer:1. The relevant cost of the project manager is zero. Bill Bates, who will manage the new project next week, is paid a fixed salary and has spare time next week. There is, therefore, no additional cost to the company for Bill to manage this project. 2. The relevant cost of the business consultant would be the $5,000 discount given to the other client for agreeing to delay the training course by a week. Colin would have to be taken off a training course, but since he can deliver it a week later, the contribution from that course is not lost, so it is not relevant. (Another way of looking at this is that the contribution is not entirely lost but reduced by $5,000 per the discount). Colin is also on a fixed salary, so will not be paid extra for working on the project. 3. There is a choice here between using the internal technical consultant, David Dawson, or an external consultant. The cost of the external consultant would be $750 (i.e. $75 an hour for 10 hours). If David were to be used, he would have to work overtime. Although the overtime rate of $100 would be incurred while working on his existing project, that overtime rate would only be paid if he were used on the new project, so the cost of using David is $100 an hour. Therefore, as the external consultant is the cheaper option, the relevant cost would be $750. 4. The relevant cost is $1,500, which is the direct cost of Edward's time ($50 * 10) plus the opportunity cost of $1,000. The direct cost of Edward's time is relevant because he is paid an hourly wage of $50, a variable cost. The opportunity cost is the lost contribution on the other project that Edward would have worked on.

3.4 Non-current Assets
Non-current assets, such as machinery, may be required for a contract. The relevant cost of such assets depends on how the organisation plans to obtain the use of it:
· If the asset is to be rented (or hired), the rental costs over the period of use are relevant.
· If the asset is to be acquired (purchased) for the contract, the cost of acquiring the asset (including related costs, such as delivery and installation) would be relevant. It may be that when the contract is completed, the asset can be sold. In this case, the expected proceeds from the sale will be relevant income that should be deducted from the total cost of acquiring the asset when calculating the relevant cost.
An asset such as the one that is required may already be owned. The relevant cost then depends on whether that asset is already operating at full capacity on other activities.
· If the asset is not used for other purposes (or has spare capacity), the relevant cost is the fall in realisable value that will arise if the asset is used for the contract.
· If the asset is already operating at full capacity, its relevant cost is its deprival value (see s.3.4.2).

3.4.1 Fall in Realisable Value
Example of Fall in Realisable Value Bob, a builder, owns a crane. He believes he could sell it today for $150,000 in the used-crane market. He is tendering for a contract to renovate the town hall, which is expected to take a year to complete. If he wins this contract, he will need to keep the crane. Once the town hall contract is complete, he will sell the crane. He estimates that he could sell it for $120,000 in one year's time. If he does not win the town hall contract,

he will sell the crane immediately for $150,000. For the town hall contract, the relevant cost of the crane is $30,000. This is the fall in the realisable value of the crane if it is used on this contract.

3.4.2 Deprival Value
If an asset that is required for a contract is already owned but currently fully utilised in other activities, the relevant cost is its deprival value (i.e. the cost of depriving the business of the asset). Deprival value is determined by consideration of the "value in use" and the "replacement cost" of the asset: Value in use is the value to the business of the asset that is already owned. This is the higher of its net realisable value (i.e. the net amount that would be realised if it was disposed of) and its economic value. Economic value is the present value of the future earnings that the asset would generate for the business.
Key Point Decision rule:
· If economic value < net realisable value, the asset should be sold.
· If economic value > net realisable value, the asset should be kept.
Replacement cost is the cost of acquiring an equivalent asset (i.e. with the same operating capability).
Key Point
Deprival value is the lowest cost option. The business needs to decide whether to:
· buy an equivalent asset for the contract (i.e. incur the replacement cost); or
· transfer the asset from existing activities (i.e. forego its value in use).
The determination of deprival value can be thought of as a two-stage decision:
· Decision 1-should the asset be kept in use in the business or sold? If an asset is in use, its economic value (EV) should be higher than its net realisable value (NRV).
· Decision 2-if deprived of the asset (e.g. through sale or use elsewhere), will it be replaced?

Example of Economic Value v Net Realisable Value
Some years ago, Hyacinth Co bought a piece of machinery for $300,000. The machine's net book value ("carrying amount" in the financial statements) is currently $50,000. Hyacinth could spend $100,000 on updating the machine, and the products subsequently made on it could generate a contribution of $150,000. The machine would be depreciated at $25,000 per annum. Alternatively, if the machine is not updated, it could be sold now for $80,000 after incurring $5,000 in advertising and other costs to make the sale. Immediately, the $300,000 purchase cost, $50,000 net book value and $25,000 depreciation charge are disregarded as they are not cash flows and are irrelevant. The economic value of retaining the machinery in the business is $50,000, i.e. the sum of cash flows:
· Machine update cost: $100,000
· Contribution from products: $150,000
However, as this is less than its net realisable value of $75,000 ($80,000 - $5,000), the machine should be sold rather than updated. Therefore, if there is a project requiring this machine, the relevant cost of using it will be $75,000 (i.e. the net sale proceeds foregone).

Example of Non-current Asset Opportunity Cost
An asset which will be transferred to a new contract, if it is undertaken, has:

Replacement cost	$200,000
Net realisable value	$50,000
Economic value	$100,000

The opportunity cost of the asset is $100,000. This is the benefit foregone.

Quiz: Deprival Value

Identify the deprival value in each for the following cases:

Case	Replacement cost	NRV	EV	Deprival value
1	500	600	550	#TO DO
2	700	600	550	#TO DO
3	700	600	650	#TO DO

Answer:

Case	RC	NRV	EV
1	500:selected:	600	550
2	700	600:selected:	550
3	700	600	650 :selected:

Quiz: Contract Quote

Stella is about to tender for a contract which requires two raw materials, steel and tungsten. Five hundred tons of steel and 1,000 tons of tungsten will be required to complete the contract. In addition, 2,000 hours of labour will be needed. Of this, 1,200 hours are in the assembly process and the remainder in the finishing process. Stella will quote a price that allows a 50% mark-up on the relevant cost. The following additional information is available for the resources required:

	In inventory	Original price per ton	Current price per ton	Net realisable value
Steel	200 tons	$10	$12	$8
Tungsten	400 tons	$20	$23	$15

Steel cannot be used by Stella for any other purpose, but tungsten is used in all the company's manufacturing processes. All labour is paid at $4 per hour, but to complete the contract in time, labour for the finishing process will have to be transferred from other work, which generates contribution at a rate of $3 per hour (after labour costs). There is currently surplus capacity for assembly labour amounting to 1,000 hours for the duration of the contract. Above this, any additional assembly labour will have to be hired on a temporary basis at the rate of $5 per hour.

Required: Determine the price Stella will quote on the contract.

Answer:

	WORKINGS	$
Steel:		
Held (NRV)	200 tons @ $8	1,600

Purchased	300 tons @ $12	3,600
Tungsten:	1,000 tons @ $23	23,000
Finishing labour:		
- Cost	800 hours @ $4	3,200
- Lost contribution	800 hours @ $3	2,400
Assembly labour:	200 hours @ $5	1,000
Relevant cost		34,800
Mark-up 50% of relevant cost		17,400
Quote		52,200

Tutorial note: The relevant costs of diverting labour from another contributiongenerating process are the labour wages and the contribution forgone. This is because removing labour from the other process loses contribution and generates savings in labour wages, which must be accounted for in the activity the labour is diverted to. Labour cost for spare capacity is usually assumed to be fixed (as the organisation must pay their wages regardless of their productivity), so utilising spare capacity does not incur relevant costs.

3.5 Non-financial Factors

From a financial point of view, a contract should proceed if the revenue from the contract exceeds its relevant cost. However, management should also consider non-financial factors before making a final decision. Some of the non-financial factors that may be considered are:

· A contract may be undertaken even if the revenue is not sufficient to cover the relevant costs if there are other reasons why the agreement is desirable. For example: - Undertaking a new type of contract may develop the business's knowledge and experience, which may be useful in obtaining subsequent business. - The contract may enhance the business's reputation (e.g. a contract for a highprofile customer).

· A profitable contract may be declined if there is a high risk of reputational damage (e.g. if the agreement will harm the environment or involves activities that may be considered unethical).

4.1 Relevant Costs As discussed earlier, the costs that should be relevant to any decision are relevant costs, which are incremental in nature. Where managers are given an analysis of profits by division, it may be tempting to assume that loss-making divisions should be shut down. However, before such decisions are taken, managers must know which relevant costs would be saved if the division were closed down. In particular, the head office may have allocated fixed costs to the division. These may not be saved if the division is closed down. Non-incremental costs should be ignored in decision-making.

Quiz: Shut-down Decision

Rolling Co has four divisions: North, South, East and West. The directors are concerned about the performance of the East and West divisions, which have consistently shown losses for the last three years. The divisional statements of profit or loss for the last year show the following:

	North	South	East	West
	$	$	$	$
Sales	5,000	10,000	7,500	6,000

Variable costs	2,500	4,000	4,000	3,000
Contribution	2,500	6,000	3,500	3,000
Fixed costs	1,500	3,500	4,000	3,200
Profits/(losses)	1,000	2,500	(500)	(200)

Further analysis of the fixed costs reveals the following:

	$	$	$	$
Directly attributable	500	1,500	2,500	2,000
Allocated (20% of revenue)	1,000	2,000	1,500	1,200
Total fixed costs	1.500	3,500	4,000	3,200

Assumed that directly attributable fixed costs would be saved if the division were closed down.
Required: Calculate the financial impact on Rolling Co of closing divisions East and West. Based on your calculations, advise the management whether the divisions should be closed.

Answer:

	East	West
	$	$
Lost contribution	(3,500)	(3,000)
Saved fixed costs (attributable only)	2,500	2,000
Net savings/(losses)	(1,000)	(1,000)

Conclusion Closing each division would lead to a reduction in profits of $1,000 per year. They should not be closed. The two divisions make a positive contribution to the company's overall profits and only show a loss because of the allocation of central fixed costs.

Quiz: Production Line Closure Decision
Foxglove Co has two production lines, A and B, and its management accounts show the following:

	A		B	
	$m	$m	$m	$m
Revenue		28		30
Marginal costs	12		20	
Fixed costs	10		14	
Total cost		22		34
Profit/loss		6		(4)

Fixed costs have been apportioned to each production line on the basis of floor space occupied in the factory. Closing down either production line would save 25% of the total fixed costs.
Require: Determine whether Foxglove should close down either production line.

Answer:
The incremental cash flows of closing down the production lines are as follows:

	A	B
	$m	$m

Revenue lost	(28)	(30)
Marginal costs saved	12	20
Fixed costs saved ($24m × 25%)	6	6
Net cash outflow	(10)	(4)

Therefore, the closure of either production line is not a good idea as the revenue lost exceeds the cost savings. It is the arbitrary apportionment of the fixed costs that is misleading in the management accounts. A more helpful presentation of the figures for decision making would be:

	A	B	Total
	$m	$m	$m
Revenue	28	30	58
Marginal costs	12	20	32
Contribution	16	10	26
Fixed costs			24
Profit/loss			2

If either production line were closed down, fixed costs saved are $6 million; however, the contribution lost from the products would be greater ($16 million or $10 million).

4.2 Non-financial Factors

When making shut down decisions, management should consider non-financial factors as well as whether losses can be reduced. For example:

· If closing a division would result in redundancies, this could lead to poor morale among remaining employees.

· The permanent loss of resources and specific skills may mean that it will not be possible to take advantage of future opportunities.

· Shutting down one division may affect demand for products produced by other divisions (e.g. if customers like to buy a range of products from one supplier, closing a particular division will limit the range that is available).

· It may be possible to bring a loss-making division back to profitability by developing new products or services. · Shutting down a division may make it possible to sell assets such as buildings to raise finance for other divisions or to reduce debt.

5.1 Joint Products

Joint products and by-products arise where the manufacture of one product makes the manufacture of other products inevitable. Joint products have significant relative sales value. A by-product is produced with one or more main products but has a small relative sales value. (So it is unlikely to influence the decision to produce main products.) Products produced are not separately identifiable until a particular stage in the production process - the split-off point (SOP). Costs incurred before the SOP are joint or pre-separation costs and must be apportioned between the products produced.

Once the products have reached the split-off point:

· It may be possible to sell the product immediately in its current state.

· The product may require further processing before it can be sold.

· The manufacturer may have a choice of selling the product immediately or processing it further.
In making the further processing decision, the manufacturer needs to compare the additional revenue gained by further processing the product against the additional costs of further processing.

Example of Further Processing Decision
Two products, G and H, are created from a joint process. G can be sold immediately after split-off. H requires further processing before it is ready for sale as a finished product. If not further processed for sale as a finished product, it can be sold as scrap at $0.30 per unit. The following data is available for the last period:

	$	Product	Selling price per unit
Total joint production costs	384,000	G	$0.84 (400,000 units)
Further processing costs (product H)	159,600	H	$1.82 (200,000 units)

The relevant costs and revenues in determining whether H should be processed further are the additional revenue of $304,000 (200,000 x ($1.82 - $0.30)) less the costs of further processing of $159,600. Further processing of H increases profits by $144,400, so H should be further processed. The joint production costs incurred before the split-off point are a common cost and therefore not relevant to the further-processing decision. They will be relevant, however, to determining whether the overall process is viable.

Quiz: Further Processing Decision
Daisy Co buys a chemical for $12,000, which is broken down into two components:

Component	Sales value ($)	Allocated costs ($)
A	7,000	6,000
B	4,000	6,000

Component A can be converted into Product A if $6,000 is spent on further processing. Product A would sell for $12,000. Component B can be converted into Product B if $8,000 is spent on further processing. Product B would sell for $15,000.
Required: Determine the optimal production plan to maximise profits.

Answer:
As the initial chemical is split into both components, it is not possible to make one component without the other; without any further processing, the breaking down of the chemical into two components is not worthwhile as the cost ($12,000) exceeds $11,000 revenue ($7,000 + $4,000). Further processing Component A into Product A incurs incremental costs of $6,000 and generates incremental revenue of $5,000 ($12,000 - $7,000). This is not worthwhile. Further processing Component B to Product B incurs incremental costs of $8,000 and generates incremental revenues of $11,000 ($15,000 - $4,000). It is worthwhile to do this, as the extra revenue is greater than the additional costs. The optimal production plan is therefore:

	$ $	$
Component A revenue		7,000
Product B revenue		15,000

| Total revenue | | 22,000 |
Chemical cost	12,000	
Further processing of Component B	8,000	
Total cost		20,000
Contribution		2,000

Having determined whether or not to further process products after the split-off point, a decision needs to be made about the financial viability of the overall process. This should consider all revenues, less all relevant costs of further processing (if appropriate) and the main process.

6.1 Outsourcing Outsourcing is buying goods or services externally rather than making or providing them internally. For many years, there has been a trend towards outsourcing non-core services. Examples of services that are often outsourced include:
· office cleaning;
· canteen and catering services;
· payroll services;
· IT services;
· security services.
Outsourcing is not limited to providing services; parts of manufacturing processes also may be outsourced. This trend has been strengthened by the reduced costs of international trade; many components may be made in lower-cost economies, and the assembly of the final products may take place closer to the markets in which the products are sold. The decision companies may have to make, therefore, is whether to make components in-house or to buy them from an external supplier.

6.2 Advantages of Outsourcing
· Lower cost. Many companies have discovered that some goods or services may be purchased for less than it would cost to provide them internally. This may be due to the economies of scale enjoyed by the third-party provider.
· Services may become a variable cost rather than a fixed cost if outsourced. For example, the cost of outsourcing payroll services may be based on the number of personnel. If payroll services were sourced in-house, staff would have to be employed to provide this service (i.e. effectively a fixed or stepped cost).
· Outsourcing allows management to focus on the core competencies of the business without being distracted by managing peripheral areas.
· A specialist supplier may be able to supply goods or services of higher quality.
· Access to a broader range of expertise as the provider deals with several clients. For example, a provider of IT services may have employees with a wider range of skills and knowledge than an internal IT function.

6.3 Disadvantages of Outsourcing

· The company relies on a third party to provide a reliable supply. Therefore, it loses control over a part of its business processes.

· Outsourcing may mean trusting a third party with confidential information about goods or services.

· Some costs may not be apparent (i.e. hidden) as anything not explicitly covered by the contract will incur additional charges.

· Quality may suffer, especially if the contract price per unit is fixed (i.e. the third party can only increase its profit by reducing costs).

· Operational dependence on the outsourcing company is linked to its financial stability. Switching to another provider may be very costly if the third-party company fails.

· Outsourcing may demotivate the workforce if the decision to outsource is associated with job losses. (There may also be bad publicity where outsourcing is to another country.)

6.4 Make vs. Buy Decisions

When deciding whether to outsource the manufacture of a particular component, organisations will obviously want to calculate the financial effect. Although financial impact will not be the only factor to be considered, it will likely be significant. If a company outsources all production of an item, there will be no in-house production. This may lead to some fixed cost savings since less production capacity will be required. The approach here is to determine the costs saved if in-house production ceases, including any incremental fixed costs, and compare this with the costs of buying-in the component from an external supplier.

Example of Make or Buy-in

Geranium Co makes a product that requires two sequential operations on the same machine. Operation 1 takes 15 minutes per unit, and Operation 2 takes 30 minutes per unit. The machine is operating at full capacity. The material cost of the product is $12 per unit. Instead of carrying out Operation 1, Geranium could buy in components for $15 per unit. This would increase production capacity because the machine has to deal with only Operation 2. Labour and variable overheads are incurred at a rate of $16 per machine hour, and the finished products sell for $30 per unit.

Make the entire product internally or buy in components?

Machine operating costs - the machine is already operating at full capacity and will remain fully utilised, but only on Operation 2. Therefore, machine running costs will not change and so are not relevant to the decision.

Material - if the buy-in option is accepted, the material cost increases from $12 to $15 per unit.

Production volume - this can increase by 50% because currently, each item takes 30 minutes in Operation 2, but 15 minutes per unit will be released by Operation 1, which now will not be needed. Assuming output is 1,000 units, say, the incremental cash flows are as follows:

Increase in revenue (500 additional units * $30) $15,000

Increase in costs ((1,500 * $15) - (1,000 * $12)) $10,500

Therefore, it is worth buying in as incremental revenue exceeds incremental costs.

Quiz: Outsourcing All Production

Big Phones makes smartphones. The company sells 1 million phones each year. Each phone includes a standard rechargeable battery. Currently, the batteries are manufactured in-house, but the company has recently received an offer from Super Batteries to supply all the batteries required for a price of $2 each. The management accountant has prepared a schedule showing the total costs of producing 1 million batteries last year as follows:

	$000
Materials	1,400
Direct labour	320
Machine running costs	240
Depreciation	250
Other overheads	400
Total	2,610

Depreciation includes depreciation of the factory building, which is apportioned to each product. $75,000 has been apportioned to the battery manufacturing department. If the manufacture of batteries were to be outsourced, this part of the factory would remain empty, at least in the short term. Other overheads include a $300,000 apportionment of general factory overheads not specific to making batteries.

Required: Determine the costs that would be saved if the offer is accepted and advise Big Phones whether it should continue to manufacture the batteries in-house or should outsource their manufacture to Super Batteries.

Answer:
If manufacturing were to stop, the following costs would be saved each year:

	$000	
Materials	1,400	
Direct labour	320	
Machine running costs	240	
Depreciation	NIL	Note
Other overheads (400 - 300 general overheads)	100	Note
Total	2,060	

Costs of buying 1 million batteries from Super Batteries would be $2 million.

Advice: The cost of buying from Super Batteries is less than the savings made from stopping the manufacture of the batteries in-house (i.e. it is more expensive to make than to buy). The batteries should therefore be bought from Super Batteries.

Note: Depreciation is ignored as it is not a relevant cash flow. Apportioned overheads would not be saved, so are not relevant savings.

Summary:
· In decision making, relevant costs and revenues are those which change as a result of the decision. All other revenues and costs are ignored.
· An opportunity cost is a benefit foregone. Opportunity costs are relevant costs.
· Decision-making scenarios include "one-off contracts" which require the calculation of the relevant cost of performing a contract.

· A relevant cost may be a current (replacement) cost or an opportunity cost (which may be zero).
· The deprival value of a non-current asset is the lower of its replacement cost and value in use. Value in use is the higher of net realisable value and economic value.
· In shut down decisions, costs of the loss-making division that will not be saved are irrelevant to the decision.
· Further processing decisions consider whether further processing of joint- or by-products is worthwhile.
· To buy-in rather than make a product is an outsourcing decision.

Chapter 5: Cost Volume Profit Analysis
This chapter covers the following Learning Outcomes. C. Decision-Making Techniques 2. Cost volume profit analysis a) Explain the nature of CVP analysis. b) Calculate and interpret the breakeven point and margin of safety. c) Calculate the contribution to sales ratio, in single and multi-product situations, and demonstrate an understanding of its use. d) Calculate target profit or revenue in single and multi-product situations, and demonstrate an e) Interpret breakeven charts and profit volume charts and interpret the information contained within each, including multi-product situations. f) Discuss the limitations of CVP analysis for planning and decision making.

1.1 Objective
Cost-Volume-Profit (CVP) analysis looks primarily at the effects of differing levels of activity on the financial results. It focuses on sales volume because although sales price and variable costs are usually known with a degree of accuracy, in the short-term at least, sales volume is not usually so predictable.
Contribution - earnings from sales after deducting variable costs. Contribution is computed by deducting variable costs from revenue. If variable costs per unit and selling price per unit are constant, contribution is increased by increasing sales volume. Contribution would also be the funds available to cover fixed costs. If there is insufficient funds to cover fixed costs, the entity would be making a loss. Any excess of contribution over fixed costs is profit.

1.2 Breakeven Point
Breakeven point - the level of activity at which neither a profit nor a loss is made.
The breakeven point is a measure of the lowest activity level at which the activity is viable, where: Total contribution = Total fixed costs

Example of Dependence on Sales Volume
Company A knows that the sales price for product X for the coming year will be around $50, and its variable costs are approximately $30. The company can therefore say, with some degree of certainty, that the contribution per unit (sales price less variable costs) is $20. Company A also expects to have annual fixed costs of $200,000. Whether Company A will make a profit in the year depends on sales volume. This may be difficult to predict with any degree of certainty.

However, it is easy to determine the sales volume that the company needs to achieve in order to make a profit; the breakeven point. In this case, Company A would need to generate $200,000 of contribution to cover the annual fixed costs of $200,000. This would mean that it would need to sell 10,000 ($200,000 / $20 per unit) units of Product X to break even.

There are three methods for calculating the breakeven point:
1. A graphical method with charts (s.2)
2. Using formulae (s.3.2); and
3. The contribution/sales ratio ("contribution margin") method (s.3.3).

1.3 Simplifying Assumptions
All the methods are based on the same simplifying assumptions as follows:
· Within the range of activity under consideration, total cost behaves as a strictly linear semi-variable cost: - fixed costs remain fixed within the range; - total variable costs change proportionally with volume.
· Unit selling prices do not change with volume.
· Costs and income are matched (i.e. there is no significant change in inventory).
· Levels of efficiency and productivity do not change (as this would affect linearity).
· There is only a single product or a constant sales mix of more than one product.

Key Point
Total costs and total revenue are linear functions of output.

2.1 Breakeven Chart
The breakeven chart plots revenue and costs ($) against volume (units). The point where the total cost and revenue lines intersect is the breakeven point (BEP).
You will not be required to draw breakeven charts or any other diagrams in the exam. However, you need to understand their construction to interpret them.

Quiz: Breakeven Chart
A company makes one product, the gamma. The selling price per unit is $100. The variable cost per unit is $20. Fixed costs per year are $1,000,000.
Required: Draw a breakeven chart for the gamma and determine from the chart how many units must be sold per year to break even.

Answer:
From the diagram below, it can be seen that the breakeven level of sales is 12,500 units.
(Draw a breakeven chart for gamma)
To plot each line, it is necessary to calculate total cost or total revenue at only two levels of output:
Total revenue
When output is 0, total revenue is zero. An output level of 15,000 units was chosen at random. At an output level of 15,000 units, total revenue would be $1.5 million ($100 per unit * 15,000 units).

Total costs

When output = 0, total costs = fixed costs, = $1 million.

At an output level of 15,000 units (chosen at random), total variable costs are $300,000 ($20 per unit * 15,000). Fixed costs are $1 million.

Therefore, total costs are $1,300,000.

2.2 Profit-Volume Chart

A "PV" chart is another way of presenting the same information as a breakeven chart, but it emphasises profits and losses at different activity levels (i.e. sales volume or value). To construct it requires only the following information:

· Profit/(loss) at any (i.e. just one) level of sales; and

· Total fixed costs (i.e. total loss at zero sales volume).

3.1 Contribution

In the short term, the fixed costs of a business do not change with output. Therefore, producing/selling one extra unit results in:

· Extra revenue (the unit selling price).

· Extra costs (the variable cost per unit).

The additional profit made from selling one extra unit is the unit contribution.

Unit contribution = Selling price - Variable cost per unit

Total contribution = Total revenue - Total variable cost

In any decision connected with varying the levels of production, fixed costs are not relevant as they do not change regardless of which course of action is taken.

Key Point

It is only the change in contribution which will affect the decision.

3.2 Breakeven Formulae

A little basic arithmetic can help answer different CVP questions.

3.2.1 What is the BEP?

Profit = Sales - Variable cost - Total fixed cost Profit

Profit = Total contribution - Total fixed cost

At BEP, profit = 0 Therefore, Total contribution = Fixed cost

But, Total contribution = Number of units * Unit contribution

Therefore, Number of units to be sold to breakeven = Unit contribution Total fixed cost

3.2.2 How to Achieve Target Profits?

Management will typically want to budget for a sales volume or sales revenue to achieve a target profit:

Sales volume to achieve a target profit = (Total fixed cost + required profit)/Unit contribution

Sales revenue to achieve a target profit = Sales volume to achieve a target profit * unit selling price

3.2.3 What is the Breakeven Revenue?

· BEP is expressed in terms of the number of units which must be sold to break even.

· Breakeven revenue is the revenue achieved at the BEP. One way of calculating this is to multiply the number of units at BEP by the unit selling price.

Quiz: Using the Formulae Hide Using the information in Activity 1, calculate:

a. the breakeven point for the gamma using the numerical approach;

b. the sales volume required to make a profit of $100,000;

c. the revenue at the breakeven point.

Answer:

a. BEP = Total Fixed cost/Unit contribution = 1,000,000/($100-$20 = 12,500 units

b. Sales volume required to make a profit to $100,000 = (Fixed cost + Required profit)/Unit contribution = (1,000,000+$100,000)/$80 = 13,750 units

c. Revenue at BEP = $100 * 12,500 units = $1,250,000.

3.3 Contribution/Sales (C/S) Ratio

3.3.1 C/S Ratio

The contribution/sales ratio (also called contribution margin) is the proportion of the selling price which contributes to fixed overheads and profits.

C/S ratio = Contribution per unit/Selling per unit or Total contribution/Total Sales revenue

3.3.2 Breakeven Revenue

The C/S ratio can be used as an alternative way of calculating breakeven revenue without first calculating the breakeven point.

Breakeven revenue = Fixed cost/ C/S ratio

Revenue required to achieve a target profit = (Fixed cost + required profit)/ C/S ratio

3.4 Margin of Safety

Margin of safety - the amount by which anticipated or existing activity exceeds (or falls short of) breakeven.

In units or in dollars$: Margin of safety = Budgeted sales - Breakeven sales)

As a percentage: (Budgeted sales-Breakeven sales)/Budgeted sales * 100%

Quiz: Target Revenue

A company manufactures a single product which has the following cost structure based on a production budget of 10,000 units.

	$
Materials - 4 kg at $3/kg	12
Direct Labour - 5 hours at $7/hr	35

Variable production overheads are recovered at the rate of $8 per direct labour hour. Other costs incurred by the company are:

	$
Factory fixed overheads	120,000
Selling and distribution overheads	160,000
Fixed administration overheads	80,000

The selling and distribution overheads include a variable element due to a distribution cost of $2 per unit. The fixed selling price of the unit is $129.

Required:
a. Calculate how many units must be sold for the company to break even.
b. Calculate the sales revenue that would yield a net profit of $40,000.

Answer:
a. Breakeven number of units

	$
Materials	12
Labour	35
Variable overheads	40
Distribution	2
Total variable cost	89
Selling price	129
Unit contribution	40
Fixed costs	$
Factory	120,000
Selling and distributing (after excluding the variable element)	140,000
Administration	80,000
Total fixed cost	340,000

BEP = Total Fixed cost/Unit contribution = 340,000/40 = 8,500 units

b. Sales revenue - Target profit $40,000

	$
Total fixed costs	340,000
Profit required	40,000
Total contribution required	380,000

Total contribution/Unit contribution = $380,000/40 = 9,500 units
Total revenue required: 9,500 × $129 = $1,225,500

4.1 Assumption
CVP analysis can be extended to multi-product situations if a constant pre-determined sales mix is applied. If the assumption of a standard mix is relaxed, there will be no unique BEP.

4.2 Calculation of Breakeven Point

4.2.1 Weighted Average C/S Ratio The easiest way to calculate breakeven revenue in multi-product situations is to apply a C/S ratio (as in s.3.3). The only difference is that the C/S ratio will be weighted:

Weighted average C/S ratio = Total contribution (from all products)/Total revenue (from all products)

The C/S ratio now specifies how much contribution will be generated by a $1 increase in sales revenue earned in the constant sales mix. It is used to find:

· breakeven revenue; and

· sales revenue required to generate a target profit.

Apply the same formulae used in single-product situations but with the weighted C/S ratio:

Breakeven revenue = Fixed cost/Weight averge C/S ratio

Revenue required to achieve a target profit = (Fixed cost + required profit)/Weighted average C/S ratio

Example of Multi-product Analysis

Company A produces Product X and Y. The information for both products is as follows:

	X	Y	Company A
Sales price ($/unit)	50	60.	
Variable cost ($/unit)	30	45	
Contribution ($/unit)	20	15	
Budgeted sales (units)	20,000	10,000	
Total contribution ($)	400,000	150,000	550,000
Total sales ($)	1,000,000	600,000	1,600,000
C/S ratio	0.4	0.25	0.34375

The weighted average C/S ratio of 0.34375 or 34.375% is simply the total contribution of X and Y divided by the total revenue of X and Y. It represents the contribution towards fixed costs on each $ of revenue when X and Y are sold in the constant mix that is two units of X for every unit of Y.

BEP in sales revenue = Fixed costs/C/S ratio = $200,000/0.34375 = $581,819 sales revenue

To achieve a target profit of $300,000 = (Fixed costs + required profit)/C/S ratio = ($200,000 + $300,000)/0.34375 =$1,454,546

Remember that when dealing with budgeted amounts, accuracy to the nearest $ is not particularly meaningful, and these amounts might be reported to management to the nearest $000 or even $m to 2 decimal places (e.g. $0.58 and $1.45 million).

Also, these are only estimates because of the constant mix assumption.

Exam advice: Weighted average C/S ratio must be used for calculations in multi-product situations.

Quiz: Multi-Product Analysis

Pear manufactures laptop computers and smartphones. The company has prepared the following forecast for the next financial period:

	Laptops	Smartphones
Budget sales	1,200	600
	$	$

Unit selling price	1,000	500	
Unit variable cost	700	400	
Unit contribution	300	100	

Budget fixed costs are $245,000 for the period.

Required:

a. The breakeven revenue, using the weighted average C/S ratio.

b. The sales revenue required to make a target profit of $245,000.

Answer:

The weighted average C/S ratio = Total (budgeted) contribution/Total (budgeted) sales

Total budgeted contribution is (1,200 * 300) + (600 * 100) = $420,000

Total budgeted revenue is (1,200 * 1,000) + (600 * 500) = $1,500,000

Weighted average C/S ratio is therefore 420,000 /1,500,000 = 0.28

a. Breakeven revenue = Fixed cost/ Weighted average C/S ratio = 245,000/0.28 = $875,000.

b. Sales revenue to make a profit of $245,000 = (Fixed cost + Required profit)/Weighted average C/S ratio = (245,000+245,000)/0.28 = $1,750,000

4.2.2 Sales Units at Breakeven Revenue

In multi-product situations, breakeven revenue shows the total revenue required to break even, assuming the budgeted sales mix. Decision makers may wish to analyse this revenue by product. This can be estimated by multiplying the total breakeven revenue by the revenue ratio for each product (i.e. the portion of total revenue that each product earns):

Revenue ratio for product X = Budgeted revenue for product X/Total budgeted revenue

At breakeven:

Revenue from product X = Total breakeven revenue * Revenue ratio for product X.

4.3 Multi-Product Profit-Volume (PV) Charts

In a multi-product environment, sales revenue is drawn on the horizontal axis (x axis) and profit is drawn on the vertical axis (y axis). Two approaches are taken to drawing the line denoting profit/loss:

· constant (fixed) sales mix; or

· ranking of products by profitability.

4.3.1 Assuming a Constant Sales Mix Assuming a constant mix of products based on the budgeted sales, it is only necessary to know the profit for two values of sales (to plot on the graph and draw a straight line between them):

· The most straightforward point is where revenue = 0 (i.e. where the company makes a loss equal to fixed costs).

· For the second point it makes most sense to calculate profit for total budgeted sales.

Example of Multi-Product Profit-Volume Chart

Zed Co makes two products, Exe and Wye. Details of these two products are as follows:

| | Exe | Wye | |
| Selling price ($/unit) | 40 | 60 | |

| Contribution ($/unit) | 24 | 18 |
| Budgeted sales (units) | 10,000 | 10,000 |

Total fixed costs are budgeted at $100,000

When sales revenue = 0, loss = $100,000 (fixed costs)

At total budgeted sales:

Revenue = (10,000 * 40) + (10,000 * 60) = $1,000,000.

Profit = Contribution - Fixed cost = (10,000 * 24) + (10,000 * 18) - 100,000 = 320,000.

(plot the The profit-volume chart)

Where revenue is zero, the cumulative profit will be a loss that equates to total fixed costs. The breakeven point occurs where the line crosses the x axis, at the point where revenue = $238,000. It is unlikely that the BEP would be determined so accurately from the graph alone, but the breakeven revenue could be checked using the formula.

4.3.2 Assuming Sales by "Profitability"

An alternative assumption is that sales are not made in a standard sales mix but by prioritising the most profitable products (i.e. the company produces and sells the product with the highest contribution first). Products are, therefore, ranked according to their C/S ratios. In this case, the PV chart will no longer be a straight line; it will be "kinked". However, a graph can be constructed from a table of profits calculated at the following points:

1. Sales revenue = 0
2. Maximum sales of the most profitable product, with no sales of the second product.
3. Maximum sales of the first and second products.
4. Maximum sales of the first, second and third products (if there are three products).
And so on.

Example of Sales by "Profitability"

Assuming now that Zed Co decides to produce and sell the product that has the highest C/S ratio up to the maximum budgeted (10,000 units), followed by the other product (again up to maximum 10,000 units).

	Exe	Wye
Selling price ($/unit)	40	60
Contribution ($/unit)	24	18
C/S ratio	0.6	0.3
Ranking	1st	2nd

The cumulative profit/(loss) corresponding to cumulative revenue is calculated as follows:

Sales volume	Contribution	Cumulative profit/loss	Revenue	Cumulative revenue
0	0	(100,000)	0	0
Exe 10,000	240,000	140,000	400,000	400,000
Wye 10,000	180,000	320,000	600,000	1,000,000

The line joining these three points gives the profit-volume chart:

(draw the profit-volume chart)

Analysis

Up to revenue of $400,000, the company is selling only Exe. After this it starts to sell Wye. Since Wye generates contribution at a lower rate per $ of revenue than Exe, the line is flatter after this

point. The breakeven point is where the line crosses the x axis, at the point where sales = $166,000. This is lower than the breakeven point, assuming a constant sales mix. This is because the C/S ratio of product Exe is higher than the weighted average C/S ratio of the two products together.

Quiz: Multi-Product Breakeven Charts
Plum manufactures two types of car; the "boy racer" and the "family saloon". The following budgeted daily information has been prepared:

	Boy racer	Family saloon
Budget sales (units)		
	300	600
	$	$
Unit selling price	10,000	15,000
Unit variable cost	5,000	12,000
Unit contribution	5,000	3,000

Budgeted fixed costs are $1 million per day

Required: Assuming that the budgeted sales represents maximum sales of each of the two products, construct the PV chart for the two products based on the assumption that:
a. sales occur in the standard (budgeted) mix; and
b. sales of the most profitable product occur first, followed by sales of the second product.

Answer:
a. Assuming that sales occur in the budgeted sales mix
 When sales = 0, loss = $1,000,000 (fixed costs).
For budgeted sales: Revenue = (300 * 10,000) + (600 * 15,000) = $12,000,000
Profit = Contribution - Fixed costs = (300 * 5,000) + (600 * 3,000)- 1,000,000 = $2,300,000
b. Assuming that most profitable products are sold first
The C/S ratio of the boy racer is higher, 50%, compared to 20% for family saloons. Therefore, boy racer would be produced first.
Revenue and profits at the key points are as follows: The amounts are as follows:

	Contribution	Cumulative Profit/loss	Revenue	Cumulative Revenue
	$000	$000	$000	
	$000	$000	$000	
Sales revenue = 0	0	(1,000)	0	0
Max sales of boy racers	1,500	500	3,000	3,000
Max sales of family saloons	1,800	2,300	9,000	12,000

5.1 Simplifying Assumptions
The main limitations of CVP analysis for planning and decision making relate to the assumptions that must be made. In summary, these are:

· Fixed costs remain constant regardless of the production decision. In practice, fixed costs may not be truly fixed and may vary as output changes. For example, fixed costs might be stepped in behaviour as production volume increases.
· Variable cost per unit is constant (which may not be the case due to discounts and other economies of scale).
· Selling price remains constant. This may not be true in practice, where an increase in sales volume can only be achieved by lowering the price.

5.2 Multi-Product Situations
5.2.1 Product Mix
Assuming a fixed product mix is necessary to work with multi-product situations. If the product mix is allowed to vary, there could be many breakeven points. In practice, a company would want to know how varying its product mix would affect profits.

5.2.2 PV Charts Advantages:
· Multi-product PV charts enable the user to see easily the relationship between revenue and profit. Breakeven revenue can also be seen.
· Identifying the most and least profitable products should lead to improved decisionmaking.
Disadvantages:
· The PV chart assumes either a constant sales mix or assumes that products are sold in order of increasing C/S ratio. The actual sales mix is likely to deviate from these assumptions, making the conclusions about breakeven revenue incorrect.
· The chart shows only profits plotted against revenue. It does not show variable costs or output in units.
· The chart assumes that products can be sold in order of profitability, which ignores the possibility that sales of one product may depend on sales of another.

Summary:
· The breakeven point is the level of activity at which a company makes neither profit nor loss. To break even, a business needs to sell enough units to cover its fixed and variable costs.
· A breakeven chart shows how total costs and revenues vary with output. The profit-volume chart shows how profit varies with output.
· The following formulae are all easily derived and are not provided in the exam:
    Breakeven point = Total fixed cost/Unit contribution
    C/S ratio = Contribution per unit/Selling price per unit
    Breakeven revenue = Fixed cost/ C/S ratio
· In multi-product situations, a standard or per-determined product mix must be assumed to remain constant. Breakeven revenue can be calculated by dividing fixed costs by a weighted average C/S ratio.
· The usefulness of CVP analysis is limited by the simplifying assumptions that have to be made to make it work.

Chapter 6: Limiting Factor Decisions
This chapter covers the following Learning Outcomes. C. Decision-Making Techniques 3. Limiting factors a) Identify limiting factors in a scarce resource situation and select an appropriate technique. b) Determine the optimal production plan where an organisation is restricted by a single limiting factor, including within the context of "make" or "buy" decisions. c) Formulate and solve multiple scarce resource problems using both linear programming graphs and using simultaneous equations as appropriate. d) Explain and calculate shadow prices (dual prices) and discuss their implications on decision making and performance management. e) Calculate slack and explain the implications of the existence of slack for decision making and performance management. (Excluding simplex and sensitivity to changes in objective functions.)

1.1 Limiting Factor Analysis (Key Factor Analysis)
In the short term, sales demand may be greater than productive capacity. For example, output may be restricted by a shortage of:
· labour; · materials;
· machinery; or
· factory space.
Where such limiting factors apply, contribution (and therefore profit) is maximised by using scarce resources on the product(s) which make the "best use" of them. It is important to note that the final limiting factor is always maximum sales demand.

1.2 One Limiting Factor
Rule: Where resources are unlimited - make all those products which give "positive contribution" up to maximum demand.
Rule: Where a factor of production is limited - contribution and profit will be maximised by concentrating production on the product(s) which make(s) "best use" of the scarce resource, up to maximum demand.

1.2.1 Approach
The following approach is used to decide which product(s) to make to maximise contribution and, therefore, profit where one of the factors of production is limited:
1. Identify the limiting factor. To find this, calculate how many units of each resource are required to produce sufficient quantities of each product to meet maximum demand. A resource is a limiting factor if it has insufficient availability to meet maximum demand.
Example of Limiting Factor Identification
Company A uses two materials in production, Material J and Material K. Material J is restricted to 12,000 kg, while Material K is restricted to 24,000 kg. The demand and material use for Products A, B, and C are shown in the table below.

Product	A	B	C
Kg of K per unit	4	1	6
Kg of J per unit	4	2	8
Maximum Demand	3000	4000	1000

Given the above data, the total kg of Material K demanded to meet maximum demand is 22,000 kg, which is less than the available material K of 24,000 kg. The total kg of Material J demand to

meet maximum demand is 28,000 kg, which is more than the 12,000 kg of Material J available. Material J is the limiting factor.

2. Calculate the contribution per unit of each product.
3. Calculate contribution per unit of limiting factor for each product:
Contribution per unit/Units of scarce resource used
4. Rank the products according to the contribution per unit of limiting factor, with products with the largest contribution per limiting factor ranked first; and
5. Concentrate production on those products with the highest contribution per unit of limiting factor - until all the scarce resource is used up, or maximum demand is fulfilled, whichever is first.

Quiz: Limiting Factor Analysis
Material R is restricted to 12,000 kg.

Product	H	1	J
Contribution per unit ($)	16	10	24
Kg of R per unit	4	2	8

Required: Calculate the maximum contribution that can be achieved.

Answer:

Product	H	I	J
Contribution per unit	$16	$10	$24
Kg of R per unit	4	2	8
Contribution per kg	$4	$5	$3
Rank	2	1	3

As there is no demand limitation (the firm can sell all products made), the product with the highest contribution should be made (Product I)
Therefore produce 12,000/2 = 6,000 units of I
Maximum contribution = 6,000 * 10 = $60,000

Quiz: Sales Restrictions
Material R is restricted to 12,000 kg.

Product	H	1	J
Contribution per unit ($)	16	10	24
Kg of R per unit	4	2	8

Suppose that sales of Product I are restricted to 4,000 units.
Required: Calculate the maximum contribution that can be achieved.

Answer:

The product with the highest contribution per limiting factor (Product I) should be made first up to maximum demand, then the product with the second highest contribution per limiting factor (Product H), until the limiting factor is used up.

	Kg
4,000 units of I uses up (4,000 × 2)	8,000
1,000 units of H uses up (1,000 × 4)	4,000
	12,000

Therefore maximum contribution

	$
From	(4,000 x $10)	40,000
From H (1,000 x $16)	16,000
	56,000

1.2.2 Limitations of Key Factor Analysis

Limitations of the key factor analysis approach to decision making include the following:

· It assumes a single objective of contribution/profit maximisation.

· It assumes constant variable cost per unit and constant total fixed costs; this may only hold over a narrow range of activity (e.g. discounts may apply to materials or sales for larger quantities).

· It deals with only one scarce resource; if there is more than one, linear programming must be used (s.3.1).

· It applies only to situations where capacity constraints cannot be removed in the short term.

1.3 Shadow Price

The shadow price (or dual price) is a term which is applied to limited resources.

Shadow price - the additional contribution that would be generated if one more unit of the scarce resource were to become available. The significance of the shadow price is that companies may be able to obtain additional quantities of a scarce resource if they are prepared to pay a higher price. The shadow price represents the maximum premium over the normal price the company would be prepared to pay for each additional unit. The maximum price for an additional unit of the scarce resource is the sum of the regular price and shadow price. Paying prices higher than this will result in lower contribution, as the cost of an additional unit of the scarce resource would be higher than the additional contribution earned from it.

1.4 Throughput Accounting

Throughput accounting was detailed in Chapter 3. It is worth noting that limiting factor analysis may also be used with throughput contribution if the objective is to maximise throughput. Usually, the limiting factor is the amount of time available on the bottleneck resource. The following approach is used: 1. Calculate the throughput per unit generated by each product. Throughput per unit is sales price less direct materials cost. 2. Calculate the throughput return per hour of bottleneck resource for each product. (See Example 5 in Chapter 3.) This is calculated as: Throughput per unit Bottleneck hour required to produce one unit 3. Rank the products based on the return per hour of bottleneck resource (from highest to lowest).

2.1 Decisions with a Limiting Factor

Chapter 4 introduced outsourcing and "make v buy" decisions that consider producing or buying all of a particular product or component. This section deals with situations in which only some production will be outsourced due to a limiting factor that prevents the business from producing all that is needed. The limiting factor could be a scarce material, a particular type of skilled labour or any other resource. The following assumptions apply:

· The business makes several products that use the limiting factor.

· The cost of making items in-house is less than that of outsourcing.

· Due to the limiting factor, it is not possible to produce the required quantities of all products. Some production needs to be outsourced.

Assuming that the company can decide which components to make in-house and which to outsource, it should:

. make those components or products where the biggest savings can be made; and

· outsource the remainder.

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

Saving per unit of scarce resource = (Buy-in price - Variable cost to make)/Number of units of scarce resource used per unit

The products with the greatest saving per unit of scarce resource should be given the highest priority for manufacture.

Quiz: Make or Buy

A company requires three components, X, Y and Z, for use in the manufacture of its main product, the Galaxia. The company can make these components or it can buy them externally. All three components require Material B in their manufacture. Monthly supplies of Material B are restricted to 8,000 kg.

Product/Component	X	Y	Z
Units required each month	2,000	2,500	4,000
Variable cost to make ($ per unit)	10	12	14
Buy-in price ($ per unit)	13	17	16
Number of kg of B used per unit	3	2	1

Required: Determine which products/components the company should make and which it should buy.

Answer:

Savings per unit of scarce resource	X	Y	Z
	13-10 3 = 1	17-12 2 = 2.5	16-14 1 = 2
Ranking	3	1	2

Comment: Therefore, the company should initially make Ys and then make as many Zs as possible.

Utilisation of B

	Kg of B
2,500 Ys x 2 kg each uses	5,000
3,000 Zs x 1 kg each uses	3,000
Total B overall	8,000

Comment: The additional 1,000 Zs and 2,000 Xs required should be bought.

2.2 Shadow Prices in Make v Buy

Shadow prices may also be relevant in a make v buy situation where:

· internal production is limited due to the shortage of a particular factor; and

· production of some items is being outsourced.

If additional units of a factor become available, more production can be brought in-house, leading to greater savings.

Key Point

The shadow price in this case is the savings per unit of scarce resource.

3.1 Linear Programming

In situations where more than one factor is limited, an alternative approach is used to determine the optimal production so as to maximise contribution (and, therefore, profit). This technique is linear programming:

· A mathematical technique for problems of rationing scarce resources between products to achieve optimum benefit.

· Objective function - quantifies the objective. For example: - profit maximisation (which is always by maximising contribution); - cost minimisation.

· Based on the assumption that the objective and the constraints may be expressed as linear equations.

· The syllabus only includes situations involving two variables. This allows the equations to be shown as straight lines on a graph.

· The graph can be used to identify the optimal solution.

· The optimal solution must be solved algebraically (e.g. using simultaneous equations).

You will not be required to draw graphs or any other diagrams in the exam. However, you need understand how the optimal solution is derived in order to interpret or solve a given graph.

3.2 The Graph

The process of graphing a linear programming model includes the following steps:

Step 1 Define unknowns. For example, x = Number of units of output of one of the products and y = Number of units of output of the other product.

Step 2 Formulate the objective function, either to maximise contribution or to minimise cost. Remember to use contribution, not profit.

Step 3 Express constraints in terms of inequalities (including non-negativity). Constraints (limiting factors) may include resource constraints, production constraints and/or levels of demand.

Step 4 Plot all constraints on a graph and identify the feasible region.

Having drawn the graph, the optimal solution can be solved using one of two methods:
1. The objective function method - also referred to as the iso-contribution method (see s.3.4). This enables the solution to be read from the graph (if the graph is drawn accurately).
2. The simultaneous equation method (see s.3.5).

3.3 Problem Formulation
Example of Linear Programming
A company makes two products, cabinets and chests. Each product passes through two departments, carpentry and polishing. The time spent in each department is as follows:

	Departmental time (hours)	
	Carpentry	Polishing
Cabinets	3	2
Chests	4	6

There are 4,800 hours available for carpentry, and 5,000 hours available for polishing. Annual production of cabinets must not exceed 1,200 units. Apart from this, all items produced can be sold The contribution to profit and fixed overheads is $100 for a cabinet and $150 for a chest.
Required: Calculate the optimal product mix which will maximise the total contribution to profit.

Answer:
Step 1 - Define unknowns
Let: x = Number of cabinets to be produced per annum; y = Number of chests to be produced per annum; C = Total contribution to profit
Step 2 - Formulate the objective function
The function to be maximised is the total contribution to profit (i.e. C). Since cabinets and chests contribute $100 and $150 respectively, for each item produced:
$C = 100x + 150y$
Step 3 - Formulate constraints
· 4,800 carpentry hours are available to provide 3 hours per cabinet and 4 hours per chest: $3x + 4y \leqslant 4,800$
· 5,000 polishing hours are available to provide 2 hours per cabinet and 6 hours per chest: $2x + 6y \leqslant 5,000$
· Production of cabinets must not exceed 1,200 units: $x \leqslant 1,200$
· Because production cannot be negative: $x \geqslant 0, y \geqslant 0$
Summary The model is therefore: Maximise $C = 100x + 150y$
Subject to: $3x + 4y \leqslant 4,800$; $2x + 6y \leqslant 5,000$; $x \leqslant 1,200$; $x, y \geqslant 0$
Step 4 - Present graphically
Plotting lines on a graph
1. Find the point where each line crosses the y axis, by setting the value of x to 0.
2. Find the point where each line crosses the x axis by setting the value of y to 0.
3. Draw a straight line between each of the points.
For carpentry hours:
If x = 0, 4y = 4,800 i.e. y = 1,200

If y = 0, 3x = 4,800 i.e. x = 1,600
For polishing hours:
If x = 0, 6y = 5,000 i.e. y = 833.33
If y = 0, 2x = 5,000 i.e. x = 2,500
Feasible region
With the given constraints, all possible values for x and y lie in the boxed area of the graph 0ABCD, called the relevant or feasible region. The point on the boundary of this area must now be found where the contribution (C) has a maximum value.
Step 5 -The objective function Only one contribution line needs to be plotted to identify the optimal solution. For example, 100x + 150y = 150,000 The highest possible value of C lies where an iso-contribution line is furthest from the origin on the edge of the feasible region.
Step 6 - Solve the intersection of the two lines: 3x + 4y = 4,800 (1) and 2x + 6y = 5,000 (2)
Solving simultaneously: 1.5 × (2) -> 3x + 9y = 7,500 (new equation 3)); 3x + 4y = 4,800 (original equation (1))
(3) - (1) -> 5y = 2,700; Therefore y = 540
Substitute for y in (1): 3x + 2,160 = 4,800; 3x = 2,640
Therefore x = 880
Step 7 - Optimal solution
The optimal solution is to produce 880 cabinets and 540 chests.
This will give a contribution of C = 100x + 150y =($100 * 880)+($150 * 540)=$169,000

3.4 Objective Function Method
3.4.1 Iso-contribution Lines
The objective function shows how contribution varies with product output.
A contribution line shows all combinations of x and y that would produce a value of contribution. The contribution line is best computed using a value of C that can be divided by the coefficients of both variables x and y. For example, a value of 15,000 is determined for C (15,000 is divisible by both 100 and 150), and some of the values on the line C = 15,000 would be as follows:
X | y |C
150 |0 |15,000
90 |40 |15,000
60 |60 |15,000
0 |100 |15,000

Key Point
You must understand where the values in the table came from. For example, if y = 60, the contribution from y is $9,000 (60 * 150). Contribution from x must, therefore, be $6,000 to achieve a total contribution of $15,000. Since each unit of x generates a contribution of $100, 60 units of x must be sold.

iso-contribution lines - every point on each line gives the same contribution value).
Two important principles can be deduced from the above:

· Contribution lines with a higher contribution value are further from the origin (the point x = 0, y = 0) than those with a lower value.
· All iso-contribution lines are parallel to each other. Just as the iso-contribution line C = 18,000 is parallel to the iso-contribution line C = 15,000, all other possible contribution lines would be parallel to this. (This is because the gradient, or slope, of each line is fixed by the relative amounts of contribution for the two products.)

3.4.2 Contribution and the Feasible Region
The diagram below shows a feasible region represented by the area 0ABCD with three iso-contribution lines:
(draw a diagram that shows a feasible region represented by the area 0ABCD with three iso-contribution lines)
The line furthest from the origin is outside of the feasible region. This means that this level of contribution could not be achieved. Most of the middle contribution line lies outside the feasible region, but there is one point, B, that is on the boundary of the feasible region. Point B represents the combination of production that is feasible at which contribution is maximised. It is the last point within the boundary that is passed by the contribution line before it leaves the boundary.

3.4.3 Slope of the Contribution Line
In the previous diagram, point B represented the maximum contribution point. However, had the contribution line been "flatter", point A could be the point of maximum contribution. The reason for drawing an iso-contribution line is to identify which point (A, B, C, or D) represents the maximum contribution.

3.5 Simultaneous Equations Method
After plotting the feasible region, it is possible to identify the point of maximum contribution without using the objective function method by calculating the contribution at each possible maximum point.
In the diagram below, the point of maximum contribution must be represented by one of the corner points A, B, C or D or a line between them (e.g. if A and B have the same contribution, all points on the line between them must have the same contribution.
(draw the diagram)
The procedure is as follows: 1. Determine the value of x and y at each point of intersection, including the points on the x and y axes (where y = 0 and x = 0, respectively) that represent non-negativity constraints. Use simultaneous equations for points where two constraints intersect. 2. Calculate the contribution at each point of intersection by substituting the values of x and y into the contribution function. 3. Compare the values of C at each point. Select the point that corresponds to the highest value of C.
As the simultaneous equations method is more time consuming than the objective function method, you should not use it unless an exam question explicitly asks for it.

Quiz: Linear Programming

A manufacturer produces two types of garden furniture - tables and benches. Both use the same material and are produced by the same workforce, which consists of skilled and unskilled workers. The managing director is trying to decide on the optimal production plan to maximise contribution each week. The following standard cost cards apply:

	Table	Bench
	$	$
Material ($5/kg)	15	10
Skilled labour ($10/hour)	50	20
Unskilled labour ($4/hour)	16	4
Variable overhead ($2/hour)	18	6
Total variable cost	99	40
Selling price	134	50
Contribution per unit	35	10

There is a shortage of the required material; only 120 kg are available weekly. There are four skilled workers, each working a 35-hour week. 100 hours of part-time unskilled labour are available per week.

Required:

a. Formulate this scarce resource problem as a linear programming model.

b. Determine how many units of each type of furniture should be produced each week to maximise contribution. Calculate the maximum weekly contribution.

Answer:

a. Formulating the model

Let x be the number of tables made per week. Let y be the number of benches made per week. The objective function to maximise contribution (C), given by $35x + 10y$ Subject to constraints:

Materials	$3x + 2y \leqslant 120$
Skilled labour	$5x + 2y \leqslant 140$
Unskilled labour	$4x + y \leqslant 100$
Non-negative	$x, y \geqslant 0$

b. Determining the optimal solution

The optimum point is at the intersection of the skilled and unskilled constraints.

Solving simultaneously: $5x + 2y = 140$ (1); $4x + y = $ (2); $8x + 2y$ 200 (3); $2 \times$ (2) -> $8x + 2y = 200$ (3)

(3) - (1) -> $3x = 60$; $= x = 20$

By substitution in (2)

$80 + y = 100$

So to maximise contribution, the company should make and sell 20 of each type of unit.

Contribution = $(20 * \$35) + (20 * \$10) = \$900$

Exam advice Identifying the optimum point using the contribution function means that, at most, only one pair of equations will need to be solved simultaneously. This is likely to be a more efficient use of exam time than also calculating contribution at point A ($600), point B ($800 by solving simultaneously the materials and skilled labour constraints) and point D ($875).

3.6 Assumptions

The following assumptions give rise to limitations using the graphical method:

· Linearity - contribution and resource utilisation per unit are the same for any quantity produced and sold in the range under consideration.

· Infinite divisibility - of products and resources. The solution may not have integer values (e.g. 12 1/4 units of x and 9 3/4 units of y) and should not be rounded. For example, for an optimisation problem: - rounding up will be to a point outside the feasible region; - if rounding down, it will depend on the gradient of the objective function, which integer value lies furthest from the origin.

· Solution is dependent on the quality of the input data. It must be complete, accurate and valid.

· Only one quantifiable objective can be satisfied. Non-quantifiable objectives are not considered at all.

· Single value estimates (e.g. expected values) can be used for uncertain variables.

· Only two "products" for graphical solution (but see s.4.3).

4.1 Shadow Price

Shadow prices (see s.1.3) can also be calculated in linear programming situations. To calculate the shadow price of a particular factor: 1. Restate the constraint for that factor with the number of units available increased by 1. 2. Recalculate the solution to the linear program. For such a small change, it is reasonable to assume that the same point on the graph would be the point of maximum contribution. However, since the equation for the line has changed (increase of 1), it is necessary to recalculate the value of x and y at that point using simultaneous equations. 3. Calculate the revised value of contribution. 4. Deduct the original value of contribution from the revised value. The increase in contribution is the shadow price of the limiting factor.

4.2 Slack

4.2.1 Non-binding and Binding Constraints

In linear programming problems involving several constraints, it is possible that not all constraints are binding at the optimal point (i.e. at the level of production which maximises contribution, not all of the available supply of one or more of the inputs is used).

Slack - the difference between maximum resources available and resources used at the optimal point. For binding constraints, the value of slack is zero. Slack can be calculated for each resource as the maximum amount available for use less the amount used at the optimal point. It can be calculated by rearranging the equations for each constraint and then substituting the values of x and y at the maximum point. Demand can also be a slack variable if there is unfulfilled demand for a particular product at the point of optimal contribution.

4.2.2 Implications of Slack

It is useful to know the amount of slack for the following reasons:

· If the amount of slack for a particular resource is low, there is a danger that the resource could become a binding constraint if the availability of other scarce resources increases. Management may, therefore start to plan for additional supplies of the resource before they are needed.

· If slack is high, it means that the availability of the resource exceeds the amount used by a significant amount. It may be possible to use this resource elsewhere in the business or sub-contract it to another business.

4.3 More Than Two Variables
A linear program can be formulated for any number of variables and any number of constraints. However, the methods used in this chapter based on drawing graphs are limited to solving problems with only two variables - represented by the x and y axes - although there can be any number of constraints. There are several methods of solving for more than two variables, including:
· the dual problem; and
· simplex.

Summary:
· Where factors of production are scarce, production decisions have to be made to maximisecontribution (and hence profit) given limited resources.
· Where one resource is scarce, the approach is to rank products by contribution generated per unit of scarce resource ("key factor").
· For make or buy decisions, the method is to rank products by saving per unit of scarce resource.
· Where there is more than one constraint, use linear programming: 1. Define variables. 2. Define the objective function (usually to maximise contribution). 3. Formulate constraints. 4. Plot constraints on a graph and identify the feasible area. 5. Use a sample contribution line to find the point on the feasible region that generates the highest contribution (i.e., furthest from the origin). 6. Solve the equation(s) for the optimal point in (5.) to specify the corresponding values of the variables. 7. Answer the question. Maximum profit MUST be calculated as maximum contribution less total fixed overheads, never using unit profit.
· The shadow price of a resource is the amount by which contribution would be increased if one more unit of the scarce resource were available.
· Slack arises when the company does not use all of an available resource. Slack can be calculated as resource available less resource used.

Chapter 7: Pricing
This chapter covers the following Learning Outcomes. C. Decision-Making Techniques 4. Pricing decisions a) Explain the factors that influence the pricing of a product or service. b) Calculate and explain the price elasticity of demand. c) Derive and manipulate a straight line demand equation. Derive an equation for the total cost function (including volume-based discounts). d) Calculate the optimum selling price and quantity for an organisation, equating marginal cost and marginal revenue. e) Evaluate a decision to increase production and sales levels, considering incremental costs, incremental revenues and other factors. f) Determine prices and output

levels for profit maximisation using the demand based approach to pricing (both tabular and algebraic methods). g) Explain different price strategies, including: i) All forms of cost-plus ii) Skimming iii) Penetration iv) Complementary product v) Product-line vi) Volume discounting vii) Discrimination viii) Relevant cost h) Calculate a price from a given strategy using cost-plus and relevant cost.

1.1 Full Cost Plus Pricing

The price of a product using full cost plus pricing is found as follows:

	$/unit
Direct production costs	X
Absorption of overheads	
Variable production overhead	X
Fixed production overhead	X
Variable non-production overhead	X
Fixed non-production overhead	X
Full cost	X
Mark-up percentage	X
Selling price	X

Selling price Per unit = (Total budgeted production cost + Total budgeted non-production cost + Mark-up)/Budgeted sales units

Advantages:
· If the budget sales level is achieved, profit will be made.
· The full cost should be readily available if a system of standard costing is in operation.
· Appropriate where fixed costs are significant.
· Useful for justifying prices (and price rises).
· Simple and cheap to operate.
Disadvantages:
· The method of accounting for overheads will have a large impact on the costs calculated for different products.
· If actual sales are below budget, losses may occur.
· Ignores external factors (e.g. demand/ price relationship, competitors' prices).
· The size of the mark-up is arbitrary.
· It may not maximise profits.

Key Point
Full cost plus pricing is a long-term pricing strategy. It aims to ensure that prices cover all variable and fixed costs.
The problems regarding overheads can be reduced using activity-based costing (see Chapter 2). A margin is added to this cost.

1.2 Marginal Cost Plus Pricing

Selling Per unit = (Budgeted Variable production cost + Budgeted Variable non-production cost + Mark-up)/Budgeted sales units

Advantages:

· Mark-up represents contribution, which is useful in short-term pricing decisions (e.g. market penetration policy).

· Treats fixed costs by their nature and not using an arbitrary allocation.

Disadvantages:

· It may lead to failure to recover fixed costs.

· It is not appropriate for long-term pricing, particularly where fixed costs are significant, because, in the long- term, fixed costs may also vary and not be sufficiently covered by mark-up.

1.3 Return on Investment (ROI)

Pricing Prices are set to achieve a target percentage return on the capital invested in production.

Selling price per unit = Budgeted full cost + (target ROI percentage x capital employed)/Budgeted sales units

ROI pricing is a long-term pricing method.

Advantages:

· Links price to both short-term costs and long-term capital employed

· Consistent with ROI as a performance measure.

· Target ROI can be set to take account of risk.

Disadvantages:

· Ignores external factors.

· Problems in calculating capital employed (e.g. whether to use book values or replacement cost).

· Subjective split of shared investment between products.

Quiz: Cost Plus and Target ROI

A golf club manufacturer is launching a new product, the Wild Thing Driver. Buildings and equipment needed for production will cost $2,000,000, and working capital requirements are estimated at $10 per unit per annum. Expected sales levels are 40,000 units per annum. Variable production costs are $30 per unit. Fixed production costs will be $300,000 per annum, and fixed non-production costs will be $100,000 per annum.

Required: a. Calculate the selling price using: i. Full cost plus 20%. ii. Marginal cost plus 40%. iii. Target ROI of 10%; b. If actual sales are only 20,000 units and the selling price was set using full cost-plus 20%, calculate profit for the year.

Answer:

a. Setting prices

i. Full cost plus 20%

$/unit

Variable costs (given), 30

Fixed costs(300,000 + 100,000)/40,000, 10

Full cost, 40
20% mark-up (20% * $40), 8
Selling price, 48

ii. Marginal cost plus 40%
                    $/unit
Variable costs (given), 30
40% mark-up (40% * $30), 12
Selling price, 42

iii. Target ROI
        $
Buildings and equipment (given), 2,000,000
Working capital ($10 * 40,000), 400,000
Capital employed, 2,400,000
Profit required ($2,400,000 * 10%), 40,000
                $/unit
Variable cost (given), 30
Fixed cost (given), 10
 Profit ($240,000/40,000 units), 6
Selling price, 46

b. Profit for the year
	$
Sales (20,000 * $48)	960,000
Variable costs (20,000 * $30)	(600,000)
Fixed costs ($300,000 + 100,000; do not vary with sales)	(400,000)
Net profit/(loss)	(40,000)

1.4 Opportunity Cost
Pricing Opportunity cost (relevant cost) pricing is a short-term strategy used to price:
· one-off projects;
· special orders; and
· tenders for contracts.
Production will use existing resources, and hence, a relevant costing approach is used: Price =
Relevant costs + mark-up

Key Point
A relevant cost basis provides a minimum price that can be used as the basis for a quotation.
(The concept of relevant costs for decision-making has already been covered in Chapter 4.)

Quiz: Opportunity Cost Price

After spending $500 on market research, Bobco Engineering wants to bid on an important one-off contract and needs to ensure its costing is both competitive and commercially rational. To complete the project it will need to devote the following resources to its construction:

· 1,500 kg of standard steel, which is regularly used in its production process. It currently has inventory of 6,000 kg purchased at an average price of $8/kg. With recent market conditions, the purchase cost is now $9.35/kg.

· 500 kg of speciality steel. It has 500 kg of such steel in inventory. This was purchased 16 months ago at $12/kg. As it has not been used since purchasing, the auditors insisted on a write-down to an estimated net realisable value of $4/kg. The purchasing manager figures that he can sell it for scrap at $2/kg. If sold, the cost to remove it from the warehouse and deliver it would be $1,000.

· 380 hours of unskilled labour. Although the current trade union contract pays $6/hour for such labour, extra workers would have to be hired in the "temporary" labour market at $7/hour.

· 196 hours of semi-skilled labour paid $9/hour under the current trade union contract. Currently, there is a surplus of such labour in the plant.

· 51 hours of skilled labour paid $18/hour under the current trade union contract. The workers are currently busy in another department, where they are producing output which is sold for $96 and which uses $15 of direct material, $9 of skilled labour, $27 of semi-skilled labour, $15 of variable overheads and $8 fixed-cost overheads allocated. It takes a half hour of skilled labour to work on this existing product. The department head has agreed to release his skilled workers but he must be compensated to be no worse off.

· Use of equipment, which was scheduled to be disposed of this period for $12,000. If used in the project, it will have to be disposed of later at an estimated selling price of $4,000.

· Exclusive use of a piece of manufacturing equipment (a fibrillator), which will not survive its use in the project. The machine originally cost $51,000 and currently has a carrying (i.e. book) value of $6,000. It could now be sold in the used fibrillator market for $8,000 (because new ones cost $45,000). If it was left in its existing use, it could generate cash flows with an estimated present value of $5,000.

· 38 kg of Ecotox, which was originally purchased for $600/kg. Under current government environmental rules, Bobco will have to pay $3,000 for the recycling company to take it away if it is not used in the contract.

Required: Calculate the price which Bobco should bid for the contract on the assumption that it wishes to charge a price equal to the relevant cost plus 25%.

Answer:

	$
Market research (sunk cost, therefore, not relevant)	0
Standard steel (regular use, so replacement cost = 1,500 kg * $9.35)	14,025
Speciality steel (not used regularly, therefore, scrap value of 500 kg * $2)	1,000
Less delivery costs (cost not incurred by using it)	(1,000)
Unskilled labour (380 hours * $7)	2,660
Semi-skilled labour (surplus, work can be done in spare time)	0
Skilled labour: Direct cost (51 hours * $18)	918
Opportunity cost (W) (51 * $60)	3,060

Use of equipment (reduced scrap value)		8,000	
Fibrillator (deprival value)		8,000	
Ecotox (saved disposal costs)		(3,000)	
Total relevant cost		33,663	
Mark-up of (25%) ($33,663 * 25%)		8,416	
Bid Price		42,079	

Working: Opportunity Cost of Skilled Labour
Each half hour of skilled labour used on the contract results in one lost unit of production for the department where the labour is normally employed. The opportunity cost is the lost contribution. The lost contribution per hour is as follows:

	$
Lost revenue (per unit, given)	96
Less: Direct materials (per unit, given)	(15)
Skilled labour (per unit, given)	(9)
Semi-skilled labour (per unit, given)	(27)
Variable overheads (per unit, given)	(15)
Fixed costs (not relevant)	0
Lost contribution per unit	30
Units per hour	2
Lost contribution per hour of skilled labour	60

1.5 Lifecycle Cost Pricing Following on from the discussion in Chapter 3, lifecycle cost pricing will not only consider current fixed and variable costs, but all the costs over the product's life. Over the product's lifetime, its total revenue should at least cover design, manufacture and closedown costs as well as costs of production. 1.6 Limitations of Cost-Based Approaches The limitations of the cost-based approaches discussed above include the following:
· They ignore external factors such as demand and competition (see s.4).
· They are unlikely to maximise profit, revenue or market share as mark-ups are subjective.
· They may result in prices completely different from those charged by competitors.
· Using a cost basis may underestimate the features in the product that are attractive to customers and could justify a higher price.
Therefore, other factors, including demand, in particular, should be taken into account before the final price is decided.

2.1 Demand Curve
2.1.1 The Concept In the economist's model, demand means the total quantity of a product or service the buyers in a market would wish to buy in a given period. Demand depends on the price charged by suppliers. For most goods, as the price falls, demand for the goods rises.

2.1.2 Equation
The demand curve can be expressed as an equation of the form: P = a - bQ

where: P is the price which would achieve a given demand, Q; a = price when Q = 0; b is the slope of the line - it shows how much the price must change by to achieve a given increase in demand:
b = change in price /change in quantity

Example of Demand
Alex owns the only bakery in a small town and is the only supplier of doughnuts. Based on an analysis of sales over the past 12 months, Alex has observed:
· If the price of a doughnut is $5.00 (500 cents), demand is zero
· For every 50 cents the price of a single doughnut decreases by, the number of doughnuts Alex sells increases by 20
Based on Alex's observations, a = 500 cents and b = 2.5 (50/20=2.5) Alex has estimated the daily demand for doughnuts as follows:
P = 500 - 2.5Q
P is the price in cents, and Q is the daily demand in units.
Alex could use this equation in several ways. For example, if Alex considered charging $1.50 (150 cents) per doughnut, the equation could be used to calculate demand at this price. 150 = (500 - 2.5 * 140)
To solve the equation, Q equals 140. This shows that at a price of $1.50 (150 cents) each Alex would expect to sell 140 doughnuts.

2.2 Marginal Revenue
2.2.1 The Concept
Marginal revenue - the increase in total revenue resulting from selling one additional unit of a product or service.
There are two effects on total revenue of selling one more unit: 1. An additional unit has been sold; this increases revenue. 2. To sell an extra unit, the price will have to be reduced for all units sold; this reduces total revenue.
When marginal revenue is positive, the effect on revenue of the extra quantity sold outweighs the impact of the fall in price. When marginal revenue is negative, the fall in price has a more significant effect than the increase in quantity sold.

2.2.2 Equation The marginal revenue function can be derived from the demand function as follows:
Price: P = a - bQ
It can be shown using a mathematical technique (calculus) that:
Marginal revenue = a - 2bQ

Quiz: Marginal Revenue
A company has estimated the following price/quantity relationship for one of its products:

$	Units
40	10
25	20

| 10 | 30 |

Required: a. Plot the demand function on a graph and find its equation. b. Find the total revenue function. c. Find the marginal revenue function. Note that this exercise is for illustration only. Candidates will not be required to plot graphs in the examination. *

Answer:
a. Draw the Demand function on a graph (not required at the exam)
b. Total revenue, TR = 55Q - 1.5Q2
c. Marginal revenue, MR
Marginal revenue = a- 2bQ
From part (a) a = 55, b = 1.5 therefore marginal revenue = 55 - 3Q.

2.3 Marginal Cost
Marginal cost - the increase in total cost from producing and selling one additional unit of a product or service.
Economists assume that marginal cost changes as output increases. Initially, marginal cost falls as output rises due to economies of scale. However, once the lowest marginal cost has been achieved, the marginal cost rises as output increases further. Accountants (and examiners) take a more straightforward approach and assume that marginal cost equals variable cost per unit (at least until full capacity is reached). The marginal cost is usually constant since it is generally assumed that the variable cost of each unit does not change, regardless of how many units are produced. However, where there are volume-based discounts on raw materials or components (i.e. discounts are available when agreed quantities are purchased), marginal cost will fall to a lower amount for all subsequent units produced.
Key Point
Marginal cost is incremental and therefore relevant in evaluating a decision to increase production and sales.

Example of Volume-Based Discount
The variable cost of product Y is as follows:
	$
Materials - 1 kg at $100 per kg	100
Labour - 2 hours at $20 per hour	40
Variable overhead - 2 hours at 15 per hour	30
Marginal cost	170

If more than 1,000 kg are purchased in a month, the supplier will give a 5% discount on all materials. The marginal cost would then be as follows: More than 1,000 units When the discount is achieved the marginal cost becomes:
	$
Materials - 1 kg at $95 per kg	95
Labour	40
Variable overhead	30
Marginal cost	165

Between 950 units and 1,000 units

he material cost of producing 1,000 units is $95,000 as the discounted price applies. This is the same as the material cost of producing 950 units without the discount. Therefore, to produce 951 units or more, 1,000 kg should be purchased to take advantage of the discount. So the marginal cost for between 950 units and 1,000 units is as follows:

		Output	Total variable cost	Marginal cost
			$	$	
950 units (950 * 170)			161,500	170
951 units - Materials (1,000 * 95)	95,000			
Labour and overhead (951*70)	66,570			
		161,570	70	
952 units - Materials	95,000			
Labour and overhead (952*70)	66,640			
		161,640	70	

No additional materials would be acquired until production exceeds 1,000 units, so the marginal cost is $70 up to 1,000 units. Fewer than 950 units For fewer than 950 units, the marginal cost is the variable cost without discounts - that is $170 per unit.

Summary of marginal costs

	$
Up to 950 units	170
951 units to 1,000 units	70
Above 1,000 units	165

2.4 Maximising Profits

The objective of most businesses is to maximise profits. The economist's model is used to find the price that will meet this objective. This is determined as follows:

· Identify the quantity of sales (Q) that would lead to maximum profits. This is the quantity at which:

Marginal cost = Marginal revenue .

· Calculate the price that must be set in order to achieve this level of sales by putting the value of Q into the demand function:

$P = a - bQ$

2.5 Summary of Algebraic Method

The method used above to calculate the profit maximising output is called the algebraic method. A summary of the steps that would be taken to identify the profit maximising output and price is as follows: 1. Establish the demand function, which has the form $P = a - bQ$. 2. Establish the equation for marginal revenue, which has the form $MR = a - 2bQ$. 3. Identify the marginal cost function. Typically, marginal cost = variable cost, so the marginal cost function will be in the form $MC = x$ (where x is a number). 4. Solve the equation $MC = MR$. This gives the value of Q at the point of maximum profit. 5. Put the value of Q into the demand function (from Step 1) to determine the price that should be charged so that demand equals Q.

2.6 Tabular Approach

An alternative approach to identifying the profit maximising point of output is to use the tabular approach. This approach may be used where information has been given about the level of demand for a small number of different prices and:

· due to the small number of items there is insufficient data to calculate a price equation accurately; or

· the relationship between the price and demand does not appear to be linear.

In these cases, marginal revenue and marginal cost can be calculated for each set of data. There may not be any point where marginal cost = marginal revenue exactly. In this case, produce up to the last point where marginal revenue exceeds marginal cost.

Quiz: Tabular Method

A baker has just introduced a new type of cake. He has been experimenting with the price to determine daily demand. On each of the last ten business days, for which he charged a different price, he recorded actual demand and production costs as follows:

Price (cents)	Quantity demanded	Total cost (costs)
460	1	385
420	2	570
380	3	749
360	4	932
325	5	1,100
302	6	1,280
269	7	1,467
244	8	1,656
212	9	1,847
180	10	2,030

Required: a. Using a tabular approach, calculate the marginal revenue and marginal cost at each price and output level. Based on this, determine the price to maximise profit and the associated quantity to be produced. b. Calculate total profit at each price and confirm that the price and quantity calculated in (a) maximise profit.

Answer:

a. Marginal cost and marginal revenue

Price	Quantity	Total revenue	Marginal revenue	Total cost	Marginal cost
460	1	460	460	385	385
420	2	840	380	570	185
380	3	1,140	300	749	179
360	4	1,440	300	932	183
325	5	1,625	185	1,100	168
302	6	1,812	187	1,280	180
269	7	1,883	71	1,467	187
244	8	1,952	69	1,656	189

| 212 | 9 | 1,908 | (44) | 1,847 | 191 | |
| 180 | 10 | 1,800 | (108) | 2,030 | 183 | |

Profit is maximised by setting a price of 302 cents and producing and selling 6 cakes each day (since this is the point at which marginal revenue is almost the same as marginal cost). The marginal revenue and cost for 7 cakes show that if production is increased to 7, revenue would increase by 71 cents, and costs would increase by 187 cents. Therefore, it would not be worth producing that seventh unit.

b. Total profit

Price	Quantity	Total revenue	Total cost	Total profit
460	1	460	385	75
420	2	840	570	270
380	3	1,140	749	391
360	4	1,440	932	508
325	5	1,625	1,100	525
302	6	1,812	1,280	532
269	7	1,883	1,467	416
244	8	1,952	1,656	296
212		1,908	1,847	61
180	10	1,800	2,030	(230)

This table confirms the conclusion in part (a) that the profit maximising price is 302 cents for 6 cakes.

2.7 Practical Disadvantages of the Economist's Model
· Although the economist's model appears to be logical, it is difficult to apply in practice for the following reasons:
Organisations are unlikely to be able to estimate demand curves for their products or services with any degree of accuracy.
· The demand curve ignores exogenous variables (i.e. variables outside of the control of management which may affect price), such as market conditions.
· In practice, demand for products may be interrelated. However, demand curves treat demand for each product as independent of demand for other products.
· Companies may have strategies other than profit maximisation (e.g. maximisation of market share or achieving a particular target profit).

2.8 Production and Sales Levels A decision to increase production and sales levels should, like any decision, consider relevant costs (see Chapter 4). These include consideration of marginal revenue and marginal cost. However, there are many other factors, some of which are inter-related, that can make evaluation of this decision quite difficult. For example:
· One of the implications of increasing production may be the need for increased storage space for raw materials and/or finished goods. The cost of additional storage space is not a variable cost but a fixed cost.

· Selling price usually has a significant effect on demand. When following a particular pricing strategy (see next section), a business will need to have production capacity to meet the demand generated.

· Increasing production may have consequences on the quality of the product (e.g. more defective items). This would not only result in additional costs (e.g. in monitoring quality control and repairs) but might lead to: - customers turning to other suppliers of more reliable products; - the selling price being driven down; and/or - reputational damage (of a brand name).

3.1 Market Skimming

Market skimming is often used when a product is launched. A high price is set initially, which generally means that demand will be low. However, a large profit margin can be made during this stage. Later, when the early adopter segment of the market is satisfied, the price may be lowered so that sales can be made to a larger market segment. Market skimming is most likely to be used in the following situations:

· To launch a new product into a market where there is no existing competition. This is typically a "breakthrough" product. Examples of breakthrough products include the car, penicillin, laptop computer, Windows operating system, ATM and iPad. Breakthrough services include the Internet and online shopping.

· The product confers some status on the customer. For example, when mobile phones were first launched commercially in the 1980s, the cost of a handset was about $2,500. Having a mobile telephone was a symbol of importance.

· The product has a short lifecycle, and it is desirable to recover the development costs as quickly as possible.

3.2 Market Penetration

Market penetration may also be used when launching a product into a new market. However, it is the opposite of market skimming, as a low price is charged initially to attract new customers. The initial price may even lead the manufacturer to make a loss in the short term. Once a customer base has been established, the price is increased. Market penetration is most likely to be used in the following situations:

· For commodity-type products where there are many existing products available. The only way to break into the market is to sell for a lower price than the existing products.

· For price-sensitive products (i.e. a small reduction in price is expected to result in a large increase in demand). This high price elasticity of demand is discussed in more detail in s.4.2.

· For products where economies of scale exist (i.e. if large quantities are produced the cost per unit falls significantly).

3.3 Complementary Product Pricing

The use of one product often requires the purchase of a second product (e.g. cars cannot run without fuel; printers require ink cartridges). Demand for such complementary products is therefore linked. Complementary product pricing requires understanding of the impact that the price of one product may have on demand for the other. When setting prices the impact on demand for the complementary product may be considered to be more important than the demand or profit relating to the first product.

Example of Complementary Products

Printers for computers are often sold at a relatively low price; once a particular model of printer has been acquired, the user has to buy a particular print cartridge. The price of the print cartridges is then relatively high because a large margin can be made on them. Consumers have no choice but to buy those cartridges unless they invest in a new printer.

3.4 Price Discrimination

Price discrimination involves setting different prices for a product or service in different markets. Customers in some markets may be willing to pay higher prices than customers in other markets, so price discrimination aims to achieve the maximum price in each available market. For price discrimination to be feasible there must be barriers between markets, otherwise investors would buy in the lower price market and resell in the higher price market, undermining the objective of discriminating. Examples of price discrimination include:

· Where switching can be prevented by selling a product to consumers for: - Unique moments in time (e.g. airline tickets for a specific flight that cannot be resold under any circumstances or cheaper rail tickets that are valid for a particular rail service); - Unique locations (e.g. a return airline or train ticket from location A to location B may be priced differently from a return ticket from location B to location A).

· Software businesses often offer heavy discounts for educational users. For example, subscriptions to office productivity software are usually cheaper for students and educational institutions. Educational purchasers must provide evidence of their status.

· Charging different tariffs and service charges for commercial customers and residential customers.

3.5 Loss Leaders

A loss leader is a product that is sold at a loss to attract customers who will then buy other products. Loss leaders are common in supermarket promotions, where products are advertised at very low, loss- making prices. The supermarkets know that once customers have entered the store to buy the promotional product, they are likely to also buy other goods.

3.6 Going-Rate Pricing This means charging the prevailing market price. This approach might be used in competitive markets (i.e. where charging above market price would lead to a loss of the majority of customers and selling below market price would not bring additional customers). Going-rate pricing is common for homogeneous products that have minimum variation (e.g. commodities such as aluminium or diesel).

3.7 Product-Line Pricing Some products are related because they are sold to the same customer or through the same outlets. Product-line pricing involves setting the price of the products in the product line together. There are two prevalent approaches: 1. Product bundling (i.e. a group of products are sold together for a price that is less than the total of the individual products). This is common in fast-food restaurants (e.g. "meal deals" containing a burger, soft drink and french fries for less than the total price of the individual items). The rationale for this approach is that the extra revenue from the third item exceeds the cost of the third item. 2. Set

differentials between different products in a range. For example, a price is set for a basic car with a small engine, and other versions (e.g. a larger engine) are sold for the basic price plus a pre-determined differential.

3.8 Volume Discounting

Many organisations offer discounts to customers who buy a certain number of products. In retail stores, for example, it is quite common to see "buy one, get one for 50%" promotional pricing. The reason for using such a strategy is twofold: 1. To offer a more competitive price overall (as the average price paid for two items will be lower than the price for one). 2. To acknowledge the law of diminishing marginal utility (i.e., the consumer gets the most satisfaction from the first unit of a product or service). As subsequent units of a product or service are consumed, the satisfaction derived from them declines. Offering the second item for a lower price encourages consumers to buy it even though it provides less satisfaction.

3.9 Relevant Cost Pricing Relevant cost pricing, or opportunity cost pricing, is often used for one-off contracts or orders. The relevant cost of the contract is calculated, and then a mark-up is added to get the price.

4.1 Level of Demand Demand is the quantity of a good or service which consumers want, and are willing and able to pay for. In practice, an organisation may not know the demand curve for their product or service. The level of demand, however, will still influence pricing; the higher the demand, the higher the price that can be charged. Demand is influenced by the following:
· Income. Demand for most goods rises when consumers' incomes rise. However, demand for inferior goods (e.g. cheap meat) might fall as incomes rise.
· Price of substitute goods. If substitutes are available for a much lower price, consumers may buy the substitutes instead.
· Price of complementary goods. Complementary goods are goods which are bought together, for example, petrol and cars. US car manufacturers expect to see a fall in demand for large vehicles when the price of petrol increases.
· Consumer tastes and fashion. For example, in Western Europe, there is a trend towards buying organically grown vegetables, so demand for these products is high.
· Advertising. Spending on advertising can increase a product's demand.
· Consumer views and capacity to pay. These will ultimately determine how much consumers are prepared to pay for products.

4.2 Price Elasticity of Demand

The price elasticity of demand (PED) is the degree of sensitivity of demand for a good to changes in the price of that good.
PED = % change in demand/% change in price
PED will generally be negative since a rise in price leads to a fall in demand. However, by convention, the minus sign is ignored when describing PED (e.g. if calculated as "- 1.5", it is described as "1.5"). Demand for a product can be described as:

· Elastic- meaning that demand is very responsive to changes in price. The change in the quantity of goods demanded will be relatively greater (i.e. in percentage terms) than the change in price. The PED will be greater than one.

· Inelastic- meaning that a change in price will have little impact on demand. Demand will change by a relatively small amount (i.e. in percentage terms) than the change in price. The PED will be less than one.

If demand is elastic (i.e. PED > 1.0), increasing the price may lead to reduced revenue.

If demand is inelastic (i.e. PED < 1.0), price rises can increase revenue (e.g. necessity goods).

PED at point 1 =

Quiz: Price Elasticity of Demand

Alex, a baker, has ascertained that the daily demand for doughnuts has the following demand function: P = 500 - 0.1Q Where P is the price in cents, and Q is the daily demand in units.

Required: Calculate the price elasticity of demand based on Alex increasing the price by 5 cents, assuming that his current price per doughnut is: a. $4 b. $2

Answer:

a. Current Price $4

At a price of P1 = 400 cents, daily demand (Q,) is 1,000 doughnuts (W). If the price rises by 5 cents to P2 = 405 cents, daily demand (Q2) will fall to 950 doughnuts.

PED = ((Q2-Q1)/Q1)/((P2-P1)/P1) = ((950-1,000)/1,000)/((405-400)/400) = -0.05/0.0125 = - 4.

Ignoring the minus sign, elasticity is 4 when the current price is $4. As this is greater than 1, demand is elastic at this point.

b. Current Price $2

At a price of P1 = 200 cents, daily demand (Q,) is 3,000 doughnuts (Woring). If the price rises by 5 cents to P2 = 205 cents, daily demand (Q2) will fall to 2,950 doughnuts.

PED = [(2,950 - 3,000)/3,000]/[(205 - 200)/200] = - 0.0167/0.025 = - 0.67

Ignoring the minus sign, elasticity is 0.67 when the current price is $2. This shows that the elasticity of demand varies along the demand curve.

WORKING

Demand function: P = 500 - 0.1Q

At the current price of 400 cents: 400 = 500 - 0.1Q

Therefore, 0.1Q = 100

Therefore, Q = 1,000 (i.e. daily demand of 1,000 doughnuts)

Similarly:

If P = 405: 405 = 500 - 0.1Q therefore, 0.1Q = 95, Q = 950

If P = 200: 200 = 500 - 0.1Q therefore, 0.1Q = 300, Q = 3,000

If P = 205: 205 = 500 - 0.1Q therefore, 0.1Q = 295, Q = 2,950

4.3 Product Lifecycle One influence on a product's price is its lifecycle (see Chapter 3). Different pricing policies might be adopted at different stages as follows:

· Introduction stage: Price skimming or penetration pricing may be used (see above). . Growth phase: If price skimming has been used, the price will be reduced during this phase. If penetration pricing has been used, the price will start to rise during this phase once the business is confident about having sufficient customer loyalty.

· Maturity phase: At this stage, it is likely that profit maximisation pricing policies will be used (see the economist's model described previously).

· Decline phase: Lower prices may be charged to sell off excess inventories. However, in some industries, products that have reached the end of their lifecycles may become specialty items, where there is still demand from a small section of the market. For example, vinyl records of music up until the 1980s are collector items for those who prefer vinyl to CDs, etc.

4.4 Competitors If there are many competing suppliers in the market, an individual company may have little power to influence prices. On the other hand, a monopolist can dominate the market and set the price. If a business has competitors, it must consider their possible reaction to its pricing policy. For example, cutting prices could lead to retaliation - a price war (this is common in supermarkets).

4.5 Customers If a business has one dominant customer, it may find it difficult to increase prices and might be forced to offer volume ("bulk buy") discounts. Businesses that offer services sometimes try to attract "prestige" clients by offering low prices. The hope is to improve reputation and attract other clients, who will then pay regular prices.

4.6 Perfect Competition
Perfect competition is a theoretical concept which describes a market in which:
· there are many sellers;
· there are many buyers; · products are identical/homogeneous;
· no barriers to entry exist; and
· there is perfect information (no hidden information, buyers know everything about the goods they are buying).

The sale and purchase of goods will be at the market clearing (or equilibrium) price, which is the prevailing price where supply and demand are equal, with no excess or shortage. Market participants have no decision to make regarding price. Individual businesses are not big enough to influence the total output of the market significantly. They are "price takers" - they must accept the market price.

If an individual company were to charge a price higher than the market price, it would not make any sales, because buyers have perfect information and will know that they can buy at a lower price from the other suppliers in the market. There is no incentive for a company to sell for a price below the market price because it can sell all of its output for the market price. In a competitive market, businesses will charge the market price.

Summary:
· Cost plus pricing methods involve adding a given margin to the cost of a product. The cost may be the marginal cost, the full cost or even the relevant cost.

· Full cost plus pricing is a long-term pricing strategy. It ensures that prices cover all variable and fixed costs.
· Opportunity cost (relevant cost) pricing is suitable for short-term pricing decisions.
· A significant weakness of cost plus methods of pricing is that they do not consider demand.
· In the economist's model, price is a function of the quantity demanded. As the price falls, demand increases.
· Marginal revenue is the increase in total revenues resulting from selling one more unit of a product or service.
· For exam purposes, marginal cost is equal to variable cost per unit (at least until full capacity is reached).
· A business maximises its profit when marginal revenue equals marginal cost.
· Pricing is a strategic decision and different pricing strategies are applied in different circumstances (e.g. when demand for one product is linked to demand for another).
· The price elasticity of demand is a measure of the degree of sensitivity of demand for a good to changes in the price of that good.

Chapter 8: Risk and Uncertainty
This chapter covers the following Learning Outcomes. C. Decision-Making Techniques 6. Dealing with risk and uncertainty in decision making a) Suggest research techniques to reduce uncertainty (e.g. focus groups, market research). b) Explain the use of simulation, expected values and sensitivity. c) Apply expected values and sensitivity to decision-making problems. d) Apply the techniques of maximax, maximin and minimax regret to decision-making problems, including the production of profit tables. e) Interpret a decision tree and use it to solve a multi-stage decision problem. f) Calculate the value of perfect and imperfect information.

1.1 Introduction
Risk - the existence of several possible outcomes, which are known in advance along with the related probability.
Uncertainty - the potential outcomes of a decision that are not known in advance.
So far, decision-making questions have assumed that the results of various courses of action are known with certainty. In the real world, this is seldom the case. Decisions often have to be made where various uncertain outcomes could result from the decision being made.

1.2 Methods The following methods of dealing with risk in decision making are examinable:
· Expected value;
· Value of perfect information;
· Decision trees;
· Maximax;
· Maximin; and
· Minimax regret.
Exam advice You must also be aware of practical ways to deal with uncertainty (see s.5).

2.1 The Concept

The expected value represents the average outcome that would be achieved if a decision were repeated many times.

Expected value (EV) = Weighted arithmetic mean of possible outcomes = $\Sigma (x_i \, p(x_i))$

This formula represents the sum (E) of each possible outcome (Xi) multiplied by its probability of occurring (p(xi)).

Generally, the decision rule would be to choose the outcome with the highest EV.

Key Point

The sum of the probabilities of all outcomes must equal to 1.

Example of Expected Value

When an unbiased six-sided die is thrown, each side has an equal chance (1/6) of being obtained. The expected value of throwing a dice many times is calculated as:

Value	Probability	Product
Xi	p(xi)	xip(xi)
1	1/6	1/6
2	1/6	2/6
3	1/6	3/6
4	1/6	4/6
5	1/6	5/6
6	1/6	6/6
Total $\Sigma(x_i \, \rho \,(x_i))$		21/6

The EV is, therefore, 21/6 or 3.5.

This means that if the dice is thrown many times (many iterations of the event), the average value of the throws would be 3.5. It is important to note that for a single throw (event), it is impossible to get 3.5 because there is no single outcome (dice face) which has a value of 3 1/2.

Quiz: Expected Value

A decision-maker must select one of three mutually exclusive projects. The outcome from each project depends on the state of the market, which can be diminishing, static or expanding. The profit for each project under each of the three outcomes is shown in the following payoff (profit) table:

State of the market	Probability	Project 1	Project 2	Project 3
Diminishing	0.4	100	0	180
Static	0.3	200	500	190
Expanding	0.3	1,000	600	200

The decision rule would be to choose the project with the highest EV.

Required: Determine the expected value (EV) for each project and select which project to pursue.

Answer:

			$000
Project 1		EV=(100 × 0.4) + (200 × 0.3) + (1,000 × 0.3)	400
Project 2		EV=(0 × 0.4) + (500 × 0.3) + (600 × 0.3)	330
Project 3		EV=(180 × 0.4) + (190 × 0.3) + (200 × 0.3)	189

Based on the EVs, Project 1 should be undertaken.

2.1.1 Advantages of EV:
· It reduces the information to one number for each choice.
· The idea of an average is easily understood.

2.1.2 Limitations of EV:
· The probabilities of the different possible outcomes may be difficult to estimate.
· The average may not correspond to any of the possible outcomes.
· Unless the same decision has to be made many times, the average will not be achieved; it is therefore unsuitable for decision making in "one-off " situations.
· The average gives no indication of the spread of possible results (i.e. it ignores risk).

2.2 Profit Tables
A profit table (also referred to as a payoff matrix) shows all possible "payoffs" (NPVs, contribution, profits, etc.) which may result from a decision-maker's chosen strategy. The data given in Activity 1 is in the form of a payoff matrix.
Exam advice You may be required to calculate the profit table based on the information given in the question.

Quiz: Profit Table
A baker sells a cake that costs $0.10 to make for $0.30 each. At the end of a day any cakes not sold must be thrown away. On any particular day the level of demand follows the following probability distribution:

Number of cakes sold	20	40	60
Probability	0.3	0.5	0.2

The following template may be used:

		Order Size		
	Demand	20	40	60
20	(Pr 0.3)			
40	(Pr 0.5)	(outcomes are computed in this part of the table)		
60	(Pr 0.2)			

Required: a. Construct a profit table to show the possible outcomes. b. Calculate the daily order the baker should place in order to maximize the expected value of daily profits.

Answer:
a. Profit Table (in $)

	Demand	Order Size 20	40	60
20	(Pr 0.3)	4.00	2.00	0 0
40	(Pr 0.5)	4.00	8.00	6.00
60	(Pr 0.2)	4.00	8.00	12.00

Sample workings:

If order q = 20 and demand = 20, profit = (20 × 0.30) - (20 × 0.10) = $4.00

If order q = 20 and demand = 40, sales are limited to 20 i.e. profit $4.00.

b. EV if order 20 = ($4 * 0.3) + ($4 * 0.5) + ($4 * 0.2) = $4.00

   EV if order 40 = ($2 * 0.3) + ($8 * 0.5) + ($8 * 0.2) = $6.20

   EV if order 60 =((0 * 0.3) + ($6 * 0.5) + ($12 * 0.2)) = $5.40

The baker should always order 40 and make, on average, $6.20.

2.3 Value of Perfect Information

2.3.1 The Concept

Imagine that, in a situation of uncertainty, it is possible to buy an accurate forecast which predicts with certainty what the uncertain variable is going to be each time a decision has to be made. The value of perfect information is the maximum amount a decision-maker would be willing to pay for advance information to know which outcome will occur.

2.3.2 Calculation

Expected value with perfect information is the expected daily profit the baker would earn if he ordered the forecast and acted on it. Some days the forecast will say that demand will be 20 cakes, other days 40 cakes, and so on. It is assumed that the probability distribution of the forecast is the same as the probability distribution of the underlying variable (i.e. demand for cakes).

Value of perfect information = EV with perfect information - EV without perfect information

2.4 Value of Imperfect Information

In the real world, it is unlikely that any forecast would be perfect. In the case of the baker, the daily forecast would not always be accurate. Even with an inaccurate forecast, however, the baker may make a higher expected return than with no forecast at all.

Value of imperfect information = EV with imperfect information - EV without information

Example of Imperfect Information

A newsagent has to decide how many newspapers to buy each day. Demand is uncertain and can either be high, with a probability of 60%, or low, with a probability of 40%. A profit table shows the profits for the possible combinations of order size and demand:

		Order Size High	Low
Demand	High	1,000	400
	Low	(200)	400

EV without information

Without any additional information, the newsagent would order the quantity which gives the highest expected profit: The expected outcome of placing a high order is $520 ((1,000 * 0.6) + ((200) * 0.4)). The expected outcome of placing a low order is $400 ((400 * 0.6) + ((400) * 0.4)).

EV with imperfect information The newsagent can commission a survey telling him the demand on a particular day. If the survey says demand will be high on a specific day, he will place a high order; if it says demand will be low on a particular day, he will place a low order. There is a 60% chance that the survey will say high and a 40% chance that the survey will say low. The survey is not always correct, and there is a 90% chance it will be correct. If the newsagent commissions the survey, the following profits, along with their associated probabilities, would be possible:

	Profit ($)	Probability
Survey says high and is correct	1,000	0.54 (0.6 * 0.9)
Survey says high and is incorrect	(200	0.06 (0.6 * 0.1)
Survey says low and is correct	400	0.36 (0.4 * 0.9)
Survey says low and is incorrect	400	0.04 (0.4 * 0.1)

EV with imperfect information = (1,000 * 0.54) + ((200) * 0.06) + (400 * 0.36) + (400 * 0.04) = $688.

The value of imperfect information in this case is:

EV with the survey $688

EV without the survey $520

Value of imperfect information $168

EVs of perfect and imperfect information can be calculated more easily using decision trees (s.2.5).

2.5 Decision Trees

2.5.1 Concept Decision making often involves multi-stage decisions. At each stage in the decision-making process, the decision maker has to choose between two or more decisions. The possible outcomes of each decision will be specified, along with the associated probability. Having made the first decision, a second decision, or possibly even more decisions, may be required. A "decision" tree helps visualise and evaluate outcomes in the decision-making process. It is a pictorial representation of the decisions which need to be made at each stage, along with their potential outcomes and associated probabilities.

Exam advice You will not be required to draw a decision tree in the exam. However, you may be required to recommend the best course of action based on a decision tree given in a question.

2.5.2 Conventions and Process

Decision trees are usually drawn from left to right, with preceding decisions on the left with each subsequent decision and outcome further to the right. The following conventions are used in drawing decision trees:

· Decision fork (point) - this is a point at which a decision- maker has to decide between two or more decisions.

· Chance fork (outcome point) - this occurs where there are several possible outcomes. Normally, for each decision taken, there will be two or more possible outcomes.

Key Point
The sum of the probabilities of all outcomes (branch) at each chance fork must equal 1 or 100%.

Having drawn the decision tree, it is necessary to calculate the expected outcome at each decision fork. To do this process, start at the right-hand side of the decision tree and work back to each decision fork to identify which is the best decision at each fork. Ultimately, the decision tree enables the decision-maker to determine the best decision to make at the first stage.

Example of Decision Tree Process
A company is considering investing in a new machine. This would involve an initial expenditure of $50,000 on patent rights, and profit in the coming year could be:
$300,000 with probability 0.6 or $200,000 with probability 0.4
If the company does not invest in the machine, profits for next year will be:
$250,000 with probability 0.7 or $150,000 with probability 0.3
This can be illustrated as follows:
Node A (now) -> Node B (investment is made $50,000) -> profit $300,000 with probability 0.6
Node A (now) -> Node B (investment is made $50,000) -> profit $200,000 with probability 0.4
Node A (now) -> Node C (investment not made) -> profit $250,000 with probability 0.7
Node A (now) -> Node C (investment not made) -> profit $150,000 with probability 0.3
At chance fork B: Expected profits are $260,000 ((0.6 * 300,000) + (0.4 * $200,000)).
At chance fork C: Expected profits are $220,000 ((0.7 * 250,000) + (0.3 * $150,000)).
At decision point A: Either invest: Expected outcome is $210,000 (260,000 - 50,000). Or do not invest: Expected profit is $220,000.
Conclusion: The investment should not be made.

Quiz: Decision Trees
Slim Foods is considering launching a non-sugar snack bar into a new market. Although the company has not yet undertaken any market research, the marketing director estimates that the product has a 60% chance of success and a 40% chance of failure in the market. A market research company has offered to do research in the new market before the company decides on whether to launch the product. Management believes there is a 60% chance the market research will recommend the launch and a 40% chance it will advise Slim Foods not to launch the product. The cost of the market research will be $30,000. The market research company has admitted that its research findings do not always turn out to be as expected once the product has been launched. The company advises that if it recommends the launch, there would be an 80% chance the product would succeed and a 20% chance it would fail. If it does not recommend the launch, there would be a 30% chance that the product would succeed if management were to launch it and a 70% chance that it would fail. In all cases, if the product succeeded, the present value of future profits from the product would be $10 million (excluding the market research costs). If the product failed, the net present value of the loss would be $4.5

million (excluding the market research costs). The company's directors are trying to decide whether to accept the market research company's offer or make a decision based only on the gut feel of the marketing director.

Required: a. Draw a decision tree to illustrate the possible decisions and their associated potential outcomes. b. Advise management how they should proceed. c. Calculate the value of the imperfect information provided by the market research company.

a. Draw the Decision Tree based on the information given.
Node A (now) -> Node B (market research $30,000) -> Node D (launch recommended at 0.6 probability) -> Node G (launch) -> Success (present value of future profits $10million with probability 0.8)
Node A (now) -> Node B (market research $30,000) -> Node D (launch recommended at 0.6 probability) -> not launch -> $0
Node A (now) -> Node B (market research $30,000) -> Node E (launch not recommended at 0.4 probability) -> Node H (launch) -> Success (present value of future profits $10million with probability 0.3)
Node A (now) -> Node B (market research $30,000) -> Node E (launch not recommended at 0.4 probability) -> Node H (launch) -> Success (present value of future profits -$4.5 million with probability 0.7)
Node A (now) -> Node B (market research $30,000) -> Node E (launch not recommended at 0.4 probability) -> Do not launch -> $0
Node A (now) -> Node C (no research) -> Node F (launch) -> Success (present value of future profits $10million with probability 0.6)
Node A (now) -> Node C (no research) -> Node F (launch) -> Fail -> $0
Node A (now) -> Node C (no research) -> (Do not launch) -> $0

b. Advice to Management
Expected Present Value of Profits with Market Research
At outcome point G (launching), the EV is $7,100,000 ((10 million * 0.8) + (-4.5 million * 0.2)). This is higher than zero (not launching), so the decision at point D would be to launch, and the EV here is $7,100,000.
At outcome point H, EV is - $150,000 ((10 million * 0.3) + (-4.5 million * 0.7)).
This is less than not launching the product, so the decision at point E is not to launch the product.
Therefore, at outcome point B (market research recommendation), if the product launch is recommended, it will be launched. If it is not recommended, it will not be launched.
At outcome point B, the expected outcome is $4,260,000 ((0.6 * 7,100,000) + (0.4 * 0)).
To get from point A to point B, the company has to pay $30,000 for market research.
$4,230,000.
Expected Present Value of Profits Without Market Research
At outcome point F, the expected net present value of profits is $4,200,000 ((10 million * 0.6) + (-4.5 million * 0.4)). The decision at point C is therefore to launch, as the net present value of not launching is zero. Therefore, the expected present value of profits at C is also $4,200,000.

No cost is involved in getting from A to C, so the expected net present value of profits is $4,200,000 if market research is not carried out.

Conclusion: The market research should be undertaken. This is because the net present value of profits is higher by $30,000 ($4,230,000 - $4,200,000) with market research.

c. Value of Imperfect Information The value of imperfect information is simply the difference between the expected value if the market research is commissioned and the expected value if it is not:

	$000	
EV with the market research	4,260	(point B)
EV without market research	4,200	(point C)
Value of imperfect information	60	

3.1 Three Types of Decision-Makers

Not all managers will make the same decision even though they have the same information; as individuals, they have different attitudes toward risk. 1. Risk-seekers are those who seek the maximum possible return regardless of the probability of it occurring. As optimists, they consider the best-case scenario. 2. Risk neutral are those who consider the most likely outcome. 3. Risk averse decision-makers dislike risk and make decisions based on the worst possible outcome (to minimise potential loss). There are different decision rules or criteria that correspond to these attitudes to risk.

3.2 Decision Rules

MAXIMAX	Select the alternative with the maximum possible payoff (i.e., the highest return under the best-case scenario). The risk seeker's (i.e. optimist's) rule.
MAXIMIN	Select the alternative with the highest return under the worst-case scenario. The pessimist's rule (i.e. risk averse).
MINIMAX REGRET	Select the alternative with the lowest maximum regret. Regret is defined as the opportunity loss from having made the wrong decision. Minimax regret is also suited to investors that are adverse to missing out.
EXPECTED VALUE (EV)	Select the option that gives the highest EV. Those who use EVs may be described as risk neutral (i.e. they are not concerned with the amount of risk associated with each option, only the amount of the expected return).

Example of Decision Outcomes

An ice cream seller needs to decide how large an order to place for ice cream (small, medium or large), taking into consideration the weather forecast (cold, warm or hot). The payoff table for the possible combinations of order size and weather is as follows:

	Weather		
	Cold	Warm	Hot
Daily order			

Small	250	200	150
Medium	200	500	300
Large	100	300	750

The highest payoff for each order size is the order size most appropriate for the weather (i.e. small/cold, medium/warm and large/hot). Otherwise, profits are lost from either unsold ice cream or lost potential sales.

Maximax: Taking an optimistic view, the ice cream seller would place a large order as this has the highest payoff, $750 (compared with the highest payoffs of $250 and $500 for small and medium orders, respectively).

Maximin: Taking a cautious approach, placing a medium order has the highest of the lowest payoffs, $200 (compared with $150 and $100 for small and large orders, respectively).

Minimax regret: From the payoff table above, determine the best choice in each weather condition:

Weather	Best choice (highest payoff, regret = 0)
Cold	Small
Warm	Medium
Hot	Large

The optimal decision for cold weather is a small order, yielding $250. In cold weather, a medium order will have a regret of $50 (payoff is $50 lower than a small order), while a large order will have a regret of $150.

Applying the same calculations for warm and hot weather, the table of regrets is as follows:

Maximum regret Daily order Outcome at best Regrets $250 0 300 600 $500 50 450 $750 150 200

| | | Weather | Maximum regret|
| | | Cold | Warm | Hot |
| Daily order | Outcome at best | Regrets
Small	$250	0	300	600	600
Medium	$500	50	0	450	450
Large	$750	150	200	0	200

The decision which corresponds to the smallest maximum regret, $200, is to place a large order.

Note: The decision-maker can only pick the order size and hope for optimal conditions. Interpreting the table of regrets, the small order has the best payoff in cold weather, but the decision-maker may suffer a maximum regret of $600 if the weather is hot. The point is to minimise the maximum regret the decision-maker may suffer in unfavourable conditions (when the choice made is not optimum given the scenario).

Quiz: Decision Rules
Given the payoff table below:

State of the market	Probability	Project 1	Project 2	Project 3
Diminishing	0.4	100	0	180
Static	0.3	200	500	190

| Expanding | 0.3 | 1,000 | 600 | 200 |

Required: Determine which project would be chosen using each of the following decision rules:
a. Maximax; b. Maximin; c. Minimax regret.

Answer:
a. Maximax Project selected - 1 (it has the highest return in an expanding market).
b. Maximin Project selected - 3 (it has the highest return in a diminishing market).
c. Minimax Regret: Table of Regrets

State of the market	Outcome at best	Project 1 regret	Project 2 regret	Project 3 regret
Diminishing	180	80	180	0
Static	500	300	0	310
Expanding	1,000	0	400	800
Maximum regret		300	400	800

Project selected - 1

A minimax regret decision-maker would choose Project 1 as it has the lowest minimum regret. If Project 1 is selected, no matter the outcome, the decision-maker will never be more than $300 below the best outcome.

4.0 Introduction

Sensitivity analysis and simulation provide alternatives to the methods used above to deal with risk and uncertainty in decision making.

4.1 Sensitivity Analysis

Sensitivity analysis calculates how responsive a decision is to changes in any of the variables used in making that decision. It looks at one variable at a time and measures how much the variable can change by (in percentage terms) before affecting the decision. The smaller the percentage, the more sensitive the decision is to that variable. Sensitivity % = Profit/Variable Note that the Variable in the formula above is an aggregated figure (e.g. revenue as a product of selling price and sales quantity).

Quiz: Sensitivity Analysis

The baker is considering launching a new type of small cake, the Esterhazy. The baker will not launch the Esterhazy if it will lose money in the first year. If it will break even or make a profit, the Esterhazy will be launched. An accountant has prepared a forecast profitability analysis for the Esterhazy, which shows that it will be profitable. The accountant's analysis is as follows:

Selling price $ 3
Variable costs $1.5
Contribution per unit $1.5
Budgeted sales per day $50
Daily contribution $75
Additional daily fixed costs $50
Additional daily profits $25

Because the cake is forecast to make a profit, the baker has decided to launch it. The baker is worried, however, about how reliable the accountant's estimates are and wishes to know how sensitive his decision is to changes in the underlying estimates.

Required: a. Calculate how sensitive the decision to launch the Esterhazy is to changes in: i. Selling price; ii. Volume of daily sales; and iii. Additional fixed costs. b. State to which of the variables in (a) the decision is most sensitive.

Answer:

a. (i) Sensitivity to price

Let p = price per unit.

Contribution per unit = p - 1.5.

At breakeven point, total contribution = total fixed costs

Breakeven price (based on budgeted sales of 50 units per day):

(p -1.5) * 50 = 50

50p - 75=50

50p = 125

p = 2.50

If the price is below 2.5, then a loss will be made. Price must fall 16.67% (0.5/3) to change the decision.

a. (ii) Sensitivity to volume of daily sales

Let v = daily sales in units

Total contribution = 1.5

At breakeven, $1.5 v = 50

v = 33.33

Forecast volume = 50 units per day

Volume must fall 33.34% (16.67/50) to change the decision.

a. (iii) Sensitivity to additional fixed costs

The budgeted contribution per day is 75.

The forecast fixed cost is 50.

Fixed costs must rise 50% (25/50) over the forecast in order to change the decision.

b. State to which of the variables in (a) the decision is most sensitive.

The forecast is most sensitive to the change in price. This is the variable where the lowest change would result in the decision changing.

Advantages:

· It gives an idea of how sensitive the decision taken is to changes in any of the original estimates.

· It can be readily adapted for use in spreadsheet packages.

Limitations:

· Sensitivity is usually only used to examine what happens when one variable changes and others remain constant.

· Without appropriate software, it can be time consuming.

4.2 Simulation

Simulation - a mathematical model constructed to represent the operation of a real-life process or situation.

Simulation is a technique which allows more than one variable to change at the same time. Most real-life problems are complex as there is more than one uncertain variable. Models can be generated which "simulate" the real-world environment within which the decision must be made.

Example of Simulation

A computer model could simulate the conditions which exist for a baker. Each time the simulation is run (each trial), the model would randomly generate a selling price per unit, daily demand and daily fixed cost. The profit for the trial would then be calculated. The simulation would be run many times. Based on the results of the simulation, a probability distribution of the daily profit of the baker could be constructed.

Although a simulation is not likely to be used in such a simple situation (as alternative models are available), it may be the only suitable method of analysing more complex situations where there are many variables which could change. One example of a mathematical model used in simulation is the "Monte Carlo" method.

4.2.1 Stages 1. Specify the major variables (excessive detail will over-complicate). 2. Specify the relationship between the variables. 3. Attach probability distributions to each variable and assign random numbers to reflect the distribution. 4. Simulate the environment by generating random numbers. 5. Record the outcome of each simulation. 6. Repeat each simulation many times to obtain a probability distribution of the likely outcomes.

4.2.2 Advantages and Limitations

Advantages:

· It overcomes the limitations of sensitivity analysis by examining the effects of all possible combinations of variables and their realisations.

· It therefore provides more information about the possible outcomes and their relative probabilities.

· It is useful for problems which cannot be solved analytically by other means.

Limitations:

· It is not a technique for making a decision, only for getting more information about the possible outcomes.

· It can be very time consuming without a computer.

· It could prove expensive in designing and running the simulation on a computer.

· It relies on reliable estimates of the probability distributions of the underlying variables.

5.1 Focus Groups

Much of the uncertainty which companies face in the real world relates to new products and whether they will be successful. To reduce this uncertainty, focus groups may be used before the launch of a product.

· A group of people are asked to give their opinion about a new product or service. The discussion occurs in an interactive environment where participants can share and discuss their views with other group members.

· Members of the group are chosen at random. Often, they are approached by employees of the marketing organisation in the street and asked to participate.

· Before the meeting, the group members may be screened to ensure they belong to the target market to which the product is aimed.

· A moderator may be present to ease the discussion.

· During the meeting, the participants may be observed, usually without their knowledge, by marketing professionals who examine their body language, facial expressions and group behaviour.

5.2 Market Research

Market research is the systematic gathering of information about customers, competitors and the market. The type of information collected in market research seeks to answer the following types of question:

· Who are the customers?
· Where are they located?
· What quantity and quality do they want?
· What is the best time to sell?
· What is the long-term price?
· Who are the competitors?

Market research can be used to help companies make decisions about the development and marketing of new products. The earlier the market research is conducted in the development of a product, the better, from a risk point of view. Market research can be based on primary or secondary data.

· Primary data means the company collects its own original data, for example, by conducting interviews.

· Secondary data means that already published data is used, such as published statistics.

Summary:
· The difference between risk and uncertainty is that risk is measured in terms of probability.
· Expected value is an average outcome based on probabilities. It is not suitable for one-off decisions. It is the decision rule for anyone who is risk-neutral.
· A profit table (payoff matrix) shows all possible payoffs which may result from the strategy chosen by the decision-maker.
· The value of perfect information is the maximum amount a business would be prepared to pay for an accurate forecast of the uncertain variables it faces. It is defined as: EV with perfect information (the forecast) less EV without perfect information
· Imperfect information has value if it results in a higher expected return than the expected value without it.
· Decision trees are a technique to visualise multi-stage decisions with various potential outcomes at each stage.

· A payoff table can be used to apply decision rules: Maximax selects the option with the highest potential outcome. Maximax is the decision rule for risk seekers; Maximin selects the best outcome of the worst case scenarios. Maximin is a decision rule for the risk averse.

· To apply the minimax regret rule also requires a table of regrets.

· Sensitivity analysis calculates how responsive a decision is to changes in any of the variables used to calculate it.

· Simulation allows for more than one variable to change at a time.

· In the real world, much of the risk that commercial organisations face comes from new products. Such risk can be reduced by focus groups or other forms of market research.

Chapter 9: Budgetary Systems and Types of Budget

This chapter covers the following Learning Outcomes. D. Budgeting and Control 1. Budgetary systems and types of budget a) Explain how budgetary systems fit within the performance hierarchy. b) Select and explain appropriate budgetary systems for an organisation, including top-down, bottom-up, rolling, zero-based, activity-based, incremental and feed-forward control. c) Describe the information used in budget systems and the sources of the information needed. d) Indicate the usefulness and problems with different budget types (including fixed, flexible, zero-based, activity-based, incremental, rolling, top-down, bottom-up, master, functional). e) Prepare flexed budgets, rolling budgets and activity-based budgets. f) Explain the beyond budgeting model, including the benefits and problems that may be faced if it is adopted in an organisation. g) Discuss the issues surrounding setting the difficulty level for a budget. h) Explain the benefits and difficulties of the participation of employees in the negotiation of targets. i) Explain the difficulties of changing a budgetary system or type of budget used. j) Explain how budget systems can deal with uncertainty in the environment. k) Discuss ethical and sustainability considerations when setting budgets. 7. Performance analysis c) Identify the factors which influence behaviour.

1.1 Introduction A budgetary control system is a way of achieving financial control of an entity. The typical budgetary control system consists of the following stages: 1. A budget is prepared for a calendar year. This shows budgeted revenues, costs and possibly cash flows and statements of financial position. Normally, the budgets are divided into monthly periods. 2. Shortly after the end of each month, when the accounts for that month have been prepared, the actual results are compared with the budgeted results. Any differences (variances) between the actual results and budgeted amounts are investigated. 3. Action may be taken to prevent or correct undesirable variances (Note that some variances are unavoidable or uncontrollable; it would be difficult to take effective action on these)

1.2 Objectives The objectives of a budgetary control system may be easily remembered with the mnemonic CRUMPET.

1.2.1 Coordination One of the main objectives of a budgetary system of control is to coordinate the different activities of an organisation. This should help achieve goal congruence and is particularly important in decentralised organisations. Without a budget, the production

department may not plan sufficient resources to meet the sales planned by the selling department.

1.2.2 Responsibility A budget is a way of delegating responsibility by showing managers which revenues and costs they are responsible for.

1.2.3 Utilisation Having a budget should lead to better resource utilisation. Decisions such as ordering inventory and hiring staff will be guided by the budget, meaning that organisations do not acquire resources in excess of their needs.

1.2.4 Motivation Research shows that giving managers a target in the form of a budget may improve their performance compared with giving them no target. If the target becomes too difficult, however, it can demotivate managers.

1.2.5 Planning Budgets are a financial plan. Requiring managers to prepare budgets forces them to think about the budget period. It makes them consider market conditions and how they will respond to them. This should lead to better decision-making than simply taking each day as it comes. Budgets cover a short-term time frame, typically one year. Most organisations have a long-term plan as well. The budget should be consistent with the long-term plan as it shows, in detail, how the budgeted period will contribute to the longer-term objectives.

1.2.6 Evaluation Managers' performance is likely to be evaluated, at least partly, by how they perform against the budget they are given. In some organisations, managers may receive bonuses based on their performance relative to the budget. Promotions may also depend on this. In such situations, managers will be extremely keen to achieve the budget.

1.2.7 Telling Budgets are a means by which superiors communicate their expectations of the managers below them.

1.3 Ethical and Sustainability Considerations
Traditionally, budgets have been set using a financial principal budget factor, focusing on economic aspects only. With business sustainability becoming more prevalent among investor demands and the need to manage ethical and sustainability risks and opportunities, the budget-setting process must incorporate ethical and sustainability elements to ensure its continued viability as an essential planning and performance management tool.

1.3.1 Application of Sustainability and Ethical Budgeting Sustainable budgeting is primarily focused in the public sector (such as through the Paris Collaborative on Green Budgeting). However, there is increasing adoption among commercial firms as investors demand greater transparency and accountability of their activities towards the external environment. The primary focus is to have clearer information and goals on how budgeting decisions affect sustainability and societal well-being measures, such as the impact on climate and local community, pollution, CO_2 emissions, etc. Performance information related to the budget can reflect additional measures, such as those on the United Nation's Sustainable Development

Goals (UN SDGs), in addition to traditional financial indicators. The budgets that should incorporate these measures range from asset expenditure budgets to planning for operational activities. The focus should not be on the budget itself but on the objectives of the budgetary process and the system, processes and controls that identify and measure achievement in these sustainability and ethical concerns. Likely, the organisation's budgetary processes are not as well-equipped to capture and report non-financial information as they are for economic indicators; investment and commitment would be needed to ensure appropriate investment in these information systems. One issue is the multiple aspects of ethics and sustainability, as opposed to the single reporting measure (currency) of financial budgeting. Budget setters need to identify the suitable measures relevant to their activities that are measurable and actionable within their available resources. For example, calculating the shareholder value in an operating activity or asset expenditure investment is done through various methods, such as discounted cash flow. However, this method ignores sustainability considerations entirely and does not reflect the other capitals besides the money needed to create value. There is also the assumption that investment in sustainable reporting technologies provides lower returns than alternatives and gains in other sustainable inputs (capitals) will not be well-received or valued by shareholders. Nevertheless, as there is increasing regulatory and investor sentiment on the sustainability of company operations, the viability of investment in the necessary methodologies to undertake sustainable budgeting will be increasingly attractive.

2.1 Long-Term Planning
A budget typically covers 12 months. Many organisations prepare longer-term plans. This section examines how the budgeting process fits the performance hierarchy. The first stage of long-term planning involves setting out the long-term, strategic objectives of the organisation (also called "corporate objectives" for a company). These objectives are often set out using a hierarchical structure, the performance hierarchy. A typical hierarchy of objectives is as follows:
MISSION -> STRATEGIC OBJECTIVES -> BUSINESS UNIT -> OBJECTIVES

2.2 Mission
An organisation's mission can be described as the reason for the organisation's existence. A typical mission statement may include the following items:
· Reason why the entity exists;
· Type of business - the products and services offered;
· Policies and standards of behaviour;
· Values and culture. Although most commercial organisations aim to maximise shareholders' wealth, a mission is usually stated in terms of the goal that generates that wealth.

2.3 Strategic Objectives
Whether an organisation is achieving its mission is often a matter of opinion, as it is not usually set out in quantifiable terms. Strategic objectives are more concrete and state what the organisation must do to achieve its mission. Strategic objectives are specific and quantifiable. Examples of strategic objectives for a company might be:
· To increase revenues by 10% per year.
· To increase dividends by 5% per year.

· To reduce global emissions of carbon gasses by 10% by 2030.

2.4 Unit Objectives Once objectives are set for the organisation, they may be set for each business unit. These should be consistent with the strategic objectives.

2.5 Setting Strategies
Having established the organisation's objectives, possibly using the performance hierarchy approach, organisations need to determine what actions to take to achieve those objectives. These strategies may be set out in a long-term plan.

2.6 Role of Budgeting in Long-Term Planning A budget is concerned with implementing the long-term plan for the budget period. The budget will be more detailed than the long-term plan, showing how the budget period will contribute to the long-term plan.

2.7 Master Budget
The master budget consolidates all other budgets. It is generally presented as a statement of profit or loss, a statement of financial position and a cash flow statement. Board approval of the master budget is part of the board's overall supervision of the business and its implementation of strategic goals. It helps ensure that the board ultimately has control over operations and expenditures. If the master budget is not approved, it will be returned to those responsible for preparing it. They will have to decide, in consultation with all those responsible at operational level for subsidiary budgets, where changes need to be made. This may be a time-consuming and challenging process as managers at the operational level may wish to avoid their budgets being cut. Other problems with the master budget include:
· A problem with any of the subsidiary budgets may have significant effects on the master budget.
· Even a minor amendment of the master budget may be complicated as it has to be processed through to the subsidiary budgets.

2.8 Functional Budgets Operational managers will be responsible for carrying out (and preparing if "bottom-up" budgeting is used - see s.3.2) functional budgets. Primary functional budgets include sales, production, materials, labour and capital. The primary budgets may be consolidations from individual cost centres (Chapter 2), profit centres or investment centres. Profit centre - a business segment where revenues are received and expenditures incurred. Investment centre - a profit centre which also has some control over its capital expenditure (investment in assets).
The preparation of functional budgets must be done in sequence, starting with identifying the principal budgeting factor (the main limiting factor), which is often sales demand. The sales, finished goods and production budgets may then be prepared, followed by the budgets for production resources and the overhead and cash budgets. This process means that data from one budget may be input for another. The individual functional budgets must be reviewed with each other to ensure they are consistent. A change in one budget (e.g. sales price and quantity) may require adjusting all the other budgets, which may be time-consuming.

3.1 Introduction

A number of different approaches to the preparation of budgets have evolved. It is important to understand these approaches and appreciate which would be appropriate for different types of organisations. The methods mentioned in the ACCA Study Guide are as follows:

· Top-down and bottom-up (s.3.2);
· Rolling budgets (s.3.3);
· Zero-based budgeting (s.3.4);
· Activity-based budgeting (s.3.5);
· Incremental (s.3.6); and
· Feed-forward control (s.3.7).

3.2 Top-Down v Bottom-Up Budgeting

An important factor in budgeting is how much participation managers enjoy in preparing their budgets. In some organisations, budgets are prepared centrally by the finance department, with the input of senior management. These budgets are then imposed on junior managers, who are expected to work towards operating their departments within budget. Other organisations allow a more participative approach. The managers of each department prepare the first draft of their budget, which is then discussed with senior managers. After some negotiation, changes may be made to the draft to ensure that the final budget meets the objectives of the whole organisation before it is approved.

Top-down budgeting - budgets are prepared by senior management.
Bottom-up (participative) budgeting - managers participate in preparing their department's budget.

In reality, the decision is not between choosing top-down or bottom-up, but deciding how much participation managers of responsibility centres should have in preparing their budgets. There are many different degrees of participation, for example:

· Managers prepare their own budgets or plans without senior management's intervention.
· Managers prepare the first draft, which senior managers then amend.
· Senior managers prepare the budgets after discussion with the managers responsible.
· Senior managers prepare the budget entirely, and the departmental managers have no input.

3.2.1 Factors to Consider

The following factors may be considered in deciding how much participation should be allowed:

· The attitudes of junior managers to their work. Some may be very proactive and want to participate in managing their department. If they are not allowed to participate, they will become disappointed and demotivated. Others may be less proactive and require detailed guidance from above (i.e. a top-down approach may be more appropriate).
· The skills of junior managers relating to budgeting. If their financial skills are weak, their participation may be limited.
· The amount of interdependence between departments. If departments rely on each other (e.g. services of one department are consumed by another), then more coordination of the budgeting process will be necessary. This will require some intervention by senior management.

· In periods of financial difficulty, when control of the resources and cash flows of the organisation is essential for survival, senior management should intervene.
· The amount of "local" knowledge of senior managers. In huge organisations, senior head-office management may have little understanding of local conditions "on the ground" (i.e. in the divisions or branches). In this case, local managers' participation in preparing their budgets is advisable.
The culture of the organisation is also a significant factor:
· In a "command and control" approach to management, everything is centrally planned, and all junior staff are told what they must do. Top-down budgeting is often a feature of such organisations.
· Other organisations may adopt a more delegated approach, giving managers autonomy. They will be given broad guidelines about what is expected but allowed to do the detailed planning without central intervention. Such organisations are more likely to adopt a participative approach.

3.2.2 Participation and the Objectives of Budgeting

Participation in the budget preparation process may help or hinder the objectives of budgeting:
· Planning: Budgets force managers to take time away from managing day-to-day operations to plan the future of their departments. The more involvement junior managers and staff have in the budgeting process, the more they will be forced to plan.
· Coordination: Coordination of the various departments in budgeting is easier if budgeting is performed centrally and there is less participation.
· Motivation: Managers are more likely to be motivated if they are involved in setting their budgets. Managers given responsibility for a department but not allowed to participate in their budgets may become demotivated.
· Evaluation of performance: If managers are evaluated on their performance against the budget, the budget must be set at an appropriate difficulty level. It should be challenging but realistic. If managers participate in preparing their budgets, there is a risk of budgetary slack. Budgetary slack - is the intentional underestimation of budgeted revenues or overestimation of budgeted costs to make budgets easier to achieve.

3.2.3 Advantages and Disadvantages

Quiz: Advantages
Suggest FOUR advantages of top-down budgeting and FOUR advantages of bottom-up budgeting

Answer:
Top-Down Budgeting
· Senior management have greater control of the budgetary process. The budgets will, therefore, reflect more accurately the corporate objectives and the long-term plan.
· Where managers prepare their own budgets, and are assessed on how they perform relative to these, there is a temptation for the managers to add "budgetary slack" (i.e. they overstate

budgeted expenses or understate budgeted revenues to make their budgets easier to achieve). Using top-down budgeting avoids this risk.

· Since budgets are prepared centrally, the activities of the various departments should be better coordinated

· It may be difficult for managers with little financial or accounting knowledge to prepare budgets for their own departments. Top-down budgeting means that these managers would not have to prepare their own budgets.

· The various budgets are more likely to be set at the same level of difficulty and would, therefore, be fairer than if bottom-up budgeting is used.

Bottom-Up Budgeting

· Managers are more likely to accept the budgeted targets for their departments and work towards achieving them if they have been involved in setting the budgets.

· Managers have a more detailed knowledge of the work which their departments do than senior management and, therefore, can produce more realistic budgets.

· Managers may feel more motivated if they are given greater autonomy and more responsibility for their departments. Giving managers greater autonomy would normally include giving them the right to participate in preparing their own budgets.

· At the end of the budget period, when managers' performance is being assessed, the managers cannot claim that the budget was unrealistic if they prepare the budget.

· Managers will better understand the financial objectives of the organisation if they are involved in budgeting. The budget process can therefore be regarded as a form of training to non- financial managers.

3.3 Rolling Budgets (Rolling Forecasts)

Rolling budget - a system of budgeting in which the budget is continuously updated.

In a rolling budget, the budget horizon (typically one year) is kept constant by adding another month (or quarter) to the end of the budgeted period as each month (or quarter) expires.

Example of Rolling Budgets

A budget is prepared for the year 20X2. At the end of January 20X2, the actual performance for January is compared against the budget. Based on this comparison, it may be decided that the budgets for 1 February to 31 December 20X2 should be changed to reflect changes in external factors. Once this has been done, a budget is also prepared for January 20X3. The new budget, therefore, covers 1 February 20X2 to 31 January 20X3.

3.3.1 Usefulness of Rolling Budgets

· The budget is continuously updated to reflect external changes, making it more relevant and valid for comparison against actual performance.

· There will always be a budget for the next 12 months. This can be useful for planning things such as cash flows.

· Managers will be more motivated as the budget is more realistic because it will be updated to take account of changes outside of their control.

3.3.2 Problems with Rolling Budgets

· The process is more time consuming as budgets have to be regularly updated and is also, therefore, more costly.

· Budgets may be changed to hide operational inefficiencies.

3.3.3 Appropriateness of Rolling Budgets

Rolling budgets are likely to be more appropriate in industries which are dynamic, where external changes can lead to the original budget quickly becoming out of date. In stable industries, little benefit may be obtained by continuously updating the budget, making a rolling budget less useful.

Quiz: Rolling Budgets

For organisations in each of the following industries, discuss whether rolling budgets would be appropriate:

· A food retailer

· A developer of handheld computer devices and mobile phones

· An airline

· An advertising agency

· A retail bank

Answer:

Food Retailer:

Food retailing is a stable business. Few unexpected external changes are likely to occur. Therefore, little benefit would be gained by continuously updating budgets, so rolling budgets are unlikely to be used.

Manufacturer of Mobile Computer Devices and Mobile Phones:

This industry is very dynamic as new products are constantly being developed. As competitors introduce new products, this may well change demand for the companies' own products. It also may affect whether existing development projects are accelerated, scrapped or changed. Accordingly, rolling budgets may be useful in this type of business.

Airlines:

Airlines are also subject to many external factors. Fuel typically accounts for 50% of the total costs of many airlines, so changes in the market price of oil will affect profits. Economic factors heavily affect demand, because travel is a "discretionary" activity for many people. Accordingly, rolling budgets may be useful, as otherwise budgets quickly could become out of date.

Advertising Agencies:

Budgeting is likely to be very difficult in advertising agencies. Revenues may vary significantly from month to month depending on whether clients decide to spend on campaigns. Accordingly, rolling forecasts could be useful.

Retail Banking:

As retail banking is a fairly stable business, there is little benefit may be gained from using rolling budgets.

Example of Rolling Budgets

Computation Company A has computed a 2-quarter rolling budget for the costs of one of its outlets:

Quarter	1	2
	$	S
Rental	4000	4000
Labour	3000	3000
Materials	4000	4000
Overheads	1000	1000
Total	12000	12000

The following events have occurred:

1. The landlord has raised the rental from Quarter 3 onwards by 10%, and Company A has accepted the revised rental agreement.
2. A new labour regulation has increased the minimum wage by $100 monthly for workers earning minimum wage from Quarter 2 onwards. This outlet has 3 of these workers.
3. The company has managed to secure a new materials supply that is 15% cheaper than previously. The outlet will receive this new supply in Quarter 3. The quantity of production and sales is the same for all three quarters.

At the end of Quarter 1, Company A will roll the budget into a new 2-quarter period (Quarter 3 and 4), with adjustments as shown:

Quarter	1 (ended)	2 (adjusted)	3 (new)
	S	S	S
Rental	4000	4000	4400 (+10%)
Labour	3000	3900 (+900)	3900
Materials	4000	4000	3400 (+15%)
Overheads	4000	1000	1000
Total	12000	12900	12700

Quiz: Rolling Budgets

Homeland Airways uses rolling forecasts. At the start of the year, the following quarterly budget was prepared:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
	$m	$m	$m	$m
Revenue	200	230	400	170
Costs:				
Fuel	70	81	120	60
Labour	60	65	70	60
Other	20	23	40	17
Profit	50	61	170	33

It is now the end of Quarter 1, and the company wishes to update the budget as follows:

1. Due to a rise in the world price of oil, budgeted fuel costs for Quarters 2, 3 and 4 should increase to 120% of the amount shown in the original budget.

2. The original budget was based on the assumption that an increase in staff costs of 10% would be negotiated with the unions. In that event, a pay rise of only 5% was agreed.

3. There is no change in budgeted revenues or other costs.

4. Quarter 1 of the following year should be based on the assumption that all items are 10% higher than budgeted for Quarter 1 of the current year, except fuel, which should be 44% higher.

Required: Prepare the rolling budget for the four quarters starting with Quarter 2 of the current year.

Answer:

	Quarter 2	Quarter 3	Quarter 4	Quarter 1
	$m	$m	$m	$m
Revenue	230	400	170	220
Costs:				
Fuel	97	144	72	101
Labour	62	67	57	66
Other	23	40	17	22
Profit	48	149	24	31

Notes:

1. Fuel for Q2 to Q4 is the original budget amount multiplied by 1.2.

2. Staff costs are calculated by multiplying the original budget amounts by 110

3.4 Incremental Budgeting

3.4.1 Use of Historical Data An incremental budget is prepared based on the previous period's budget or actual performance, with incremental amounts added for the new budget period. These increments will include adjustments for inflation and planned increases in sales prices and costs. As the allocation of resources is based on the previous period's figures, it is not generally recommended as it fails to consider changing circumstances. Also, it encourages a "spend it or lose" mentality, as spending the budget is likely to ensure a reasonable allocation in the next period.

Example of Incremental Budgeting in a School

A school has budgeted $1.5 million for staff salaries this year. When preparing the budget for the next year, the head teacher estimates:

· Two new members of staff will be needed to teach languages, with a salary of $30,000 each (before any pay rises);

· All staff members will be awarded a pay increase of 5% in line with inflation.

The budget for staff will then be $1.638 million [($1.5m + $30k + $30k) * 1.05], an overall increase of 9.2%.

Although this approach is quick and easy, it accepts without questioning the $1.5 million salaries included in the calculation; it does not challenge the starting point.

3.4.2 Usefulness of Incremental Budgeting

· This approach may be appropriate for a stable business with good cost control.
· Managers need only justify the increments.
· The system is relatively simple to operate and easy to understand.
· Conflicts should be avoided if departments can be seen to be treated similarly.
· Coordination between budgets is easier to achieve, as increments in functional budgets are easily aggregated into master budgets.
· The effect of change can be seen quickly.

3.4.3 Problems with Incremental Budgeting
· Assumes activities and methods of working will continue in the same way regardless of whether they are needed.
· It gives no incentive for developing new ways of working (e.g. to increase efficiency) or the reduction of costs.
· It encourages a "spend it or lose" mentality so that the budget is maintained next year.
· The budget may become out of date and no longer relate to the level of activity or type of work being carried out.
· The priority for resources may have changed since the budgets were set originally.
· Any budgetary slack in a previous budget is not reviewed. It is also easier to add and justify budgetary slack to make achieving budgets easier.
· When a budgeting system has been in operation for some time, there is a tendency for the following year's budget to be justified by referencing the levels currently being achieved. However, the analysis process should consider all changes affecting the organisation's future activities.
· Even using such an analytical base, some organisations find that historical comparisons, particularly the current resource constraints, can inhibit innovative budget changes. This can severely handicap an organisation because the budget should be the first year of the long-term strategic plan. If changes are not started in the budget period, it will be more difficult for the organisation to make the progress necessary to achieve long-term objectives.

3.5 Zero-Based Budgeting (ZBB)
3.5.1 Weakness of Incremental Budgeting One way of breaking out of the cyclical budgeting problems associated with incremental budgeting is to go back to basics and develop the budget from an assumption of no existing resources (i.e. a "zero base"). Using this basis, all resources must be justified, and the chosen way of achieving any specified objectives must be compared with the alternatives. For example, in considering budgeted sales, an optimum means of achieving the sales objectives in a particular market for a specific product or service may be developed without considering the costs and structure of the current sales department. The company must then plan how to implement this new strategy.

3.5.2 Features of ZBB Traditional budgets are typically produced using a "line item" approach, which lists each type of expense (e.g. staff costs, depreciation, etc.) and the amount budgeted by each department. ZBB focuses on the activities or programmes each department would like to undertake. It considers questions such as:
· Is the activity necessary?

· What happens if the activity ceases?
· Is the current level of provision adequate?
· What other ways are there of carrying out the activity?
· How much should the activity cost?
· Do the benefits gained from the activity at least match the costs?
These questions are primarily answered by breaking the budgetary process down into the three distinct stages of the ZBB approach: 1. Each manager identifies activities or programmes to undertake in the budgeted period. A "decision package" (like a "mini-budget") is then prepared for each activity that analyses how much will need to be spent. There also may be some narrative explaining the benefits of the package and quantifying any revenues (or cost savings) if appropriate. 2. A budget committee reviews and ranks all the decision packages (in decreasing order of benefits). Management accepts each package up to the point at which the total budgeted expenditure is reached. 3. Resources are allocated to the activities selected in Step 2. The budget is then a consolidation of all the accepted packages.

3.5.3 Decision Package

A decision package is produced for each activity the managers wish to undertake in the following year. For example, a large accountancy firm's decision package might relate to "ACCA training". A package may be broken down into:
· a "base level" package specifying the minimum level of service that would be required; and
· Incremental packages with additional expenditure.
A base package for ACCA training might include exam registration and study materials. An incremental package could include training courses. Then, when ranking packages, the budget committee can decide whether to accept just the base package or provide additional funds for the incremental package. Decision packages also may be mutually exclusive (i.e. two or more packages are alternative approaches to the same problem). For example, one package may be for making a component in-house and another for outsourcing. It would not make sense for the budget committee to select both packages.

3.5.4 Benefits of ZBB

The benefits of ZBB are substantial. (They have to be; otherwise, no organisation would implement it.)
· It forces budget setters to re-evaluate every activity. Obsolete activities are removed. Wastage and budget slack should be eliminated.
· Allocation of resources is linked to results and needs.
· It develops a questioning attitude and encourages managers to look for alternatives.
· It encourages a bottom-up approach to budgeting. This should boost the motivation of employees.
· It prevents "budget creep" (based on previous year's figures with a percentage add-on) associated with other budgeting techniques.

3.5.5 Drawbacks of ZBB

· Departmental managers may not have the necessary skills to construct decision packages. They will need training, which requires time and money.

· In a large organisation, the number of activities will be so large that the amount of paperwork generated from ZBB will be unmanageable.

· Ranking the packages can be difficult since many activities cannot be compared based purely on quantitative measures. Qualitative factors need to be incorporated, but this is difficult.

· Top-level management may not have the time or knowledge to rank thousands of packages. This problem can be partly overcome by having each manager level rank the packages of the managers who report to them.

· It is a complex and time-consuming process. Therefore, the complete process may be carried out only every five years (say). An alternative approach is to look in-depth at one area of the business each year on a rolling basis so that each area prepares a ZBB every five years.

· Since decisions are made at budget time, managers may feel unable to react to changes during the year. This could harm the business if it fails to respond to emerging opportunities and threats.

· The organisation's management information systems might be unable to provide the necessary information.

· As the budgeting cycle is annual, short-term goals may be prioritised instead of long-term objectives.

3.5.6 When ZBB Is Appropriate

Discretionary cost - a capital or revenue expense that can be curtailed, eliminated or postponed without affecting short-term profitability.

ZBB is most appropriate in organisations that have a high portion of discretionary costs (e.g. research and development, training and advertising). Expenditure on such items may be reduced without the organisation ceasing to function; however, such expenditure does bring benefits. ZBB enables organisations to reassess how much they spend on such discretionary items. Organisations with relatively low discretionary expenditure would not gain as much from introducing ZBB.

3.5.7 Use of ZBB in the Public Sector The use of ZBB is more prevalent in public sector bodies due to the following factors:

· Showing a budget based on activities rather than line items is more transparent. A budget that shows the total amount spent on employee costs does not provide useful information to taxpayers. However, if the budget shows the amount to be spent building a new motorway, taxpayers can appreciate where their taxes are being spent.

· The ranking of decision packages can be beneficial in allocating limited public sector resources, where governments face demands for funds from numerous programmes. Ranking helps ensure that taxpayers' money is spent where it will best meet the government's objectives.

· A large proportion of expenditure, but not all, will be discretionary. This means that a mixed approach might be taken to budgeting, where some allocations will be budgeted using an incremental approach and some using a ZBB approach.

Example of ZBB in a School

As part of preparing its annual budgets, a school needs to decide how it will provide for or facilitate school lunches. The school's catering manager considers three options:

Option 1: Provide an area where pupils can eat their own packed lunches, with the school also offering sandwiches and other food and drinks, prepared and sold by catering staff.
Option 2: Provide a self-service cafeteria with hot and cold food and drinks available.
Option 3: Provide a complete, hot food, catered service.
The base level of service would be option 1, with options 2 and 3 the higher level service options. Alternatively, the school may consider two mutually exclusive decision packages:
1. Provide a service internally; or
2. Outsource the whole catering activity to an external provider.
The catering manager may produce a cost-benefit analysis at this stage to establish the costs and benefits of different options and packages. The ultimate decision is likely to rest with the headteacher and/or the school finance officer, the person who has budgetary responsibility for the whole school. This person will consider the catering budget alongside other school budgets.

3.6 Activity-Based Budgeting (ABB)
3.6.1 Principles of ABB
Most budgeting techniques assume that costs vary with the level of output. However, the costs of support activities do not necessarily depend on the number of units produced or sold (see Chapter 2). For these types of costs, a more sophisticated budgeting approach is appropriate. Activity-based budgeting (ABB) follows activity-based costing (ABC) principles, identifying cost drivers to determine budgeted costs. Having decided how many units to produce and sell, the organisation needs to define the cost of the required activities. These depend on the drivers identified for each activity.

3.6.2 Preparation of AB Budgets Preparing activity-based budgets is rather like performing ABC in reverse. The following steps are used: 1. Estimate the budgeted volume of sales and production in units. 2. For each activity (e.g., machine set-up), estimate the number of driver units required to support the budgeted sales and production volume (e.g., the number of production runs). 3. Determine the cost of each unit of driver. This may require an analysis of factors such as labour time required, labour cost per unit, etc. 4. Calculate the budgeted cost of each activity (number of drivers * cost per unit of driver).

Quiz: Activity-Based Budgeting ABC Co produces food for farm animals. It makes three ranges of food: poultry, cattle and sheep. The food is produced and sold in metric tonnes to agricultural wholesalers. The company is preparing its budgets for the next financial year and wishes to use an activity-based approach to budgeting for its overheads. Direct costs per tonne are as follows:

	Poultry	Cattle	Sheep
Materials	$500	$700	$850
Labour cost	$120	$140	$800
Weekly production	1,000	750	900

The company uses ABC and has identified the following support activities for which overhead costs are incurred:

| Activity | Driver |
| Machine set-ups | Number of production runs |

| Ordering materials | Number of orders | |
| Storage | Tonne days of storage | |

The expected number of drivers that will be used each week by each of the three products is shown as follows:

	Poultry	Cattle	Sheep
Production runs	8	15	9
Purchase orders	20	25	30
Tonne days of storage	14	18	36

The management accountant has already calculated the cost per unit of driver for the machine set-ups and storage as follows: Cost per unit of driver $500 per production run $10 per tonne day Hide

Activity	Cost per unit of driver
Machine set-ups	$500 per production run
Storage	$10 per tonne day

Unfortunately, the management accountant quit at the end of the last month, and you have been asked to complete the budget. You have discovered the following information about the purchase order process:

1. Each order takes 30 minutes to process (on average). The cost of employing clerical staff is $10 per hour. Clerical staff would work a minimum of 40 hours per week.
2. Office supplies cost $180 per clerk per week.
3. Each clerk would require a desktop computer. The cost of providing the computer is estimated at $20 per week.

Required: a. Calculate the cost per purchase order based on the information provided. b. Prepare the weekly budgeted costs, showing the total budgeted cost of each activity separately.

Answer:
a. Cost per purchase order

	$
Clerical staff costs (one member of staff)	400
Office supplies	180
Computer (one clerk)	20
Total weekly cost	600
Number of purchase orders	75
Cost per order	8

b. Weekly budgeted costs

	$	$
Materials (500 * 1,000) + (700 * 750) + (850 * 900)		1,790,000
Direct labour (120 * 1,000) + (140 * 750) + (800 * 900)		945,000
Total direct costs		2,735,000
Indirect costs:		
Machine set-ups (500 * (8 + 15 + 9))	16,000	
Purchase orders (8 * (20 + 25 + 30))	600	

Storage costs (10 * (14 + 18 + 36))	680	
Total indirect costs		17,280
Total costs		2,752,280

3.6.3 Advantages of ABB
· Management attention is focused on the activities of the organisation. These are something that management can control more easily than focusing on total costs.
· A better understanding of what causes costs to be incurred may provide opportunities for cost reductions.
· May identify "non-value adding" activities which can be eliminated.

3.6.4 Disadvantages of ABB
· It is complicated and expensive to implement as it requires detailed analysis of overheads and measuring of activities. If direct costs are more significant than indirect costs and the product range is narrow, the costs of switching to ABB are likely to outweigh the benefits.
· As many fixed costs do not vary with changes in the volume of drivers in the short run, ABB may provide misleading information.

3.6.5 Appropriateness of ABB
ABB is a complex method. It will likely be used only in large companies with the resources to implement such an approach. It is most appropriate in these situations:
· The organisation has high overheads.
· There are many different activities (drivers) to which the overheads relate.
· The organisation has many products with differing production times and methods.
See Chapter 10 for an example of preparing an activity-based budget.

3.7 Feedback and Feed-Forward Control
3.7.1 Feedback Control A feedback control system is a system in which outputs are monitored against a predetermined standard. Action is taken to remedy any deviations. The feedback is the information concerning the difference between the actual output and the desired output. A budgetary control system is an example of a feedback control system. For each period, the actual results are compared against the budget. If the budget is not achieved, action can be taken to correct the factor that caused the budget to be missed.

3.7.2 Closed-Loop System A closed-loop system is any system with feedback. Reliance on feedback makes such systems reactive rather than proactive.
· Standard: What the system aims for (e.g. the budget).
· Sensor: Measures the system's output (i.e. accumulation of actual data).
· Comparator: Compares the information from the sensor to the standard (e.g. variance analysis).
· Effector: Control action (e.g. management action to minimise future adverse variances and repeat favourable variances).

3.7.3 Open-Loop System
An open-loop system is a system without feedback. There are two reasons for the absence of feedback: 1. Feedback is not produced (e.g. variance analysis not undertaken). 2. Feedback is produced but not used appropriately (e.g. variances are not communicated to the appropriate manager)

3.7.4 Positive and Negative Feedback
Positive feedback means that the output has achieved or even exceeded the plan. Negative feedback means the output is below the plan (e.g. actual profits are below budget for a particular period). The cause of negative feedback should be investigated so that corrective action can be taken to reduce the likelihood of repetition in the future. Positive results (e.g. favourable variances) should also be investigated to determine whether they can be repeated. However, care must be taken here (e.g. a favourable sales price variance might reduce profits if demand is sensitive to price changes).

3.7.5 Feed-Forward Control
The major problem with feedback control systems is that by the time the feedback is received, it is too late to take action to correct the deviation for the period under review. For example, if actual costs are higher than budgeted, action can be taken to stop the same deviation from occurring in future periods. The current period, however, is already history, and no action can be taken to change that. In feed-forward control systems, predicted future results are compared against the desired outcome. If it appears that the desired result will not be achieved based on the current prediction, action can be taken now so that it is achieved.

Key Point
Target costing (see Chapter 3) is an example of feed-forward control. The expected cost per unit is compared with the desired cost per unit, and action is taken to eliminate the gap.

Example of Feed-Forward Control
Alpha operates in a business not subject to seasonal variations in demand or costs. The company has budgeted to make a profit of $10 million for the current financial year, which ends on 31 December. On 30 June, profits for the year's first half are $4 million. Based on this, the directors forecast that profits for the year will be only $8 million, not $10 million unless some action is taken. Because this information is available halfway through the year, the directors can take action to remedy the situation to try to achieve the budgeted profit figure of $10 million for the year. The forecast profit of $8 million is, therefore, feed-forward.

4.1 Aspects of Information Quality
In considering the sources of information for use in budgetary systems, attention should be paid to aspects of the quality of information. These may be summarised as "ACCURATE".

Aspect	Meaning	Considerations
Accurate	Fair, free from bias, truthful, with sufficient focus and precision.	Quality of source, level of detail, precision, quantitative accuracy, references.

Complete	It contains all the necessary information, with no material details missing. Details, coverage, references, scope.
Cost-effective	The benefit of information is higher than the cost of producing it. Costs of obtaining, processing and communicating information.
User-focused	Tailored to information users" needs. Format, templates, style, permissions, logical flow, level of detail.
Relevant	Information is useable for actions (control, decision-making) Source, context, user, timing.
Authoritative	Trustworthiness of information Source, provenance, transparency, processing.
Timeliness	It is clear when the information was produced. Date, time, possible obsolescence, and alternative sources available.
Easy to use	Easy to understand and prioritise Format, template, language, syntax, use of jargon, typology, graphics.

4.2 Sources of Data and Information

Data and information come from multiple sources - both internal (inside the business) and external. Businesses need to capture and use information which is relevant and reliable. This was discussed in detail in Chapter 1.

4.2.1 Internal Sources Accounting records are a primary source. They detail past transactions which may be used as the basis for planning (e.g. preparing a financial budget or forecast). They are primarily used to record what has happened to the financial resources of a business. For example, how cash has been obtained and spent, what assets Accounting records also provide non-financial information. For example, documented reasons for raising debit notes to suppliers or credit notes to customers can provide useful information about the quality of materials purchased/finished goods sold. Data analysed from sales invoices give a profile of which products, to whom and in which markets sales are being made. Much internal information is related to the accounting system but not a direct part of it. For example:

· Employee records (personal details, wage rates or salary, skills and experience, training records);
· Costings for tenders for contracts;
· Production department data (e.g. number of machines, operating capacity, repairs and maintenance records);
· Records of direct contact with customers (e.g. complaint letters, calls received by a customer service centre).

Not all internal information is provided formally. For example, relevant and reliable information may be communicated through regular meetings without formal documentation.

4.2.2 External Sources

External sources provide information about how business activities must be undertaken. For example:

· Businesses must keep records to collect taxes on behalf of the government, and so need regular and up-to-date information about the taxation system (e.g. VAT, corporate profits tax) and what actions need to be taken (e.g. returns submitted, payments made).

· Businesses need to be aware of laws that affect their activities (e.g. environmental legislation, health and safety regulations, labour law).
"Market" or "competitive intelligence" (i.e. information about the markets in which a business operates) may be obtained through market research.

5.1 Traditional Approaches to Budgeting
The traditional approach to budgeting uses an incremental approach. Changes to budgetary systems are likely to occur when organisations move away from traditional approaches to budgeting to more sophisticated methods (e.g. ZBB or ABB).

5.2 Difficulties
In changing the approach to budgeting, organisations are likely to encounter the following obstacles:
· Resistance to change - employees who do not appreciate the value of change may be reluctant to help, especially if it requires additional work.
· Scepticism - particularly at senior management levels. Managers who do not understand the benefit of the change may not give their full support.
· Training everyone involved in the process of change. New methods will require an investment in training so that all those involved will be competent to perform the new types of budgets.
· Additional time and costs involved in moving to a new system, including for consultants and staff overtime.

6.1 Forecasting
 budget is effectively a forecast of what can be achieved. The forecast has to make assumptions about the external environment. The following are some of the factors that may cause uncertainty in the budget-setting process:
· The overall economic performance of the markets in which the business sells. Economic growth may lead to increased demand for products or services.
· Actions of competitors. A competitor's launch of a great new product may reduce demand considerably.
· Performance of employees. It may be difficult to estimate how productive employees will be and how many employees will actually be required.
· Market prices of inputs. The prices of many commodities (e.g. metals and oil) are determined by highly developed international markets and can be very volatile.
· Demand for new products will be uncertain. Popularity will not be known until the products have been launched. However, this uncertainty can be reduced through market research.
The following methods can be used to deal with uncertainty:
· Flexed or flexible budgets;
· Rolling budgets; and
· Revision of the budgets at the end of the period before comparing with actual results.

6.2 Flexible Budgets
Flexible budgeting involves preparing two or more budgets, using different assumptions for each about the level of sales or production. At the end of the financial period, the budget would

be flexed to the actual activity level for comparison to actual performance. To prepare budgets at different activities levels requires an understanding of cost behaviour (i.e. fixed, variable and stepped).

Total cost is expressed as a linear equation: Total cost = Fixed cost + (Variable cost x Activity level)

Techniques that may be required to calculate costs include:

· High-low method; and

· Learning curve. (See Chapter 10 for quantitative analysis in budgeting.)

6.2.1 Advantages of Flexible Budgets

The requirement to prepare more than fixed budget means that:

· Managers are required to consider a range of forecasts;

· Actual results can be compared more meaningfully against the budget for the closest level of activity.

6.2.2 Disadvantages of Flexible Budgets

· Difficulty in separating fixed and variable elements of indirect costs (overheads).

· Cost may not behave as assumed (e.g. linearly or as predicted by a learning curve).

6.3 Flexed Budgets

At the end of the year, prior to comparing the actual figures against the budget, the budgets are re- calculated (flexed) using the original budget assumptions, but the actual activity levels. This means that the comparison is more valid. Fixed costs may also be flexed if different activity levels result in changes to fixed costs (such as in the case of stepped fixed costs).

Quiz: Flexed Production Cost

Corfe Co manufactures computer laptop batteries and it has developed a new battery which has a longer usage time than batteries currently available in laptops. The selling price of the battery is forecast to be $45. The maximum production capacity of Corfe Co's factory is 262,500 units. The management accountant has prepared an annual flexible budget as follows:

Production (units)	185,000	200,000	225,000
	$	$	$
Material costs	740,000	800,000	900,000
Labour costs	1,017,500	1,100,000	1,237,500
Fixed costs	750,000	750,000	750,000

In addition to the above costs, the management accountant estimates that for each increment of 50,000 units produced, one supervisor will need to be employed. A supervisor's annual salary is $35,000.

Required: Calculate the flexed total production cost for production at 80% of maximum capacity.

Answer:

An 80% activity level is 210,000 units (80% * 262,500) which is closest to 200,000 of the levels budgeted.

Material and labour are both variable costs. The unit variable costs are the same at all levels: Material is $4 per unit (e.g. $800,000/200,000) and labour is $5.50 per unit (e.g. $1.1m/200,000), so total variable cost per unit is $9.50.
Therefore:

	$000	
Total variable costs($9.50 * 210,000 units)	1,995	
Fixed costs	750	
Supervision (5 x $35,000)	175	
Total	2,920	

Quiz: Flexed Budgets
A company has obtained the following information regarding costs and revenue for the past financial year:

Sales	10,000 units
Production	12,000 units

Standard cost per unit:

	$
Direct materials	5
Direct labour	9
Fixed production overheads	8
	22
Standard selling price.	30

Actual results:

Sales	9,750 units
Revenue	$325,000
Production	11,000 units
Material cost	$65,000
Labour cost	$100,000
Fixed production overheads	$95,000

Require: Produce a flexed budget statement showing the flexed budget and actual results. Calculate the total variances (differences) between the actual and flexed figures for the following:
· sales;
· materials;
· labour; and
· fixed production overheads.

Answer:

	Flexed budget	Actual results	Variances
Sales - units	9,750	9.750	

Production - units	11,000	11,000		

		$000	$000	$000	Adverse/favourable
Sales price (30 * 9,750)		292.5	325	32.5	favourable
Cost of sales					
Opening inventory		0	0		
Production costs:					
Materials (5 * 11,000)		55	65	10	adverse
Labour (9 * 11,000)		99	100	1	adverse
Fixed production overheads(8 * 12,000)		96	95	1	favourable
Total production costs		250	260	10	adverse
Closing inventory (22 * (11,000-9,750))		(27.5)	(27.5)		
Total cost of sales		222.5	232.5		
Profit		70	92.5	22.5	favourable

7.1 Factors Which Influence Behaviour

In many organisations, managers are at least partly evaluated on how they perform compared to the budget. The budget is, therefore, likely to influence the behaviour of those managers. The budget is hoped to motivate managers to achieve higher organisational profits. Several factors will affect this.

7.2 Hopwood's Management Styles

One of the first management writers to consider the effect of budgets on behaviour was Hopwood, who carried out a survey of budgeting practices during the 1970s to identify how budgets influenced the behaviour of managers. He identified three different management styles in the companies he visited: budget constrained, profit conscious and non-accounting.

7.2.1 Budget-Constrained Style

Managers are evaluated on their ability to meet budgets in the short term. Failure to meet budgets means that managers will have poor evaluations, even if there was a good reason for exceeding the budget.

7.2.2 Profit-Conscious Style

In the profit-conscious company, managers are judged more on their ability to contribute to long-term success rather than simply meeting the budget. Budgets are used, but are applied more flexibly. For example, if the budget was not reached, but there was a good reason for this, the manager would not be penalised.

7.2.3 Non-accounting Style

Accounting data is not important for performance evaluation. Qualitative factors are seen as more important (e.g. customer satisfaction). The following table summarises the effect of these styles on the behaviour of managers:

	Budget- constrained	Profit- conscious	Non- accounting
Involvement with costs	High	High	Low

Job-related tension	High	Medium	Medium	
Manipulation of data	Extensive	Little	Little	
Relationships with superiors and colleagues	Poor	Good	Good	

7.3 Setting the Level of Difficulty of the Budget
Research has shown that:
· Targets can be used to motivate employees;
· If individuals have higher levels of intended achievement, their actual achievement rises.
But if targets are too easy to achieve (e.g. basic standards), individuals will not be motivated to improve performance. On the other hand, targets which are too difficult (e.g. ideal standards) can be demotivating. Research suggests that targets which are just out of reach are optimal for motivation (e.g. just above the current standard). This is only a general rule. The optimal target may be different from individual to individual. Note that an adverse variance may be produced even though performance has been maximised. Care must be taken to ensure that the budget holder does not react adversely to this. A solution to the adverse variance might be to use a lower standard for performance evaluation.

7.4 Benefits and Difficulties of Employee Participation
The benefits of bottom-up budgeting, whereby managers or employees participate in the setting of their budgets, have already been discussed in this chapter. The same benefits apply to setting other performance targets.
7.4.1 Benefits of Employee Participation
· Employees are more likely to accept and work towards targets they have been involved in setting.
· Employees will be more motivated if they are given more autonomy.
· The targets should be realistic, as employees would not agree to targets which are not.
7.4.2 Potential Problems of Employee Participation
· Employees may try to set targets which are too easy. In budgets, they may add "slack" to the budgets. Budgetary slack means adding expenses to the budget in excess of what is really needed.
· Setting the targets is likely to be more time consuming if employees are involved.
· Setting of targets may not be fair, given that some employees will be better negotiators than others and will, therefore, be able to negotiate lower targets.

8.1 Criticisms of Traditional Budgeting
For many years there has been much criticism of the traditional budgetary processes. Hope and Fraser detail these criticisms in their book Beyond Budgeting. This looks at the problems inherent in the traditional budgeting process, and suggests an alternative approach to performance management, the "Beyond Budgeting" model. In discussing budgets, Hope and Fraser use a broader definition of budgeting than simply producing a financial plan. They mean the whole performance measurement process of agreeing on the targets, setting reward schemes based on achieving those targets, using budgets to allocate resources, and controlling performance based on this process. They refer to this as the "fixed performance contract". The main criticisms of this budgeting model as described by Hope and Fraser are as follows:

8.1.1 Budgets Take Up Too Much Time The budgeting process takes up too much of the time of senior management, and does not add sufficient value to the organisation to justify this.

8.1.2 Traditional Budgeting is Irrelevant in the Modern Business Environment In the more competitive environments that have existed since the 1980s, businesses must react quickly to customer needs. This requires transferring power from the centre to managers who are closer to the customers. The old "command and control" structure of organisations represented by traditional budgeting process has become outdated. The primary drivers of shareholder value in the modern business world are intellectual capital such as brands, loyal customers and proven management teams. These are outside of the orbit of the budgetary control system.

8.1.3 Dysfunctional Behaviour Budgets were initially introduced as a planning tool for managing costs and cash flows. However, over time budgets also came to be used as performance management tools for managing the business. The "fixed performance contract" was introduced, as follows:
· A fixed target - usually expressed in terms of budgeted sales, costs, profits and ratios such as return on capital employed.
· Incentives were introduced based on achieving these targets, such as bonuses and promotions for achieving the budgets.
· Resources are allocated to departments based on the budget.
This system sounds good in theory, but in practice it can lead to an annual "performance trap" whereby the actions of all managers are focused on meeting the performance targets of the current year. This may lead to dysfunctional behaviour, or gaming. Gaming means manipulating a system to achieve some advantage (e.g. building slack into budgets). During their research, Hope and Fraser encountered the following examples of gaming:
· Managers negotiate the lowest targets and the highest rewards.
· Always make the bonus whatever it takes (e.g. by "window dressing"). For example, ensuring that sales targets are met by making sales on a "sale or return" basis at the end of the financial year to a friend. The following year the goods are returned.
· Never put the customer above the sales targets.
· Never share knowledge or resources with other teams.
· Ask for more resources than you need. You will be cut back to what you actually need.
· Always spend what's in the budget or you will lose it.
· Always be able to explain adverse variances on causes beyond your control.
· Never provide accurate forecasts - hide bad news or you will be expected to compensate.
· Always meet the numbers, never beat them. · Never take risks.

8.2 Beyond Budgeting Model
Beyond Budgeting - a set of guiding principles to enable an organisation to manage its performance and decentralise its decision-making process without the need for traditional budgets.
Hope and Fraser suggest that the traditional budgetary control process should be replaced by the following system:

· Replace financial targets with targets based onkey performance indicators (KPIs) and use "stretch goals" for planning that are not linked to reward schemes.
· Appraise managers using comparisons with peers and benchmarks and reward them accordingly.
· Devolve responsibility for planning away from the centre.
· Manage resources to be available for worthwhile opportunities.
· Use rolling forecasts, performance league tables and other KPIs to measure and control performance rather than just relying on comparison of actual performance against the budget.

8.2.1 Setting Targets

Stretch goal - a goal that requires an organisation or person to push themselves to their limits. Where managers rewards are linked to achieving fixed financial targets, managers negotiate the lowest targets. This means that the organisation does not achieve its potential. Beyond budgeting encourages managers to set challenging targets or "stretch goals" that cannot be achieved by making small improvements to existing performance.
· Managers are asked what their department could achieve if it aimed to maximise performance over the short to medium term.
· Since their rewards will not depend on achieving these targets, managers will not have an incentive to simply negotiate easy targets. Raising targets encourages maximum profit potential.
· Setting targets based on Key Performance Indicators (KPIs; measures tied to critical success factors) is quicker than setting detailed financial budgets, therefore reducing the time spent on budgeting.
· Targets set are more aligned with the strategy of the organisation than financial targets.

8.2.2 Rewarding People

In traditional budgeting, fixed targets are set at the start of the year and managers are rewarded if they achieve those targets, regardless of any external changes in the environment. This leads to manipulation of data and gaming - an attitude of "make the target whatever it takes".
· Beyond budgeting uses relative targets (e.g. how managers perform compared to peers) or benchmarks (e.g. profits compared to competitors or market share).
· Targets are therefore more relevant and realistic, unlike internally set targets.
· Targets are also fairer, as they take into account changes in the external environment automatically; if the economy is not doing well in a particular year, the competitor's profits will also be lower. This helps to eliminate gaming as managers now see that the targets are fair.

8.2.3 Action Planning

In traditional budgeting, budgets are often prepared at the start of the year using top-down methods. These fix the behaviour that is expected of the managers. The problem is that in a dynamic business environment, organisations need to be able to react quickly to changes (e.g. to customer demand). The traditional budget limits such reaction. ·
· In the beyond budgeting model, business unit managers and front-line staff develop their own plans for maximising customer satisfaction and shareholder wealth.
· The role of senior management is to provide higher-level targets and to challenge the plans produced by business unit managers.

· Unit managers will typically prepare medium-term goals on an annual basis and short-term goals on a quarterly basis. They can therefore respond to changing demand and anticipate business threats and opportunities. This continuous and open process allows teams to create value.

8.2.4 Managing Resources In traditional budgeting, budgets decide how resources should be allocated to each department. If new projects become available that were not envisaged when the budget was prepared, funds may not be made available for them. This may lead to good business opportunities being missed.

· In the beyond budgeting model, resource decisions are devolved to front-line teams, making them more responsive. Managers are more accountable; there is greater ownership and less waste.

· Funds are allocated to projects based on a "fast track" review process (i.e. if front-line teams need additional resources, they will be approved if they meet agreed criteria).

8.2.5 Coordinating Actions

In traditional budgeting, the budgets of all departments are coordinated. According to Hope and Fraser, although the departments may be coordinated with each other, they are not aligned with the strategy of the organisation. An additional problem is that it is not enough to perform this coordination once every year.

· In beyond budgeting, coordination occurs through cross-company interaction.

· Service level agreements between the different departments are used to coordinate their activities. Under such agreements one department commits to providing goods or services to another, based on expected demand, covering an appropriate time frame.

· Operating capacity rises and falls according to demand, rather than to meet a predetermined budget. Production is more flexible and there is less waste as fewer items are made for inventory.

8.2.6 Controlling Performance

In traditional budgeting systems, control is exercised by comparing actual performance against budget and asking managers to explain any variances. Corrective action is then taken to bring actual performance back into line with the budget. This leads to too much focus on the short term, according to Hope and Fraser. Few organisations focus beyond the end of the current financial year.

· Beyond budgeting model uses a more diverse range of forward-looking indicators to manage performance. There is a greater focus on trends and forecasts.

· Extensive use of rolling forecasts and leading indicators provide managers with a view of what will happen in the future.

· There is also greater use of comparison of KPIs achieved against benchmarks and the use of league tables. This provides managers with a more sophisticated view of performance and should eliminate manipulation of data.

8.3 Evaluation of Beyond Budgeting
8.3.1 Advantages

· Divisional managers will be more motivated as they will be given autonomy to plan for their own business units.

· Creates a climate based on competitive success. Using relative performance measures and comparing performance with external benchmarks encourages managers to focus on beating competitors rather than other managers.

· Faster response to changes in customer needs as managers can react quickly to new threats and opportunities rather than adhere to an outdated budget. Resources will also be made available for new projects if they are worthwhile even if not originally in the budget.

· Performance is not only focused on financial numbers but on KPIs that reflect the organisation's overall objectives (KPIs are covered in detail in Chapter 15).

· More customer-focused attitude of departments that supply other internal departments.

8.3.2 Disadvantages

· The organisational culture may not support this approach (e.g. where senior managers are accustomed to a command-and-control style of management).

· May not be appropriate in organisations in which financial control is crucial to success (e.g. in public sector organisations where funds are limited).

Summary:

· A budgetary control system is a means by which management exercises control over the organisation through setting budgets and comparing performance against the budget. Action is taken to remedy deviations from the budget.

· The main objectives of a budgetary control system are planning, coordination of the activities of the organisation and ensuring better resource utilisation.

· Budgets may also be used to delegate responsibility to managers, who are then evaluated on how they perform relative to the budget.

· Budgets should contribute towards the long-term plans of the organisation.

· Top-down budgeting means that budgets are prepared by senior management and imposed on the departments responsible for achieving them.

· Bottom-up budgeting means that departments participate in preparing their own budgets.

· A rolling budget is continuously updated and most likely suitable in a rapidly changing environment where the original budget quickly becomes outdated.

· Incremental budgeting is a traditional approach to budgeting which bases next year's budget on the current year's budget or actual figures.

· ZBB starts "from scratch" and requires the costs and benefits of all activities to be quantified and justified. It is particularly useful in the public sector but costly and time-consuming to implement.

· Activity-based budgets use ABC principles to calculate the budgeted overhead costs.

· Budgets influence the behaviour of managers, because their evaluation depends on whether they achieve the budget. Research suggests that targets that are just out of reach are optimal for motivation.

· The Beyond Budgeting model aims to replace traditional budgetary control systems with a more modern approach which replaces financial targets with key performance indicators.

Chapter 10: Analytical Techniques

This chapter covers the following Learning Outcomes. D. Budgeting and Control 2. Analytical Techniques a) Analyse fixed and variable cost elements from total cost data using the high-low method. b) Explain and apply analysis techniques including correlation, regression and time series. c) Estimate the learning rate and learning effect. d) Apply the learning curve to a budgetary problem, including calculations on steady states. e) Discuss the benefits and limitations of correlation, regression and time series techniques, and also the reservations with the learning curve model.

1.1 Need for Forecasting

Management accountants need to use forecasts for many areas of their work. For example, in budgeting it is useful to be able to forecast sales. This chapter revises the calculations of the high-low method, time series, correlation and regression, all assumed knowledge of Management Accounting and introduces a new topic, the learning curve.

1.2 Simple Average Growth Models Such models take average growth from the past, using the geometric mean, and assume that this level of growth will continue in the future.

Example of Geometric Mean

The sales of Beta during the last three years were as follows:

Year Sales in $000

20X2 100

20X3 180

20X4 210

20X5 300

The growth rate of sales each year is as follows:

20X3 80% (180 - 100)/100

20X4 16.67% (210 - 180)/180

20X5 42.9% (300 - 210)/210

The simple average growth rate is 46.5%, calculated as (80% + 16.67% + 42.9%)/3.

However, this overstates the rate of growth: If the 20X2 sales of $100,000 were to increase by 46.5% each year for three years, the sales in 20X5 would be $314,000, not $300,000.

The more accurate growth rate is obtained using the geometric mean. This is used to calculate average growth rates and is most commonly used in business and finance to calculate growth rates in percentages. Growing by 80% is the same as multiplying by 1.8, so the geometric mean for the three years is cube root(1.8 * 1.1667 * 1.429) = 1.442, so the average growth rate is 44.2%.

This can then be used to calculate expected sales in future periods.

1.3 High-Low Method

The high-low method is a technique for estimating the fixed and variable elements of a semi-variable cost so that more accurate forecasts of costs can be made. The method is simple:

· Collect a range of data points over a period of time corresponding to different levels of activity;

· Select the costs (y) associated with the highest and lowest levels of activity (x) and assume a straight- line relationship between these two points.

This method is limited by its simplicity. Furthermore, using only the extreme levels of activity to determine the relationship between two variables is risky, as extreme values are likely to be unusual. Great care should be exercised when forecasting costs outside the range of the extremes (i.e. extrapolating).

Quiz: Cost Equation

The total cost of output for the last four months is as follows:

Output	Costs
3,000	3,500
2,400	3,000
3,600	4,350
4,000	4,800

Required: a. Find the equation y = a + bx, where y is cost, and x is output level. b. Forecast next month's cost if output is expected to be 4,500 units.

Answer:
a. Linear equation

	Output	Costs
High	4,000	4,800
Low	2,400	3,000

y = a + bx

Gradient, b = (4,800-3,000)/(4,000-2,400) = 1,800/1,600 = 18/16 =1.125

Substituting in the low level of activity (alternatively, use the high level) When x = 2,400 y = 3,000

3,000 = a + (1.125 × 2,400)

3,000 = a + 2,700

a = 300

y = 300 + 1.125x

b. Forecast for next month Cost = 300 + (1.125 * 4,500) - $5,362.50

Quiz: High-Low Method

A new battery will be manufactured on a machine currently owned by Corfe Co, which was previously used for a product which has now been discontinued. Maximum demand for this new battery would be 262,500 units.

The management accountant estimates that every 1,000 units will take 14 hours to produce. The annual machine hours and maintenance costs for the machine for the last four years have been as follows:

| | Machine time (hours) | Maintenance costs |

		$000	
Year 1	5,000	850	
Year 2	4,400	735	
Year 3	4,850	815	
Year 4	1,800	450	

Maintenance costs have both fixed and variable elements.
Required: Calculate the estimated maintenance cost for production of the battery at 80% of maximum demand.

Answer:
Variable cost per hour ($850,000 - $450,000)/(5,000 - 1,800 hours) = $125 per hour T
herefore, fixed cost ($850,000 - (5,000 * $125)) = $225,000
Production demanded is 80% of 262,500 units, which is 210,000 units.
Number of machine hours required for production (210 * 14 hours) = 2,940 hours
Therefore, total cost ($225,000 + (2,940 * $125)) = $592,500.

2.1 Components of a Time Series
Time series analysis can be applied to any figures that vary over time, including sales, production and costs.
The main components of a time series are:
· Trend (T)
· Seasonal variations (S)
· Cyclical variations (C)
· Random variations due to non-recurring influences (I)
Random variations are usually due to unforeseen events and situations, and their degree of impact is difficult to predict. They may be favourable, i.e. positive in nature (e.g., unexpected withdrawal from the market of a competitor), or adverse, i.e. negative (e.g., damage to business due to freak weather conditions). A time series (Y) can be summarised in an equation as:
$Y = T + S + C + I$

2.1.1 Trend
Trend - the underlying long-term movement in values over time.

Example of Trend
Millstream Co manufactures three products -Red, Blue and Green. Sales over recent years of the products have been as follows:

	Blue	Red	Green
	Units	Units	Units
20X0	9,000	4,500	4,850
20X1	8,500	5,000	5,200
20X2	8,200	5,750	4,900
20X3	7,400	5,600	4,800

20X4	7,700	5,900	5.100
20X5	7,300	6,300	4,900
20×6	6,800	6,550	5,000

Sales of Blue show a clear downward trend, even though they rose in 20X4. Sales of Red show a clear upward trend, even though they fell in 20X3. Sales of Green show a constant trend of around 5,000 units.

2.1.2 Seasonal Variations

Seasonal variations - short-term fluctuations in value caused by differing circumstances affecting results at different times of the day, week, month, year, etc. Factors causing seasonal variations may include:

· The weather (e.g. products selling better in hot rather than cold weather);
· Annual events (e.g. new year retail sales, "Black Friday", etc.);
· Customers have more time to shop (e.g. on weekends rather than weekdays).

Example of Seasonal Variations

The sales for one of Leybourne Co's products over each season in the last three years are as follows. Each season lasts three months.

	Units
Spring 20X0	5,500
Summer 20X0	6,700
Autumn 20X0	5,600
Winter 20X0	4,700
Spring 20X1	5,900
Summer 20X1	7,200
Autumn 20X1	6,300
Winter 20X1	5,100
Spring 20X2	6,500
Summer 20X2	7,900
Autumn 20X2	7,000
Winter 20X2	5,700

The figures for each season in 20X1 and 20X2 are higher than those for the preceding year, showing an upward trend overall. However, there are significant seasonal variations (e.g. Winter 20X2 is lower than Summer 20X0).

2.1.3 Cyclical variations

Cyclical variations - medium-term changes in values resulting from factors that repeat in cycles. Cyclical variations are longer-term than seasonal variations.
Economic cycles - the alternation between booms and recessions -exemplify cyclical variations.

2.2 Identifying the Trend The trend can be found using:

· A "line of best fit" drawn on a graph;
· The least squares method of linear regression (see s.3).
· The calculation of moving averages.

2.2.1 Moving Averages Method

Moving averages method- removes seasonal variations from data by averaging, taking the average of the results of a fixed number of periods. The moving average model smooths out data sets to reveal their overall trend, with little regard for outlying data points. To calculate the trend: 1. Calculate a "moving" total for the number of periods which make up a normal cycle (usually a year). 2. Calculate a "moving" average by dividing the moving total by the number of periods in a normal cycle. This is the trend figure (T). 3. When the moving average is for an even number of periods (e.g. 4 quarters), the averages in (2) must be averaged again. This is so that the final computed moving average can be compared directly to a data point in the actual data.

2.3 Identifying the Seasonal Variations

Seasonal variations quantify changes in actual data due to prevailing conditions in a particular season, which is consistent over time (e.g. summer would have seasonally higher temperatures than winter, which would be consistently true every year; or people travel more during peak holiday seasons). When forecasting, seasonal variations are added to the forecast trend to account for potential future seasonal conditions.

2.3.1 Additive Model Having identified the trend, the next stage is identifying the seasonal variations. Using the equation:

$Y = T + S + C + I$

Ignoring C (as we are looking at short-term forecasting) and I (which is impossible to predict):

$Y = T + S$, therefore $S = Y - T$

The additive model assumes that the components of the time series are independent, meaning the trend will not affect the seasonal variations. To calculate the seasonal variations: 1. For each trend value (T), calculate the seasonal variation (i.e. the difference between the actual data and the trend figure). 2. Calculate the average of the seasonal variation for each period in a cycle (e.g. quarterly data will have four averages, one for each quarter). 3. If the average seasonal variations calculated do not sum to 0, make a final adjustment to each variation so that the total equals 0. The example below uses a moving average set with odd numbers, so the moving average only has to be computed once to be comparable to the data point in the actual data.

Example of Seasonal Variations - Additive Model

Frances opens a cafe from Tuesday to Saturday each week. A sales trend is therefore calculated using a 5-day moving average. The daily variations (Step 1) are then calculated as the difference between actual sales and the trend for each day as follows:

Week	Day.	Actual(Y)	5-day moving total	5-day moving average(T)	Seasonal variation (S = Y-T)
		$000	$000	$000	$000
	Tues	330			
	Wed	400			
1	Thurs	360	1,990	398	-38
	Fri	430	2,000	400	+30
	Sat	470	2,020	404	+66

2	Tues	340	2,035	407		-67	
	Wed	420	2,060	412		-67	
	Thurs	375	2,095	419		-44	
	Fri	455	2,110	422	+33		
	Sat	505	2,140	428	+77		
3	Tues	355	2,160	432		-77	
	Wed	450	2,190	438		+12	
	Thurs	395	2,230	446		-51	
	Fri	485					
	Sat	545					

Step 2. Calculate the average of the seasonal (i.e. daily) variations.

	Tues	Wed	Thurs	Fri	Sat
	$000	$000	$000	$000	$000
Week 1			-38	+ 30	+ 66
Week 2	-67	+ 8	-44	+ 33	+ 77
Week 3	-77	+ 12	-51		
Average	-72	+ 10	-44.3	+ 31.5	+ 71.5	- 3.3

Step 3. Add 3.3/5 = 0.66 to each variation to ensure the averages total 0:

	Tues	Wed	Thurs	Fri	Sat	Total
	$000	$000	$000	$000	$000	$000
Average	-72	+ 10	-44.3	+ 31.5	+ 71.5	-3.3
Adjustment	0.66	0.66	0.66	0.66	0.66	3.3
Adjusted average	- 71.34	+ 10.66	-43.64	+ 32.16	+ 72.16	0

The seasonal variation is negative on Tuesdays and Thursdays and positive on Wednesdays, Fridays, and Saturdays.

The seasonal variations will be added to the forecast trend to account for expected future seasonal variations on those days.

Quiz: Additive Model

Dewie Co's profits for the last three years have been as follows:

Year	Quarter	Actual profits
		$000
1	1	66
	2	90
	3	72
	4	118
2	1	72
	2	96

| | 3 | 74 |
| | 4 | 126 |

3	1	78
	2	102
	3	76
	4	132

Required: Calculate the trend and seasonal variations using the additive model.

Answer:
1. Calculate the trend and the seasonal variations:

Year	Quarter	Actual profits (Y)	4-quarter moving total	4-quarter moving average	Average (T)	Seasonal variation (S = Y-T)
		$000	$000	$000	$000	$000
1	1	66				
	2	90				
			346	86.5		
	3	72			87.25	- 15.25
			352	88.0		
	4	118			88.75	+ 29.25
			358	89.5		
2	1	72			89.75	- 17.75
			360	90.0		
	2	96			91.00	+ 5.00
			368	92.0		
	3	74			92.75	- 18.75
			374	93.5		

	Quarter	Value	Total	Trend	Mid trend	Seasonal variation
	4	126			94.25	+ 31.75
			380	95.0		
3	1	78			95.25	- 17.25
			382	95.5		
	2	102			96.25	+ 5.75
			388	97.0		
	3	76				
	4	132				

2. Average seasonal variations for each quarter:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	
	$000	$000	$000	$000	
Year 1			-15.25	+ 29.25	
Year 2	-17.75	+ 5.00	-18.75	+ 31.75	
Year 3	-17.25	+ 5.75			
Average	-17.50	+ 5.375	-17.00	+ 30.50	+ 1.375

3. Adjustment to sum to 0:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
	$000	$000	$000	$000	$000
Average	-17.5	+ 5.375	-17.00	+ 30.50	1.375
Adjustment	-0.344	-0.344	-0.344	-0.344	-1.376
Adjusted average	-17.844	5.031	-17.344	30.156	-0.001

2.3.2 Multiplicative Model
The multiplicative model is based on proportions rather than absolute values and is expressed as: Y = T * S * C *I Or ignoring C and I, Y = T * S and therefore S = Y/T.
The seasonal variation expressed as a proportion of the trend is sometimes called a seasonal index. The other difference between the calculations using the additive and multiplicative models is that the average seasonal index should sum to the number of seasons in the time series (e.g. 12 for monthly variations, 4 for quarterly variations).

Quiz: Multiplicative Model
Guildford Gifts' retail sales for the last three weeks have been as follows:

		$
Week 1	Mon	910
	Tues	930
	Wed	980
	Thurs	940
	Fri	1,040
	Sat	1,200
	Sun	970
Week 2	Mon	920
	Tues	945
	Wed	975
	Thurs	960
	Fri	1,090
	Sat	1,210
	Sun	1,040
Week 3	Mon	950
	Tues	960
	Wed	995
	Thurs	975
	Fri	1,120
	Sat	1,240
	Sun	1,080

Required: Calculate the trend and seasonal variation using the multiplicative model.

Answer:
1. Calculate the trend and the seasonal variations:

		Actual (Y)	7-day moving total	7-day moving average (T)	Seasonal variation (S = Y/T)
		$000	$000	$000	
Week 1	Monday	910			
	Tuesday	930			
	Wednesday	980			
	Thursday	940	6,970	996	0.944
	Friday	1,040	6,980	997	1.043

Week	Day				
	Saturday	1,200	6,995	999	1.201
	Sunday	970	6,990	999	0.971
Week 2	Monday	920	7,010	1,001	0.919
	Tuesday	945	7,060	1,009	0.937
	Wednesday	975	7,070	1,010	0.965
	Thursday	960	7,140	1,020	0.941
	Friday	1,090	7,170	1,024	1.064
	Saturday	1,210	7,185	1,026	1.179
	Sunday	1,040	7,205	1,029	1.011
Week 3	Monday	950	7,220	1,031	0.921
	Tuesday	960	7,250	1,036	0.927
	Wednesday	995	7,280	1,040	0.957
	Thursday	975	7,320	1,046	0.932
	Friday	1,120			
	Saturday	1,240			
	Sunday	1,080			

2. Average seasonal variations for each day:

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Week 1				0.944	1.043	1.201	0.971	
Week 2	0.919	0.937	0.965	0.941	1.064	1.179	1.010	
Week 3	0.921	0.927	0.957	0.932				
Average	0.920	0.932	0.961	0.939	1.054	1.190	0.991	6.987

3. Adjustment to sum to 7 (shown for completeness only as it makes no difference to the indices to two decimal places):

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
Average	0.920	0.932	0.961	0.939	1.054	1.190	0.991	6.987
Adjustment	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.014
Adjusted average	0.922	0.934	0.963	0.941	1.056	1.192	0.993	7.001

2.4 Seasonally-adjusted Data
Seasonally-adjusted ("deseasonalised") data (i.e. actual data that has been stripped of seasonal variations) can be used to explore the trend and any remaining random component. When actual data is given, and seasonally-adjusted figures are required:
· For the additive model: subtract positive variations from actual data and add negative variations to actual data;
· For the multiplicative model: divide actual data by the seasonal variation factors.

Example of Seasonally-adjusted Data - Multiplicative Model
Data for sales on the days of one week is as follows:

	Actual sales (Y)	Seasonal index (S)	Deseasonalised data (Y/S)
	$	$	$
Mon	7,500	0.91	8,242
Tues	8,100	0.98	8,265
Wed	8,400	1.01	8.317
Thurs	8,200	0.98	8,367
Fri	8,900	1.06	8,396
Sat	9,100	1.07	8,505
Sun	8,500	0.99	8,586

The de-seasonalised data may be compared to the forecast trend to see if any significant variations are not accounted for in seasonal variations and may be linked to cyclical or random variations.

Quiz: Seasonally-adjusted Data - Additive Model
Actual production costs and seasonal variations for the four quarters of the year are as follows:

Quarter	Actual production costs	Seasonal adjustments (S)
	$	$
1	11,500	-1,000
2	13,500	+ 500
3	14,000	+ 800
4	13,000	-300

Required: Calculate the seasonally-adjusted figures for the four quarters.

Answer:

Remember to subtract the positive seasonal variations and add the negative seasonal variations.

Quarter	Actual costs	Seasonal adjustments	Seasonally-adjusted data
	S	$	
1	11,500	-1,000	12,500
2	13,500	+ 500	13,000
3	14,000	+ 800	13,200
4	13,000	-300	13,300

2.5 Forecasting Using Time Series Analysis

A trend can be used to predict future values by extrapolating beyond the historic values using a graph or an equation that describes the trend (e.g. using regression as described in the next section). Once a trend value has been calculated for a future period, it must be adjusted for seasonal variations using the additive or multiplicative model. In time series analysis, each period will be given an integer. For example, if Year 1 Month 1 is identified as 1, Year 2 Month 1 will be 13, etc.

Example of Forecasting Using Time Series Analysis

The trend for quarterly profits is described by the equation below: $64,000 + 1000x$, where x is the number of quarters and x = 1 represents 20X1 Quarter 1. The seasonal index for Quarter 2 is 0.96.

The profit forecast for 20X4 Quarter 2 (i.e. ((4 * 3) + 2)) = Quarter 14) is:

Forecast trend = $64,000 + 1,000(14) = \$78,000$

Adjusting for seasonal index, forecast profits = $\$78,000 * 0.96 = \$74,880$

Quiz: Forecasting Using Time Series Analysis

The trend for quarterly sales volume is described by the equation below: $100,000x + 170,000$, where x is the number of quarters and x = 0 represents 20X1 Quarter 1. The seasonal variation for Quarter 3 is +40,000 units.

Required: Calculate the forecast sales volume for 20X5, Quarter 3.

Answer:

For 20X5 Q3, x = 18 (i.e. ((4 * 4) + 3 - 1), because x = 0 at 20X1 Q1)

Trend sales volume = $(100,000 * 18) + 170,000 = 1,970,000$ units

Forecast sales volume = $1,970,000 + 40,000 = 2,010,000$ units

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2.6 Benefits and Limitations of Time Series Analysis

2.6.1 Benefits of Time Series Analysis

· It enables future predictions based on past experience.

· As compared to the high-low method, it ignores outlying data points.

· Analysing data into parts facilitates more accurate forecasting (than using trend alone).

2.6.2 Limitations of Time Series Analysis
· Data must be ordered over time (i.e. the point in time at which the variable is measured must be known) to calculate the trend
· The reliability of a forecast depends on the amount of data on which the trend and seasonal variations are based. The less data that is available, the less reliable the forecast will be.
· Due to the "loss" of data in calculating moving averages, data needs to be collected over a longer period for a meaningful trend to emerge using the moving averages method.
· Random factors may influence calculations, especially over fewer data sets. If non-recurring influences are significant, forecasts may not be reliable.
· Extrapolation becomes less reliable the further into the future the forecast is made due to changes in trends, seasonal variations and other (residual) factors.

3.1 Correlation
Correlation -the closeness of the relationship between two or more variables. Examples of variables that might be correlated include:
· Length of journey on public transport and fare paid;
· Hours spent studying and marks in an exam.
Correlation between variables can be shown on a scattergraph.

3.1.1 Types of Correlation
The following phrases are commonly used to describe correlation between variables:
· Positive correlation - when an increase in one variable is associated with an increase in the other (e.g. advertising expense and revenue).
· Negative correlation - when an increase in one variable is associated with a decrease in the other (e.g. bicycle traffic and rainfall).
· Perfect correlation - when a change in one variable is matched by a change of equal degree in the other variable. This only exists when all the points of a scattergraph lie on a straight line.
· Zero correlation - when there is no relationship between the variables. Between the extremes of perfect and zero correlation, the correlation may be described as "high" or "low".

3.2 Correlation Coefficient (r)
3.2.1 Exam Formula The degree of correlation between two variables can be measured using the correlation coefficient, r, which is given by the exam formula:
$r = (n\Sigma xy - \Sigma x \Sigma y)/\sqrt{((n\Sigma x^2 - (\Sigma x)^2)(n\Sigma y^2 - (\Sigma y)^2))}$
Where:
n = the number of pairs of values
Σx = the sum of the x values
Σx^2 = the sum of the squares of the x values
$(\Sigma x)^2$ = the square of the sum of the x values
Σy = the sum of the y values
Σy^2 = the sum of the squares of the y values
$(\Sigma y)^2$ = the square of the sum of the y values
Σxy = the sum of the products of each pair of x and y values

The value of the correlation coefficient will always lie between -1 and 1:

· r = +1 denotes perfect positive correlation (i.e. all points on an upward sloping straight line);

· r = - 1 denotes perfect negative correlation (i.e. all points on a downward sloping straight line); and

· r = 0 means the variables are uncorrelated (i.e. no linear relationship).

Example of Correlation Coefficient

Coastway Café wants to determine the extent to which the number of ice-creams sold (y) is correlated to the average daily temperature (x). The correlation coefficient is calculated from pairs of data as follows:

	Average daily temperature		Number of ice-creams			
	(x)	(y)	xy	×2	y2	
	14	59	826	196	3.481	
	27	102	2,754	729	10,404	
	20	84	1,680	400	7,056	
	22	85	1,870	484	7,225	
	17	75	1,275	289	5,625	
Σ	100	405	8.405	2,098	33,791	

n = 5

$(\Sigma x)2 = 100 * 100 = 10,000$

$(\Sigma y)2 = 405 * 405 = 164,025$

r = [(5*8,405) - (100*405)]/square root((5*2,098-10,000)(5*33,791-164,025))= 0.98

There is therefore a high positive correlation between the average daily temperature and the number of ice-creams sold.

Quiz: Correlation Coefficient

Cutters uses a machine which can be operated at different speeds. This machine is continuously operated without stopping. The production manager has collected the following data for the life of a component before it wears out at different machine speeds.

Machine speed (revolutions per second)	Life of component (hours)
17	19.2
20	18.5
20	17.0
25	15.8
26	14.1
28	11.4
31	12.4
32	10.6
36	11.2
40	8.8

Required: Calculate the correlation coefficient and comment on your results.

Answer:

	Machine speed	Life of component				
	X	y	xy	x2	y2	
	17	19.2	326.4	289	368.65	
	20	18.5	370.0	400	342.25	
	20	17.0	340.0	400	289.00	
	25	15.8	395.0	625	249.64	
	26	14.1	366.6	676	198.81	
	28	11.4	319.2	784	129.96	
	31	12.4	384.4	961	153.76	
	32	10.6	339.2	1,024	112.36	
	36	11.2	403.2	1,296	125.44	
	40	8.8	352.0	1,600	77.44	
Σ	275	139	3,596	8,055	2,047.3	

n = 10
$(\Sigma x)2 = 275 * 275 = 75,625$
$(\Sigma y)2 = 139 * 139 = 19,321$
r = [(10*3,596) - (275*139)]/square root((19*8,055-75,625)(10*2,047.3-19,321))= -2,265/2,381.9 = -0.95
There is a high negative correlation between the operating speed of the machine and the life of the component.

3.2.2 Interpretation of r
A high correlation between two variables does not necessarily justify the conclusion that a causal relationship exists. There may be no direct connection at all, in which case the correlation is described as "spurious correlation". This can occur for two reasons: 1. There may be an indirect connection (i.e., x and y depend on a third variable). 2. The correlation may be a coincidence and due entirely to chance.

Example of Spurious Correlation
Total annual video game sales around the globe over the last 60 years are closely correlated to total nuclear energy production. Both variables have increased steadily, but there is no causal relationship between them. They have both increased with the increasing demands of a growing global population.

3.3 Coefficient of Determination
The coefficient of determination measures how much of the total change in the amount of one variable can be explained by the change in the other variable. Unlike the correlation coefficient, it is a measure of the cause of the variation. It is calculated as the square of the correlation coefficient, r2, and must therefore always be a positive number.

Example of Coefficient of Determination
The correlation coefficient between the number of quality control tests undertaken on a line of products and the number of customer complaints is -0.8.
The coefficient of determination is, therefore, -0.82 = 0.64. This means that 64% of the changes in the number of customer complaints can be explained by changes in the number of quality control tests.

3.4 Regression
Correlation describes the closeness of a linear relationship between two variables, but it does not allow forecasting of the value of one variable given the value of the other. To forecast variables, it is necessary to assume a linear relationship between them that can be described by the equation y = a + bx, where a is the point of intersection on the y-axis (i.e. when x = 0) and b is the gradient of the line. The values of a and b can be determined by:
· Judging "by eye" a line that best fits the data plotted on a scattergraph;
· Computing the "line of best fit" mathematically using the least squares regression method.
The formulae are provided in the exam as follows:
a = Σy/n - bΣx/n
b = (nΣxy - ΣxΣy)/(nΣx2 - (Σx)2)
Exam advice Calculate b first to substitute in the formula for a.

3.5 Benefits and Limitations
3.5.1 Benefits of Correlation and Regression Analysis
· Correlation analysis can indicate the existence of associations between variables.
· As least squares regression uses all pairs of data it is much more accurate than the high-low method and less affected by extreme values.
· Correlation can be used with regression analysis to indicate the strength of the relationship indicated by the equation.

3.5.2 Limitations of Correlation and Regression Analysis
· A limited amount of data may reduce the reliability of forecasts made. The reliability of the analysis and forecasts also depends on the quality of the data.
· Correlation is easily misinterpreted as high correlation does not necessarily indicate a linear relationship, and there may be no direct connection between highly correlated variables.
· Linear regression analysis is based on the assumptions of a linear relationship, which may not be valid, and assumes that the dependent variable depends solely on the independent variable, whereas it may depend on a number of variables.
· Forecasts that extrapolate values outside the range of data from the past, may be invalid and must be interpreted with caution.

4.1 The Learning Effect
If workers specialise, there is a tendency for labour hours per unit to fall as they become more familiar with the task. During World War II, empirical evidence from aircraft production found the rate of improvement to be so regular that it could be reduced to a formula. The learning

effect starts from the production of the first unit/batch. Each time cumulative production doubles (i.e. one to two, two to four, four to eight, etc.), the cumulative average time per unit falls to a fixed percentage of the previous average time. This percentage is the learning rate. It is important to recognise the learning effect. For example, when launching a new product at a cost plus price, if the cost is overstated, the price may be too high, reducing sales volume. Or worse still, the product might not be launched at all in the mistaken belief that it costs too much.

4.2 Tabulation

Quiz: Tabulation
A product will take 100 hours for the first unit, and an 80% learning curve applies.
Required: Complete the following table and draw the corresponding graph.

Units	Cumulative average time	Cumulative total time	Incremental total time
1	100	100	100
2			
4			
8			

Answer:

Units	Cumulative average time	Cumulative total time	Incremental total time
1	100	100	100
2	80	160	60
4	64	256	96
8	51.2	409.6	153.6
16	40.96	655.36	245.76

(draw the corresponding graph)
Exam advice You will not be required to draw graphs in the exam.

4.3 Learning Curve Formula Although a graph could be used to provide an estimate, it is more accurate to use the following exam formula:
y = a * x raised to the power of b
Where y = cumulative average time per unit to produce x units a = time taken for the first unit of output x = the cumulative number of units produced b = the index of learning (log LR/log2) LR = the learning rate as a decimal

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Quiz: Learning Curve Formula
It is estimated that it will take 500 hours to produce the first unit of a new product. Workers have a 95% learning effect.
Required: Calculate how long it will take to produce the seventh unit. Note: The index of learning b is given as -0.074.

Answer:

		Average	Total
Cumulative average time for first seven units (Y = 500 * 7 raise to the power of -0.074)	432.95		
Total time for first seven units (7 × 432.95)			3,030.65
Cumulative average time for first six units (Y = 500 * 6 raise to the power of -0.074)	437.91		
Total time for first six units (6 * 437.91)			2,627.46
Total time for the seventh unit			403.19

Quiz: Labour Cost

McSporran is a new business. It is budgeting costs for the production of kilts. Work studies show that the first batch will have a labour cost of $2,000, and an 85% learning effect applies. In period 1, budget production is 5 batches. In period 2, budgeted production is 7 batches. The wage rate per hour will be constant. (Therefore, using $s rather than hours in the formula is possible.)

Required: Calculate the budgeted labour cost for period 2.

Note: The index of learning b is given as -0.2345.

Labour cost for period 2 = Total cost for 12 batches - Total cost for 5 batches (period 1 and 2) (period 1)

Total cost for 12 batches = 12 (2,000 * (12 raised to the power of -0.2345)) = $13,401

Total cost for 5 batches = 5 (2,000 * (5 raised to the power of-0.2345)) = $6,856

Labour cost for period 2 = 13,401 - 6,856 = $6,545

4.4 Conditions for a Learning Curve to Apply Conditions for a learning curve to apply include the following:

· The activity is labour intensive.

· The units are identical (i.e. a repetitive task).

· Low labour turnover.

· No prolonged breaks in production.

4.5 Applications of Learning Curve Theory

Learning curve theory has applications in many aspects of management accounting:

· Standard setting - the labour standard should be set/revised based on the expected learning effect.

· Budgeting - variable costs per unit are expected to fall with an increase in production - which is particularly important to cash budgeting.

· Pricing decisions - an accurate labour cost may be predicted.

· Work scheduling - workforce planning (e.g. in systems which integrate production scheduling, job costing, control of workforce, performance measurement, etc.).

4.6 Reservations About the Learning Curve
· Knowing what the learning rate will be for new products. The usual assumption is that it will be similar to products made in the past. This may not always be a valid assumption.
· The learning curve is useful when a product's production occurs continuously. However, if there is a break in production, workers may "forget" the skill and the learning curve will not be so predictable.
· In the modern business world, many products are tailor-made for customers. The mass production of identical items, on which the learning effect is based, is not always appropriate.
· In some heavily unionised industries, there may be "go slow" agreements where workers agree not to work to their full capacity to save jobs.

4.7 Steady State With more repetitions, the improvements get smaller until, eventually, the learning process stops and reaches a "steady state". There are no further improvements to be made. As cumulative output increases, the effect of the learning curve diminishes. When cumulative output reaches a certain point, no further learning will occur. The time taken per unit reaches a steady state, and all units produced beyond this point will take the same amount of time per unit.
Incremental time per unit (steady state) = Total time (all units at steady state) - Total time (all units before steady state)

Example of Steady State Computation
Drake Co is budgeting the labour hours it needs to produce its new product, the Rega. Drake Co estimates that the learning rate of its workforce on this production is 85%, and that steady state is reached on the 20th unit. The index of learning b is given as -0.2345. The time taken to produce the first unit is 2 hours. Calculate the incremental labour time per unit for the 20th and subsequent units. The incremental time per unit can be computed by deducting the total time required to make 19 units from the total time needed to make 20 units. That time would apply for the 20th and all subsequent units.

	Hours
Total time taken to make the first 20 units (Woring)	19.814
Less: Total time taken to make the first 19 units (Working)	19.051
Time taken to make the 20th and subsequent units	0.763

WORKING Using the formula Y = a * (x raise to be power of b)
b = - 0.2345 (given)
a= 2
For first 20 units: Cumulative average time per unit, Y = (2)(20 raised to the power of -0.2345) = 0.99069
Total time (20 * 0.99069) = 19.814
For first 19 units:
Cumulative average time per unit, Y = (2)(19 raised to the power of -0.2345) = 1.00268
Total time (19 * 1.00268) = 1.00268
The 20th unit took 0.763 hours to produce. This would apply to all units produced after the 20th unit. For example, if total production was 100 units, the total labour hours would be: 19.814

hours (Total time to make 20 units) + 80 * 0.763 hours (steady state incremental time per unit) = 19.814 + 61.033 = 80.847 hours (total time to produce 100 units)

Key Point
Steady state is achieved when the incremental time per unit is constant. Note that even after steady state is reached, the cumulative average time per unit would still be decreasing.

Quiz: Learning Curve and Steady State
Supercars produces cars on a production line. One of the production line processes, Process 10, is labour intensive. A new model, the XY123, will be introduced to production next month. As this is a new model, the labourers in Process 10 will have to learn how to apply this process specifically to XY123. The time taken for the first car is expected to be one hour. A learning rate of 85% is expected. The effect of the learning curve is expected to stop after 30 units have been produced, and all subsequent units will take the same time to make as the 30th unit. Supercars has budgeted to manufacture 100 XY123s in the first month of production.
Required: a. Calculate the labour time per unit which will apply for the 30th and subsequent units. b. Calculate the total labour time to make the first 100 units of the XY123. Note: The index of learning b is given as -0.2345.

Answer:
a. Labour time for the 30th and subsequent units

	Hours	
Total time taken to make the first 30 units (W)	13.513	
Less: Total time taken to make the first 29 units (W)	13.166	
Time taken to make the 30th and subsequent units	0.347	
WORKING		
Using the formula Y = axb b = - 0.2345 (given)		
a = 1		
For first 30 units:		
Cumulative average time per unit, Y = 30-0.2345	0.45042	
Total time (30 x 0.45042)		13.513
For first 29 units:		
Cumulative average time per unit, Y = 29-0.2345	0.45401	
Total time (29 × 0.45401)		13.166

Exam advice For the total hours to be accurate to 3 decimal places, it is necessary to calculate the average times per unit to 5 decimal places (because they are to be multiplied by numbers between 10 and 100)

b. Total labour time for the first 100 units After the 30th unit, the time per unit remains constant at 0.347 hours per unit, the same as the time taken for the 30th unit, since the learning effect ceases at this point.

	Hours
Total time taken to make the first 30 units (per (a))	13.51

| Time taken to make the next 70 units (70 x 0.347) | 24.29 |
| Time taken to make the first 100 units (hours) | 37.80 |

4.8 Estimating the Learning Rate

4.8.1 Tabular Approach A learning rate for a new product can be estimated using a tabular approach based on production to date and the time taken, if the cumulative units are given in exponentials of 2 (e.g. 2, 4, 8, 16, and so on). The point at which the learning rate stops (i.e. when a "steady state" is reached, as described above) can also be calculated. It is when the incremental time per unit becomes constant.

Quiz: Learning Rate

Foxy Co makes personal computers. The components for the PCs are bought from various manufacturers, and the factory workers at Foxy Co assemble these to make a finished PC. Production of a new type of PC has just begun. The management accountant has asked a worker to keep a record of how much time they took to make each new computer. The worker provided the following summary for the first month:

	Incremental time taken (minutes)
1st unit	340
2nd unit	204
3rd and 4th units	326
5th to 8th units	522
9th to 16th units	964
17th to 32nd units	1.928
Total	4.284

The time shown within each band is the total for that band, not the average per computer.
Required: a. Calculate the learning rate that applied to the new PC. b. Estimate the point at which the learning period finishes.

Answer:
a. Learning rate

Cumulative output (units)	Cumulative total time (minutes)	Cumulative average time per unit (minutes)
1	340	340
2	544	272
4	870	217.5
8	1,392	174
16	2,356	147.25
32	4,284	133.875

As cumulative output doubles:
From 1 to 2 units: 272/340 = 80%
From 2 to 4 units: 217.5/272 = 80%
Therefore, the learning rate appears to be 80%.

b. End of the learning period The learning rate ends when the incremental time per unit becomes constant. Because there is no information about the time taken for each individual item, it is necessary to calculate the average incremental time for each group or band of units produced. When this becomes constant, the learning process ends:

	Incremental time taken	Average incremental time
1st unit	340	340
2nd unit	204	204
3rd and 4th units	326	163
5th to 8th units	522	130.5
9th to 16th units	964	120.5
17th to 32nd units	1,928	120.5

The time taken per unit becomes constant at 120.5 from the start of the band that includes the 9th to the 16th unit. Conclusion: The learning effect ends after the 8th unit.

4.8.2 Algebraic Approach
An algebraic approach must be used when only information about the cumulative average time is for two levels of output that are not exponentials of 2.
Exam advice This might be the case in an objective test question.

Example of Algebraic Approach to Learning Rate
The first unit of a product took 300 minutes; the total time taken for the first 8 units was 2,056 minutes. Therefore, the cumulative average time per unit for the first 8 units is 257 minutes (2,056 / 8). Cumulative output has doubled three times since the production of the first unit (from 1 to 2, to 4, then to 8), and the cumulative average time per unit has fallen to 257. If the learning rate is r.
Then, $300 \times (r^3) = 257$
So, $(r^3) = 257/300 = 0.8567$
Therefore, $r = \sqrt[3]{0.8567} = 0.9497$ i.e. approximately 95%

Quiz: Expected and Actual Learning Rates
Go Fast Cars has just started manufacturing a new model of its "lightning" sports car. The time taken for one process was two hours for the first car produced. A budget was prepared using an expected 80% learning rate based on prior experience. Recently, the company invested in sophisticated new manufacturing equipment. Workers are assisted by robots and computerised machine tools in the process in question. As this has enabled the company to reduce the workforce, several labourers have recently been made redundant. The actual production time of the first 16 units was higher than expected, suggesting that the learning rate might be greater than 80%. The budgeted and actual cumulative total times for the first 16 units are given below in minutes:

	Cumulative output	Cumulative total time budgeted	Cumulative total time actual	Cumulative average time actual
1		120	120	

2		192		216				
4		307		389				
8		492		700				
16		786		1,260				

Required: a. Calculate the actual learning rate experienced for this process. b. Suggest reasons why the actual learning rate was higher than expected.

Answer:

a. Actual learning rate

Cumulative output	Cumulative total time budgeted	Cumulative total time actual	Cumulative average time actual
1	120	120	120.00
2	192	216	108.00
4	307	389	97.25
8	492	700	87.50
16	786	1,260	78.75

As cumulative output doubles from 1 to 2, cumulative average time falls to 90% (108/120). This is repeated as cumulative output doubles from 2 to 4 (97.25/108), 4 to 8 (87.5/97.25) and 8 to 16 (78.75/87.5).

The actual learning rate is, therefore, 90%. This is higher than the expected learning rate of 80%, leading to the actual time taken being higher than budgeted.

b. Possible reasons for higher learning rate

It is potentially confusing that a higher learning rate means the effect of learning is lower. In this activity, the actual learning rate was 90% compared with a budgeted learning rate of 80%. The higher rate meant that the actual time taken to produce the first 16 units exceeded the time budgeted.

In the past, Go Fast Cars experienced learning rates of 80% when introducing new models. The new model has a higher learning rate of 90%, to the surprise (and no doubt disappointment) of management. It is necessary to identify the factors that may have led to this. The learning curve is most significant in more labour-intensive industries where the tasks are repetitive, there is low labour turnover, and staff members are motivated. In such situations, staff will learn more quickly, leading to a lower learning rate. Several developments at Go Fast Cars may have reduced the learning effect and led to a higher learning rate.

· The introduction of technology means that the processes are less labour intensive. There is, therefore, less scope for learning, as much of the process is likely to be automated anyway and automated processed are likely to work at a constant rate.

· The recent redundancies may have demotivated the remaining staff members, as they may believe that the company has little loyalty towards them. When morale is low, employees are less likely to work as productively as possible, leading to a higher learning rate.

Quiz: Algebraic Approach

The first batch of a new product took six hours to make, and the total time for the first 16 units was 42.8 hours, at which point the learning effect ended.
Required: Calculate the rate of learning.

Answer:
The cumulative average time per unit for the first 16 units is 2.675 hours (42.8/16).
Cumulative output has doubled four times since the production of the first unit (from 1 to 2, to 4, to 8, to 16).
Therefore, if the learning rate is r. Then, 6 x (r raised to the power of 4) = 2.675
So, (r raised to the power of 4) = 2.675/6 = 0.446
Therefore, r = (4th root if 0.446) = 0.817 i.e. approximately 82%

Summary:
· The high-low method is a simple and crude method used to find the relationship between variables, which takes only the highest and lowest values from the observations.
· In a time series (i.e. a series of figures recorded over time), the trend is the underlying long-term movement of data values. Seasonal variations are fluctuations due to differing conditions that affect results at different times, leading to differences between actual outcomes and results predicted by the trend alone.
· A trend can be calculated using moving averages or least squares regression.
· Seasonal variations can be calculating using the additive model (Y = T + S) or the multiplicative model (Y = T * S).
· Time series analysis can forecast future results by extrapolating the trend and adjusting for seasonal variations.
· Correlation describes the relationship between changes in the value of two variables. It may be positive, negative or zero. The correlation coefficient, r, measures the degree of correlation between two variables.
· The coefficient of determination, r2, measures the proportion of the variation in the dependent variable caused by the variation in the other variable.
· Linear regression analysis can be used to determine a line of best fit and forecast the value of one of the variables.
· Learning curve theory is based on the concept that the time taken to make a unit of a product or service falls as workers become more experienced.
· As cumulative output doubles, the cumulative average time taken falls to a fixed percentage – the learning rate.
· The learning curve formula is provided in the exams.
· The steady state describes the point from which the learning effect ceases.
· There are two methods of calculating the learning effect: tabulation and an algebraic approach. Only the algebraic approach can be used when information about the cumulative average time is for only two levels of output that are not exponentials of 2.

Chapter 11: Standard Costing

This chapter covers the following Learning Outcomes. D. Budgeting and Control 3. Standard costing a) Explain the use of standard costs. b) Outline the methods used to derive standard costs and discuss the different types of cost possible. c) Explain and illustrate the importance of flexing budgets in performance management. d) Explain and apply the principle of controllability in the performance management system.

1.1 By Management

Standard cost - the predetermined (planned) cost of a unit of a product (goods or service) or a component of product cost (e.g. material, labour) during a specific period in the near future. It is the planned cost of a product under current and/or anticipated operating conditions. Production costs are affected by internal factors over which management has a large degree of control. An important role of executive management is to help departmental managers understand their part in contributing to the organisation's success.

Standard costs and the variances which arise from them:

· Keep management informed about the economy, efficiency and effectiveness of production processes.

· Facilitate supervisory personnel being made directly responsible for the variances under their control.

Variances provide a measure of the fairness of standards and facilitate further analysis, investigation and action (e.g. to eliminate causes of undesirable variances).

· Adjustments should be made to an unreasonable standard if variance analysis is to be meaningful.

· Variance analysis should encourage and reward cost control commensurate with desired levels of performance.

Variances - differences between actual prices and standard prices and actual quantities and standard quantities.

Variance analysis - the process of calculating and interpreting variances.

Example of Standard Cost Card

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

A standard provides a "benchmark" or "norm" for measuring performance. Standards are widely used (recommended daily allowances (RDA), drinking measures, materials standards for building constructions, quality standards, health and safety standards). In management accounting, standards generally relate to two aspects of inputs used in producing

goods/services: 1. Quantity standards specify how much resource (raw materials, labour) should be input to produce a unit of product/ service. 2. Price (or cost) standards stipulate how much should be paid for each unit of resource. The main reason for categorising standards - into price and quantity - is because different managers are usually responsible for the activities of buying and using inputs which occur at different points in time. For example:

· The purchasing manager's responsibility is exercised when materials are purchased.

· The production or factory manager's responsibility is exercised only when the materials are used, which could be months later (even in a different budget period). Management should investigate the significant variances revealed (by a comparison of actual quantities and prices against the standards) to establish their cause(s) and to take corrective action to prevent their reoccurrence. This facilitates management "by exception" because investigation is unnecessary if deviations are insignificant. However, an expectation that has not been met is an opportunity to uncover the root of the problem. If the underlying cause is not discovered and corrected, the problem is likely to recur and may worsen.

1.2 Variance Investigation

The main purpose of variance investigation is to improve operational performance:

· Actual cost and performance is compared with the standard cost of actual performance.

· The differences between actual results and what should have happened according to the standards are variances.

· Management should consider both the nature ("why did it arise?") and magnitude ("by how much has it increased/decreased"?) of any variance.

· A corrective action could include re-calibrating/re-setting the specifications of an item of equipment or changing a supplier.

· An amended standard cost may be prepared for the next period.

1.3 Uses of Standard Costing Systems

Standard costing systems may be used to:

· Assist in planning by providing management with insights into the probable effect of decisions on cost levels (and profits);

· Help establish budgets (see later);

· Control costs, direct and motivate employees and measure efficiencies;

· Highlight opportunities for possible cost reductions;

· Simplify the costing of products and facilitate reporting of costs on a timely basis;

· Assign cost (e.g. through processes of allocation, apportionment and absorption) to inventories of raw materials, work in process and finished goods;

· Provide a cost basis on which to tender for contracts/set sales prices (see chapters on relevant costing and pricing).

1.4 Examples of Use

· In production, many manufacturing companies use "standard cost cards" to specify the standard amount of resources (components, materials, different grades of labour, machine time, overheads, etc) and the standard price for each product.

· Service centres for national chains of car service centres set standard labour times and parts to be used in routine car maintenance tasks (e.g. changing spark plugs, replacing exhaust/tyres, etc). Actual performance can be compared against the standards for each service centre.
· Restaurant and drink retail outlets (e.g. Pizza Express, Starbucks) have standards for ingredients (quality, quantity and price), speed of service, etc.
· Hotel chains may use standards for many aspects of their operations - laundry, housekeeping, restaurants and bars.

1.5 Use of Standards in Budgeting
Budgeting is a method by which reliable information relating to the operation and control of an entity is obtained on a timely basis. Like budgets, standard costs:
· facilitate control and highlight possibilities for cost reductions;
· use predetermined costs for the budget period; and
· provide information for reports which compare actual costs with predetermined costs (see operating statements later).

	Budget	Standards
Scope	A statement of expected costs (to direct activities to an agreed action plan).	Specify what costs should be for a level of performance achieved.
Highlights	Volume of activity and level of costs to be maintained (as desired by management).	Level to which costs should be reduced (to increase profit).

2.1 Setting Standards
Standard setting calls for the combined expertise of those responsible for procuring resource inputs and overseeing their use. For a production company, this usually will include accountants, buyers, engineering and factory supervisors and managers. Standards should be set to encourage efficient future operations and to eliminate inefficiencies. When setting standards, different approaches can be taken regarding the level of difficulty (ideal or attainable) and the time period the standard relates to.

2.2 Ideal Standards These are standards which can only be achieved under ideal operating circumstances. They do not make allowances for:
· Machine breakdowns
· Interruptions to schedule
· Idle time/capacity.
The usefulness of ideal standards may be viewed both positively and negatively:
· They are a constant reminder to strive to improve economy, efficiency and effectiveness.
· They are demotivating, as managers know that they will never be able to achieve them.
· When examining variances, it is difficult to assess how much of the adverse variance is because the standard is unrealistic or actual operations are inefficient.

2.3 Basic Standards A basic standard is a long-run (underlying) average standard. As it is based on historical data (i.e. past performance) it has two weaknesses:
· Out of date. x Likely to be too easy to achieve in the future.

2.4 Current Standards A current standard is established for use over a short period, reflecting current conditions. It is obtained by adjusting the expected standard. x Its main disadvantage is that it is time consuming and costly to implement (e.g. new current standards must be recalculated each month).

2.5 Attainable Standards Attainable standards are challenging but should be attainable under existing operating conditions. They do make an allowance for a normal (i.e. expected) level of:
· machine breakdowns; and
· breaks (rests) by the workforce.
They do, however, require a high, though reasonable, level of efficiency. Attainable standards are more likely to be used than ideal standards because:
· They are achievable, so that so managers will be motivated.
· Any variances will highlight only abnormal conditions for the attention of management. This is useful for assisting in "management by exception".

2.6 Information Used for Setting Standards
In setting standards, for each input used, two criteria have to be determined: 1. Price per unit of input (e.g. kg or hour). 2. Quantity used per unit of output. There are various methods which might be used for setting these standards.
2.6.1 Price per Unit of Input The price per unit of input is usually set to reflect current market prices for the budgeted period. The difficulty with prices is that they may change due to external factors. A solution to this is that the budget or standard may be revised prior to performing variance analysis to take this into account. (Revisions of budgets are dealt with in Chapter 14.)

2.6.2 Quantity of Materials Quantities may be determined by a "bill of materials" prepared by product design, the engineering department or a works foreman. Allowance may need to be made for an expected level of waste (i.e. if there is a normal loss in a production process, input quantities must be grossed up for the loss in order to achieve a required level of output).

2.6.3 Direct Labour Hours For direct labour, "time and motion" studies of operations may be used to determine the most efficient production method. Time measurements determine standard hours for the typical worker to complete a job.

2.6.4 Wage Rates Wage rates are determined by company policy/negotiations between management and unions. Sometimes, standards may have to be set before the annual wage negotiations have been concluded.

2.6.5 Variable Overheads For variable overheads, a rate per unit of activity is calculated. The activity measure which exerts the greatest influence on costs is used - usually direct labour hours (although an alternative is to use machine hours).If there is no observable direct relationship between resources and output, past data may be used to forecast.

2.6.6 Fixed Overheads Because fixed costs are largely independent of changes in activity, they are constant over wide ranges in the short term. Therefore, for control purposes, a fixed overhead rate per unit of activity is inappropriate. For inventory valuation purposes, IAS 2 Inventories requires standard fixed overhead rates; however, this is not a requirement for management accounting.

3.1 The Principle
The controllability principle is that managers should be judged only on things within their control. In a system of responsibility accounting, managers are given responsibility for particular areas of the organisation. At the end of the period, the performance of managers may be judged at least in part by:
· variances which are attributed to their department;
· differences between actual and budgeted revenues, costs and profits.
Managers' remuneration may also be linked to this (e.g. bonuses could be paid if managers achieve their budgeted profit figures). It is essential, therefore, that the performance management system is fair.

Quiz: Controllability
Rehan is the production manager of a factory making ball bearings. His performance is judged using variance analysis. The variance analysis for the last month has just been performed and includes the following:
· An adverse materials price variance due to a change in the supplier. The supplier was changed because Rehan complained that the quality of the products sold by the previous supplier was substandard.
· A labour idle time variance caused by two factors: 1. A strike lasting two days over pay. 2. A machine breakdown, meaning staff could not work until the machine was fixed.
· A fixed overhead variance caused by an increase in factory rent. All rental contracts are dealt with by the company's legal department.
Required: Discuss which of the events above (if any) are outside of Rehan's control and should, therefore, be ignored when assessing his performance.

Answer:
Materials price variance. This variance was caused by Rehan's decision to switch supplier. He should, therefore, be held responsible for the variance. His decision to switch supplier may have been sensible and may reflect positively on some of his other variances, but the price variance was caused by Rehan.
Idle time variance - the strike. There is no clear-cut answer to this. On the one hand, it could be argued that the strike was caused by the trade unions rather than by Rehan, so he was not to blame. But if Rehan, as production manager, is responsible for negotiating and agreeing wages, he may be responsible. Idle time variance - machine breakdown. At first, it may appear that the machine breakdown was outside Rehan's control. However, as production manager, Rehan is responsible for the maintenance of the machines in the factory and, therefore, any breakdowns.

Fixed overhead variance. It seems relatively clear-cut that this particular expense is outside of Rehan's control. He has no responsibility for negotiating the rent. Therefore, he should not be "blamed" for this variance.

4.1 Importance of Flexed Budgets

At the start of the year, when a budget is prepared, estimates are made about the volume of sales and production. It is unlikely that the actual volume of sales and production will be the same as per the budget. This makes it difficult to compare actual performance against the budget, as they are based on different levels of activity. The budget can be flexed at the end of the period before this comparison takes place. The flexed budget is then compared to the actual results. This results in a more valid comparison, as like is being compared with like.

Key Point

Flexing the budget means that the budget is recalculated using the actual volume of sales and production.

Example of Budgeted v Actual Results

The following are extracts from a company's budgeted and actual results:

Budgeted production	100 units	
Budgeted materials cost per unit	$5	
Actual production	200 units	
Actual materials cost per unit	$4	
The three relevant figures here are as follows:		
Original budget	100 x $5 = $500	
Flexed budget	200 x $5 = $1,000	
Actual cost	200 x $4 = $800	

The $500 difference between the original budget and the flexed budget reflects the additional expected cost which resulted from higher-than-expected volume. The $200 difference between the flexed budget and the actual cost reflects that $200 less was spent on materials than expected, given the volume of activity. This variance is the more useful assessment of performance.

4.2 Usefulness

· The flexed budget is prepared at the same level of activity as actual output.
· Actual revenues and costs are compared to what budgeted costs and revenues should be for the actual level of activity achieved. This highlights variances caused by higher or lower prices and costs than budgeted.
· The difference between the original budgeted profit and the flexed budget profit shows the effect on profit of operating at a different activity level from plan.

Summary:
· A standard cost is a planned cost for a product or service.

· When actual costs are compared against the standard, the resulting variances can be investigated to identify the cause. Standard costing is, therefore, an important element in financial control.

· Ideal standards, which assume perfect operating efficiency, are likely to be impossible to achieve in practice, so their use is demotivating.

· Attainable standards should be challenging but achievable under existing operating conditions.

· Controllability is the principle that managers should be evaluated only on that which they can control.

· When actual activity levels vary from budget, the original budget must be flexed in order to make meaningful the comparison with actual results. Flexing a budget means recalculating the budget based on the original budget assumptions, at the actual level of activity.

Chapter 12: Basic Variance Analysis

This chapter covers the following Learning Outcomes. D. Budgeting and Control 7. Performance analysis a) Analyse and evaluate past performance using the results of variance analysis. Note that this is a review of basic variance knowledge and interpretation from Management Accounting. Learning Outcome D7a also applies to advanced variance analysis (Chapters 13 and 14)

1.1 Introduction

This chapter revises the "basic variances" examined in Management Accounting and introduces the labour idle time variance. Various methods may be used to compute the basic variances shown here. Exam advice Although "basic" variances are examined in Management Accounting, they are also examined in Performance Management. However, at this level, there is more emphasis on understanding the possible causes.

Quiz: Variance Analysis
The standard revenue and cost of a squidget is as follows:

Activity 1 Variance Analysis			Hide	
The standard revenue and	cost of a squidget is as follows:			
Standard				$ per unit	
Sales price				100	
Costs:					
Material	(2 kg @ $20/kg)			40	
Labour	(11/2 hrs @ $2/hr)		3		
Variable overheads	(11/2 hrs @ $6/hr)		9		
Fixed overheads	(11/2 hrs @ $10/hr)		15		
Cost of production			67		
Profit per unit			33		
Original budget			$ per unit		$000
	(50,000 squidgets @				

			$000		$000
Sales	$100)		100		5,000
Production	(55,000 squidgets) (110,000 kg @				
Materials	$20/kg)		40		2,200
Labour	(82,500 hrs @ $2/hr)		3		165
Variable overheads	(82,500 hrs @ $6/hr)		9		495
	(82,500 hrs @				
Fixed overheads	$10/hr)		15		825
Standard cost of					
production			67		3,685
Less: Closing inventory	(5,000 @ $67)				(335)
Standard cost of goods					
sold					3,350
Budgeted profit	(50,000 @ $33)		33		1,650
Actual results			$000		$000
	(53,000 squidgets @				
Sales	$95)				5,035
Production	(56,000 squidgets)				
Materials					
Purchased	130,000 kg		2,700		
Closing inventory	20,000 kg @$20		(400)		
			2,300		
Labour	(85,000 hours paid)				180
	(83,000 hours				
Variable overhead	worked)				502
Fixed overhead			935		
			3,917		
Closing inventory	(3,000 @ $67)				(201)
			3,716		
Actual profit					1,319

A calculation of the flexed budget shows the following variances:

		$000	Flexed budget $000	Actual $000	Variance
Sales	(53,000 x $100)	5,300	5,035		265 Adverse
Production costs					
Materials	(56,000 × 2kg × $20) (56,000 x 11/2 hrs x	2,240	2,300		60 Adverse
Labour	$2) (56,000 x 11/2 hrs x	168	180		12 Adverse
Variable overheads	$6)	504	502		2 Favourable
(56,000 x 11/2 hrs x					
Fixed overheads	$10)	840	935		95 Adverse
Less: Closing inventory		(201)	(201)		

| Cost of goods sold | | | 3,551 | 3,716 | | | |
| Profit | | | 1,749 | 1,319 | | | |

Required: Applying absorption costing and using the PROFORMA solutions that follow as prompts, calculate the variances for:

a. Sales (s.1.2);

b. Materials (s.1.3);

c. Labour (s.1.4);

d. Variable overheads (s.1.5); and

e. Fixed overheads (s.1.6).

Answer:

a. Sales Variances

(i) Sales Volume

	Units	
Actual sales	53,000	
Budgeted sales	50,000	
Difference	3,000	
x standard profit per unit	$33	
Sales volume variance ($000)	99	Favourable

(ii) Sales Price

(ii) Sales Price	$000	
Actual sales at actual price (actual revenue)	5,035	
Actual sales at standard price (53,000 x $100)	5,300	
Sales price variance	265	Adverse

b. Materials Variances

	$000	
Actual materials purchased at actual price	2,700	
Actual materials purchased at standard price (130,000 x $20)	2,600	
Materials price variance	100	Adverse
(ii) Materials Usage	Kg	
Materials used (130,000 - 20,000)	110,000	
Standard materials for actual production (56,000 x 2)	112,000	
Difference	2,000	
× standard price per kg	$20	
Materials usage variance ($000)	40	Favourable

c. Labour Variances

(i) Labour Rate Variance

	$000	
Actual hours paid at actual rate	180	
Actual hours paid at standard rate (85,000 x $2)	170	
Labour rate variance	10	Adverse

(ii) Idle Time Variance

	Hours	
Hours paid	85,000	
Hours worked	83,000	
Idle time	2,000	
x standard hourly rate	$2	
Idle time variance ($000)	4	Adverse

(iii) Labour Efficiency Variance

	Hours	
Labour hours worked	@83,000	
Standard labour hours for actual production (56,000 x 1.5)	84,000	
Difference	1,000	
x standard rate per hour	$2	
Labour efficiency variance ($000)	2	Favourable

d. Variable Overhead Variances
(i) Variable Overhead Rate Variance

Variable Overhead Rate Variance	$000	
Actual variable overhead cost	502	
Labour hours worked x standard variable overhead rate per hour(83,000 * $6)	498	
Variable overhead rate variance ($000)	4	Adverse

(ii) Variable Overhead Efficiency Variance
Hours Labour hours worked 83,000 Standard labour hours for actual production 84,000 Difference 1,000 x standard variable overhead rate per hour $6 Variable overhead efficiency variance ($000) 6 Favourable

	Hours	
Labour hours worked	83,000	
Standard labour hours for actual production	84,000	
Difference	1,000	
x standard variable overhead rate per hour	$6	
Variable overhead efficiency variance ($000)	6	Favourable

(e) Fixed Overhead Variances
(i) Fixed Overhead Expenditure Variance

	$000	
Actual fixed cost	935	
Budgeted fixed cost	825	
Fixed overhead expenditure variance	110	Adverse

(ii) Fixed Overhead Volume Variance

| | Units |

Actual production	56,000
Budgeted production	55,000
Difference	1,000
x standard fixed overhead rate per unit	$15
Fixed overhead volume variance ($000)	15	Favourable

(iii) Fixed Overhead Capacity and Efficiency Variance

	Hours		Hours
Actual labour hours	83,000	Actual labour hours	83,000
Budgeted labour hours	82,500	Standard hours for actual output	84,000
Difference	500		1,000
x standard rate per hour	$10	x standard rate per hour	$10
Fixed overhead		Fixed overhead	
capacity variance ($000)	5(F)	efficiency variance ($000)	10(F)

Key point
Variances are favourable if they result in an increase in profits or adverse if they lead to a fall in profits. When computing a variance, it must be shown whether the variance is favourable or adverse.

1.2 Sales Variances
1.2.1 Sales Volume Variance The sales volume variance shows the effect on profit of selling more or less than the budgeted quantity. Note that the activity below uses absorption costing principles.

1.2.2 Sales Price Variance The sales price variance shows the effect on profit of selling at a higher or lower price than the standard.

1.3 Materials Variances
1.3.1 Causes The total cost variance can be broken down into two further variances:
· Price, if the price paid per kg is not at standard.
· Usage, if more (or less) is used than should have been used for the production achieved.

1.3.2 Materials Price Variance
Materials Price Variance = Actual materials purchased at actual price - Actual materials purchased at standard price Materials; if positive, Adverse; if negative, Favourable.
Key point
The materials price variance is based on the quantity of materials purchased during the period. If more materials are purchased than used, there will be an increase in inventory.

1.3.3 Materials Usage Variance

Exam advice When calculating usage and efficiency variances, always use the actual usage and not the actual purchases (if usage and purchases differ) and compare the actual usage to the standard usage for actual output, not the original budgeted usage.

1.4 Labour Variances
1.4.1 Causes
The total labour cost variance can be broken down into three variances.
1. Rate, if the hourly rate was higher or lower than expected.
2. Idle time, if there were unproductive hours.
3. Efficiency, if more (or fewer) hours were worked than should have been. In principle, the calculation of the labour rate variance is the same as the materials price variance, and the labour efficiency variance is the same as the materials usage variance.

1.4.2 Labour Rate Variance
Labour Rate Variance - Actual hours paid at actual rate - Actual hours paid at standard rate
Labour rate variance; if positive, Adverse; if negative, Favourable.

1.4.3 Idle Time Variance (ii)

idle Time Variance	Hours
Hours paid	85,000
Hours worked	83,000
Idle time	2,000
x standard hourly rate	$2
Idle time variance ($000)	4

1.4.4 Labour Efficiency Variance

Labour Efficiency Variance	Hours
Labour hours worked	83,000
Standard labour hours for actual production (56,000 x 1.5)	84,000
Difference	1,000
x standard rate per hour	$2
Labour efficiency variance ($000)	2

1.5 Variable Overhead Variances
1.5.1 Causes
The total variable overhead cost variance can be broken down into two variances where variable overheads are accounted for on a labour hour basis:
1. Rate, if the actual rate incurred is non-standard.
2. Efficiency, which is identical in cause to the labour efficiency variance but is calculated using the standard variable overhead absorption rate.
Exam advice Assume that variable overheads are incurred during productive labour hours only (i.e. hours worked) unless told otherwise.

1.5.2 Variable Overhead Rate Variance

Variable Overhead Rate Variance	$000

Actual variable overhead cost	502
Labour hours worked x standard variable overhead rate per hour (83,000 × $6)	498
Variable overhead rate variance ($000)	4	Adverse

1.5.3 Variable Overhead Efficiency Variance

Variable Overhead Efficiency Variance	Hours
Labour hours worked	83,000
Standard labour hours for actual production	84,000
Difference	1,000
x standard variable overhead rate per hour	$6
Variable overhead efficiency variance ($000)	6	Favourable

Key point
As for the labour efficiency variance, the variable overhead efficiency variance compares actual hours worked with the standard labour hours for actual production. This recognises that if more/fewer hours are worked than the standard, variable overheads will increase/decrease because these are incurred when people are working. For example, machines will be running, so additional power costs will be incurred.

1.6 Fixed Overhead Variances

1.6.1 Causes Two possible variances arise:

1. The expenditure variance compares the actual fixed cost with the original budget. If the company uses marginal costing, this is the only variance which is calculated.

2. If the company uses absorption costing ONLY, a second variance is calculated, called the volume variance: - A "favourable" volume variance represents a correction to profits for over-absorption; - An "adverse" variance is a correction for under-absorption.

1.6.2 Fixed Overhead Expenditure Variance

Fixed Overhead Expenditure Variance	$000
Actual fixed cost	935
Budgeted fixed cost	825
Fixed overhead expenditure variance	110	Adverse

Key point
Because fixed costs are fixed, the expenditure variance is the only real fixed overhead variance (i.e. that results in cash flow).

1.6.3 Fixed Overhead Volume Variance

Fixed Overhead Volume Variance	Units
Actual production	56,000
Budgeted production	55,000
Difference	1,000
x standard fixed overhead rate per unit	$15

1.6.4 Fixed Overhead Capacity and Efficiency Variances

If the fixed overhead is absorbed using labour hours, the fixed overhead volume variance can be further analysed into two additional variances: the capacity variance and the efficiency variance.

Fixed overhead volume variance -> Capacity variance Efficiency variance

The capacity variance compares actual labour hours worked with the original budget. If more hours were worked than budgeted, more fixed overheads are absorbed, so there will be a favourable variance. If fewer hours were worked than budgeted, there will be an adverse variance. Having more actual hours than budgeted is positive as it means the entity can produce more than expected. The efficiency variance is similar to the labour efficiency and variable overhead efficiency variances. It compares the actual labour hours worked with the standard labour hours for actual output.

	Hours			Hours
Actual labour hours	83,000	Actual labour hours		83,000
Budgeted labour hours	82,500	Standard hours for actual output		84,000
Difference	500			1,000
x standard rate per hour	$10	x standard rate per hour		$10
Fixed overhead		Fixed overhead		
capacity variance ($000)	5(F)	efficiency variance ($000)		10(F)

2.1 A Reconcilation

The operating statement is a formal reconciliation of budgeted profit (under absorption costing) to actual profit. The reconciling items are the individual variances.

Exam advice Unless explicitly told otherwise, assume that all inventories (raw materials and finished goods) are stated at standard rather than actual cost.

Example of Reconciliation

Under Absorption Costing Required: Using the variances calculated in Activity 1, prepare an operating statement for the period under absorption costing.

		Favourable	Adverse		
		$000	$000	$000	
Budgeted profit (BQ * standard profit per unit)				1,650	
Sales margin variances					
Price (AP - SP) AQ			265		
Volume (AQ - BQ) standard profit per unit	99			(166)	
Standard profit on actual sales				1,484	
Cost variances					
Materials					
. price (SP - AP) AQp			100		
· usage (SQ - AQ) SP	40				
Labour					
· rate (SR -AR) AHp Labour			10		
· idle time (SH - AHp) SR			4		
. efficiency (SH - AHw) SR	2				

Variable overhead				
. rate (SR -AR)AHw			4	
. efficiency (SH -AHw) SR	6			
Fixed overhead				
· expenditure budget - actual			100	
. capacity (AHw - BH)SR	5			
. efficiency (SH -AHw) SR	10			
	63	228	(165)	
Actual profit			1,319	

3.1 Differences

There are two differences between this and the total absorption approach just seen: 1. The only fixed overhead variance will be the expenditure variance. There can be no volume variances, as there is no attempt to absorb fixed overheads into production. 2. The sales volume variance must be re-calculated using standard contribution rather than standard profit.

3.2 Pro-Forma

Quiz: Reconciliation
Prepare an operating statement for the period under marginal costing.

		Favourable	Adverse
		$000	$000	$000
Budgeted contribution				2,400
(BQ x standard unit contribution)				
Sales margin variances				
Price as before		256		
Volume (AQ - BQ) standard unit contribution	144			(121)
Standard profit on actual sales				
Cost variances as before				
Materials				
· price		100		
· usage	40			
Labour				
· rate		10		
· idle time		4		
· efficiency	2			
Variable overhead				
· rate			4	
· efficiency	6			
	48	118	(70)	
			2,209	
Fixed overhead				
Budgeted		825		

Expenditure variance as before		110	
			(935)
Actual profit			1,274

4.1 Profit with Inventory at Actual Cost
The actual profit with inventory valued at actual cost is: sales - costs + closing inventory

4.2 Variances
When inventory is valued at actual cost, some of the current period's production cost variances are carried forward in the inventory value rather than being expensed in profit or loss (which happens when inventory is valued at its standard cost).

4.3 Accounts
For internal (management control) purposes, inventory is usually valued at its standard cost to highlight variances and to encourage any necessary remedial action to be taken. For external financial reporting (e.g. annual accounts), inventory is usually valued at its actual cost in accordance with IAS 2 Inventories.

5.1 General Causes Variances may be caused by:
· Planning errors (e.g. inaccurate standards)
· Measurement errors (e.g. time recording errors)
· Random factors (e.g. natural disasters)
· Operational factors (e.g. management policies).

Operational factors may indicate that the process is out of control, and it is these which are considered below.
Exam advice If asked to discuss or comment on the causes of variances, read the scenario carefully to identify the clues to the potential causes. Reasons that are irrelevant to the scenario or that contradict the information provided will not earn marks.

5.2 Specific Causes

	Favourable	Adverse
Materials price	Bulk discounts	Market price increase (shortage)
	Good purchasing	Bad purchasing
	Delivery costs	
		Different supplier
		Different material
		Change in quality
Materials usage	Better quality	Defective material
	More efficient	Theft
		Excessive waste or spoilage
		Stricter quality control
		Different batch sizes
		Change in mix

Variance	Favourable	Adverse
Labour rate	Lower skilled labour	Wage rise
		Overtime working
		Bonus payments
	Different skill mix	
Idle time		Strikes
		Lack of material
		Breakdowns
		Injury/Illness
		Lack of orders
Labour efficiency	Positive motivation	Negative motivation
	Higher pay	Lower pay
	Better equipment	Poor equipment
	Learning effect	Slow working
	Better material	Poor material
	Higher skill	Lower skill
Overhead expenditure	Cost savings/cutbacks	Cost increases Excessive service usage
	Incorrect split of semi-variable and fixed costs	
Overhead efficiency	(see Labour efficiency)	
Overhead capacity	Increase in productive hours	Excessive idle time
		Shortage of plant capacity
Sales price	Market shortage	To achieve an increase in volume
		Change in quality
		Response to competitors
		Pass on cost changes
Sales volume	Increase in market share	Fall in market share
	Increase in market size	Fall in market size

5.3 Interdependence of Variances

Frequently, two or more variances will be caused by the same operational factor. It is necessary to consider the overall effect when considering any course of action.

5.3.1 Examples

· Purchase high-quality material: - Adverse materials price - Favourable materials usage.
· Raise the selling price: - Favourable sales price - Adverse sales volume.
· Use highly skilled labour: - Adverse labour rate - Favourable labour efficiency - Favourable variable overhead efficiency - Favourable fixed overhead efficiency.

5.3.2 A More Complex Example
Purchase high-quality material:
· Adverse materials price
· Favourable materials usage
· Favourable labour efficiency
· Favourable variable overhead efficiency
· Favourable fixed overhead efficiency
· Favourable sales price
· Adverse sales volume.

Summary:
· Variance analysis is a detailed investigation into why actual profits differ from the budget; it compares the actual costs against the standards.
· Formulae for the variances are as follows:
    Notation:
        AQ = Actual quantity (AH = Actual hours)
        BQ = Budgeted quantity (SH = Standard hours)
        AP = Actual price (AR = Actual rate)
        SP = Standard price (SR = Standard rate)
        SMn = Standard margin
    Sale variances:
        Sales volume: $(AQ - BQ)$ SMn
        Sales price: $(AP - SP)$ AQ
        Materials variances:
        Price: $(SP - AP)$ AQp
        Usage: $(SQ - AQu)$ SP
    Labour variances:
        Rate: $(SR - AR)$ AHp
        Idle time: $(AHw - AHp)$ SR
        Efficiency: $(SH - AHw)$ SR
    Variable overheads:
        Rate: $(SR - AR)$ AHw
        Efficiency $(SH - AHw)$ SR
    Fixed overheads:
        Expenditure: Budget − Actual
        Volume: $(AQ - BQ) \times$ Standard rate per unit or $(SH - BH)$ SR (Absorption costing only)
        Capacity: $(AH - BH)$ SR (Absorption costing only)
        Efficiency: $(SH - AH)$ SR (Absorption costing only)
        Capacity + Efficiency = Volume

· The budgeted quantity in usage variances and standard hours in efficiency variances is always "budgeted for actual production".
· The only differences between variance analysis using absorption and marginal costing are:
   Sales volume variance is valued at standard profit per unit for absorption and standard contribution per unit for marginal.
   There is only one fixed overhead variance for marginal costing; the expenditure overhead.
· Variances could be caused by planning, measurement, random factors or operational factors. As far as investigating variances are concerned, operational factors are more important.

Chapter 13: Advanced Variance Analysis
This chapter covers the following Learning Outcomes. D. Budgeting and Control 4. Material mix and yield variances a) Calculate, identify the cause of, and explain mix and yield variances. b) Explain the wider issues involved in changing mix (e.g. cost, quality and performance measurement issues). c) Identify and explain the relationship of the material usage variance with the material mix and yield variances. d) Suggest and justify alternative methods of controlling production processes. 5. Sales mix and quantity variances a) Calculate, identify the cause of, and explain sales mix and quantity variances. b) Identify and explain the relationship of the sales volume variances with the sales mix and quantity 7. Performance analysis a) Analyse and evaluate past performance using the results of variance analysis.

1.1 The Concept
The basic variances examined in the previous chapter included variances for materials: the materials price and usage variances. The basic variances assumed that the production process used only one type of material. Clearly, most real world products use more than one material. The standard cost of a product assumes a specific quantity of materials is used. Actual production costs may differ from the standard in the following ways:
· The prices paid for the materials may differ from the standard price. This will be reflected in the price variance. This is calculated in the same way as before, except that it is necessary to calculate price variances for each material used.
· The materials may be used in different proportions to the standard. This may lead to a different average cost. This is reflected in a variance called the mix variance.
· The standard may assume that there is some level of standard loss. The actual loss may be more or less than the standard loss. This is reflected in a yield variance.

Example of Mix and Yield Variances
A perfume is made by mixing essential oils with alcohol. Essential oils cost $15,000 per litre. Alcohol costs $10 per litre. In the standard, 1% of the liquid input is essential oil, and 99% is alcohol. If the production manager uses more oil and less alcohol, this would lead to a more expensive mix, as essential oil costs more than alcohol. This would result in an adverse mix variance. A normal loss of 37.5% of input occurs when making one litre of perfume. Therefore, the standard specifies using 1.6 litres of liquid to make one litre. If the production manager

inputs 1.6 litres of inputs and produces more than 1 litre, this would result in a favourable yield variance.

1.2 Calculating the Mix Variance

A tabular approach best illustrates how to calculate the mix variance:

	Actual quantity used	Actual quantity in standard mix	Difference	Variance
	litres/kg	litres/kg	litres/kg	S
	A	B	(A - B)	(A - B) * standard cost
Material 1 Material 2				
Material 3				
Total	X	X	0	$y

Points to note:

· Actual quantity used (column A) describes the actual amount of each material employed in production.

· Actual quantity in the standard mix equals the total actual quantity used (total column A) multiplied by the standard proportions. The quantity totals for columns A and B will be the same.

· Variance due to materials mix equals the third column multiplied by the standard price for each unit of input.

This method determines variances as the actual quantity of each material less the standard quantity for each material (represented as column A less column B). Using more of a particular material than its standard means additional cost (i.e. an adverse variance if column A item is larger than column B).

1.3 Calculating Yield Variance

The yield variance compares actual output with the output expected based on the actual input. It amounts to the difference between expected and actual output multiplied by standard cost per unit.

Pro Forma Calculation	Units
Actual output	A
× litres/kg should yield	B
Difference	(A - B)
	* standard cost per unit
Yield variance	x

The alternative tabular approach takes longer but is conceptually easier to understand. Firstly, it looks at the actual total quantity of materials, but this is split in the proportion of the standard mix. Secondly, it considers what the total quantity of materials used should have been for the actual output produced. Again, this is calculated in terms of the standard mix.

	Actual quantity in standard mix	Standard quantity for actual output	Variance
	litres/kg	litres/kg litres/kg	$
			(B - A) * standard cost

	A		B		(B - A)			
Material 1								
Material 2								
2								
Total								

Quiz: Materials Mix and Yield

The standard material cost of a unit of a product is:

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

The actual production 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

Required: Calculate the following variances: a. Total materials cost; b. Materials price; c. Materials mix; d. Materials yield; and e. Materials usage.

Answer:

a. Total materials cost variance

		$	
Standard cost of actual production (5,000 units * $8)		40,000	
Actual cost of actual production (27,000 + 11,000)		38,000	
		2,000	Favorable

b. Materials price variance

		Actual quantity at actual price	Actual quantity at standard price	Variance
		$	$	$
Material				
X		27,000 (9,900 * 3)	29,700	2,700
Y		11,000 (5,300 * 2)	10,600	(400)
		38,000	40,300	2,300	Favorable

c. Materials mix variance

		Actual quantity used	Actual quantity in standard mix	Difference	Variance
kg		kg	kg	S	
X		9,900 (2/3)	10,133	233 @ $3	699
Y		5,300 (1/3)	5,067	(233) @ $2	(466)
		15,200	15,200	0	233	Favorable

d. Materials yield variance

		Units
Actual output		5,000
15,200 kg should yield (@ 3 kg per unit, 15,200/3)		5,067

Difference (shortfall)		(67)	
* standard cost per unit		$8	
Yield variance ($)		(536)	Adverse

Alternative approach to yield variance:

		Actual quantity in standard mix	Standard quantity for actual output	Difference	Variance	
kg	kg	kg	$			
X	10,133	10,000	(133)	@$3	(399)	
Y	5,067	5,000	(67)	@$2	(134)	
	15,200	15,000		(533)	Adverse	

Actual output was 5,000 units. Standard usage is 2 kg of X and 1 kg of Y per unit.

e. Materials usage variance

	Actual quantity used actual output	Standard quantity for	Difference	Variance
	kg	kg	kg	$
X	9,900	10,000	100	300
Y	5,300	5,000	(300)	(600)
	15,200	15,000		(300) Adverse

Check: Materials usage variance = Mix variance + Yield variance = 233 - 533 = 300 adverse.

------
quiz: Materials Mix and Yield

The Imperial Chemical Company (ICC) makes various chemicals. Chemical X is made by combining three substances in a furnace. The following is the standard cost of 100 kg of Chemical X:

		$ per	
	kg	kg	cost
			$
Material A	75	0.7	52.5
Material B	25	1.3	32.5
Material C	25	3.0	75.0
	125		160

The loss of 25 kg in production is expected due to evaporation. Variances are calculated every day. Yesterday's output of 1,300 kg was obtained from the following inputs:

	kg
Material A	850
Material B	300
Material C	350
	1,500

Required: a. Calculate the materials mix variance. b. Calculate the yield variance.

Answer:

a. Mix variance

Material	Actual quantity used kg	Actual quantity in standard mix (Worikng) kg	Difference kg	Variance $
A	850	900	50 @ 0.7	35
B	300	300	0	0
C	350	300	(50) @3	(150)
	1,500	1,500	0	(115

The mix is adverse, because a higher proportion of the more expensive material (C) was used compared with the standard mix. WORKING Standard proportions are:

Material A: 75/125 = 0.6 (i.e. 60%)
Material B: 25/125 = 0.2
Material C: 25/125 = 0.2

These proportions are applied to the actual quantity used (1,500) to calculate the actual quantity in the standard mix.

b. Yield variance

125 kg of input yields 100 kg of output, so the standard yield is 80% (100/125).

	kg
1,500 kg should yield (80%)	1,200
Actual output	1,300
Difference (excess)	100
x standard cost per unit ($160 +100)	$1.60
Yield variance ($)	160

The yield variance is favourable because more output was achieved than expected, given the input.

Actual Alternative approach kg	Actual quantity in std mix kg	Standard quantity for actual output kg	Difference kg	Variance $
A 900	(1,625 * 75/125)	975	75 @ 0.7	52.5
300	(1,625 * 25/125)	325	25 @ 1.3	32.5
C 300	(1,625 * 25/125)	325	25 @ 3	75.0
1,500		1,625	0	160

Input for the actual output of 1,300 kg should have been 1,625 kg (1,300 * 125/100).

1.4 Interpreting Material Mix and Yield Variances

A favourable overall materials mix variance means the actual mix is cheaper than the standard mix. Cheaper materials have been substituted for more expensive ones. The perfume manufacturer in Example 1 would have a favourable mix variance if he used less than 1% of essential oils in the mix. While a cheaper mix saves money, it may imply poorer quality of the final product. This may mean a loss of customers in the long run. A favourable yield variance means that actual output exceeds the output expected for the given input units. This could be due to: less spillage due to production methods; or less waste due to quality of materials used as inputs.

1.5 Inter-relationship Between Price, Mix and Yield Variances

The materials price variance(s) may be outside the control of the production manager. For example, prices may be seasonal, based on a market rate, or negotiated by a buyer. Sometimes, a manager may obtain cheaper inputs from an alternative supplier. This will result in favourable price variances. However, if the cheaper materials are of lower quality, this may increase materials waste, resulting in an unfavourable yield variance. A manager who creates a favourable mix variance using an increased proportion of less expensive material may inadvertently cause an unfavourable yield variance. Exam advice When interpreting mix variances remember the controllability principle and manager performance assessment, as discussed in Chapter 11.

1.6 Wider Issues Relating to Product Mix

The materials mix may vary from standard for many products.

Example of Varying Materials Mix

Imagine cooking a meal at home. Perhaps you are following a recipe from a cookbook. Do you weigh the ingredients precisely so that your mix is exactly the same as the cookbook (the standard)? Or perhaps you vary them slightly based on your taste or simply because you do not measure everything precisely; you roughly estimate how much you have put in. You know that you will still have a meal, and hopefully, one that tastes good.

The standard product mix was likely set after considering the following issues:
· Balancing mix and yield - using a cheaper "mix" of materials often yields less. The standard mix attempts to minimise costs at an acceptable yield
· Quality - a cheaper mix may lead to lower cost, but this may also lower the quality.

1.6.1 Reasons for Varying the Mix

In practice, managers may move away from the standard mix for the following reasons:
· The price of materials may change away from the standard, so one becomes relatively more or less expensive.
· Inaccurate measurement of inputs due to carelessness or mistake.
· Intentionally using a cheaper mix to get a favourable mix variance.

1.6.2 Impact of Varying the Mix

A cheaper mix will lead to a favourable mix variance. However, adverse effects may also result.
· It may lead to a lower yield. When assessing the financial performance of the manager, the mix and yield variance need to be considered together. If the mix and yield variance added together give an overall favourable variance, that may be considered good from a financial perspective.
· It may reflect lower output quality. In the longer term, this will lead to a fall in sales reflected in an adverse sales volume variance. The sales volume variance will take some time to show and may occur in a later period, making it difficult to assess management performance in the current period.

Exam advice Always look for the whole picture when answering exam questions. A favourable mix and yield variance may result in an unfavourable non-financial impact (e.g. quality, customer satisfaction).

1.7 Alternative Methods of Controlling Production Processes

If production managers are evaluated on materials mix and yield variances, they may act to improve the measured variances at the expense of other important factors - particularly quality. To overcome this undesirable consequence, the performance evaluation of a manager should also consider additional measures. This could include rates of wastage or conversion rates of input. Customer satisfaction and quality are also important. However, measuring quality can be challenging, as it can be subjective.

2.1 The Concept

Where the company sells more than one product, the budget will include the budgeted quantity of each product sold. The actual sales can be compared with the budget, and the sales volume variance can be calculated. The overall sales volume variance can be analysed into two further categories: The sales mix variance compares the actual quantities of goods sold to the actual quantities sold at the standard mix. It shows the effect on contribution or profit of selling a different "mix" to the standard. If the products have different margins, the different mix will affect profits. . The sales quantity variance compares the actual quantity (units) of goods sold in the standard mix with the budgeted quantity sold in the standard mix.

2.2 Calculating the Sales Mix Variance

The best way to calculate the sales mix variance is to use a table:

Product	Actual sales in units	Actual sales units in budgeted mix	Difference in units	Standard margin	Sales mix variance
				$	$
	A	B	A - B	C	(A - B) * C
X					
Y					
Z					

In principle, the calculation of sales mix variance is similar to the materials mix variance. It is the difference between actual product sales and actual total sales allocated in the budgeted product sales mix multiplied by the standard margin per unit. The standard margin is either standard contribution or profit per unit, depending on the costing method used.

Exam advice Standard margin is either standard contribution per unit or standard profit per unit. If standard contribution, the variance is "sales mix contribution variance". If standard profit, the variance is the "sales mix profit variance".

2.3 Calculating the Sales Quantity Variance

The starting point for the quantity variance is actual sales, adjusted to the standard mix. This is then compared with budgeted sales, and the differences are multiplied by the standard margin.

Product	Actual sales in budgeted mix	Budgeted sales	Difference	Standard margin	Sales quantity variance
	(units)	(units)	(units)	$	$
	A	B	A - B	C	(A - B) x C
X					
Y					
Z					

Quiz: Sales Price, Mix and Quantity Variances

A company sells three related products: Q, P and R. The budgeted sales mix is 50% for Q and 25% for products P and R. The current period budget and actual sales are:

Budget	Products		
	Q	P	R
Unit sales	200	100	100
Price	$20	$25	$30
Contribution	$3	$4	$6
Actual			
Unit sales	180	150	170
Price	$22	$22	$26

Required: Calculate the sales price, sales mix contribution variance and sales quantity variances.

Answer:

Price variance

Q(180 × (22 - 20))	360
P (150 × (22 - 25))	(450)
R (170 × (26 - 30))	(680)
	(770)

Sales mix contribution variance

Product	Actual sales	Actual sales in budgeted mix	Difference	Standard contribution	Sales mix contribution variance
	(units)	(units)	(units)	S	$
Q	180	250	(70)	3	(210)
P	150	125	25	4	100
R	170	125	45	6	270
	500	500	0		160

Favorable

The sales mix variance is favourable because customers have switched from product Q, which has the lowest contribution margin, to products P and R, which have higher margins.

Quantity variance

Product	sales in budgeted mix (units)	Budgeted sales	Actual Difference	Standard contribution	Sales quantity variance
	(units)	$	$		
	250	200	50	3	150	
	125	100	25	4	100	
R	125	100	25	6	150	
	500	400			400	Favourable

2.4 Interpreting the Sales Mix and Quantity Variance
2.4.1 Usefulness of Sales Mix and Quantity Variances When sales of various products are unrelated, the demand and price for each product will be considered separately to optimise profits. The budgeted sales mix has no significance. The sales price and volume variance calculated on a product-by-product basis should provide sufficient information for management to identify any products underperforming. Sales mix and quantity variances will not provide additional useful information. Analysing the sales volume variance into mix and quantity variances is only likely useful when sales of the various products are interrelated. The analysis may indicate that products are substitutes or complements. Similar products could be differentiated by package size or brand. In such situations, the mix of products may have been considered when the budget was prepared, and management will be interested in the sales mix and quantity variances.

2.4.2 Meaning of Sales Mix Variances An adverse mix variance means that customers are buying less of the higher-margin products and are instead buying lower-margin products. It implies substitution of one product for another, rather than a reduction in the overall quantity of products sold.

Example of Contribution Margin
A coffee drinker decides to stop buying an expensive coffee beverage from a coffeehouse chain and switches to a cheaper drink from the same chain but continues to buy the same number of cups of coffee. This would reduce the contribution margin of the coffee seller.

2.4.3 Meaning of Sales Quantity Variance
The sales quantity variance shows the actual quantity of goods sold against the budget. An adverse variance may be due to poor economic conditions or a new competitor. This variance identifies factors which affect sales of all the products. 2.4.4 Inter-relationships Between Variances The variances above are likely to be interrelated, so any analysis of variances should look at all the variances together rather than individually. For example:
· Sales price and sales volume variances: a fall in selling prices for products would lead to an adverse price variance. However, if it also leads to higher demand for the products, the volume variance would be favourable.
· Sales mix and quantity variances: an adverse sales mix variance may be due to customers switching to cheaper ranges or brands as these may be considered better value. If these "better

value" products attract customers from other products too, this will lead to a favourable quantity variance.

Summary:
· Materials mix variances measure the effect of using a different mix of inputs in the production process.
· Materials yield variances compare the actual output with the expected output, given the input material quantities and standard wastage.
· Sale mix variances show how changing the mix of products affected contribution.
· Sales quantity variances show the effect on budgeted sales of selling a higher or lower quantity.
· The budgeted sales mix has no significance when product sales are unrelated.
· Sales volumes of different products may be inter-related, for example, a sales decrease in one product may be compensated by a sales increase for a substitute product.
· Because of the relationship between price and demand, an unfavourable sales price variance will usually lead to a favourable volume variance (and vice versa).

Chapter 14: Planning and Operational Variances
This chapter covers the following Learning Outcomes. D. Budgeting and Control 6. Planning and operational variances a) Calculate a revised budget. b) Identify and explain those factors that could and could not be allowed to revise an original budget. c) Calculate, identify the cause of and explain planning and operational variances for: i) sales, including market size and market share; ii) materials; labour, including the effect of the learning curve. d) Explain and discuss the manipulation issues involved in revising budgets. 7. Performance analysis a) Analyse and evaluate past performance using the results of variance analysis. b) Use variance analysis to assess how future performance of an organisation or business can be improved. (d) Discuss the effect that variances have on staff motivation and action. (e) Describe the dysfunctional nature of some variances in the modern environment of JIT and TQM. (f) Discuss the behavioural problems resulting from using standard costs in rapidly changing environments.

1.1 Principles
At the end of a budget period, before comparing an organisation's actual performance against the budget, budgets may be revised to take account of environmental changes that were not anticipated when the budget was prepared. The reason for such revision is that because managers are judged on how they performed relative to the budget, it is unfair to use a budget that turns out to be unrealistic. The principles that should be applied when revising budgets are as follows:
· If something occurred during the budget period that was outside the control of the manager meant that the budget became unrealistic, the original budget should be revised.
· Management should not revise budgets to hide inefficiencies.
· Senior management should approve only appropriate revisions.

Quiz: Budget Revisions

The budget for an airline for the year ended 31 December 20X1 was prepared in October 20X0. Since the budget was prepared, the following events occurred:

· The price of oil increased 25% on world markets. This caused airline fuel prices to rise. Fuel accounts for 25% of the airline's costs.

· Due to a strike, the airline could not operate for four weeks of the year. There was no revenue during this period.

· The airline lost an additional two weeks of revenue due to the eruption of the Eyjafjallajokull volcano in Iceland and the associated ash cloud.

Required: For each event above, discuss which should result in budget revisions and which should not.

Answer:

Budget revisions should be made regarding the increase in fuel costs and the volcano ash - as these are clearly outside of the control of management. The lost revenue from the strike is less clear. On the one hand, the strike could be "blamed" on the management for poor industrial relations. It would, therefore, be inappropriate to revise the budget, and management should be "blamed" for the loss of revenue during this period. On the other hand, it could be argued that it was outside management's control because unions called the strike.

Exam advice Although the answer above may appear a little "woolly" in that it does not reach a definite conclusion, the real world often presents situations with no "right" answer. Both sides of the argument need to be given in response to questions of this nature rather than a quick conclusion.

2.1 Problems of Traditional Variance Analysis

Traditional variance analysis compares: ACTUAL PERFORMANCE versus EXPECTED

Management should consider revising the standards for expected performance:

· If the actual environment differs from what was anticipated when the original standard was set; or

· Even if the environment has not changed, the benefit of hindsight shows that an unrealistic standard was used (e.g. ideal standard). The factors to consider in deciding whether to revise a standard are essentially the same as whether to revise a budget (as above). The variances calculated by comparing actual performance against the revised standard are referred to as operational (or operating) variances. The calculation of these is the same as the method used to calculate traditional variances; the only difference is that a revised standard is used.

· The difference between the revised standard and the original standard is the planning variance (or budget revision variance). These variances can relate to any element of the standard product specification or to sales/production volumes.

Planning variance - arises when an original budget is revised with the benefit of hindsight (i.e. ex-post meaning "after the fact").

Operational variance - arises when actual performance differs from a revised standard.

2.2 Planning Cost Variances
There are various methods of calculating planning variances. The following approach starts with the traditional variance (e.g. a material price variance), which is then analysed into planning and operational variances. Exam advice This is the preferred approach for the Performance Management exam.

2.2.1 Materials Price and Labour Rate
The approach to calculating the materials price and labour rate variances is the same, so these two variances are dealt with together here.
· For materials, the references to quantity are to quantities of materials;
· For labour, the quantities are labour hours.

Traditional Price/Rate Variance
	$
Actual quantity * Actual price	x
Actual quantity * Standard price	X
Price variance	x
If the standard price is subsequently revised, the traditional variance can be analysed into planning and operational variances as follows:
Planning Price Variance
This shows the effect of revising the standard cost by comparing the standard cost of actual materials using the old and new standard cost:
	$
Actual quantity * Original standard price	x
Actual quantity * Revised Standard price	X
Planing price variance	x
This is adverse if the revised standard price is higher than the original standard price.

Operational Price Variance
	$
Actual quantity * Actual price	x
Actual quantity * Revised Standard price	X
Operational price variance	x
This is favourable if the actual price is less than the revised standard price.

Quiz: Materials Price Variances
The standard cost of Material X is $4 per kg. During the month, 10,000 kg were purchased at a total cost of $42,500.
Required: a. Calculate the traditional material price variance for the month. b. The purchasing manager argued that the original standard cost in the variance report was unrealistic. Market

prices of Material X rose considerably during the month, and it has been agreed that a more realistic standard cost would have been $4.50 per kg. Calculate the planning price and operational price variances for the month. c. Comment on how the operational price variance provides a fairer indication of the performance of the purchasing manager than the traditional price variance.

Answer:
a. Traditional price variance

	$
Actual materials at actual price	42,500
Actual materials at standard price (10,000 * $4)	40,000
Materials price variance (adverse)	2,500

b. Planning and operational variances

	$
Actual materials at original standard price (10,000 * $4)	40,000
Actual materials at revised standard price (10,000 * $4.5)	45,000
Planning price variance (adverse)	5,000
Operational variance	

	$
Actual materials at actual price	42,500
Actual materials at revised standard price (10,000 * $4.5)	45,000
Operational price variance (favourable)	2,500

c. Comment on the purchasing manager's performance The price variance reflects, to some extent, the performance of the purchasing manager:
· If the purchasing manager is effective, he may be able to negotiate better prices.
· If price variances are adverse, however, this suggests that the manager is not managing to achieve the standard price and is therefore not "doing a good job."

The traditional price variance is $2,500 adverse, suggesting that the purchasing manager has not performed well. However, this would not be a fair conclusion. The actual cost of materials was higher than the standard because the market prices of Material X increased after the standard was set. This increase was outside the manager's control, so he should not be held responsible. Therefore, the traditional variance does not reflect the purchasing manager's performance fairly. The operational variance compares the performance against a standard that has been updated to reflect the change in the market price. It provides a more reliable indicator of performance. In this case, the operational price variance is favourable, which suggests that the purchasing manager has performed well. He has managed to obtain a price below the market price. Because this is more reliable, it can be said to be fairer.

2.2.2 Materials Usage and Labour Efficiency

The approach to calculating the materials usage and labour efficiency variances is the same, so they are dealt with together here.

Traditional Usage/Efficiency Variance

	Kg/Hours, etc
Actual quantity used	X
Standard quantity for actual output	X
Difference	X
At standard price/rate per unit/hour	$x
Materials usage (labour efficiency) variance	$x

Planning Usage/Efficiency Variance

	Kg/Hours, etc
Original standard quantity for actual output	X
Revised standard quantity for actual output	X
Difference	X
At original standard price/rate per unit/hour	$x
Materials usage/labour efficiency planning variance	$x

This is adverse if the revised standard quantity is greater than the original standard quantity.

Operational Usage/Efficiency Variance

	Kg/Hours, etc
Actual quantity used	X
Revised standard quantity for actual output	
Difference	X
At original standard price/rate per unit/hour	$x
Materials usage/labour efficiency operational variance	$x

Quiz: Labour Efficiency Variances and operational variances

A standard cost was set for a new product at the start of a month. The standard for the labour component was 0.25 hours at $10 per hour. In the last month, the actual output of the product was 1,000 units, and 320 labour hours were worked. At the end of the month, it was agreed that the factory accountant had been a little unrealistic in setting a standard of 0.25 hours per unit. A more appropriate standard would have been 0.3 hours per unit. It has been agreed that the standard will be revised to this amount. There was no idle time and no learning curve effect. Required: a. Calculate the traditional labour efficiency variance. b. Calculate the labour efficiency planning and operational variances. c. Comment on how the operational efficiency variance gives a more appropriate indication of the performance of the factory manager than the traditional efficiency variance.

Answer:
Operational efficiency variance

a. Traditional labour efficiency variance	Kg/Hours, etc
Actual hours worked	320

Standard hours for actual output (1,000 x 0.25)		250	
Difference	70		
At standard rate per hour		$10	
Labour efficiency variance (adverse)		$700	

(b) Planning on operational efficiency variances Planning efficiency variance		Hours	
Original standard hours for actual output		250	
Revised standard hours for actual output (1,000 x 0.3)		300	
Difference	50		
At standard rate per hour		$10	
Labour planning efficiency variance (adverse)		$500	
Operational efficiency variance		Hours	
Actual hours worked	320		
Revised standard hours for actual output		300	
Difference	20		
At standard rate per hour		$10	
Labour operational efficiency variance (adverse)		$200	

c. Fairness of operational efficiency variance The traditional efficiency variance is $700 adverse. This would reflect unfavourably on the factory manager as the actual factory hours were almost 30% more than the standard. It has been claimed, however, that the standard was overly optimistic. Using an inappropriate standard would certainly not be fair, so the traditional variance would not be a fair performance measure. The standard has been revised to make it more realistic. The operational variance compares the actual performance against the revised standard and should, therefore, be a fairer indicator of the performance of the factory manager. This is still adverse, but the actual hours worked are only 6.7% higher than the revised standard, so the situation is not as bad as the traditional variance indicates. Care must be taken when revising such standards to ensure they are not adjusted to hide poor performance. It would be necessary to challenge the assertion that the original standard was overly optimistic and to ascertain how the revised standard time of 0.3 per unit was reached.

Quiz: Materials
Standard material cost/unit:	4 kg at $2.50 =$10
Budgeted output:	20,000 units
Actual output:	22,000 units
Materials actually used:	86,000 kg at $3
With hindsight, a better standard would have been 3.75 kg per unit at $2.80 per kg. Required: a. Calculate the traditional variances: i. Price variance; ii. Usage variance; iii. Overall material variance (price + usage). b. Analyse the price variance into planning and operational. c. Analyse the usage variance into planning and operational.

Answer:

a. Traditional price and usage variances

	$
Price variance (2.50 - 3.00) 86,000	43,000 A
Usage variance (22,000 x 4 - 86,000) $2.50	5,000 F
Total variance	38,000 A

b. Planning price and operational price variances

Planning variance	$
Actual materials at original standard price (86,000 * 2.5)	215,000
Actual materials at revised standard price (86,000 * 2.8)	240,800
Planning price variance (adverse)	25,800
Operational variance	$
Actual materials at actual price (86,000 * 3)	258,000
Actual materials at revised standard price (86,000 * 2.8)	240,800
Operational price variance (adverse)	17,200
Note: The sum ($25,800 + $17,200) equals the traditional price variance of $43,000

c. Planning usage and operational usage variances

Planning usage variance

	Kg
Original standard quantity for actual output (22,000 × 4)	88,000
Revised standard quantity for actual output (22,000 x 3.75)	82,500
Difference	5,500
At original standard price per kg	$2.50
Materials planning usage variance (favourable)	$13,750
Operational usage variance	

	Kg
Actual quantity used	86,000
Revised standard quantity for actual output	82,500
Difference	3,500
At original standard price per kg	$2.50
Materials operational usage variance (adverse)	$8,750

Note: The sum ($13,750 - $8,750) equals the traditional usage variance of $5,000 favourable. This revised analysis still indicates that there is inefficiency on the part of the buying department, but also suggests that there could be more efficient usage of materials. Compare this with the traditional analysis, which suggested a more serious inefficiency in buying (i.e. $43,000 adverse price variance) coupled with efficient usage of materials.

2.3 Learning Curve and Labour Variances

Where a learning curve applies, standard costs based on the cost of producing the first unit of a product may quickly become out of date, meaning that the variances will become meaningless. To adjust for this, the "standard hours for actual production" in the labour efficiency variance should take into account the learning curve (see Chapter 10).

Quiz: Learning Curves and Variances
Martin Co developed a new product. It set a standard labour cost based on the expected time to make the first unit of the product, which was 100 minutes. A 90% learning rate is expected to apply, and the budgeted cost per hour of labour time is $12 per hour. This learning rate was not incorporated into the standard. The actual time taken to make the first four units was 350 minutes and the cost was $80.
Required: a. Calculate traditional labour rate and efficiency variances. b. Re-calculate the labour efficiency variance to take account of the learning rate.

Answer:
a. Labour rate variance

			$
	Actual labour hours * Actual rate		80
	Actual labour hours * Standard rate (350/60) x $12		70
	Labour rate variance (adverse)	10	
	Labour efficiency variance		
			$
	Actual labour hours * Standard rate		70
	Standard hours for actual production x Standard rate		
	Standard hours for actual production x Standard rate (4 units * 100 minutes) x $12/60	80	
	Labour efficiency variance (favourable)		10

b. Re-calculated labour efficiency variance

	Actual labour hours x Standard rate		70
	Standard hours for actual production x Standard rate		
	(working) 324 minutes x $12/60		65
	Labour efficiency variance (adverse)		5

WORKING Standard hours for actual production, taking into account the learning rate of 90%:

Output (units) Cumulative average time Total time 1 100 2 90 180 4 81 324

Output (units)	Cumulative average time	Total time
1	100	100
2	90	180
4	81	324

2.4 Market Size and Market Share Variances
2.4.1 The Concept A traditional sales volume variance may result from:

· a market size variance, which arises because the size of the market was different from expected due to a change in the external environment (e.g. economic growth); or
· a market share variance, which arises because the share of that market was different from the budget (e.g. due to effective advertising). If the actual market size for a product is known, the sales volume variance can be analysed as follows: Sales Volume Variance SALES VOLUME PLANNING VARIANCE Sales managers can control the market share variance but cannot control the market volume variance. Therefore, any bonus for the sales manager should be linked to the market share variance.

2.4.2 Market Size Variance

	Units
Budgeted sales quantity	X
Revised budgeted quantity	
(Actual market size x Budgeted market share)	X
Difference	X
* Standard contribution/profit per unit	$X
Market size variance	$X

Exam advice If marginal costing is used, multiply the differences by the standard contribution per unit. If absorption costing is used, multiply the differences by the standard profit per unit.

2.4.3 Market Share Variance

	Units
Actual sales quantity	X
Revised budgeted quantity	X
Difference	X
x Standard contribution/profit per unit	X
Market share variance	$X

Quiz: Sales Planning and Operational Variances
Acme has a sales budget of 1,795 units at a unit contribution of $20.00. This is based on the company maintaining a 5% market share. The market for the industry was estimated to be 35,900 units. Actual sales volumes were as follows: Acme 1,850 units, Industry 37,500 units. Required: Calculate for Acme: a. the traditional sales volume variance; and b. the market size and market share variance.

Answer:
a. Sales volume variance (1,850 - 1,795) $20 = $1,100 Favourable

b. Planning and operating sales volume variances table

Market size variance	Units
Budgeted sales quantity	1,795
Revised budgeted quantity (37,500 × 5%)	1,875

| Difference | 80 |
| × Standard contribution per unit | $20 |
| Market size variance | $1,600 | (F)
Market share variance	Units
Actual sales quantity	1,850
Revised budgeted quantity	1,875
Difference	25
x Standard contribution per unit	$20
Market share variance	$500	(A)

The market size variance is favourable, meaning that the actual market size was greater than expected. This is a planning variance and is outside of the control of Acme Co. The market share variance is adverse because actual sales were below the budgeted market share of the actual market.

2.5 Advantages and Disadvantages
Advantages:
· Distinguishes between those variances caused by bad planning or unavoidable factors and those resulting from operating factors.
· Adverse operating variances provide feedback control on processes which need correcting.
· Planning variances can be used to update standards to current conditions.
· Motivation may improve if managers know they will only be assessed on variances under their control (i.e. operational variances).

Disadvantages:
· Extra data requirements (e.g. market size).
· More time-consuming.
· Managers may claim that all adverse variances have external causes and all favourable variances have internal causes (i.e. manipulation of revised standards).
· Operational managers may claim that all adverse variances are due to poor standard setting at the planning stage (but take credit for all favourable

2.6 Manipulation
From the previous discussion, it should be apparent that budgets and standards prepared at the start of the year may need revision at the end of the year if they are inappropriate because of factors that occurred outside of the organisation's control. Managers who have not achieved their budgets/targets may try to hide adverse variances by revising their budgets and standards. Therefore, to prevent manipulation, there must be strict rules to ensure that budget revisions are only made when appropriate. Revisions should only be permitted when there is independent, verifiable evidence (e.g. a published price index for a change in market price).

3.1 Effect on Staff Motivation and Action Standard costing and variance analysis may be used as part of the performance evaluation of managers and staff. Variance analysis will, therefore, have some effect on motivation.

· As for budgets, a challenging target can motivate managers and staff to work harder, compared with having no target.

However, there are many potential problems related to the use of variance analysis:

· If managers use variance information insensitively, morale may suffer. Employees (workforce and supervisors) should be congratulated on tasks well done, but management by exception tends to focus on what has gone wrong. Employees berated or disciplined for adverse variances may attempt to conceal them or take actions to ensure that the variances within their control are favourable, which may not be in the company's best interests. For example, a rush to increase productivity at the end of the budget period to avoid an unfavourable labour efficiency variance may reduce the quality of output.

· Accurate preparation of standards can be difficult. For example, workers may operate below their ability during standard-setting runs to build "slack" into the standard.

· Labour quantity standards and efficiency variances make two assumptions that may not hold true: 1. Output increases if workers speed up (i.e. the pace of production is dictated by labour). However, the volume of output may be influenced more by the processing speed of equipment. 2. Labour is a variable cost. However, the cost of a workforce may be fixed. Undue emphasis on efficiency can result in an excessive build-up of work in progress and finished goods inventories.

3.2 Variances and Performance Evaluation This chapter and the three preceding chapters have mentioned the use of variances to evaluate performance. This section provides comprehensive guidance on this aspect of variance analysis.

3.2.1 Identify the Cause of the Variance Possible causes of traditional variances were discussed in Chapter 12, and Chapter 13 gave reasons for materials mix and yield variances. In the real world (and in examination questions), there may be other causes. The first stage in using variances to evaluate performance is to understand what caused them. Having identified the cause of a particular variance, it is worth identifying whether other variances were also affected. For example: .

· A favourable materials price variance may have been caused by buying cheaper materials, but this may also have resulted in an adverse materials usage variance.

· It would be meaningless therefore to say that the favourable price variance was "good" and that the adverse usage variance was "bad".

All variances caused by a common factor should be considered together. It may be worthwhile to add the variances together (treating favourable variances as positive and adverse variances as negative) to appreciate the total financial impact. Exam advice Variances that are related to a common factor should be evaluated together.

3.2.2 Identify Who Is Responsible

It may be that variances are being used to assess the performance of a particular manager (e.g. a factory manager). Managers should only be judged on variances that are within their control. Variances are usually the responsibility of the following departments and their managers:

· Materials price variance - the purchasing department. However, look for signs that the purchasing department may have been put under pressure to buy from a particular supplier. Or,

if the purchase was requisitioned at very short notice, the purchasing department may have been unable to obtain a favourable price that it might have had otherwise.

· Labour rate variances - this depends on who decides how much to pay particular workers. It could be the human resources department or the factory manager.

· Labour efficiency variances are usually assumed to be the responsibility of the person who supervises the workers - this could again be the factory manager. However, these variances may also be related to the rate variance - a higher grade of labour will generally lead to an adverse rate variance, but the labourers might work more efficiently.

· Material usage variances are also associated with a production manager. However, variances may also have been caused by the purchase manager buying a quality of material different from the standard.

· Mix and yield variances are typically controlled by the production manager, who supervises the production process. However, these may also be affected by the quality of materials used, which could be the responsibility of the purchasing manager.

· Overhead variances will be the responsibility of the appropriate managers - equipment maintenance expenditure, for example, would depend on the maintenance manager.

3.2.3 Consider Whether the Standard Was Fair

As previously explained, a standard should be revised if it becomes outdated or is otherwise unreasonable (e.g. it was a poor estimate). Operational variances are generally a more reliable indicator of performance than traditional variances.

3.2.4 Non-financial Factors

Variances reflect only the financial view. Non-financial factors such as quality may be equally important, but these factors are ignored by variances. This is a significant limitation of variance analysis. If variances are favourable, this means costs are being kept under control. However, if this is at the expense of quality, the favourable variance may have some negative consequences.

Example of Non-financial Factors A past exam question involved a company that manufactured soup. The production manager had been told that his performance would be judged on the reported variances. He had successfully kept costs down, reporting large favourable mix and yield variances. From a financial point of view, this seemed positive. On the other hand, the sales manager was angry that customers were complaining about the quality of the soup. This was related to the production manager diluting the soup to reduce costs, which also reduced quality. In the long term, this threatened to lead to a fall in demand, leading to a fall in profits.

3.2.5 Improving Future Performance After identifying the causes of variances, appropriate action can be taken to ensure that future performance improves. For example:

· Including non-financial factors as well as variances in managers' appraisal systems.

· Regular review and updating of variances to reflect changes in the external environment.

· Using target costing to identify ways to reduce costs further.

3.3 Relevance of Variances in the Modern Environment of JIT and TQM Many writers have argued that variance analysis is not relevant in the modern, rapidly changing business world and that it can lead to dysfunctional behaviour for these reasons:
· Use of a standard costing system may lead to an overemphasis on quantitative elements of performance. It is important that qualitative performance is not neglected (e.g. customer satisfaction, employee morale, innovation), particularly in a total quality management environment.
· Just-in-time (JIT) and flexible manufacturing systems aim to provide more tailored production to meet customers' needs. There may, therefore, be less standardisation of production, which makes comparison with a standard less meaningful.
· JIT purchasing systems emphasise forging close, long-term relations with suppliers. Under such a system, input costs will likely be known with certainty in advance, so there will be no price variances.
· Traditional standard setting is based on a company's own costs and procedures. This may be too inward- looking where the company operates in a rapidly changing, competitive market.
A more modern approach is benchmarking, which also takes into account the practices of other organisations in the industry (i.e. external information).

3.4 Behavioural Problems in Rapidly Changing Environments
The use of standard costing and variance analysis can have adverse effects on behaviour in a rapidly changing environment.
· Merely meeting standards may be insufficient to ensure a company's survival in a competitive environment. It may be necessary to focus on trends in variances which aim for continual improvement.
· Standards provide an internal focus to management. In a rapidly changing environment, an external focus would be more appropriate.
· New products come online more frequently. There may be learning curves associated with these. Standards which fail to reflect learning curves may not set an appropriate target. They could be too easy, which would not challenge staff, or too difficult, which would be demotivating.

Summary:
· Actual performance is compared with budgets at the end of each budget period. Before performing this comparison, it may be appropriate to revise the budget if it turns out to be unrealistic in retrospect or if factors outside the control of the relevant manager occurred which make the original budget inappropriate.
· Standards also may be revised before performing variance analysis:
   Operational variances compare actual performance against a revised budget or standard.
   Planning variances compare the original standard with the revised standard for actual output.
· Traditional cost variances can be analysed into planning and operational as follows:
   Price (rate) planning variance:
   (Actual quantity * Original standard price) – (Actual quantity * Revised standard price)
   Operational price (rate) variance:
   (Actual quantity * Actual price) – (Actual quantity * Revised standard price)

Planning usage (efficiency) variance:

(Revised SQ for actual output − Original SQ for actual output) * Original standard price

Operational usage (efficiency) variance:

(Actual quantity − Revised SQ for actual output) * Original standard price.

· The sales volume variance can also be analysed into a market size (planning) variance and a market share (operational) variance.

· A revised budgeted sales quantity is found by multiplying the budgeted market share with the actual market size.

Market size variance is (Original budget quantity − Revised standard quantity) * Standard contribution/profit per unit.

Market share variance is (Revised standard quantity − Actual sales quantity) * Standard contribution/profit per unit.

· The use of standard costing and variance analysis aims to improve operational efficiency. Managers need to be aware of the potential adverse effects of variance analysis on behaviour.

Chapter 15: Performance Measurement

This chapter covers the following Learning Outcomes. E. Performance Measurement and Control 1. Performance analysis in private sector, public sector and not-for-profit organisations a) Describe, calculate and interpret suitable financial performance indicators (FPIs) for example profitability, liquidity, efficiency and gearing. b) Describe, calculate and interpret suitable non-financial performance indicators (NFPIs). c) Analyse past performance and suggest ways for improving financial and nonfinancial performance. d) Explain the causes and problems created by short-termism and financial manipulation of results and suggest methods to encourage a long-term view. e) Discuss the issues organisations face by favouring short-term financial gain over long-term sustainability. g) Discuss the difficulties of target setting in qualitative areas.

1.1 Main Objectives of Performance Measurement

As part of an organisation's corporate strategy planning, directors will define the organisation's objectives. These objectives may be organised into a hierarchy of objectives, the performance hierarchy. Performance measurement aims to show how successfully the organisation achieves its objectives. Therefore, performance indicators are part of the organisation's control system. The main objectives of a performance measurement system are to:

· design measures which are consistent with the strategy for each level of the organisation;

· set objective, quantifiable targets based on those measures rather than subjective appraisal;

· develop reward schemes based on managers' performance against the targets; and

· judge managers fairly, i.e. on outcomes they control.

1.2 The Performance Hierarchy

The idea of the performance hierarchy was introduced in the chapter on budgeting. As a reminder, the objectives of an organisation are often based on a performance hierarchy. Typically, the hierarchy consists of the following:

· Mission - the main reason for the existence of the organisation.

· Corporate objectives - more concrete objectives, stating what the mission means in practical terms to the primary stakeholder groups (e.g., to increase the company's market value by more than a given percentage over a specific period of time).
· Subsidiary objectives - other objectives of the organisation may relate to various stakeholder groups (e.g. to reduce the amount of pollution by a given percentage).
· Unit objectives - these are objectives for the operating departments (units) of the organisation. They should contribute to the subsidiary and corporate objectives.

1.3 Hierarchy of Objectives
Because there is a hierarchy of objectives, there will also be a hierarchy of performance measures. Performance targets and measures will be set at all levels within the organisation. In a well-designed system, these targets and measures will be consistent with the organisation's overall goals.

2.1 Introduction Traditional performance measurement considered only financial measures. This was deemed appropriate because it was assumed that the primary objective of all organisations was to maximise shareholder wealth. Focusing on financial measures seemed a natural way to achieve this objective. Much of the material covered already in earlier chapters relates to FPIs, in particular:
· Budgeting;
· Standard costing and variances;
· Activity-based costing;
· Specialist management accounting techniques.
This section introduces additional, widely used ratios for financial performance evaluation.

2.2 Returns on Capital
Measures describing returns to the various providers of capital include return on equity (ROE) and return on capital employed (ROCE):
Return on equity = Profit after tax/(Share capital + reserves) * 100
Return on capital employed = Profit BEFORE interest and tax/Capital employed * 100
Capital employed is equivalent to total assets less current liabilities = total equity plus long-term debt. Where opening and closing capital are known, an average is usually used. Exam advice It is important is to match the profit figure with the appropriate capital. If profit is after interest, divide by equity. If profit is before interest, divide by equity plus long-term debt, because that profit will be shared between providers of debt and equity finance.

2.2.1 Meaning of Return on Capital Employed ROCE shows the return generated on the long-term capital invested in the company. This can be compared with other companies in the same industry sector or to the company's cost of capital. Comparing companies in other sectors does not provide valid information. Service industries, for example, require less capital than manufacturing industries and will show a greater return on capital employed for each dollar of profit.

2.2.2 Methods to Improve Return on Capital Employed ROCE is validly improved by investing in projects that generate a higher return on capital. Other methods of increasing ROCE that are not actually improvements include:

· The use of different accounting policies may affect profits and capital employed.

· Delaying investment in new plant and machinery or reducing investment in intangible assets. As the existing non-current assets depreciate, their carrying amount (net book value) falls, reducing the capital employed and improving ROCE. Such measures may harm the organisation in the long term.

2.3 Profit Margins

Profit margins relate profit to revenue. There are different profit margins because there may be more than one profit figure reported in the statement of profit or loss (gross profit, profit before interest and tax, etc.). The most commonly used are the gross and net profit margins.

2.3.1 Gross Profit Margin Gross profit is calculated by deducting the costs of buying or making the company's products from sales revenue. Therefore, it reflects the performance of the company's products.

Gross profit margin = Gross profit/Revenue 8 100

2.3.2 Meaning of Gross Profit Margin

A falling gross profit margin over time means that:

· either the selling price at which the company sells its goods is declining, or

· the cost of making or buying those goods is increasing, but those increases cannot be passed on to customers.

In either case, a prolonged decline is a bad sign. It suggests that the company's products or services are losing popularity, which raises concerns for the viability of the business. Gross profit margins may also reflect an organisation's pricing strategy.

· Companies that use a premium pricing strategy are likely to have a high gross profit margin.

· Companies that aim to sell for a low price, to achieve a larger volume of sales are likely to have a low gross profit margin.

2.3.3 Methods to Improve Gross Profit Margins Gross profit margins may be improved by:

· Introducing new products that are popular with customers. These can be sold for a higher margin.

· Using target costing to reduce the cost of sales (target costing is in Chapter 3).

· Reclassifying direct expenses as administrative would increase the gross profit margin but not improve overall profitability. Gross profit depends on the company's policy for classifying expenses as direct or administrative. Changes in such policies should be viewed with suspicion.

2.3.4 Net Profit Margin

Net profit describes profit after deducting all costs. Net profit margin shows overall profits as a percentage of revenue.

Net profit margin = Net profit after tax/Revenue * 100

2.3.5 Meaning of Net Profit Margin Net profit, sometimes called "the bottom line ", shows overall profits (after deducting all costs) as a percentage of revenue.

· Although this gives a broad indicator of the organisation's performance, further analysis should consider that the causes of changes must be investigated.

· Net profit margin reflects the following three areas: 1. The underlying popularity of the company's products and services (this is also reflected in the gross margin). 2. The amount of control the company has over administrative-type expenses. 3. Costs of debt financing. This will depend partly on whether the company has changed the amount of debt and partly on whether interest rates have changed.

2.3.6 Ways to Improve the Net Profit Margin

· Introduce new products that are popular with customers. These can be sold for a higher margin.

· Use target costing to reduce the cost of sales. ¥ Increasing sales volume should increase net profit margins if a high portion of the company's costs are fixed (e.g. in a training company).

· Better control over administrative expenses (e.g. salaries). ¥ Using less debt finance.

2.4 Asset Turnover Ratio

The asset turnover ratio relates revenue to the amount of capital invested in the business: Revenue/Capital employed

It indicates whether or not the capital invested is appropriate, given the value of sales revenue. Excessive levels of capital invested will lead to a low turnover ratio. The asset turnover ratio can be improved by:

· Selling non-current assets that are surplus to requirements.

· Recognising impairments and writing down the value of the assets. (Arguably, this is merely financial engineering as it does not improve actual performance.)

· Improving working capital management, for example by collecting receivables more quickly or reducing inventory levels through better inventory management.

2.4.1 Analysis of Return on Capital Employed

Return on capital employed ratio (see s.2.2) is the product of the operating profit margin and the asset turnover:

ROCE = Operating profit margin * Asset turnover

Profit before interest and tax/Capital employed = Profit before interest and tax/Revenue * Revenue/Capital employed

This relationship can provide insights into the ROCE for a particular business. For example, if a business is experiencing a decline in ROCE, this could be due to:

· a decline in the asset turnover ratio; or

· a fall in the profit margin; or

· a decline in both of the above.

Finding out which of these factors gave rise to the decline will point the analyst in the right direction to find the underlying causes.

2.5 Liquidity Ratios

Liquidity ratios measure the ability of the organisation to meet its liabilities as they become due (e.g. suppliers, interest on bank loans, overdrafts). Creditors could take legal action against a company that fails to pay its liabilities when due, which, in the worst case, could lead to liquidation of the company. Many profitable companies occasionally face liquidity problems. Operating cash flows represent the ultimate measure of liquidity. If a company generates positive operating cash flows sufficient to replace non-current assets, it is less likely to experience liquidity problems.

2.5.1 Current Ratio The purpose of the current ratio is to measure the adequacy of current assets to meet current liabilities (without having to raise additional finance). A ratio of less than 1 means current liabilities exceed current assets Current ratio = Current assets (at period end) Current liabilities (at period end)

2.5.2 Inventory Holding Period The purpose of the inventory holding period is to measure the amount of time inventory is held before it is sold, measured in days. The shorter the period, the lower the holding costs of inventory and the faster inventory can be converted into cash. Inventory Holding Period (days) = 365 * Average Inventory ($)/Cost of Sales($)

2.5.3 Receivables Collection Period
The purpose of the receivables collection period is to measure the amount of time receivables are held before they are collected, measured in days. The shorter the period, the lower the financing costs of receivables, and the faster receivables can be converted into cash. Shorter periods also indicate a lower risk of bad debt.
Receivables Collection Period (days) = 365 * Average Receivables($)/Total Credit Sales($)

2.5.4 Payables Payment Period
The purpose of the payables payment period is to measure the amount of time payables are held before it is they are paid, measured in days. Payables can be used as a form of interest-free financing. The longer the payables payment period, the lower the financing cost. Longer periods also indicate more cash retention. However, this needs to be balanced against the risk of losing access to payables financing if suppliers are no longer willing to provide it.
Payables Payment Period (days) = 365 * Average Payables($)/Total Credit Purchases($)

2.5.5 Quick Ratio (Acid Test Ratio)
The quick ratio measures immediate liquidity (by eliminating the least liquid asset, inventory, from current assets).
Quick ratio = (Current assets - Inventory at period end)/Current liabilities at period end
Sometimes referred to as the "acid test" ratio, the quick ratio is a more conservative version of the current ratio. A low or declining ratio may indicate an inability to meet its liabilities as they come due. This could result from insufficient cash flows to pay its suppliers on time or a cash shortage due to investments in non-current assets.

Example of Quick ratio

An international food retailer, which regularly reports a current ratio of about 0.3, illustrates the fallacy of using a single current ratio target to indicate satisfactory liquidity. The company has low inventory, as food only lasts a few days. It has few receivables, as most of its sales are for cash. It invests cash balances in non-current assets and holds low cash balances. Also, the company does not pay its suppliers for three months, so it has large payables balances. Far from indicating liquidity problems, the company uses its suppliers as a free source of financing.

2.5.6 Ways to Increase Liquidity Ratios
Acceptable ways of increasing (i.e. improving) liquidity ratios include:
· Using long-term finance (loans and equity) to finance acquisitions of non-current assets. This is usually done to match the financing period with the useful life of the non-current asset.
· Generating positive cash flows to repay short-term liabilities on time.
Liquidity ratios may also be increased by adjusting year-end balances ("window dressing"); however, this is not a genuine improvement.

Quiz: Quick ratio (window dressing)
The following are extracts from the statement of financial position of a company:

	$000
Receivables	900
Cash	500
Payables	1,000

Required: a. Calculate the quick ratio. b. Re-calculate the ratio if $400,000 of payments are made just before the year-end.

Answer:
a. Quick ratio = $1.4m/$1m 1.4
b. Quick ratio = ($1.4m-0.4m)/($1m-0.4m) = $1m/$0.6m = 1.7

2.6 Gearing
Gearing (or "leverage") measures the portion of a company's finance provided by debt. The advantage of debt is that it is a relatively cheap source of financing:
· Providers of debt require a lower return than providers of equity finance because they face less risk, as they receive preferential repayment in the event of default.
· Interest on debt is also a tax-deductible expense, which further reduces the cost of debt.
However, companies with too much debt (gearing) increase the risk of being unable to repay the debt's interest and principal.

2.6.1 Gearing Ratios
Gearing ratios measure the proportion of long-term borrowed funds (which pay a fixed return) to equity capital (shareholders' funds) and provide information about a company's financial risk due to debt burden. Two gearing ratios are commonly used:
Equity/Debt * 100 (gives gearing as a percentage) OR

Debt/Equity plus debt * 100

Example of Gearing
The following are extracts from the statement of financial position of three different companies:

	A	B	C
	$	S	S
Shares capital and reserves	10,000	3,000	7,500
Long-term debt	=	7,000	2,500
Capital employed	10,000	10,000	10,000
	No gearing	70% highly geared	25% low gearing

2.6.2 Meaning of Gearing
A gearing ratio in isolation means very little. It is only useful if the gearing of the organisation is compared with industry averages or with other companies in the same business area to determine whether or not the gearing is too high.
· In industries with stable profits, companies can sustain higher gearing levels. High gearing ratios increase risk in companies where profits fluctuate because a fall in profits may mean the company cannot repay interest on its loans.
· An increase in gearing over time may reflect changes in the level of debt deemed acceptable to the finance director. Alternatively, it may indicate that insufficient cash flows cause the company to borrow money to finance short-term operations.

2.7 Interest Cover
Interest cover shows how much the return on debt (interest) is covered by profit (before tax because interest is an allowable expense for income tax purposes). Lenders use this measure to determine the vulnerability (sensitivity) of interest payments to a fall in profit.
Interest cover = Profit before interest and tax/Interest

2.8 Approach to Financial Performance Evaluation Exam Questions
2.8.1 Comments Not Calculations
Few marks will be available for simply calculating ratios in performance evaluation questions. Candidates need to show that they can comment on what the numbers and calculations show about how the organisation has performed.

2.8.2 Approach Before writing anything, spend a few minutes reviewing and analysing the information. The following is a suggested approach to this planning time:
· Review the "big picture" - look at revenue growth, profit growth and any other major trends visible in the data.
· Calculate a limited number of ratios that you think are necessary to investigate further any trends identified in the analysis (e.g. if revenues have grown, but profits have not changed, it

may be worth calculating gross profit margins to determine if this is the cause of the sluggish profits).

· If capital is given, calculate the return on capital employed, as this can indicate how well the organisation provides a return on the capital invested.

· Review the information given in the scenario and look for clues which might explain the trends. Information such as "the company operates in a competitive environment" might explain falling gross profit margins.

Having planned in this way, start to write your answer. Comment on each trend identified. Comment means:

· State what happened (e.g. profits increased by 20% between quarter 1 and quarter 2).

· State why this happened using any relevant information provided in the scenario to help identify why (e.g. revenue increased by 10%, and many of the company's costs are fixed, which has led to a 20% rise in profits).

· Link this to other related items. For example, investment in new machinery that increases capacity or capability may cause a significant increase in depreciation. On the other hand, retaining and maintaining legacy (old) machinery may cause increasing repair spending.

· Express an opinion (e.g. an increase in profits of 20% is impressive given that the company is operating in a competitive environment). It is a good idea to show any ratio calculations separately (e.g. in an appendix). This looks professional. This appendix may be in the spreadsheet answer space for constructed response questions in PM computer- based exams.

Quiz: Financial Performance Measurement

Well-heeled ("WH") is a children's shoe shop in a major capital city suburb. The shop was started in 20X7, quickly establishing a reputation for high-quality children's shoes. There are no other shoe shops in this particular suburb, but there is a large shopping centre in the next suburb, 5 km from WH, with several children's shoe shops. The retail space next door to WH became vacant at the start of 20Y0. Because WH's existing landlord also owned this, WH decided to rent this space, expanding the area of the shop from 40 square meters to 60. The company employs one full-time shop assistant, and starting in 20Y0 hired an additional assistant to work on Saturdays. The owner of WH also works in the shop but does not take a salary for her time. The country in which WH is located was severely affected by an economic downturn in the first half of 20Y0 but started to recover in the second half of 20YO. Inflation in 20X9 and 20Y0 was 2%. The statements of profit or loss for the years 20X9 and 20YO are presented below:

			20X9		20Y0	
$		$	$		$	
Sales			180,000		240,000	
Less: Cost of sales			120,000		168,000	
Gross profit			60,000		72,000	
Less expenses						
Staff Costs		20,000			30,000	
Rent		7,200			10,800	
Marketing		5,000			6,000	

Light and heat	1,000		1,200	
		33,200		48,000	
Net profit			26,800		24,000	

Required: Assess the financial performance of the shop using the information above.

Answer:
Sales revenues increased by one-third (33%) between 20X9 and 20Y0. This is impressive as the shop is only 5 km from a big shopping centre (a significant competitor). It is also remarkable, given that the economy was in recession during the first half of 20Y0. The cause of the increase in sales could be due to price increases or volume increases. Given the fall in the gross profit margin (see following), it would seem more likely that sales volumes have risen. This reflects the reputation that the shop is gaining locally for high-quality products.

Gross profit margins fell from 33.3% in 20X9 to 30% in 20Y0. This suggests that sales prices have fallen or supplier cost increases have not been passed on to customers. This is probably because, during a recession, the business recognises that customers are more price-conscious. Prices may also have been lowered to gain more customers, which may be related to the increase in revenues. If gross margins continue to decline, this may cast doubt on the viability of the business in the long term. In this case, however, it seems more likely that the fall in margins will be a temporary phenomenon caused by the recession.

Staff costs have increased by 50%. This is likely due to the employment of an additional shop assistant in 20Y0. Because the assistant works only on Saturdays, however, we would not expect that alone to account for a 50% increase. The existing shop assistant was probably given a pay rise to compensate for being busier now that the shop size has increased. Staff costs as a percentage of revenue have risen from 11.1% in 20X9 to 12.5% in 20Y0. The owners need to ensure that they do not let this cost continue to rise above the level of sales, or this will reduce profitability.

Rent also has increased due to the larger space occupied. The cost per square metre has remained constant at $180 per square metre per year, which shows that the landlord has not increased the rent, possibly due to the recession. A corresponding increase in revenue has not matched the 50% increase in space, but it does leave the shop space to grow in future years.

Marketing has increased by 20%. Because revenue has increased by 33.3%, however, it seems that the marketing effort is producing good results.

Light and heat have increased by 20%. This is good given the 50% increase in the size of the shop. In practice, light and heat are items outside businesses' control, as the prices are set by large energy providers with little competition. Net profit declined despite the increase in revenues.

Net profit margin was 10% in 20YO compared to 14.9% in 20X9. This margin fall is mainly due to the fall in gross margins (had gross margins remained constant, profits would be $8,000 higher) and partly due to additional staff costs and rent. Hopefully, gross margins may increase in future years as the economy recovers. The staff costs and rent should remain relatively stable in the coming years, allowing an increase in revenues without an increase in such expenses. The company owners would probably be disappointed that profits fell despite a significant revenue increase. However, the business is in an excellent position to benefit from an economic recovery in 20Y1.

3.1 Financial Performance Indicators (FPIs)

3.1.1 Inherent Weaknesses
Traditional performance measurement relied almost exclusively on financial measures. However, since the 1980s, many companies recognised inherent weaknesses in focusing only on financial factors.

· FPIs may lead to excessive focus on cost reduction. Short-term cost reductions may be achieved at the expense of long-term performance due to the effect on staff morale, quality and other factors.

· FPIs ignore the drivers of business success. The things which drive business success are: - Quality; - Delivery; - Customer satisfaction; - After-sales service.

· FPIs can be affected by using different accounting policies and "window dressing" to make the performance look better. Possible solutions to this are to use: - Profit growth over several years; - Encouraging managers to consider the factors that drive long-term success (that may otherwise be sacrificed for short-term gains) using non-financial performance measures. Since the 1980s, many companies have started developing non-financial performance indicators.

Key Point
Although many organisations are obsessed with financial performance measures, NFPIs drive businesses forward in the long run. FPIs may measure success, but they do not ensure success.

3.1.2 Short-Termism and Financial Manipulation
Many organisations use financial performance measures such as profit and ROCE. Managers are often given bonuses or better promotion prospects if the organisation achieves these financial targets; failure to achieve them may adversely affect promotion prospects. Therefore, managers may take a short-term view and concentrate on achieving the next set of financial targets, ignoring the longer term. This short-termism in performance management is often called short-termism (or myopia). Short-termism may exist for the following reasons:

· Receiving a bonus now seems much more attractive than earning it in the future.

· If managers expect to be promoted, or there is high management turnover, they may view that future financial performance is irrelevant to them, as they will be working elsewhere by then.

· Shareholders may take a short-term view of performance and will be disappointed if the targets of the current period are not met. This is particularly relevant to listed companies that fear failure to meet the quarterly earnings expectations of stock market investors.

There is nothing wrong with improving the current year's profits. However, some actions to improve financial performance in the current period will harm the business in the longer term. For example:

· Failing to invest in worthwhile projects (i.e. that would generate profits over several years) because: - They may reduce profits in the shorter term; - The initial investment in capital assets and increase in depreciation leads to a lower ROCE in the early years of a project.

· Failing to invest in "value building" activities (e.g. research and development, training, advertising and marketing) that may bring long-term benefits but would reduce reported profits in the current financial periods (because they cannot be capitalised under financial reporting standards).

· Cutting expenditure activities that would lead to better quality of a product. In the long term, this may lead to losing customers and revenue.

· Reducing headcount, which may lead to a reduction in the quality of customer service.

· Recruitment freezes and cutbacks in training and development during economic downturns, which means that the organisation does not develop the skills and knowledge needed to compete when the economic climate improves.

· Salary freezes that may lead to increased staff turnover. High staff turnover can lead to the loss of "corporate knowledge" (tacit knowledge and skills employees hold that the organisation has not developed a system to retain) and high costs of recruiting and training new staff. Short-termism may also increase the risk of financial manipulation, which can take many forms of earnings management (e.g., the recognition of revenue and expenses), profit smoothing or manipulation of key accounting ratios (e.g., misclassification of debt or equity).

Key Point
Short-termism can be a particular problem in the public sector because governments typically set budgets annually with no longer-term plans being set.

The use of NFPIs can mitigate short-termism in the following ways:
· Measures of the quality of a product or a service should ensure managers do not cut back on these.
· Measures relating to staff satisfaction (e.g. staff turnover) should reduce cutbacks in staff-related expenditure.
· A more balanced view of performance should focus on the drivers of longer-term growth.

3.1.3 Short-term Financial Gain vs. Long-term Sustainability
The financial impact of focusing on short-term financial gain will erode an organisation's value-creation ability in the long term. Also, any adverse effects on the external environment may be detrimental to the organisation's ability to generate returns or meet its objectives in the future. For example:

· A hotel delays investment in refurbishing rooms and facilities. In the short term, the smaller asset base figure inflates traditional performance measures (e.g. ROCE), seemingly indicating strong financial performance. However, in the long run, the attractiveness of the hotel declines, reducing its ability to demand sustainable revenues from customers and reducing margins and

profitability. Eventually, the hotel's customer ratings are downgraded, making it difficult to increase prices without major refurbishment and marketing expenditure.

· A company builds a factory without considering the needs and demands of the local community regarding pollution control, provision of affordable housing, traffic management and contribution to the community. In the short term, ignoring these external factors leads to higher profits, as the company focuses on generating income from operations. However, in the long run, increased pollution, unaffordable housing and traffic congestion are likely to lower the overall attractiveness of the area to potential talent and contribute to increased stress and health concerns among employees. These issues increase operating costs, particularly in healthcare, time off due to illness and recruitment. A significant risk includes the involvement of the local community's government representatives in instituting laws and regulations designed to reduce the effect of the firm's negative externalities. The negative publicity may affect customers' perception of the company, reducing the margins it can charge as they consider alternatives with more sustainable credentials.

3.2 Key Performance Indicators

Many companies identify critical success factors (CSFs) at the strategic level.

· Organisations should only identify a few critical success factors, usually from their mission statement, objectives and strategy.

· Key performance indicators (KPIs) measure how well an organisation meets its critical success factors.

Critical success factors - an area where an organisation must perform well if it is to succeed.

Critical success factors - those product features that are particularly valued by a group of customers, and, therefore, where the organisation must excel to outperform the competition. Johnson, Scholes, and Whittington

Key performance indicator (KPI) - a quantifiable metric that measures the achievement of a goal or objective. KPIs should be:

· specific (e.g. measure profitability rather than "financial performance", a term which could mean different things to different people);

· measurable (e.g. number of customer complaints rather than "level of customer satisfaction"); and

· relevant (i.e. they measure achievement of a critical success factor).

Example of Key Performance Indicators

Vodafone Group plc, the British multinational mobile telephone operator, monitors the following key performance indicators quarterly:

· Mobile data growth and network quality (Mbps)
· Broadband and converged consumer customers (million)
· Data ad 4G data users (million)
· Mobile contract churn
· loT ("Internet of Things") SIM growth
· M-Pesa (African payments platform) customers

3.3 Operational NFPIs

Having set NFPIs consistent with the organisation's strategic objectives, non-financial performance measures can be set at all levels of an organisation.

Quiz: Manufacturing NFPIs
Suggest some possible non-financial performance measures which might be used in a manufacturing organisation to measure the following attributes: a. Product quality; b. Product delivery; c. Customer satisfaction; and d. After-sales service.

Answer:

Attribute	NFPI
(a) Product quality	· Percentage of items rejected by quality control · Number of items returned by customers
(b) Product delivery	· Percentage of customer orders delivered on time · Waiting time from order to delivery
(c) Customer satisfaction	· Number of customers returning · Number of complaints
(d) After-sales service	· Waiting time · Number of complaints · Customer surveys to measure their satisfaction.

3.4 Advantages of NFPIs
· Usually easier to calculate than financial reports, they can be provided much more quickly (e.g. at the end of each shift).
· More flexible as organisations can come up with any measures appropriate to their objectives.
· Less affected by changes in financial policies than financial measures.

3.5 Ways to Improve Performance Indicated by NFPIs
3.5.1 Quality Indicators Many organisations use quality improvement programmes to improve the measured quality of products or services. Such programmes typically include quality control and quality assurance:
· Quality control focuses on measuring the quality of the products and comparing this against a predetermined standard. Typically, this involves quality inspectors.
· Quality assurance means having procedures to ensure good quality. This might include redesigning processes, using better-quality materials and "quality meetings" during which staff members suggest ways to improve quality.

Quiz: Non-financial Performance
Ben's Grub Co (BG) operates a food takeaway and delivery service based in Homeland. Customers buy ready meals by walking into one of BG's takeaway shops or placing an order for home delivery by telephone or Internet. Home deliveries are delivered by motorcycle. BG's mission is to provide excellent-quality food by buying only the freshest products and excellent service by recruiting and retaining the best staff. Its meals are of good quality and aimed at busy

middle- class professionals with high disposable income levels. A performance measurement report focusing on non-financial measures has been used for several years. The report for the last two years contains the following information, with industry average figures, where available:

	Year 1	Year 2	Industry average
% of orders delivered in 30 minutes	86%	81%	80%
Quality of meals - rating by			
independent reviewer (out of 10)	8	7	6
Average customer rating (out of 5)	4.3	3.7	3
Number of meals sold	62,000	70,000	
Number of online sales	18,000	27,000	
Number of website visits	400,000	450,000	
Number of new meals launched	3	5	
Number of complaints	500	760	
Staff turnover			
(Number of leavers + Average headcount)	35%	30%	60%
Number of employees	20	22	

The industry average conversion rate (number of online sales as a percentage of website visits) is 4.5%.

Required: Assess the non-financial performance of BG for the last two years based on the information provided.

Answer:

BG aims to provide excellent service and excellent quality to busy middle-class professionals. Such customers probably pay a higher price but expect a superior level of quality for both food and service. BG must keep the quality level high; otherwise, customers may be lost. Delivery is an essential aspect of quality of service and is measured by the percentage of orders delivered in 30 minutes. This has fallen from 86% in Year 1 to 81% in Year 2. This may be because more meals have been sold, putting additional pressure on the delivery staff. Although Year 2 delivery performance is still better than the industry average, this decline must be stopped. Management needs to investigate the reasons for the fall and take remedial action (e.g. hire additional motorbike drivers). The quality of meals also has declined, according to an independent rating. In isolation, the decline of only 1 point (from 8 to 7) may not be a cause of great concern, as such ratings are very subjective and may depend on several factors. However, the decline in customer ratings from 4.3 to 3.7 corroborates the suggestion that food quality has declined. Both ratings are above the industry average, but this is to be expected, given the focus on excellent quality. Management should spend time checking that the quality of the food is improved and try to find out why these ratings are declining. The number of meals sold has increased by 13% (from 62,000 in Year 1 to 70,000 in Year 2). This appears to be due to the increase in online sales, which have increased by 9,000 (i.e. 50%). This suggests that the website is attracting more customers. Some existing customers are likely switching to online ordering from more traditional methods. Receiving online orders is an essential tool for the business, and it has done well to exploit this. The overall increase in sales is also a good sign; even if the quality of food and service has declined, this has not been reflected yet in the sales figures. The

number of website visits has increased by 11.1 % (from 400,000 to 450,000), which shows that more people are discovering the website. It is not stated whether any Webmarketing activities might have increased its visibility (e.g. paying search engines such as Google a fee for ensuring that Ben's Grub is listed towards the top of any search for "takeaway food" or having links placed on other websites). The "conversion rate" is the number of online sales as a percentage of website visits. As this shows the percentage of visits that lead to a sale, it measures how well the website persuades visitors to place an order. In Year 1, the conversion rate was 4.5%, rising to 6% in Year 2. The Year 1 rate was the same as the industry average; the Year 2 rate shows an increase above this. This indicates that the website is relatively good at encouraging potential customers to place an order. The number of complaints has risen by 52%. As a percentage of meals sold, this was 0.8% in Year 1 and 1.1% in Year 2). Although the proportion of complaints appears low, the increase is a cause for concern. It could be related to the reduction in the percentage of meals delivered in less than 30 minutes or the apparent decline in the quality of meals. The number does not seem significantly large, so hopefully, the situation can be remedied to avoid the loss of customers.

Staff turnover is well below industry averages in both years and has declined over the two years. This is a positive sign that staff members enjoy working for BG. It is essential in service industries that staff members are motivated, as any lack of motivation may lead to customers experiencing a poor level of service. Low staff turnover also means that the costs of training new staff are reduced, and customers benefit from better service from experienced staff. BG has explicitly recognised the importance of staff in its mission statement (where it mentions that it wishes to recruit and retain the best staff), and it seems that the company is indeed managing to keep its staff. There has been a slight increase in employees from 20 in Year 1 to 22 in Year 2. Staff utilisation can be calculated by dividing the number of meals sold by the number of staff. This was 3,100 in Year 1 and rose slightly to 3,182 in Year 2. Although higher staff utilisation is good from a financial point of view, it should not be too high, as this may lead to staff being overworked and the quality of service declining. Given the other signs of a fall in the quality of service, management should seriously consider employing additional staff. Overall, BG has increased sales (particularly online sales), implying a successful year. However, there are signs that service and food quality are declining. Therefore, management must take action to ensure that this is stopped before customers are lost.

3.5.2 Customer Service
Customer service is vital in service industries, but the level of after-sales service is also critical in manufacturing industries. Ways to improve performance in customer service include:
· Training to ensure staff understand the importance of customer service.
· Incentives to staff to reward improvements (e.g. "employee of the month" rewards and prizes for good performance).

3.6 Target Setting in Qualitative Areas
· The budgeting and standard costing chapter dealt with problems in setting financial targets. Most issues relating to setting financial targets also apply to qualitative areas. In qualitative areas, however, there may be additional complications.

3.6.1 Qualitative Areas of Performance

The most critical qualitative areas of performance tend to be:

· Quality of product or service · Customer satisfaction

· Delivery

· After-sales service.

These are the areas that organisations wish to measure using NFPIs.

3.6.2 Difficulties of Setting Targets for Qualitative Areas When setting targets for qualitative areas, the following difficulties will be experienced:

· Identifying the drivers of improved performance. Rather than simply measuring customer satisfaction, for example, it is better to determine what staff can do to achieve greater customer satisfaction and then set targets based on these. However, it is often difficult to identify these drivers, and some judgement will be required.

· Many qualitative factors cannot be measured. For example, how do you measure "friendliness of staff"?

· Staff behaviour in response to set targets. Staff will aim to achieve the targets but perhaps not in the expected manner.

· Setting the level of difficulty of the targets. Excessively difficult targets will demotivate staff, while too easy targets will not improve performance.

Example of Call Centre

A call centre recently introduced a target of two minutes per call to increase the number of calls handled. It was discovered that staff hung up on customers after two minutes to avoid a variance.

Summary:

· Performance measurement shows how well an organisation achieves its stated objectives.

· An organisation can rank its objectives in a hierarchy from its mission, strategic objectives and critical success factors down to lower-level goals to support strategic objectives.

· Traditional performance measurement systems focus on financial measures. There are many different financial performance indicators. The most important categories are: Return on capital; Profit margins; Asset turnover ratios; Liquidity ratios; Gearing ratios; Interest cover.

· Financial measures exclude essential factors that drive the financial performance of an organisation. NFPIs should be used in addition to financial measures to overcome the inherent weaknesses of financial measures.

· A critical success factor is a performance outcome that an organisation requires to achieve success.

· NFPIs can measure qualitative aspects of performance (e.g. product quality, customer satisfaction and staff morale).

Chapter 16: Further Aspects of Performance Analysis

This chapter covers the following Learning Outcomes. E. Performance Measurement and Control 1. Performance analysis in private sector, public sector and not-for-profit organisations f) Explain and interpret the Balanced Scorecard, and the Building Block model proposed by Fitzgerald and Moon. h) Explain the need to allow for external considerations in performance management, including stakeholders, market conditions and allowance for competitors. i) Interpret performance in the light of external considerations and the need to consider sustainability. 3. Specific performance analysis issues in not-for-profit organisations and the public sector a) Comment on the problems of having non-quantifiable objectives in performance management. b) Comment on the problems of having multiple objectives in not-for-profit organisations and the public sector. c) Explain how performance could be measured in not-for-profit organisations and the public sector. d) Explain Value for Money (VFM) as a public sector objective and how the 3Es can be used to achieve VFM. b) Suggest ways in which external considerations could be allowed for in performance management.

1.1 Introduction

Chapter 15 examined the weaknesses inherent in relying exclusively on financial performance indicators (FPIs) and the benefits of using non-financial performance indicators (NFPIs) to supplement these. NFPIs became very popular around the turn of the century. Two problems arose, however:

· Some organisations went too far, ignoring or giving insufficient attention to financial performance. This is inappropriate. The primary objective of a commercial organisation is to maximise shareholder wealth.

· Organisations developed too many NFPIs, many of which conflicted and were confusing. In response to these problems, Kaplan and Norton developed the balanced scorecard approach. The objective of the balanced scorecard is to provide top management with an integrated set of performance measures. The balanced scorecard looks at performance from four different perspectives: 1. Customer perspective - how do our customers see us? 2. Internal business process perspective - at what must we excel? 3. Learning (or innovation) and growth perspective - how can we continue to grow and change in the modern dynamic business environment? 4. Financial perspective - how do we look to shareholders? The four perspectives should complement each other. If customers are satisfied, for example, this should lead to increased revenues and profits, which improve the financial perspective.

1.2 Balanced Scorecard Philosophy

1.2.1 Setting Measures and Performance Targets

Objective - a specific, measurable statement of what will be done to achieve goals within a defined time frame. (Although the terms objectives and goals are widely used interchangeably, a goal tends to be more of a longer-term aspiration.)

Performance measure - a quantitative or qualitative characterisation of performance used to evaluate progress toward an objective.

"Balanced" is used because managerial performance is assessed under all four perspectives. For each perspective, management needs to identify: 1. Objectives - what are the main objectives? 2. Measures - how can the performance be measured against the objectives? 3. Targets - what targets should be set for each measure? 4. Initiatives - what actions could be taken to improve performance?

1.2.2 Leading and Lagging Indicators Kaplan and Norton were interested in the cause and effect aspects of performance measurement.
· Lagging (downstream) indicators show the effect of decisions long after they are made. The balanced scorecard refers to financial measures as a lagging indicator because that performance results from past decisions.
· Leading (upstream) indicators drive future financial performance. These are the non-financial performance indicators relating to customers, internal business processes and learning and growth.

1.2.3 Importance of Strategy Kaplan and Norton also realised that many performance measures chosen by organisations were inconsistent with their organisational strategy. A company's objectives for the four areas should reflect its mission and strategy, and appropriate measures should be selected to reflect these objectives. Many companies began to use the balanced scorecard not simply as a performance measurement tool (its original objective) but to help clarify and manage strategy.

1.3 Advantages and Disadvantages
Advantages of the balanced scorecard approach to performance measurement include:
· It leads to a wider view of performance rather than concentrating on the financial aspects of performance. Managers are unlikely to be able to distort the performance measure as poor performance is difficult to hide using multiple measures.
· It takes a long-term perspective of business performance and links performance measurement to the organisation's objectives and strategy. This ensures that what is measured is relevant to the strategy and objectives of the organisation.
· Using only a small number of KPIs ensures that management can concentrate on the most critical aspects (i.e. "what gets measured gets done") and avoid confusion arising from having too many performance indicators.
Of course, there are potential difficulties:
· Introducing the balanced scorecard would require training and a culture change. Managers and staff may initially be sceptical.
· Identifying the most appropriate measures may be difficult.
· Obtaining the data to determine whether some measures have been achieved may be problematic.
· The balanced scorecard focuses only on the needs of two stakeholders - owners and customers; it ignores the needs of other groups, such as employees.
· Suppose management is not sufficiently selective in its choice of appropriate KPIs. In that case, managers have to analyse many KPIs, some of which may conflict with each other, and determine which gives the most significant results.

Example of The Balanced Scorecard

For low-cost airlines (e.g. Ryanair and easyJet) to stay competitive, management must develop performance measures which support the carriers' strategy and focus on critical aspects of performance. The following measures have been developed to reflect important aspects of the low-cost carrier's business model:

Objective	Measure
Business process perspective	
Punctuality	% of flights on time
Effectiveness of direct selling	Enquiry/booking conversion rate
Innovation and growth	
Route network development	Time taken to build traffic to breakeven load factor for new routes
Number of routes withdrawn	
Development of individuals Customer perspective	Expenditure on training
Internal promotion rates	
Customer satisfaction	Customer ratings (service/VMF)
	Customer complaints/compensation payments
Customer loyalty	Repeat business
	Switching to other airlines
Financial perspective	
Profitability	Return on capital employed
Financial stability	Gearing
Utilisation	Load factors
Low costs	Cabin crew cost per seat per km

2.1 Characteristics of Service Industries

As mentioned in Chapter 3, four specific characteristics of services make performance measurement in service industries more difficult than in manufacturing industries. 1. Simultaneity (inseparability) - services are consumed as they are produced. 2. Heterogeneity (i.e. lack of homogeneity), also called variability - each service provided could be unique because people are involved, and the quality of service cannot be standardised. 3. Intangibility - the service may have no physical aspects (e.g. smell, touch, sound, visual representation, etc.). As a consequence, the service provider may find it challenging to identify the service aspects customers value. Customers may also find it difficult to communicate what they value about the service to the service provider. 4. Perishability - services cannot be stored. A service must be provided when the customer wants; it cannot be prepared in advance. To have sufficient resources to meet peak demand, an organisation will likely have unused capacity at non-peak times.

2.2 Fitzgerald and Moon's Building Block Model

2.2.1 Purpose of the Model Fitzgerald and Moon designed the Building Block model as a framework for service companies to use in developing a performance evaluation system linked to reward schemes for managers. There are three "blocks" - dimensions, standards and rewards.

DIMENSIONS: Financial performance, Competitiveness, Quality, Innovation, Flexibility, Resource utilisation.
STANDARDS: Ownership, Achievability, Equity.
REWARDS: Clarity, Controllability, Motivation.

2.2.2 Dimensions
Dimensions are the aspects of performance which must be measured. There are six dimensions in the Fitzgerald and Moon model. Organisations need to identify performance measures based on these six dimensions. (Similar to the four perspectives in the balanced scorecard model.) The six dimensions are: 1. Financial performance 2. Competitiveness 3. Quality 4. Resource utilisation 5. Flexibility 6. Innovation.

Financial performance and competitiveness are the results, while quality, resource utilisation, flexibility and innovation are the determinants. If the organisation performs well in the determinants, this will lead to good performance in the results. Example 2 Car Dealer's Performance Additional research by Fitzgerald discovered a large car dealer network in the UK that used the following performance dimensions and measures:
· Financial performance: Measurement of profitability by dealer, with the information disseminated to the dealer owners.
· Competitiveness: Market share from published industry data and measurement at the business unit level using new car registrations by postcode.
· Quality of service: A combination of measures, including formalised management inspections, mystery customer transactions, and post-transaction customer assessment through feedback questionnaires. Contact with customers is repeated regularly on an annual basis to continue developing long-term relationships with the customer.
· Resource utilisation: Sales per employee, among other operational measures for cost and asset utilisation.
Flexibility and innovation are not directly measured at this organisation, although there are specific formalised structures to manage flexibility (e.g. dealing with peak season or sales/maintenance surges from customers). A point is made that, in the absence of formalised measures for flexibility and innovation, these dimensions are discussed during business planning.

2.2.3 Standards
Three principles should be applied in setting targets for managers: 1. Ownership - managers should take ownership of (believe in) the targets. Managers who participate in setting targets will be more likely to believe in them. 2. Achievability - targets should be challenging but achievable; otherwise, managers will dismiss them rather than be motivated to achieve them. Owing to the principalagent problem, those responsible for results will always push for easier

targets. 3. Equity - the organisation should maintain a realistic level of difficulty for its standards across all business areas and be fair and unbiased in its performance assessment.

2.2.4 Reward Schemes

Reward schemes may be linked to performance by paying managers bonuses if they achieve targets. Three principles apply: 1. Clarity - employees must understand the performance measurement scheme. 2. Motivation - bonuses should motivate staff to achieve the targets. 3. Controllability - managers' performance evaluations should only measure factors they control.

Example of Building Block Model

SmartC is a package delivery company located in Maxland, a developing country. Since its formation 50 years ago, it has become one of the country's largest and most successful shipping companies. Its mission is "to exceed customers' expectations in the transfer of packages by offering the highest quality services at competitive prices". SmartC offers a range of delivery services, such as:

· Standard overnight delivery;

· A premium add-on of guaranteed 10:30 am delivery;

· A cheaper, three-day service for less time-critical deliveries SmartC has recently launched an app that allows customers to set pickup times and locations on their smartphones, which has received positive reviews in the technology press.

SmartC has identified the following critical success factors:

· Deliver sustainable profits to shareholders;

· Leave customers highly satisfied at every interaction with SmartC;

· Provide a range of services which meet our clients' evolving needs;

· Lead the industry with constant innovation.

Managers at SmartC have a dynamic compensation package which includes share options, goalbased incentives, commissions, and non-monetary public recognition. SmartC also allows for flexible work schedules and is piloting an on-site childcare programme at one of its locations. SmartC receives positive coverage in the press about its work environment and is considered an attractive employer, with motivated employees and a good reputation among job seekers. However, SmartC's profits have dropped in recent years due to increasing competition from global transport companies recently entering the Maxland market.

Applying the building block model:

Dimensions

Results: As a listed company, management will be very interested in measuring financial success - is it delivering sufficient profits and returns for its shareholders? Competitiveness is also critical to measure as new competitors are entering the market in Maxland - is SmartC maintaining or losing market share?

Determinants: SmartC's managers and staff need to focus on the dimensions of performance that will determine positive financial and competitive results. For example, on-time deliveries will lead to customer loyalty. This falls under quality of service. The company's varied service range should meet the needs of different customer segments; this is an example of service flexibility. Flexibility and quality of service should, in turn, drive positive financial results, for example, higher sales revenue.

Innovation is also essential to SmartC as it invests in new technology and improves processes with its smartphone app. Resource utilisation is critical to its financial success as efficient use of delivery vehicles, staff and financial resources will reduce costs and improve profitability. In other words, innovation and resource utilisation drive financial success (higher profits) and competitiveness (maintaining market share).

Setting standards for dimensions

Financial performance: Growth in sales, net profit margin and return on investment (ROI) are potential targets for regional managers. For example, fixed targets could be set, such as 8% annual growth in sales or a target ROI of 14%. Or, SmartC could use a league table approach by ranking the regions according to these standards and then rewarding managers accordingly. (ROI is detailed in Chapter 17.)

Competitiveness: With new players in the market, SmartC needs to measure this area of external performance. It can set absolute market share as a standard for measuring competitiveness by dividing SmartC's revenue by the total revenue of the industry in Maxland. A target for regional managers could be to maintain market share as competitive rivalry is increasing in the industry.

Quality: As a service organisation, SmartC must deliver quality service to retain its customer base. It can set targets for courier agents, such as 98% on-time delivery or call centre representatives to take an order in 3 minutes on average. It will be essential to ensure that these targets are fair and achievable to motivate employees (see below).

Resource utilisation: SmartC can measure resource utilisation using efficiency standards such as average delivery time or number of deliveries per day. However, equity should be considered here, as urban regions could outperform rural regions as urban customers will be clustered closer together. Flexibility of service and innovation: Flexibility of service can be measured with targets such as 90% of orders scheduled to customers' requests. Innovation can be measured by the % of customers using the smartphone app.

Note: While the categories used in this section look similar to those used in the section on dimensions above, they are being discussed in the context of targets, which is why they appear under the standards heading.

Rewards

SmartC appears to have an effective reward system. The compensation package covers a range of financial and non-financial rewards and benefits, which contribute to the motivation of employees by meeting their different needs. For example, new parents will be motivated by the childcare facilities; other staff may be motivated by the flexible workplace arrangements. It also appears that rewards are performance-based (e.g. "goal-based incentives"), leading to increased motivation. SmartC must ensure that rewards are controllable and clear, for example, by providing targets that are well-defined and then agreed upon in appraisal meetings.

3.1 Identifying Objectives

3.1.1 Types of Not-for-profit Organisation

The non-profit sector includes:

· Public sector bodies such as schools and hospitals.

· Not-for-profit (NFP) organisations (e.g. charities) and non-governmental organisations (NGOs). NGOs may receive significant funding from the government; NFP organisations typically raise funds from those interested in the organisations' goals.

Most, but not all, public sector organisations do not have profit as their primary objective and were established to provide "public goods". Their objectives may include usage maximisation and generating satisfaction from those benefiting from the services. Objectives of NFP organisations are more difficult to measure and rank because:
· They are challenging to quantify. How can a hospital's aim "to improve health in the area" be measured? Information from several sources may be required (e.g. hospital admissions, rates of specific diseases, ultimately life expectancy). Charities may find it challenging to measure the alleviation of suffering or raising the level of public awareness.
· The achievement of some objectives may be simpler to measure than others. Therefore, there is a risk that the organisation will focus on what can be easily measured rather than what is most important to its long-term future.
· Achievement of some objectives may be subjective. For example, the objective "to provide a good quality of education" may mean different things to different people.
· Many non-profit bodies have multiple stakeholders, each with potentially conflicting objectives.
· There may be no clear primary objective (in contrast with commercial companies with profit maximisation as their primary objective to which all other goals are assessed).

Example of state-funded university
· University management is accountable to multiple stakeholders.
· However, stakeholder requirements may conflict: - Students may desire small class sizes, extensive library, etc. - The government wants to minimise costs per student.
· Designing a performance measurement system with multiple and conflicting objectives is complicated. Management must rank its stakeholders and prioritise goals accordingly.

3.1.2 Charities
Charities are one type of not-for-profit organisation, but with several additional distinguishing features:
· They exist solely to benefit defined groups in society;
· They may be eligible for favourable tax treatment; therefore, they may have to be registered with a regulator;
· Their activities are restricted or limited by a regulator;
· They rely on the financial support of the public and businesses to achieve their objectives;
· Their financial viability relies heavily on voluntary (unpaid) managers and workers.
A charity may engage in commercial activities that serve its objectives (e.g. many charities operate chains of retail shops); however, it is the charity's purpose (as specified in its constitution) that is its primary objective (e.g. Oxfam was founded in 1942 for famine relief; Oxfam International is now an NGO with member organisations in 19 countries).

3.2 Value for Money Objectives

The value for money (VFM) framework attempts to evaluate the performance of NFP and other non- commercial organisations. VFM focuses on how well the organisation has achieved its objectives given the funding it received. Three performance indicators (the "3Es") measure VFM: 1. Economy - minimising inputs in terms of lowest cost for the quality required (i.e. the lowest cost option may not necessarily be chosen if it does not provide sufficient quality); 2. Efficiency - maximising the output/input ratio; 3. Effectiveness - achievement of objectives.

Example of Measuring VFM
The following diagram indicates possible VFM measurements for a typical university.
University
     |
Area: Economy, Efficiency, Effectiveness
     |
Possible measures: Minimising costs per student, maximising student/staff ratio, quality of degrees awarded
High effectiveness may conflict with economy and efficiency. Multiple and conflicting objectives also may exist due to the various stakeholders involved. There may, for example, be conflicts between stakeholders whose primary concerns are financial/commercial (government/taxpayers) and those concerned with quality of service (e.g. users of National Health Services). Determining the overriding objectives (or the trade-off between different objectives) may be difficult.
High effectiveness may conflict with economy and efficiency. Multiple and conflicting objectives also may exist due to the various stakeholders involved. There may, for example, be conflicts between stakeholders whose primary concerns are financial/commercial (government/taxpayers) and those concerned with quality of service (e.g. users of National Health Services). Determining the overriding objectives (or the trade-off between different objectives) may be difficult.

Quiz: NFP Objectives
In recent decades, the public sector has considerably increased management accounting adoption (e.g., in hospitals and schools). Many governments specify objectives for public services, for example: Hospitals - "to improve the standard of patient care". Schools - "to improve the quality of education". Governments have also stressed the efficient use of resources in these areas. Required: Comment on the above objectives and assess how management accounting can contribute towards their achievement.

Answer:
The objectives quoted in the question are too general to provide a mechanism for measuring whether the school or hospital has attained those objectives. Despite widely acknowledged difficulties measuring the efficiency and effectiveness of not-for-profit (NFP) organisations, management accountants must help managers involved in decisions regarding the organisation's resources. This is especially so in the case of NFP organisations, where a significant proportion of the cost base is fixed.

· Economy can be defined as: "The terms and conditions under which the authority acquires human and material resources. An economical operation acquires resources of the appropriate quality and provides a service to the appropriate standard at the lowest cost."

· Effectiveness is "The extent to which a programme achieves its established goals or other intended effects."

· Efficiency is: "The relationship between goods or services produced and resources used to produce them. An efficient operation produces the maximum output for any given resource input or minimum input for any given quantity and quality of services provided."

From the above definitions, it can be seen that efficiency is the optimum of economy and effectiveness (i.e. the measure of output over input). The above "3 Es" explains what governments mean by "the efficient use of resources in these areas". The introduction of management accounting techniques within hospitals and schools has led managers to focus more on achieving economy, efficiency and effectiveness. The principal problem, typical of schools and hospitals, is measuring such organisations' output (i.e. effectiveness). In acknowledging that non-financial objectives can be more subjective than financial objectives when deciding whether they have been achieved, management accountants need to ensure the definition of organisational objectives in a manner which facilitates the measurement of the extent to which "patient care" and "quality of education" have been achieved. Measurable objectives having been established, the management accountant should develop performance indicators to measure effectiveness (i.e., the extent to which the prescribed goals have been met). The management accountant must ensure that the control systems capture the information used to assess the organisation's effectiveness and that any deficiencies are remedied.

3.3 Non-Financial Performance Indicators (NFPIs)

NFPIs were introduced in Chapter 15. NFPIs are particularly useful in NFP organisations for the following reasons:

· The overall objectives of NFP organisations are usually non-financial, so it does not make sense to judge their performance primarily using financial measures.

· Commercial organisations generally have one overriding objective: to maximise shareholders' wealth. However, NFP organisations, particularly in the public sector, have multiple objectives to reflect the needs of different stakeholders (e.g. various people will have different beliefs about what they think a local council should provide).

· It may be challenging to identify a cost unit in NFP organisations (e.g. in a hospital that carries out many different types of procedures, there is no single appropriate unit of output). This makes financial performance measurement more difficult.

Key Point

Performance measurement requires a broad range of performance measures, many of which will be non- financial.

Quiz: Non-financial Performance Indicators

Suggest ONE non-financial performance indicator for each of the situations below. Explain why you think it would be a useful measure of performance: 1. The quality of education in a school. 2. The effectiveness of a charity that aims to reduce the effects of a particular illness on the population in a developing country. 3. The quality of clinical care in a hospital. 4. The effectiveness of the local police force in dealing with crime.

Answer:
Note: The question only asked for one indicator for each situation. Additional indicators have been provided as further examples. Other suggestions may also be valid.

Proposed indicator
1. Quality of education in a school
Exam results - % of pupils passing final(why a useful measure? Exam results are a measure of how much the pupils exams have learned. Pass rates reflect how well the students have been taught)
% of pupils that achieve entry to University or higher education (why a useful measure? One objective of schools is to enable talented students to achieve their potential and gain entry to a good university.)

2. Effectiveness of charity in reducing the effects of a disease
Fall in the number of cases of a disease reported each period (why a useful measure? Shows a fall in the disease, which may reflect the charity's work.)
Number of people inoculated against a disease (why a useful measure? Reflects the work performed by the charity, although this may not measure very well how effective the results were.)

3. Quality of clinical care in a hospital
% of patients that are cured and not readmitted within three months (why a useful measure? Shows % of cases with a positive outcome, reflecting the level of clinical care given.)
Waiting time for operation (time from referral by doctor until procedure performed) (why a useful measure? Long waiting times may be caused by poor clinical care in hospitals, delaying additional operations)

4. Effectiveness of local police force
% of arrested criminals convicted (why a useful measure? Reflects the ability of police to collect sufficient evidence to ensure criminals are convicted.)

3.4 Setting Targets
Targets are often used to improve performance. Actual performance is compared with the targets, and management investigates when targets are missed. This is similar to the concept of comparing financial performance against budgets or the use of standard costing and variance analysis. Setting qualitative targets (those relating to NFPIs) can be difficult in NFP organisations because:

· Determining the appropriate level of difficulty for the target is difficult. A target that is too difficult may demotivate. A target that is too easy may encourage inefficiency.
· Meaningful targets need to take into account differences in the external environment. For example, a school's demographics may significantly influence exam results. It may not be appropriate to set the same targets for all schools.
· Managers judged by the performance measures need to "buy into" the targets set. Managers may be more willing to accept targets if they have been involved in developing them.
· Identifying measures for qualitative areas can be challenging enough, even before consideration of setting the target.
· Targets are often based on results rather than effort. In many organisations, the hard work of staff may not always be reflected in the results (e.g. mortality rates in hospitals may reflect many factors, not just the efforts of the medical staff).

3.5 Assessing Performance Assessing performance in the NFP sector is similar to that in the commercial sector. However, it is essential to consider the organisation's objectives. Performance is only meaningful when judged on what the organisation wishes to achieve.
· Most NFP organisations do not exist to make profits, so using traditional performance measures such as return on capital employed is meaningless. (Some NFP companies do exist to make profits (e.g. charity shops), but these are required to pass all profits on to charitable causes.)
· Reducing costs may be good in the sense of increasing efficiency. However, cost reduction may conflict with some non-financial objectives if the quality of the service provided to stakeholders is adversely affected.

Quiz: Evaluation of Performance
Ayersome Leisure (AL) is a sports centre owned and managed by the council of Bigton. Its mission is "To promote healthy living in Bigton". The council has become increasingly concerned by the growing deficit generated by the centre as the council has to subsidise all such deficits. The financial report of the centre for the last two financial years (most recent and prior) and the budget for the most recent year are as follows:

	Prior	Most recent	Budget
$000	$000	$000	
Revenue	700	606	792
Less costs:			
Depreciation	25	25	25
Salaries	450	500	550
Maintenance	150	200	200
Other costs	124	75	125
Surplus(deficit)	(49)	(194)	(108)

The centre offers four sporting activities: Squash, Swimming, Gym and Badminton. The following information is available in respect of these for the most recent financial year:

	Squash	Swimming	Gym	Badminton
Hours open each day: % utilisation	12	10	12	6

	Daytime	50	70	15	50	
	Evening	80	70	50	50	
Revenue ($000)		101	203	252	50	
Annual cost saving ($000)						
If activity is discontinued:		21	120	51	60	

AL offers free access to all facilities to local schools to encourage sports development and to those over 60 years old to promote healthy lifestyles. Free-access users comprise 30% of all users. It is estimated that 60% of these users would continue using the facilities if they had to pay the standard charges. The remaining 40% would not use the facilities if free access were withdrawn. Except for the avoidable costs identified (i.e. the annual cost savings if an activity is discontinued), all costs are general fixed overheads. There has been a decline in evening users of both the gym and the swimming pool because a private health club opened during the year in Bigton. A former visitor to the club commented that he preferred the health club because even though it was much more expensive than AL, it attracted a more exclusive clientele.
Required: a. Evaluate the financial and non-financial performance of the sports centre for the most recent year. b. Suggest ways the centre's financial performance could be improved.

Answer:
a. Performance
The deficit for the most recent financial year is $194,000. This is almost four times that of the prior year and 80% higher than the budgeted deficit. Understandably, the council is concerned about this. The main reason for failure to meet the budget is the decline in revenue, most likely due to opening of a new health club in Bigton, which has attracted some users away from a public sports centre. There is little that AL's management can do about this, as it would not be appropriate for a publicly- funded leisure centre to offer the same luxurious levels of service as a private health club. However, the existence of the competition and the expected decrease in revenue must be planned for in the future and costs reduced. Salaries have increased by 11% compared to the prior year, although this is only half the budgeted increase. This is due to either increased staff numbers or increased salaries or both. Given the revenue decline, management should not have raised the staffing level. Accessibility of the sports centre is good, with squash and gym being available 12 hours per day and swimming 10 hours per day. Badminton is only available for six hours daily, which may reflect a lack of demand. The utilisation of all activities is over 50% except for the gym, which has only 15% utilisation during the day, perhaps due to gym users being at work. Squash is particularly in demand, with 80% utilisation in the evenings. The high utilisation rates mean that the centre provides services valued by the community. The provision of free facilities to the over 60s and schools may appear to be bad from a financial point of view, but AL's objective is to promote healthy living, not to make a profit. Of the 30% of users who enjoy free access, 40% would not use the facilities if they had to pay, so the sports centre satisfies a social need by encouraging people to exercise. Overall, the financial performance is poor, and the sports centre needs to find ways to reduce the deficit in future years. However, the sports centre provides the local community with a good and valued service.

b. Improving Financial Performance As noted in part (a), revenue fell considerably due to the opening of a private health club. The private club provides an exclusive service to its clients, while a publicly-owned sports centre has an objective of inclusivity. There is little that AL can do to win back the clients who prefer the exclusivity of a private club, so the revenue fall must be accepted. Therefore, improving financial performance requires AL to focus on cost reductions. Badminton is not a particularly popular activity. Revenue from badminton was $50,000. If Badminton were discontinued, costs of $60,000 would be avoided. Therefore, ceasing badminton would save $10,000 a year. Management may consider reducing staff costs. Reducing staff costs to prior year levels would save $50,000. Additional savings might be possible if staff levels are reduced during times of low utilisation (e.g. in the gym during the day when usage is only 15%). While squash and swimming are available for 12 hours per day, it may be possible to reduce this availability during less busy times. Opening one hour later and closing one hour earlier could save costs without causing too much inconvenience to users. Finally, it is noted that 30% of users enjoy free access. If this were to be withdrawn, 60% of these would continue to use the facilities. This means revenue would increase by approximately $109,000 (30% * 606,000 * 60%). However, withdrawing free access may go against AL's stated mission. As a compromise, perhaps free access to over-60s could be "means-tested" (i.e. individuals over 60 on low incomes would continue to enjoy free entry, but those on higher incomes would have to pay).

3.6 Other Approaches

In many countries, the government has increased the use of performance measurement in the public sector to :

· Improve efficiency - thereby reducing government spending and tax.

· Increase transparency - so taxpayers can see what their taxes are being used for.

· Improve decision-making about allocating scarce resources - so that available finance is used where it will best achieve the government's objectives.

Although the "3 Es" framework (above) is a cornerstone of many approaches to performance measurement, other commonly used approaches to performance measurement in the public sector include:

· Zero-based budgeting (see Chapter 9)

· Benchmarking - this compares the performance of a public sector organisation to that of a "best-in-class" organisation. For example, the performance of a procurement department in a hospital may be compared against that of a commercial organisation. An appropriate metric to measure this performance might be the total cost of placing an order.

· League tables - these institutional rankings are used in health, policing and education. They help determine whether schools or hospitals are deemed to be "failing", whether police forces are tackling crime effectively and how students rate their university courses. Ranking schools by exam results may lead to poorerperforming schools working harder to compete with better-performing schools.

4.0 Introduction

Organisations do not exist in a vacuum, so performance measurement must consider external and internal factors.

4.1 Stakeholders
A stakeholder is defined as any person or group affected by an organisation. (Traditionally, performance measurement focused only on the owners' interests.) Ignoring stakeholder objectives may result in adverse implications for an organisation.
· For example, if staff salaries are too low, good employees may become demotivated and leave the organisation.
· There also could be strikes. These factors could lead to poor customer service, ultimately affecting the organisation's profits.
Management needs to consider the most critical stakeholders, consider their objectives, and identify ways to measure how these objectives are being met. Staff surveys, for example, are a common method used to assess staff satisfaction.

Example of Stakeholder Groups
The following are the most common stakeholder groups and the aspects of the organisation's performance that are important to them and which the organisation may wish to measure:

Group	Objectives
Employees	Satisfactory remuneration, Good working conditions
Customers	Good-quality products
Suppliers	Long-term relationships, Pay within agreed terms
General public	Employment opportunities, Economic effect on the region, Environmental impact
Government	Compliance with law (e.g. environment)

Quiz: Stakeholder Views of Performance
The government of Northland privatised the Northland Railway Company in 20X6. The company was split into smaller companies, each operating the trains on a specific route. These companies were then sold to the private sector. One of the private companies formed was the Great Suburban Railway Company, which provides passenger train services on a busy commuter route between the capital city of Bigton and Smallton, a distance of 100 km. Financial and other information relating to the Great Suburban Railway for three financial years are presented below.

	20X7	20X8	20X9
Revenue ($000)	30,000	32,000	35,000
Profit ($000)	(1,000)	2,000	5,000
Number of passenger journeys (000)	2,000	1,900	1,900
Number of employees	500	450	400
% of trains arriving on time	70%	72%	75%

Other information
The Great Suburban Railway is the only company licensed to operate a rail route between Bigton and Smallton. The aims of privatising the trains were to stop the subsidy the government

had previously paid to the train company and to increase the punctuality of services. Since privatisation, passengers have complained that the number of carriages on each train has been reduced, leading to a shortage of seats during peak times.

Required: Discuss the performance of the Great Suburban Railway from the perspective of: a. the shareholder; b. the government; and c. the population of Smallton.

Answer:

a. From the perspective of shareholders Shareholders will be pleased with the performance since privatisation. Revenues have increased by 16.67% from 20X7 to 20X9, which is good for a business such as railways where demand is likely to be limited. The increase appears due to higher ticket prices, as the number of passenger journeys (volume) fell during the period. While the company recorded a loss in 20X7, the first year after privatisation, it made a good profit in 20X8 and 20X9. Profits have risen by more than revenue in absolute terms. This shows that the company has reduced costs at the same time that revenues have increased. Net profit margin rose from 6.25% in 20X8 to 14.2% in 20X9. The company has performed well from the perspective of shareholders.

b. The government Generally, The government will be pleased that it no longer has to subsidise the railway and that the company appears to survive in the private sector. Another objective of privatisation was to increase the punctuality of trains. The Great Suburban Railway has improved punctuality, measured as the percentage of trains arriving on time, from 70% to 75% between 20X7 and 20X9, so some progress has been made. However, 25% of trains are still late, and the government (and passengers) will not be pleased.

c. The population of Smallton The main objective for the people of Smallton likely is to have a reliable train service to the capital which charges reasonable prices. Punctuality has already been discussed, and passengers would likely be happy with the increase in the percentage of trains arriving on time. However, they would hope for further improvements in this area. One area that customers are likely to be unhappy about is the apparent increase in ticket prices. Dividing total revenue by number of passenger journeys, the average ticket per journey has risen from $15 in 20X7 to $18.42 in 20X9, an increase of 22%. This is a significant increase and is not likely to be popular unless accompanied by better service in some way. Customers also complain about the reduced number of carriages, leaving people without seats during peak times. So, it does not appear that passengers are experiencing better service. The number of passengers has fallen by 5% between 20X7 and 20X9. This is likely to be due to the increase in prices. People may find alternative ways to travel to the capital (such as by bus or car) or reduce their journeys. Overall, the people of Smallton are not likely to be happy with the performance of the privatised company.

4.2 Market Conditions and Competitors
An organisation's market conditions will affect its economic performance and may affect various parts of the organisation differently. For example, performance analysis should consider market differences when comparing two divisions. Competitor performance will directly affect

organisational performance. Price competition within a market, for example, will likely lead to price cuts of the organisation's products and have a financial impact. Performance evaluations should consider factors that management cannot control. This principle has been discussed in previous chapters on budgeting and variance analysis, so in summary:

· Performance evaluation should measure actual results against revised budgets to account for factors not originally considered.

· Standards can be revised to take into account changes in the environment. For example, the sales volume variance can be split into a market size and a market share variance.

· Performance can be benchmarked against competitors or organisations adopting best practices in specific business areas in addition to internal targets.

Performance measurement should be flexible enough to consider external factors.

4.3 Sustainability

Since the turn of the century there has been increasing recognition amongst stakeholders of the importance of sustainability and the effects of organisations on society and the environment. To ignore the environment within which organisations operate is not a sustainable approach. At the same time, demand for environmentally friendly products and processes (e.g. electric vehicles) continues to increase. Therefore, Adopting a sustainable business model is simultaneously a challenge and an opportunity for organisations.

Sustainability - meeting the needs of the present without compromising the ability of future generations to meet their own needs.

In addition to the overall importance of sustainability, there may also be a direct link between environmental behaviour and performance. There are numerous ways in which poor environmental behaviour may damage an organisation:

· fines (e.g. for pollution or other breaches of regulations);

· increased liability to environmental taxes (e.g. carbon taxes);

· reputational damage;

· loss of sales or consumer boycotts;

· inability to secure finance;

· loss of insurance cover.

However, reducing material, energy and water usage should not only reduce environmental impact but may also reduce operating costs. Similarly, a focus on reducing waste could, in turn, improve process efficiency and reduce the amount (and therefore the cost) of materials used. Equally, although health and safety measures might not add value directly, they can help to protect an organisation from the cost of accidents which might otherwise occur (e.g. increased staff absence and possible compensation claims for work-related injuries).

Summary:

· The balanced scorecard approach to performance measurement aims to ensure that performance measures support the organisation's overall strategy. It considers performance from four perspectives – customer, internal processes, learning and growth, and financial.

· Performance measurement in the service sector is more challenging to measure than in the manufacturing sector, due to: Simultaneity; Perishability; Heterogeneity; Intangibility
· The six dimensions of Fitzgerald and Moon's Building Block model for performance measurement in service businesses are: 1. Financial performance; 2. Competitiveness; 3. Quality of service; 4. Resource utilisation; 5. Flexibility; 6. Innovation
· Performance measurement in non-profit organisations is more difficult due to: difficulty in quantifying the objectives; multiple stakeholder interests.
· Performance measurement in the non-profit sector is often based on the "3Es" (i.e. economy, efficiency and effectiveness).
· Sustainability (i.e. meeting the needs of the present without compromising the ability of future generations to meet their own needs) is not only a challenge but an opportunity for organisations.

Chapter 17: Divisional Performance Evaluation
This chapter covers the following Learning Outcomes. E. Performance Measurement and Control 2. Divisional performance and transfer pricing c) Explain the meaning of, and calculate, Return on Investment (ROI) and Residual Income (RI), and discuss their shortcomings. d) Compare divisional performance and recognise the problems of doing so.

1.0 Introduction
Decentralisation - delegation of authority to make decisions. All organisations decentralise to some degree, some more than others. Decentralisation is a necessary response to the increasing size of an organisation and the complexity of the environment in which it operates. Even in a small company, one person cannot make all the decisions; therefore, senior managers delegate decision-making responsibility to subordinates.
Decentralisation requires the creation of autonomous business units or divisions to align responsibility with decentralised authority. These units can be:
· Revenue centres - managers are responsible for decisions about revenue generation (usually including selling costs);
· Cost centres - managers are responsible for decisions about costs;
· Profit centres - managers are responsible for decisions about costs and revenues; and
· Investment centres - managers are responsible for cost, revenues, and asset investment decisions.

1.1 Benefits
· Senior management can concentrate on strategy - delegating routine decisions frees senior management for long-term corporate planning.
· Faster decision-making - divisional managers are "on the spot" and can react quickly to changes.
· Better decision-making - specialist managers will likely understand their part of the business better than senior management.
· Motivation - divisional managers are given responsibility and status and may increase effort.

· Training and career progression - divisional managers acquire skills and experience which may prepare them for senior management (e.g. managers may be "rotated" between divisions).
· Tax advantages - locating divisions in certain areas which enjoy tax incentives or government grants.

1.2 Problems
· Lack of goal congruence - the risk that divisional managers will make decisions inconsistent with overall organisational objectives.
· Increased information requirements - reporting systems must be introduced to monitor divisional performance.
· Lost economies of scale - costs may rise through duplication of common activities. A central purchasing department may achieve better prices and lower overall overhead than divisional purchasing departments.
· Loss of central control - top management loses control to divisional managers. Conflict may occur if top management disagrees with the decisions of divisional managers.

1.3 Conditions for Successful Decentralisation
SUCCESSFUL DECENTRALISATION: Carefully designed performance evaluation systems to reduce risk of dysfunctional decisions, Business has several separate activities, Central policies to integrate and control (e.g. major capital expenditure, strategic decisions and transfer prices), Divisions should be independent from each other.

2.1 Measurement Characteristics
A significant risk of decentralisation is that managers may make decisions that are not in the best interests of the overall company ("dysfunctional decisions"). Senior management is therefore responsible for measuring and monitoring divisional performance and divisional managers to ensure, among other things, that junior managers' decisions are in the company's best interests. Therefore, a good performance measurement system should provide for the following:
· Goal congruence - performance measures should encourage decisions consistent with company objectives.
· Timeliness - performance reporting must be fast enough to allow any required corrective action.
· Controllability - evaluation should assess only divisions and divisional managers on performance under their control.

2.2 Possible Measures
Focusing on one key performance measure will likely lead to problems associated with inadequate performance measurement, such as myopia and gaming the system (see Chapter 15). Therefore, senior managers should evaluate divisional performance based on a range of measures using a balanced scorecard approach (see Chapter 16). The range of measures could include:
· variance analysis - taking care to identify controllability (see Chapter 10);
· ratio analysis (s.2.2.1);

· non-financial measures (s.2.2.2);
· return on investment (s.3); and
· residual income (s.4). The most suitable measures will depend on the type of business unit monitored (see 2.3.3).

2.2.1 Ratio Analysis Profitability Measures Liquidity Measures Other Measures

Profitability Measures	Liquidity Measures	Other Measures
· Net profit margin	· Current ratio	· Contribution per key factor/limited
· Gross profit margin	· Quick ratio	resource
· Contribution margin	· Receivables collection	· Sales per employee
· Expenses as a percentage of	period	· Industry-specific
sales	· Payables payment	cost-related ratios such as:
	period	- transport cost per km
	· Inventory holding period	- overheads per chargeable hour

2.2.2 Non-financial Measures
Non-financial measures include, for example:
· Staff turnover (also days lost through absenteeism)
· New customers gained
· Proportion of repeat bookings
· Orders received
· Set-up times (also customer waiting times)
· New products developed
· % Returns
· % Rejects/reworks (also number of complaints received)
· On-time deliveries
· Client contact hours
· Training time per employee.

2.2.3 Measures by Division Division

Division Type	Possible Measure
Revenue centre	Financial
	· Sales variances (volume, price, mix)
	· Selling costs ratio
	Non-Financial
	· Sales volume per employee
	· Customer satisfaction rating
	· Customer retention
Cost centre	Financial
	· Cost variances
	· Costs per unit produced
	Non-financial

| | · Labour turnover | |

Profit centre	As above, plus:
	Financial
	· Controllable profit (if assessing manager)
	· Traceable profit (if assessing division)
	· Sales variances
	· Profit margins
	· Contribution margins
	Non-financial
	· Customer returns

Investment centre	As above, plus:
	Financial
	· Return on investment (s.3)
	· Residual income (s.4)
	· Sales variances
	· Liquidity ratio
	- Current ratio
	- Receivables days
	Non-financial
	· Number of new products developed

2.3 Controllable and Traceable Profit

Controllable profit statements are commonly used in profit centres. Here is an example of a pro forma statement:

	$	$
External sales		X
Internal sales		X
	X	
Variable costs Controllable by manager	X	
Fixed costs Controllable by manager	X	
		(X)
Controllable divisional profit		X
Divisional costs outside manager's control		(X)
Traceable divisional profit		X
Allocated head-office costs		(X)
Divisional net profit		X

A problem with such statements is deciding what is controllable or traceable. A manager's performance should be assessed only on costs and revenues under their control. However, the

division's success should be evaluated on costs and revenues that are traceable to the division. For example, depreciation on divisional plant and equipment would not be a controllable cost in a profit centre (because the profit manager does not make investment decisions). It would, however, be included as a traceable fixed cost in assessing the division's performance.

Key Point

3.0 Introduction In an investment centre, managers have the responsibilities of a profit centre plus responsibility for capital investment. Two measures of divisional performance are commonly used: Return on investment (ROI) and residual income (see s.4).
Return on investment (ROI) - a return on capital employed which compares income with the operational assets used to generate that income.

3.1 Calculations
Key Point
Profit is before interest and tax because interest is affected by financing decisions, and tax is an appropriation.

3.1.1 For Manager
ROI = Controllable profit/Capital employed * 100

3.1.2 For Division
ROI = Traceable profit/Capital employed * 100
Decision rule - Divisional performance is favourable if ROI is greater than the cost of capital.

3.2 Components of Capital
Capital investment usually has two components:
· Fixed capital -> Non-current assets
· Working capital -> Net current assets
ROI is the divisional version of company ROCE (a measure analysts use to advise shareholders to buy or sell the company's shares). It is a measure of divisional performance. It is not an investment appraisal method. In practice, however, divisional managers often use ROI for investment appraisal.

If divisional managers choose projects with high ROI, the division's ROI should be high. The head office will favourably assess the manager. But, an ROI hurdle should not be the sole measure of a division's purpose, as it may lead to dysfunctional decisions.

Quiz: ROI
The managers of Division X and Division Y are evaluated using return on investment (ROI) as the primary measure of divisional performance. Each manager is considering a potential investment project for their respective departments. Details of the potential projects, along with information about existing departmental ROI, are provided below:

	Division X	Division Y
Controllable investment in possible project	$100,000	$100,000
Controllable profit from possible project	$16,000	$11,000
Current division ROI	18%	9%
Company cost of capital		13%

Required: a. Determine whether the divisional managers would accept the project available to their respective divisions. b. Comment on whether each manager's decision is congruent with the organisation's primary objective, which is to maximise the wealth of its shareholders.

Answer:
a. Investment decisions
Division X -> ROI of new project = 16% -> Below current ROI -> Reject project
Division Y -> ROI of new project = 11% -> Above current ROI -> Accept project

b. Goal congruence The new project available to Division X has an ROI above the cost of capital and should probably be accepted. The new project available to Division Y has an ROI below the cost of capital and should probably be rejected. The divisional managers make decisions in their best interests, not the company's.
Conclusion: There is a lack of goal congruence. Maximising shareholders' wealth is achieved by investing in projects in which the return on those projects is higher than the cost of capital required to finance them.

3.3 Advantages of ROI
· As a relative measure, it is easy to compare divisions.
· Similar to ROCE used externally by analysts.
· Focuses attention on scarce capital resources.
· Encourages reduction in non-essential investment by: - selling off unused non-current assets; and - minimising the investment in working capital.
· Easily understood percentages (especially by non-financial managers).
· Can be further analysed (i.e. between profit margin and asset turnover).

3.4 Disadvantages of ROI
· Risk of dysfunctional decision-making.
· The definition of capital employed is subjective. For example, should non-current assets be valued using - carrying amount (i.e. net book value); - historical cost; or - replacement cost? Should lease assets and intangible assets be included?
· If net book value is used, ROI will increase over time because of depreciation. For example, assume an asset cost $100,000, generates $15,000 profit per year, and is depreciated 20% per annum on a straight-line basis. The ROI at the end of year 1 would be 18.75 % [($100,000 - $20,000) / $15,000 = 18.75%]. However, ignoring the time value of money and assuming constant profit generation, at the end of year 3 the ROI would be 37.5% [($100,000 - $60,000) / $15,000 = 37.5%]. This may encourage managers to defer asset replacement.

· Risk of window-dressing; boosting reported ROI by: - under-investing; and - cutting discretionary costs (especially if ROI is linked to bonus systems).

4.0 Introduction
Residual income (RI) - pre-tax profit less imputed interest charge for capital invested. Residual income focuses on wealth creation by deducting from profit an imputed interest expense (representing the cost of capital invested).

4.1 Calculations
4.1.1 For Manager

	$
Controllable profit	X
Imputed interest charge	(X)
Residual income	X

4.1.2 For Division

	$
Traceable profit	X
Imputed interest charge	(X)
Residual income	X

Key Point Decision rule - accept a project/investment if residual income is positive.

4.1.3 Imputed Interest
Imputed interest is a notional interest charge on the division by the head office.
Imputed interest = Capital employed * Interest rate
The company's cost of capital is often used as the basis for the interest rate.

Quiz: ROI and Residual Income
Division X is a division of XYZ Co. Currently, it earns an annual profit of $2.2 million and has net assets of $10 million. Division X's cost of capital is 10% per annum. The division is considering two proposals. 1. Investing a further $1 million in non-current assets to earn an annual profit of $0.15 million. 2. Disposal of assets at their net book value of $2.3 million. This would lead to a reduction in profits of $0.3 million. Proceeds from the disposal of assets would be credited to the head office, not Division X.
Required: Calculate the current ROI and residual income for Division X and show how they would change under each proposal.

Answer:
Current situation ROI
ROI $2.2m/$10m =22%
RI $2.2m - ($10m * 10%) = $1.2m

Proposal 1

ROI $2.35m/$11m =21.4%
RI $2.35m - ($11m * 10%)=$1.25m

Proposal 2
ROI $1.9m/$7.7m =24.7%
RI $1.9m-(7.7m * 10%)=$1.13m
Commentary:
Under the current situation, ROI exceeds the cost of capital, and residual income is positive. The division is performing well.
Proposal 1 is acceptable to the company. It offers a 15% return ($0.15m/$1m), greater than the cost of capital. However, divisional ROI falls, which could lead to the divisional manager rejecting Proposal 1. This would be a dysfunctional decision. Residual income increases if Proposal 1 is adopted, and this performance measure should lead to goal-congruent decisions.
Proposal 2 is not acceptable to the company. The return on existing assets is 13% ($0.3m/$2.3m), which is greater than the cost of capital and hence should not be disposed of. However, divisional ROI rises, which could lead to the divisional manager accepting Proposal 2. This would be a dysfunctional decision. Residual income decreases if Proposal 2 is adopted, and once again, this performance measure should lead to goal-congruent decisions.

Quiz: Residual Income
Following the quiz of ROI and Residual for XYZ Co. The method of evaluating the performance of divisional managers has changed from return on investment to residual income. The two divisional managers are considering the investment projects:

	Division X	Division Y
Controllable investment in possible project	$100,000	$100,000
Controllable profit from possible project	$16,000	$11,000
Current division ROI	18%	9%
Company cost of capital	13%	

Required: a. Determine what will be the decision of each of the divisional managers. b. Is the decision-making goal congruent?

Answer:
a.

	Division X	Division Y
Controllable profit	16,000	11,000
Imputed interest	(13,000)	(13,000)
Residual income	3,000	(2,000)

The manager of Division X will accept the project. The manager of Division Y will reject the project.

b. Goal congruent? Yes

4.2 Advantages

· Residual income overcomes some of the problems associated with ROI (dysfunctional behaviour and holding on to old assets).

· It can be linked to net present value, which, theoretically, is the best way to make investment decisions. The present value of an investment's residual income equals the investment's net present value. In the long run, companies that maximise residual income will also maximise net present value and, in turn, shareholder wealth.

· A risk-adjusted cost of capital can reflect different risk positions of different divisions.

4.3 Disadvantages

· Definition of capital employed. (As for ROI)

· Effect of depreciation. (As for ROI)

· Window dressing. (As for ROI)

· It is challenging to compare divisions of different sizes. The manager of the larger division will generally show a higher residual income because of the size of the division rather than superior managerial performance.

· Less easily understood than a percentage.

Quiz: Residual Income

A divisional manager is evaluated by the head office using RI and uses RI to appraise projects.

Company cost of capital = 10%

New project details: Investment $600,000, 3-year life, No residual value, Annual cash inflow $500,000.

Required: Calculate RI for each of the three years. Use net book value at the start of each year as capital employed.

Answer:

	Year		
	(1)	(2)	(3)
	$000	$000	$000
Cash flow	500	500	500
Depreciation	(200	(200)	(200)
Profit	300	300	300
NBV	600	400	200
Imputed interest	60	40	20
Profit - interest = residual income	240	260	280

Quiz: ROI and Residual Income

PQR Co is considering opening a new division to manage a new investment project. The forecast cash flows of the new project are as follows:

| Year | 0 | 1 | 2 | 3 | 4 | 5 |
| Net cash flow($m) | (5.0) | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |

The company's cost of capital is 10% per annum. Depreciation is calculated on a straight-line basis.

Required: Calculate the project's projected ROI and residual income over its five-year life.

Note: This activity demonstrates the tendency of ROI and residual income to improve over time. Despite constant annual cash flows, both measures improve over time as the net book value of assets falls. This could encourage managers to retain outdated assets.

Answer:

ROI						
Year	1	2	3	4	5	
Opening investment (NBV)	5.0	4.0	3.0	2.0	1.0	
Net cash flow ($m)	1.4	1.4	1.4	1.4	1.4	
Straight line depreciation	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	
Profit	0.4	0.4	0.4	0.4	0.4	
ROI	8%	10%	13%	20%	40%	

Residual income						
Year	1	2	3	4	5	
Profit	0.4	0.4	0.4	0.4	0.4	
Imputed interest	(0.5)	(0.4)	(0.3)	(0.2)	(0.1)	
RI	-0.1	0	0.1	0.2	0.3	

Commentary This activity demonstrates the tendency of ROI and residual income to improve over time. Despite constant annual cash flows, both measures improve over time as the net book value of assets falls. This could encourage managers to retain outdated assets.

Summary:
· Decentralisation allows senior managers to focus on strategy rather than operations. It promotes faster and better decision-making and may better motivate divisional managers. It may, however, result in loss of central control, incongruence of goals and strategies, and increased information requirements.
· Divisional performance measures should be goal-congruent, timely and controllable by the divisional manager.
· The most suitable divisional performance measures depend on whether the business unit is a cost, profit, or investment centre.
· Controllable profit is within the manager's control. Traceable profit is after charging divisional costs outside the manager's control.
· The calculation of return on investment (ROI) is based on: controllable profit (for evaluation of manager); or traceable profit (for evaluation of division).
· Divisional ROI will increase as the manager approves projects with ROI higher than the division's existing ROI.
· Residual income is controllable profit less an imputed interest charge. Incongruent decisions are minimised when a division accepts projects with positive residual income.

· The major drawback of the residual income approach is measuring returns from divisions of different sizes.

Chapter 18: Transfer Pricing
This chapter covers the following Learning Outcomes. E. Performance Measurement and Control 2. Divisional performance and transfer pricing a) Explain and illustrate the basis for setting a transfer price using variable cost, full cost and the principles behind allowing for intermediate markets. b) Explain how transfer prices can distort the performance assessment of divisions and decisions made.

1.0 Introduction
Transfer price - the price at which one division transfers goods or services to another division within a company or from one subsidiary to another within a group.
An earlier chapter described methods of setting prices for goods and services between independent parties. In an organisation with divisions, the output of one division may form the input for another. A transfer pricing system is required to prepare management accounts for the two divisions, which reflect the work performed by both divisions. The same principles apply equally to two companies in the same group that trade with each other

1.1 When Needed
A transfer pricing policy is needed when:
· An organisation has been decentralised into divisions; and
· Inter-division trading of goods or services occurs. Transfers between divisions must be recorded in monetary terms as revenue for supplying divisions and costs for receiving divisions. Transfer pricing is more than just a bookkeeping exercise. It can have a significant effect on the behaviour of divisional managers.

1.2 Objectives of Transfer Pricing
The objectives of transfer pricing are: 1. Goal Congruence 2. Divisional Autonomy 3. Divisional Performance Evaluation

1.2.1 Goal Congruence From the performance measurement perspective, it is essential to understand that transfer prices are only necessary to encourage divisions with each other to trade in a way that maximises profits for the company.
· Transfer prices should encourage divisional managers to make decisions in the best interests of the organisation as a whole.
· Any organisation with divisions faces a risk of dysfunctional decision-making. Where inter-division trading occurs, this risk is particularly high.
· Achievement of goal congruence must be the primary objective of a transfer pricing system.

Key Point

The Performance Management (PM) exam focuses on transfer pricing from a performance management perspective. Other transfer pricing applications, for example tax mitigation, are beyond the scope of the PM exam.

Example of Goal Congruence

ABC Consulting has offices in several major cities in Central Europe. Sometimes consultants in one office work on projects for other offices. The transfer price charged is $1,100 per day of consulting. The managing director of the Budapest office of ABC Consulting discovered that he could hire reliable consultants on a freelance basis for $500 per day. On a recent project, in July, he used the services of a local freelance consultant for five days, paying $2,500 in total. "I've saved the Budapest office $3,000!" he declared triumphantly at the end of the week. During the week in question, the Prague office of ABC Consulting had a free consultant who could have done the work the freelance consultant was hired to do. This consultant earns a fixed salary, so the additional cost to the company of this consultant working on the project in Budapest would have been a flight ticket of $200 and accommodation of $500 in total.

The decision of the managing director of the Budapest office to hire the freelance consultant cost ABC an additional $1,800 (the fee paid to the freelance consultant of $2,500 less the savings on travel and accommodation of $700). This is an example of goal incongruence. The managing director of the Budapest office made a decision that was good for the Budapest office, but not good for the overall group. The reason for this was that the internal transfer price was too high.

1.2.2 Divisional Autonomy

Divisional managers should be free to make their own decisions. A transfer pricing system should help eliminate the head office telling divisions what to do. Also, autonomy should improve the motivation of divisional managers. That said, head office must be mindful when one of the divisions has a much stronger negotiating position than the other. This can result in a transfer price that is unduly beneficial to the performance of the stronger division and detrimental to the performance of divisions in a weaker position.

1.2.3 Divisional Performance Evaluation

Transfer prices should be "fair" and allow an objective assessment of divisional performance. The transfer price used should permit each division to make a profit. Profits motivate and allow divisional performance to be measured using positive ROI or RI.

Key Point

If there is a conflict between two objectives of a transfer pricing system, goal congruence must take priority.

2.1 Supplying Division Perspective

The selling division will accept a minimum transfer price equal to: Marginal (variable cost) + Opportunity cost

The opportunity cost is usually the lost contribution from external sales, either of:

· The product subject to the transfer price; or

· other products which the supplying division makes.

2.1.1 Scenario 1 - Opportunity Cost Is Zero
When to use:
· No external market or External market but spare capacity
· No production constraints
In this situation, opportunity cost is zero because internal transfers do not reduce contribution from external sales.

Quiz: No Opportunity Cost
Division Buy requires some components for its electronic games console. Division Sell has some spare capacity and could make the components for a variable cost of $60 each.
Required: a. Calculate the minimum transfer price acceptable to Division Sell. b. State what will happen if Division Buy can buy externally for $55. c. Conclude whether the actions of Division Buy and Division Sell in part (b) lead to goal congruence.

Answer:
a. Minimum transfer price= Marginal cost + Opportunity Cost = $60 +$0 =$60. The opportunity cost is $0 because the 500 units needed could be produced within the spare capacity of Division Sell.

b. External price $55 Division Buy will buy externally. No transfer takes place.

c. Conclusion Both divisions are acting in the company's overall best interests. By buying externally for $55, Division Buy saves the company $5 per component since the cost to make the components is $60.

2.1.2 Scenario 2 - Opportunity Cost Arises
Key Point
An opportunity cost arises when an internal sale sacrifices an external sale.
When to use: An external market exists, and The supplying division operates at full capacity

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Quiz: With Opportunity Cost
Division Red makes Product Y and Product Z. The factory's maximum capacity is 5,000 units per month. This capacity can be used to make either 5,000 units of Product Y, 5,000 units of Product Z or any combination of the two. Y Z Selling price $12 $16 Variable cost $9 $11 Extra cost if sold externally $1 Contribution $2 $4
Required: a. Determine which product Division Red would make and what would be the monthly contribution of the division. b. Division Blue has asked Division Red to supply 1,000 units of Product Y monthly. Determine the minimum transfer price which would be acceptable to Division Red. c. Division Blue informs Division Red that it can buy product Y from an external

supplier for $11 per unit and is not prepared to accept a price above this from Division Red. Explain what would happen if both divisions were given autonomy to make their own decisions. Comment on whether this benefits the company as a whole.

Answer:
a. Division Red would make Product Z, as this generates the highest contribution per unit. Therefore, the total contribution would be $20,000 per month $5,000 * $4).

b. The minimum transfer price acceptable to Division Red for Product Y is:

	$
Marginal(variable) cost	9
Opportunity cost	4
Minimum transfer price	13

The opportunity cost is the lost contribution per unit from selling Product Z because Division Red would make Product Z (which has a higher contribution per unit than Product Y) for external sale if it did not need to supply Product Y to Division Blue.

c. Division Red would refuse to sell for less than $13, so Division Blue would buy externally for $11 per unit Both divisions are acting in a way that is good for the organisation as a whole. Although the variable cost to the company of making Product Y is only $9, the opportunity cost of $4 is a real cost. The cost to Division Red of producing Product Y, and therefore the cost to the company, is $13 per unit. By buying externally for $11, Division Blue saves the company $2 per unit.

2.2 Buying Division Perspective
The maximum transfer price acceptable to the buying division will be the lower of:
· the external market price (if an external market exists); or
· the net revenue of the buying division.
The net revenue of the buying division means the ultimate selling price of the goods/services sold by the buying division, less the cost of those goods incurred by the buying division.

Example of Maximum Transfer Price
The bottling division of a large soft drink manufacturer buys special syrup, made according to a secret recipe, from the syrup division. The bottling division adds carbonated water to the syrup to make the drink, then bottles and sells it to distributors. Each bottle is sold for $0.50. The bottling division has calculated that the costs of making and bottling the drink (excluding the cost of buying the syrup) are $0.20 per bottle. Therefore, the net revenue of the bottling division is $0.30 per bottle. If the syrup division were to propose a transfer price above $0.30 per bottle for the syrup, the bottling division would incur a loss.

2.3 Economic Transfer Price Rule
In summary: Minimum (per selling division) transfer price $\geqslant$ Marginal cost of selling division;
And Maximum (per buying division) transfer price $\leqslant$ The lower of:

· External market price (if an external market exists); and
· Net marginal revenue of buying division.

Quiz: Alternative Transfer Prices
Division I is an intermediate division. It supplies a special chemical to division F, the final division.
Division I has spare capacity. The output of the chemical is limited. Variable cost per kg is $500. No external market for the chemical exists.
Division F processes the chemical into the final product. Each unit of the final product requires 1 kg of the chemical. Demand for the final product exceeds production.
The selling price per unit of the final product is $1,000. The further processing cost per unit in Division F is $200.
Required: a. Calculate the maximum price Division F will be prepared to pay for one kg of the chemical. b. Calculate the minimum price Division I will accept for 1 kg of the chemical. c. Comment on the performance evaluation issues if the transfer price is: i. $500 ii. $800. d. Suggest an alternative transfer price which would lead to a fairer evaluation of the performance of the two divisions.

Answer:
a. Maximum transfer price to Division F = Net revenue

	$
Selling price	1,000
Further processing costs in Division F	(200)
Net revenue	800

The net revenue of $800 per kg represents the maximum that Division F would pay Division I for the chemical. If the price exceeds this, Division F will incur a loss.

b. Minimum price acceptable to Division I

	$
Marginal(variable) cost per kg	500
Opportunity cost	0
Minimum transfer price	500

c. Performance evaluation
i. If the minimum transfer price of $500 is used, Division I will make no profit.
ii. If the maximum transfer price of $800 is used, Division F makes no profit.

d. Alternative transfer price
Any transfer price between $500 and $800 per kg should be acceptable to both parties. Without any further information about the nature of the production process and how much effort the two divisions make, it is difficult to judge what would be a "fair" transfer price. One suggestion might be to set a transfer price that is the mid-point between the minimum and the maximum.

This would be a price of $650 per kg. If this were the case, both divisions could share the profits equally.

3.1 Market Price Method

A market price may be used if buying and selling divisions can buy/sell externally at market price. However, it may need to be adjusted downwards if internal sales incur lower costs than external sales (e.g. due to lower delivery costs).

Advantages:
· Optimal for goal congruence if the selling division is at full capacity.
· Encourages efficiency - the supplying division
Disadvantages
· Only possible if a perfectly competitive external market exists.
· Market prices may fluctuate. must compete with external competition.

3.2 Full Cost Plus

Under the full cost plus method, the supplying division charges full absorption cost plus a mark-up. Standard costs should be used rather than actual costs to avoid selling divisions transferring inefficiencies to buying divisions.

Advantages
· Easy to calculate if a standard costing system
· Covers all costs of the selling division.
· May approximate to market price.
Disadvantages
· The fixed costs of the selling division become exists. the variable costs of the buying division - which may lead to dysfunctional decisions.
· If the selling division has spare capacity, it may lead to dysfunctional decisions.
· The markup is arbitrary.

3.3 Variable Cost Plus

Variable cost plus is similar to full cost plus.

3.4 Marginal Cost

Marginal cost = Variable cost + Any incremental fixed costs, e.g. stepped costs
Advantages:
· Optimal for goal congruence when: - the selling division has spare capacity; or - no external market exists.
Disadvantages
· It may be difficult to calculate (variable cost is often used as an approximation).

Example of Cost-based Approaches
Consider a division (A) which transfers its production to another division (B):

| | A | B |

		$		$	
Selling price			??		70
Transfer-in price			Not applicable		??
Own variable cost			18		10
Own fixed cost			12		10
Divisional profit			??		??

Using variable cost:

Setting the transfer price at the variable cost of Division A produces excellent economic decisions. If the transfer price is $18, Division B's marginal costs would be $28 ($18 + $10). The company's marginal costs are also $28, so there will be goal congruence between Division B's wish to maximise its profits and the company maximising its profits. If marginal revenue exceeds marginal costs for Division B, it will also do so for the company.

Although good economic decisions are likely to result, the variable cost approach is unlikely to be used in practice due to significant drawbacks:

· Division A will make a loss as its fixed costs cannot be covered. This is demotivating.

· Performance measurement is distorted. Division B is not charged enough to cover all costs of manufacture. This effect can also distort investment decisions made in each division. For example, Division B will enjoy inflated cash inflows.

· Division A has no incentive to be efficient if the transfer price covers all variable costs. Its inefficiencies will be passed up to Division B. Therefore, if used as a transfer price, it should be a standard variable/marginal cost so that efficiencies and inefficiencies stay within the division responsible for them.

Using full cost/full cost plus/variable cost plus:

A transfer price set at full cost (or, better, full standard cost) is slightly more satisfactory for Division A as it can aim to break even. Its main drawback, however, is that it can lead to Division B making dysfunctional decisions that maximise its profits but not the company's. For example, if the selling price fell to $35, Division B would cease manufacturing because its marginal cost would be $40 (($18 + $12) + $10). However, from the company perspective, the marginal cost is only $28 ($18 + $10), and a positive contribution would be made even at a selling price of only $35. The head office could tell Division B to continue making and selling the product, but that would compromise divisional autonomy; Division B's managers will resent an instruction to make negative contributions that affect their reported performance. The full cost plus approach would increase the transfer price by adding a mark-up. This would now motivate Division A, as profits can be made there and may also allow profits to be made by Division B. However, this can lead to dysfunctional decisions as the final selling price falls. The difficulty with full cost and cost-plus approaches is that they treat Division A's fixed costs and profits as marginal costs of goods transferred to Division B. Therefore, Division B has the wrong data for making sound economic decisions for the company.

Using variable cost as transfer price basis, $18:

Division	A	B	Group	Notes
	$	$	$	
Selling price	18	70	70	Only external sales are recognised at the group level.

Transfer price	N/A	(18)	N/A	Transfer price has no effect at the group level.
Variable cost	(18)	(10)	(28)	Division A and B variable costs are charged at the group level.
Fixed cost	(12)	(10)	(22)	Total fixed costs are charged at the group level.
Profit	(12)	32	20	

Using full cost as transfer price basis, $30:

Division	A	B	Group	Notes
	$	$	$	
Selling price	30	70	70	Only external sales are recognised at the group level.
Transfer price	N/A	30	N/A	Transfer price has no effect at the group level.
Variable cost	(18)	(10)	(28)	Division A and B variable costs are charged at the group level.
Fixed cost	(12)	(10)	(22)	Total fixed costs are charged at the group level.
Profit	0	20	20	

Whichever transfer price is used, there is no effect on profits reported at the group level.

Key Point
Any transfer price other than the variable cost of the transferring division has the risk of dysfunctional decision-making unless an upper limit equal to the net (marginal) revenue in the receiving division is also imposed.

3.5 Incongruent Goal Behaviour
All the practical approaches suffer from the potential problem that the transfer price may lead to behaviour that is not congruent with the overall goals of the company (or group). The selling division may set a price too high for the buying division, leading the buying division to buy externally or forgo production.

Example of Lack of Goal Congruence
A selling division has spare capacity. It produces Product B, which has a marginal cost of $10 per unit. Another division within the company used Product B in its production. The selling division can provide all of the supplies required by the buying division within its spare capacity. The buying division can also obtain supplies of Product B externally for $15 per unit. The buying division will buy externally if the transfer price exceeds $15 per unit. This leads to an extra cost to the company overall of $5 per unit of product B because Product B could be produced internally by the selling division for $10 per unit.

4.1 An Intervention
Dual pricing is sometimes used in situations where no transfer price would be acceptable to both the buying division and the selling division, so in the absence of intervention by the head office, the two divisions would not trade with each other. The head office may wish both

divisions to trade for non-financial reasons; therefore, it may use a dual pricing system to encourage them. Dual pricing works as follows:

· A higher price is used when calculating the revenue of the selling division for goods supplied to the buying division.

· A lower price is used when calculating the costs in the buying division for the goods supplied to it by the selling division.

· The head office absorbs the difference between the two as a head office overhead.

Summary:

· Transfer prices are needed when goods or services are bought and sold within the same company or between subsidiaries in the same group.

· The primary objective of a transfer pricing system is goal congruence.

· A division with no external market for a product or spare capacity has zero opportunity cost because transfers do not reduce the contribution from external sales. The minimum transfer price is then the marginal cost.

· A division with an external market and no spare capacity would lose external sales if an internal transfer is required. The minimum transfer price is then the marginal cost plus the lost contribution.

· The maximum transfer price acceptable to the buying division is the lower of: the external market price (if there is one); or its net revenue.

· An economic transfer price must lie between the minimum acceptable to the selling division and the maximum acceptable to the buying division.

· Alternative cost-based approaches all suffer from the potential problem of incongruent divisional and overall corporate goals.

Quiz: Information Systems for Operations

Which type of information system is most likely to assist managers involved with the day to day operations of a business?

A.Decision support system
B.Management information system
C.Transaction processing system
D.Executive information system

Answer:

The correct answer is C. Managers involved in day-to-day operations are supported by transaction processing systems. Decision support systems and management information systems are normally associated with tactical managers, while executive information systems are associated with strategic managers.

Quiz: Password Controls

Which of the following would NOT be an effective control over the use of passwords?

A.Using different passwords for access to different functions
B.Keeping a written record of passwords
C.Forcing users to change their passwords every month
D.Specifying minimum requirements for what each password should contain
Answer:
The correct answer is B. Keeping a written record of passwords is not an effective control

Quiz: Staff Recruitment Reports
A report that provides information about staff recruitment and turnover is most likely to be used for which of the following?
A.Performance management
B.Strategic planning
C.Tactical management
D.Operational management
Answer:
The correct answer is C. Staff planning and management is likely to be a medium-term activity

Quiz: Data Visualisations for Revenue Trends
Which of the following data visualisations would be MOST suitable to show management how total revenue changes over time?
A.Compound bar chart
B.Line chart
C.Percentage component bar chart
D.Pie chart
Answer:
The correct answer is B. Of the options available, only a line chart would show a trend.

Quiz: Vs of Big Data
With which of the Vs of big data is obtaining confirmation from another source of a tweet trending on Twitter most associated?
A.Variety
B.Value
C.Veracity
D.Volume
Answer:
The correct answer is C. Veracity is associated with ensuring truth or accuracy.

Quiz: Levels of Management
Strategic, tactical and operational describe three levels of management.
Which of the following tasks would NOT normally be performed by tactical managers?
A.Preparation of budgets for the next financial year
B.Making pricing decisions for the local market
C.Deciding to move into new markets
D.Planning how many staff to recruit each year

Answer:
The correct answer is C.
Tutorial note: This is a strategic decision, so is likely to be taken by strategic managers.

Quiz: Information Systems
What type of information systems monitor the elementary activities and transactions of the organisations?
A.Management-level systems
B.Operational-level systems
C.Knowledge-level systems
D.Strategic-level systems
Answer:
The correct answer is B.
Tutorial note: Operational-level systems support operational managers by keeping track of the elementary activities and day-to-day transactions of the organisation (e.g. sales, cash receipts and payments, payroll, inventory levels).

Quiz: System Outputs
Projections and responses to queries are typical outputs from what type of system?
A.Decision Support Systems
B.Management Information Systems
C.Executive Information Systems
D.Transactions Processing Systems
Answer:
The correct answer is C.

Quiz: Enterprise Resource Planning (ERP) Systems
Which TWO of the following statements about Enterprise Resource Planning (ERP) systems are correct?
A.They aim to allow all departments within an organisation to share information
B.They are used only by strategic managers
C.They typically include an accounting module
D.They are primarily used for the preparation of budgets
Answer:
The correct answers are A and C.
Tutorial note: ERPS are likely to be used by all levels of managers in an organisation, not only at the strategic level. While ERPS may include budgeting functionality, this would be only a small part of the system's functionality.

Quiz: Logical Access Controls

The following statements have been made about logical access controls:

1.Their primary purpose is to stop unauthorised access to the data and software in a system

2.They include the use of passwords

3.It is never possible for logical access controls to stop all unauthorised attempts to access confidential data

Which of the statements above are true?

A.1 and 2 only

B.1 and 3 only

C.2 and 3 only

D.1, 2 and 3

Answer:

The correct answer is D.

Quiz: Management Information Systems

The following statements have been made about management information systems:

1.They are designed to report on existing operations

2.They have an external focus

Which of the above statements is/are true?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is A. Tutorial note: (1) is true as management information systems provide information to help management plan and control the operations of the organisation. (2)is not true – management information systems will include mainly internal information.

Quiz: Security Controls

The following are all types of control within an organisation:

1.Logical access controls

2.Database controls

3.Hierarchical passwords

4.Range checks

Which of the above controls help to ensure the security of highly confidential information?

A.1 and 2 only

B.3 and 4 only

C.1, 2 and 3 only

D.1, 2, 3 and 4

Answer:

The correct answer is C. Tutorial note: Range checks ensure the validity of the data being input but do not ensure the security of the data once it has been input.

Quiz: Data Analytics
Which TWO of the following statements regarding data analytics are correct?
A.It is the processing of big data
B.It eliminates decision risk
C.It can identify trends, patterns and associations
D.It is a tool that transforms data into a visual context
Answer:
The correct answers are A and C.

Quiz: Activity-Based Costing (ABC) in Service Industries
Which of the following statements about activity-based costing is/are TRUE?
1. It is not relevant for service industry businesses.
2. It is based on marginal costing principles.
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:
The correct answer is C. Both statements are not true. ABC can be used in service industries as well as manufacturing, so (1) is not true. Marginal costing implies ignoring fixed overheads. ABC apportions all production overheads, whether fixed or variable, so (2) is also not true.

Quiz: ABC in Manufacturing
The following statements have been made about activity-based costing (ABC) in a manufacturing environment:
A.ABC eliminates the use of volume as a means of measuring costs.
B.Judgement may be required in selecting the drivers for a particular activity.
Which statements are true/false?

	Statement 1	Statement 2
A	True	True
B	False	False
C	True	False
D	False	True

Answer:
The correct answer is D. While not all activities are volume based, some are, so ABC does not eliminate the use of volume. Therefore statement (1) is incorrect. Judgement will certainly be required in selecting drivers for a particular activity, as there may be several potential drivers, but only one can be selected for use in ABC.

Quiz: Budgeted Overhead Costs

Doe Co produces two products, the Ray and the Me. The following information is available about these products.

	Ray	Me	Total
Budgeted production (units)	2,500	2,000	4,500
Machine hours per unit/total	4	3	16,000
Number of production set-ups	12	8	20
Number of orders	72	48	120

Other overhead costs are absorbed on the basis of machine hours. Using activity-based costing, what is the budgeted overhead cost per unit of the Me, to the nearest $?

	$
Production set-up costs	36,000
Ordering costs	84,000
Other overhead costs	64,000

A.$35
B.$36
C.$39
D.$41

Answer:

The correct answer is B. Production set-up costs per set-up = $36,000/20 = $1,800
Cost per order = $84,000/120 = $700
Other overhead costs per machine hour = $64,000/16,000 = $4
Overhead costs of product Me:

	$
Set-up costs (8 * $1,800)	14,400
Ordering costs (48 * $700)	33,600
Other overheads (2,000 * 3 * $4)	24,000
	72,000

Overhead cost per unit =$72,000/2,000 = $36

Quiz: Fixed Overhead Costs in ABC
Growler Co manufactures two products. The following information is available about these products.

	Gord	ED
Budgeted production (units)	8,000	5,000
Material per unit ($)	15	20
Labour per unit ($)	40	50
Machine hours per unit (hours)	3	5

Fixed overheads relating to materials are $140,800. The cost driver for fixed overheads relating to materials is the cost of material purchased.
General fixed overheads are $284,200. These are absorbed on the basis of machine hours

Using activity-based costing, what is the budgeted fixed overhead cost per unit of product Ed, to the nearest $0.01?

A.$37.28

B.$38.64

C.$41.80

D.$43.37

Answer:

The correct answer is C.

Total material budget = (8,000 * $15) + (5,000 * $20) = $220,000

Fixed overheads related to materials = $140,800

OAR = $140,800/$220,000 = $0.64 per $ of material

Ed material fixed overhead = $0.64 * $20 = $12.80

Total machine hours budget = (8,000 * 3) + (5,000 * 5) = 49,000 hours

General fixed overheads = $284,200

OAR = $284,200/49,000 = $5.80 per machine hour

Ed general fixed overhead = $5.80 * 5 = $29

Total fixed overhead cost per unit of Ed = $12.80 + $29 = $41.80

Quiz: Advantages of ABC

The following have been suggested as advantages of using activity-based costing (ABC).

1. ABC is based on the idea that a single cost driver drives the cost behaviour of all items in the cost pool.

2. ABC enables a better understanding of what causes costs.

3. ABC helps the implementation of responsibility accounting.

4. ABC allocates more overheads to high-volume products.

Which of the above are advantages of using ABC?

A.1 and 2

B.1 and 3

C.2 and 3

D.2 and 4

Answer:

The correct answer is C. One problem with ABC is that some items may have more than one cost driver. The allocation of more overheads to high volume products is a problem with traditional absorption costing.

Quiz: Throughput Contribution Ranking

A textiles manufacturer makes three textiles at its Bigtown factory: Ax, By and Cz. The dyeing process has been identified as a bottleneck resource.

Information about the three products is as follows:

Product	Ax	By	Cz
Selling price per metre	10	11	12.5
Material cost per metre	3.0	3.0	4.0

Other variable costs   2.0   3.5   2.0
Time taken in dyeing per metre   10 minutes   10 minutes   15 minutes
The manufacturer wishes to maximise throughput contribution.
What will be the ranking of the textiles in order of priority for the throughput maximising production plan?
A.Ax, then By, then Cz
B.Cz, then By, then Ax
C.By, then Ax, then Cz
D.By, then Cz, then Ax
Answer:
The correct answer is C.

Product	Ax	By	Cz
Selling price per metre	10	11	12.5
Material cost per metre	3.0	3.0	4.0
Throughput contribution per metre 7	8	8.5	
Time taken in dyeing (minutes)	10	10	15
Metres per hour	6	6	4
Throughput contribution per hour 42	48	34	
Therefore ranking ②	①	③	

Quiz: Life Cycle Costing
The following statements have been made about life cycle costing:
1. It focuses on the short-term by identifying costs at the beginning of a product's life cycle.
2. It identifies all costs which arise in relation to the product each year and then calculates the product's profitability on an annual basis.
3. It accumulates a product's costs over its whole life time and works out the overall profitability of the product.
4. It allocates costs to each stage of a product's life cycle and writes them off at the end of each stage.
Which of the above statements is/are correct?
A.1 and 3
B.3 only
C.1 and 4
D.2
Answer:
The correct answer is B. All of the statements are false except statement 3.

Quiz: Environmental Failure Costs
Which of the following should be categorised as environmental failure costs by an airline?
1. Compensation payments to residents living close to airports for noise pollution caused by their aircraft
2. Air pollution due to the airline's carbon emissions from their aircraft engines
3. Penalties paid by the airline to the government for breaching environmental regulations
A.2 only

B.1 and 3 only
C.2 and 3 only
D.1, 2 and 3
Answer:
The correct answer is D. Environmental failure costs are costs incurred as a result of environmental issues being created either internally or outside the company. These can be financial or societal costs. Compensation, penalties and air pollution are all environmental failure costs.

Quiz: Theory of Constraints
The following statements have been made about the theory of constraints:
1. Nothing can be done about the binding constraint.
2. Throughput contribution (sales – material costs – labour costs) should be maximised.
3. There should be no idle resources in the bottleneck areas.
4. Other processes should not produce at a higher rate than the bottleneck process.
Which of the above statements are correct?
A.1 and 2
B.1 and 3
C.2 and 4
D.3 and 4
Answer:
The correct answer is D. The organisation should take steps to remove the current bottleneck, even though eventually a new bottleneck will be created. Throughput contribution = Sales – material costs only

Quiz: Target Cost Calculation
Payn Co is about to make an investment of $900,000 in manufacturing product 123. Payn Co's board wishes to make a return of 25% on the investment in product 123 in the next year. Payn Co expects to sell 20,000 units of Product 123 for $40 per unit.
What is the target cost of Product 123?
A.$28.75
B.$30.00
C.$31.00
D.$32.00
Answer:
The correct answer is A.

	$000
Expected revenue (20,000 * $40)	800
Required profit ($900,000 * 25%)	(225)
Total target cost	575

Target cost per unit = $575,000/20,000 = $28.75

Quiz: Profitability Calculation for Special Projects

Nottingham Co is planning to use three staff members for a special project, but the company needs to calculate whether the project will be profitable.

The full employment costs for the three staff involved in the project, for the life of the project, would be $15,600. The cost of hiring agency staff to cover the work they would normally undertake would be $21,400. Another alternative is for three regular staff to cover the work of the staff involved in the project and to hire new additional staff to cover for these three regular staff at a cost of $18,000.

What is the cost of staff that should be included in the calculation of the profitability of the project?

A.$5,800
B.$15,600
C.$18,000
D.$21,400

Answer:

The correct answer is C. There are two options to choose from. Nottingham Co should choose the option with the lowest relevant cost: Option 1 – hiring agency staff to cover for the three staff who will work on the contract. The relevant cost is the incremental cost – which is the cost of the agency staff, which is $21,400. Option 2 – three regular staff would cover the work of the staff who will work on the contract, and agency staff will be used to cover their work. The relevant cost is the agency cost of $18,000. Option 2 has the lowest relevant cost, so would be used. The relevant cost is therefore $18,000. The full employment costs of the staff who will work on the project are not relevant as these will not change – they will be paid regardless of whether the project goes ahead or not.

Quiz: Relevant Cost of Raw Materials

A company is evaluating a new contract which requires 400 kg of raw material M. It has 100 kg of material M in inventory which were purchased recently. Since then the purchase price of material M has risen by 4% to $52 per kg. Raw material M is used regularly by the company in normal production.

What is the relevant cost of material M for the contract?

A.$20,000
B.$20,600
C.$20,800
D.$21,632

Answer:

The correct answer is C. Since the material is used regularly in the business, the relevant cost is the replacement cost of $52 per kg, giving a total cost of 400 * 52 = $20,800

Quiz: Relevant Cost of an Idle Machine

A machine owned by a company has been idle for some months but could now be used on a one-year contract which is under consideration. The net book value of the machine is $1,000. If not used on this contract, the machine could be sold now for a net amount of $1,200. After use

on the contract, the machine would have no saleable value and the cost of disposing of it in one year's time would be $800.

What is the total relevant cost of the machine to the contract?

A.$400
B.$800
C.$1,200
D.$2,000

Answer:

The correct answer is D.

	$
Opportunity cost now	1,200
Cost of disposal in one year's time	800
	2,000

Quiz: Make-or-Buy Decision Costs

What are the relevant costs in a make-or-buy decision?

A.The avoidable costs of both options
B.The opportunity costs of both options
C.The controllable costs of both options
D.The differential costs of both options

Answer

The correct answer is D.

Quiz: Processing Further or Selling

Loxwood Co is considering whether to sell its product, the tom, or process it further to make a different product, the tig. It has already incurred processing costs of $3 per unit in relation to the tom. If it sells the tom, it will sell 60,000 units at $8 per unit. Each unit of the tig requires 3 units of the tom and Loxwood Co would expect to sell 20,000 units of the tig. Further variable costs associated with the tig would be $6 per unit and further fixed costs would be $150,000. The selling price of the tig would be $40 per unit

What would be the gain or loss of using the available units of tom to manufacture the tig?

A.$230,000 profit
B.$200,000 profit
C.$50,000 profit
D.$130,000 loss

Answer:

The correct answer is C. Difference = Sales revenue from selling the tig – Additional costs of manufacturing the tig – Sales revenue foregone from selling the tom

Difference = (20,000 * $40) – (20,000 * $6) – $150,000 – (60,000 * $8) = $50,000, a positive figure, therefore a profit.

The processing costs of $3 per unit have already been incurred, so should be ignored.

Quiz: Discontinuation of a Product to maximize short-term profit

Cornaur Products uses a scarce material in the manufacture of four products. Data per unit of each product is shown below:

	Y	W	S	E
Selling price	$38.72	$29.86	$41.17	$31.25
Variable cost	$30.58	$25.56	$34.19	$20.53
Material input (kg)	1.7	1.5	1.9	1.6

In the next period, insufficient material will be available to manufacture all four products and therefore one product must be discontinued.

In order to maximise short-term profit, which product should be discontinued?

A.Product Y

B.Product W

C.Product S

D.Product E

Answer:

The correct answer is B.

	Y	W	S	E
	$	$	$	$
Selling price per unit	38.72	29.86	41.17	31.25
Variable cost per unit	30.58	25.56	34.19	20.53
Contribution per unit	8.14	4.30	6.98	10.72
Material input	1.7kg	1.5kg	1.9kg	1.6kg
Contribution per kg	4.79	2.87	3.67	6.70

Cease production of product with lowest contribution per unit of limiting factor, i.e. W.

Quiz: Shadow Price of Material

Burseldon Co manufactures two products, the Cee and the Dee. Information about the products is as follows:

	Cee	Dee
$ per unit	$ per unit	
Selling price	240	270
Material ($5 per kg)	25	30
Labour ($20 per hour)	80	100
Variable overhead	30	44
Fixed overhead	40	48

In the next period, maximum demand for each product will be 60,000 units of Cee and 45,000 units of Dee. Material will be restricted to 500,000 kg.

What is the shadow price of material?

A.$0

B.$8

C.$16

D.$21

Answer:

The correct answer is C.

Firstly check whether material is a constraint.

Cee material used per unit = $25/$5 kg = 5 kg

Dee material used per unit = $30/$5 kg = 6 kg

Total material used = (60,000 * 5) kg + (45,000 * 6) kg = 570,000 kg

This is greater than 500,000 kg, indicating material is a constraint.

Contribution per unit of Cee = $240 – $25 – $80 – $30 = $105

Contribution per unit of Dee = $270 – $30 – $100 – $44 = $96

Contribution per unit of scarce resource

Cee = $105/5 = $21, Dee = $96/6 = $16

Cee will be produced first. Material requirements for Cee = 60,000 * 5kg = 300,000 kg, less than the 500,000 kg available, so the shadow price will be the contribution per unit of scarce resource for Dee as production of Dee will be restricted.

Quiz: Slack Resources

Riley Co manufactures two products, the eg and the pey. The following constraints have been identified in relation to labour and machine time:

Labour time 6eg + 4pey $\leqslant$ 9,000 hours

Machine time 0.4eg + 0.3pey $\leqslant$ 625hours

Maximum demand in the period is 750eg and 1,000pey.

Which of the following is/are slack resources?

A.Labour time only

B.Machine time only

C.Neither labour nor machine time

D.Both labour and machine time

Answer:

The correct answer is D.

Assuming maximum demand:

Labour time = (6 * 750) + (4 * 1,000) = 8,500 hours, less than the 9,000 hours maximum

Machine time = (0.4 * 750) + (0.3 * 1,000) = 600 hours, less than the 625 hours maximum

Quiz: Profit-Maximising Output

Bruno Co manufactures two products, the x and the y. The following constraints apply:

Materials: 4x + 7y $\leqslant$ 7,000 kg

Labour time: 8x + 6y $\leqslant$ 10,000 hours

x, y > 0

Using simultaneous equations, what is the profit-maximising output of x?

A.500 units

B.875 units

C.1,250 units

D.1,750 units

Answer:

The correct answer is B.

Profit-maximising point must be at intersection of 2 constraints (can't be on x or y axis as x, y > 0 (NOT in this scenario ⩾ 0)

8x + 14y = 14,000 Materials equation × 2 Equation 1

8x + 6y = 10,000 Labour equation Equation 2

Subtracting Equation 2 from Equation 1

8y = 4,000, y = 500

Substituting in Equation 2

8x + (6 * 500) = 10,000

8x = 7,000, x = 875

Quiz: Required Sales for Target Profit

Morava Co produces a product which has a variable cost of $28 and a selling price of $39. Budgeted sales and production volumes for the next month are 18,000 units. Budgeted fixed costs are $121,000 per month.

If Morava wishes to generate a profit of $11,000, how many units must be sold?

A.1,000

B.10,000

C.11,000

D.12,000

Answer:

The correct answer is D. For target profit questions, use the amended break-even formula for sales volume required to achieve a target profit:

(Target profit + fixed cost)/Contribution per unit = ($11,000 + $121,000)/($39 - $28) = 12,000

Quiz: Breakeven Point in Sales Revenue

Dilnot Co produces and sells rucksacks and shoulder bags in a standard mix of 3 rucksacks to 2 shoulder bags. The following information is available about the two products:

	Rucksacks	Shoulder bags
	$	$
Variable cost	54.00	32.50
Contribution to sales ratio	0.4	0.5

Dilnot Co's annual fixed costs are $1,608,900.

What is the breakeven point in sales revenue (to the nearest $100)?

A.$3,640,500

B.$3,650,300

C.$3,720,000

D.$3,758,000

Answer:

The correct answer is C.

Calculate the sales price for each product which is Variable cost/(1 − C/S ratio):

Rucksack: $54/(1 − 0.4) = $90

Shoulder bag: $32.50/(1 − 0.5) = $65
Calculate the contribution:
Rucksack: $90 * 0.4 = $36
Shoulder bag: $65 * 0.5 = $32.50
Calculate the weighted average sales revenue for the sales mix:
$90 * (3/(3 + 2)) + $65 * (2/(3 + 2)) = $80
Calculate the weighted average contribution for the sales mix:
$36 * (3/(3 + 2)) + $32.50 * (2/(3 + 2)) = $34.60
Calculate the weighted average C/S ratio:
$34.60/$80 = 0.4325
Breakeven revenue = Fixed costs/C/S ratio = $1,608,900/0.4325 = $3,720,000

Quiz: Margin of Safety
Cummings Co manufactures a single product, which it sells for $5. Its annual sales revenue is $80,000 and its annual fixed costs are $25,000. Its contribution/sales ratio is 40%.
What is Cummings Co's margin of safety to the nearest 0.1%?
A.21.9%
B.28.0%
C.47.9%
D.92.0%
Answer:
The correct answer is A.
Sales volume = $80,000/$5 = 16,000 units
Contribution per unit = 40% * $5 = $2
Break-even = $25,000/$2 = 12,500 units
Margin of safety = ((16,000 − 12,500)/16,000) * 100% = 21.9%

Quiz: Cost-Volume-Profit (CVP) Analysis
The following statements have been made about cost-volume-profit (CVP) analysis.
CVP analysis uses an absorption costing approach.
CVP analysis assumes that variable cost per unit and selling price per unit are constant over the full range of production.
CVP can be used when multiple products are sold in a varying sales mix.
CVP analysis ignores the impact of changes in inventory.
Which of the statements above are correct?
A.1 and 2
B.3 and 4
C.1 and 3
D.2 and 4
Answer:
The correct answer is D. CVP focuses on contribution matching fixed costs, a marginal costing approach. It assumes that the sales mix is constant.

Quiz: Market Skimming Pricing

Which of the following statements about market skimming pricing are true?

It is appropriate when the price sensitivity of demand is unknown.

It is likely to discourage competitors from entering the market.

It is useful when launching a product into a competitive market.

A.1 only

B.2 only

C.3 only

D.1, 2 and 3

Answer:

The correct answer is A.

Market skimming uses high prices to maximise the unit profit in the early stages of the product life cycle. This is likely to encourage competitors to enter the market, rather than discourage them. Also, if demand is not known, it will be more beneficial to charge high prices and reduce them if demand is insufficient. It is not appropriate when launching a product into a competitive market as the high price would mean customers would buy from other sources.

Quiz: Selling Price to Maximise Profit

The selling price (P) of a product is related to the quantity sold (Q) by the following equation:

$P = 60 - 0.01Q$

The total cost is given by $TC = 5,000 + 8Q$.

What selling price will maximise profit?

A.$47

B.$34

C.$26

D.$8

Answer:

The correct answer is B.

WORKING

$TC = 5,000$ (fixed cost) $+ 8$ (variable cost per unit) Q

Marginal cost (MC) = variable cost = 8

Marginal revenue, is given by $MR = a - 2bQ$ where $a = 60$ and $b = 0.01$, so $MR = 60 - 0.02Q$

Profit is maximised at the point where $MR = MC$

$60 - 0.02Q = 8$

Therefore, $Q = (60 - 8)/0.02 = 2,600$ and $P = 60 - 0.01(2,600) = 34

Quiz: Maintaining Mark-up on Full Cost

Roe sold 2,000 units of a product during the year at a mark-up of 25% on full cost. The selling price was $100 and fixed costs of production were $40,000.

Next year the variable costs of production are expected to increase by 10%. Fixed costs of production and sales quantity are expected to remain unchanged.

What selling price will maintain the mark-up of 25% on full cost?
A.$107.33
B.$107.50
C.$108.00
D.$110.00
Answer:
The correct answer is B.
Full costs in current year = (2,000 * $100)/125% = $160,000
Of which, Variable costs = $160,000 – $40,000 = $120,000
Next year:
variable costs = $120,000 * 110% = $132,000
Therefore, total costs = $132,000 + $40,000 = $172,000
To maintain 25% mark-up on cost, sales revenue = $172,000 * 1.25 = $215,000
Therefore selling price per unit = $215,000/2,000 = $107.50

Quiz: Full Cost Plus Pricing
Which of the following statements about full cost plus pricing are true?
1. It is appropriate when fixed costs are relatively large.
2. It is appropriate for long-term pricing.
3. It will guarantee a profit is made if the budgeted sales level is achieved.
4. It will produce a price similar to what competitors are charging.
A.1 and 2 only
B.3 and 4 only
C.1, 2 and 3
D.1, 3 and 4
Answer:
The correct answer is C. Basing a price on cost fails to take into account what competitors are doing.

Quiz: Price Elasticity of Demand
Gemson estimates that at a price of $50 it can sell 2,000 units of its product and at a price of $40 it can sell 2,600 units of the product.
What is the price elasticity of demand, to 2 decimal places, when selling price is $50 and quantity sold is 2,000?
A.0.67
B.0.92
C.1.08
D.1.50
Answer:
The correct answer is D.
PED = % change in quantity demanded/% change in price
= [(2,600 – 2,000)/2,000 * 100%]/[(40 – 50)/50 * 100%]
= 30%/20% = 1.50
Note: PED ignores the sign (+/-)

Quiz: Expected Values in Decision Making
The following statements have been made about the use of expected values in decision making:
1. Expected values ignore the risk associated with decisions.
2. Expected values are most useful for recurring rather than one-off events.
Which of the above statements is/are true?
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:
The correct answer is D. Both statements are correct. Using expected values implies choosing the project with the highest expected value regardless of the risk associated with each one. Expected values are more appropriate for events that are repeated, since the expected value is an average of the outcomes. Tutorial note: For a "one-off" event the expected value of the outcomes may not be one of the possible outcomes.

Quiz: Minimax Regret Criterion
PT provides expert quality assurance services on a consultancy basis. The management of the company is unsure whether to price the services it offers at the Deluxe, High, Standard or Low fee level. There is uncertainty about the mix of staff that would be available to provide each of the services. As the staff are on different pay scales the mix of staff would affect the variable costs of each service.
The table below details the annual contribution earned from each of the possible outcomes.

Staffing mix	Fee level			
	Deluxe	High	Standard	Low
X	$135,000	$140,000	$137,500	$120,000
Y	$150,000	$160,000	$165,000	$160,000
Z	$165,000	$180,000	$192,500	$200,000

If PT applies the minimax regret criterion, what fee level it will it choose?
A.Deluxe
B.High
C.Standard
D.Low
Answer:
The correct answer is C. The decision is the fee level. The condition is the staffing mix.
The following table shows the best feel level for the given staffing mix:
Staffing mix (condition),Best fee level (highest payoff in condition, regret = 0)
X, High
Y, Standard
Z, Low
Having identified the best choices (regret = 0), the table of regrets is constructed:

Staffing mix	Fee level			
	Deluxe	High	Standard	Low
X	$5,000	0	$2,500	$20,000
Y	$15,000	$5,000	0	$5,000
Z	$35,000	$20,000	$7,500	0
Maximum regret	$35,000	$20,000	$7,500	$20,000

The Standard fee strategy minimises the maximum regret.
Note: Remember that regret is the difference between a given choice and the best choice in a given condition.

Quiz: Value of Survey for Cinema Decision
Greenwood Movies Co is considering whether to build a small or large cinema. The available market data suggests that there is a 30% risk that demand will be low.

	Demand	
	Low	High
	$	$
Small	100,000	400,000
Large	(300,000)	600,000

Greenwood Movies Co has calculated that it would be best to build the large cinema, on the basis that it has the higher expected value. However, Greenwood Movies Co could commission a survey which would accurately predict the level of demand.
What is the maximum that Greenwood Movies Co should pay for the survey?
A.$100,000
B.$120,000
C.$310,000
D.$330,000
Answer:
The correct answer is B.
Expected value without the survey
= ($600,000 * 0.7) + (−$300,000 * 0.3) = $330,000
Expected value with the survey
= ($600,000 * 0.7) + ($100,000 * 0.3) = $450,000
Maximum value of the survey = $450,000 − $330,000 = $120,000

Quiz: Decision Rules for Risk-Averse Investor
Which of the following decision rules would suit a risk-averse investor?
1. Maximax
2. Maximin
3. Minimax regret
4. Expected value
A.1 and 3
B.2 and 3
C.3 and 4
D.2 and 4

Answer:
The correct answer is B. Maximax would suit a risk-seeking investor, expected value would suit a risk-neutral investor.

Quiz: Sensitivity to Changes in Demand
The cost card for Product Tom is as follows:

	$
Selling price	150
Variable costs	(70)
Contribution per unit	80
Fixed costs	(50)
Profit per unit	30

Expected demand for the tom is 10,000 units.
What is the sensitivity of Tom, to the nearest 0.1%, to changes in demand?
A.37.5%
B.40.0%
C.60.0%
D.62.5%
Answer:
The correct answer is A.
At breakeven demand, contribution of Tom = fixed costs
Assume breakeven demand = x
80x = (10,000 * $50)
x = 6,250
Sensitivity = ((10,000 – 6,250)/10,000) * 100% = 37.5%

Quiz: Flexed Budget
Which of the following describes a flexed budget?
A.One that is set prior to the control period and not subsequently changed in response to changes in activity, costs or revenues
B.One that is continuously updated by adding a further accounting period when the earliest accounting period has expired
C.One that is changed in response to changes in the level of activity
D.One that is changed in response to changes in costs
Answer:
The correct answer is C.
Flexed budgets are where the budget is updated at the end of the period to take into account the actual level of activity, but otherwise based on the original budget assumptions such as cost per unit. This makes it easier to compare actual performance against the budget.

Quiz: Zero-Based Budgeting
Which of the following definitions best describes Zero-Based Budgeting?

A.A method of budgeting whereby all activities are re-evaluated each time a budget is formulated

B.A method of budgeting where an attempt is made to make each cost heading as close to zero as possible

C.A method of budgeting which recognises the difference between the behaviour of fixed and variable costs with respect to changes in output and is designed to change appropriately with such fluctuations

D.A method of budgeting where the sum of revenues and expenditures in each cost centre must equal zero

Answer:

The correct answer is A.

Quiz: Bottom-Up Budgeting

Jaitinder Co has decided to change from a top-down system of budgeting to a bottom-up system of budgeting.

Which of the following is Jaitinder Co likely to face as a result of this change?

A.More likelihood of unachievable budgets being set

B.More coordination being needed between different departments

C.Less opportunity for management below senior management to exercise initiaitve

D.Less budgetary slack being bulit in

Answer:

The correct answer is B.

Quiz: Beyond Budgeting

The following statements have been made about Beyond Budgeting:

It focuses on financial targets.

It involves the use of stretch goals.

It emphasises strong central planning.

It gives resource decisions to front-line teams.

Which of the above statements are correct?

A.1 and 2

B.1 and 3

C.2 and 4

D.3 and 4

Answer:

The correct answer is C. Beyond Budgeting moves away from financial targets to emphasise key performance indicators and it means devolution of responsibility for planning away from the centre.

Quiz: Budgeted Production Cost

Jessie Co manufactures a single product. The following estimates of costs have been made for various level of production of the product.

Production (units)	50,000	70,000	100,000
	$000	$000	$000

Variable   3,655   5,117   7,310
Fixed   3,452   3,452   3,452

In addition to the costs listed above, $380,000 of incremental costs will be incurred for every complete 20,000 units produced.

What is the budgeted total production cost if production is budgeted to be 85,000 units?

A.$9,665,500
B.$10,045,500
C.$11,185,500
D.$11,565,500

Answer:

The correct answer is C.

Variable cost per unit = $7,310,000/100,000 = $73.10 (or calculate as $5,117,000/70,000).

Incremental costs incurred at 85,000 units is 4 increments of 20,000.

Therefore, total production cost = ($73.10 * 85,000) + $3,452,000 + ($380,000 * 4) = $11,185,500

Tutorial note: The question will indicate the number of fixed cost increments. In this case, the cost occurs after 20,000 units are completed, so a production level of 85,000 units incurs four increments.

Quiz: Flexed Budget Cost

The flexed budgets for two levels of activity are as follows:

	Level 1	Level 2
Production (units)	10,000	20,000
Budgeted total cost	$81,900	$126,060

The budgeted total cost figures reflect that there is a step-up in the total fixed cost of 15%, which occurs when production reaches 15,000 units. The variable production cost per unit remains constant in the range 10,000 to 20,000 units.

What is the total cost associated with a flexed budget for 16,000 units of production?

A.$104,400
B.$108,396
C.$111,060
D.$114,057

Answer:

The correct answer is C.

Let V = Variable cost per unit

and F = Total fixed cost below 15,000 units

So, 10,000 V + F = 81,900

And 20,000 V + 1.15 F = 126,060

Solving simultaneously:

V=3.75

F=44,400

Flexed budget for 16,000 units = (16,000 * 3.75) + (44,400 * 1.15)=$111,060

Quiz: Learning Rate

The first time an employee performed a new task it took 25 minutes. The second time it took 20 minutes and the third time it took 17.55 minutes.

What is the learning rate?

A.10%

B.20%

C.80%

D.90%

Answer:

The correct answer is D. As cumulative output doubles, cumulative average time per unit falls according to the learning rate: When output is 1, cumulative average time = 25 minutes. When cumulative output is 2, cumulative average time per unit is ½ (20 + 25) = 22.5

Therefore, learning rate = 22.5/25 = 0.9 or 90%

Quiz: Seasonal Adjustment

Flufted Co's sales in April were $135,000. The underlying trend for April was $120,000 and the seasonal factor is 1.12.

Using the multiplicative model for seasonal adjustment what were the seasonally-adjusted sales for April to the nearest $?

A.$107,143

B.$120,536

C.$134,400

D.$151,200

Answer:

The correct answer is B.

Seasonally-adjusted sales = Actual sales/Seasonal factor

Seasonally-adjusted sales = $135,000/1.12 = $120,536

Quiz: Coefficient of Determination

The correlation coefficient between number of units of a product tested by the quality control function and the number of complaints about the product is −0.25.

What is the coefficient of determination?

A.−0.5

B.−0.0625

C.+ 0.0625

D.+ 0.5

Answer:

The correct answer is C.

Correlation coefficient is r and coefficient of determination is r2 = −0.252 = + 0.0625

Quiz: Regression Analysis Problem

Which of the following is a problem with regression analysis?

A.It assumes a non-linear relationship.

B.It assumes the two variables are independent of each other.

C.It assumes that what has happened in the past reliably indicates what will happen in the future.

D.It is impossible to tell how much reliance can be placed on the regression equation.

Answer:

The correct answer is C. Regression analysis assumes that what has happened in the past reliably indicates what will happen in the future. However, past data may not be sufficiently reliable for forecasting, especially when extrapolating values outside the range of past data. Regression analysis assumes a linear relationship and that one variable is dependent upon another. The correlation coefficient and coefficient of determination indicate how strong the relationship between the two variables is.

Quiz: Ideal Standards

Which of the following do ideal standards allow for?

A.Machine breakdowns

B.Idle time

C.Schedule interruptions

D.None of the above

Answer:

The correct answer is D. Ideal standards can only be achieved under ideal operating circumstances and so make no allowance for anything that is not ideal.

Quiz: Flexed Budget Statements

The following statements have been made about flexed budgets:

1. The flexed budget is prepared at the expected level of activity.

2. The flexed budget is used to identify variances caused by a different level of activity to what was budgeted.

3. The flexed budget uses the original budget assumptions in relation to selling price and cost per unit.

4. Which of the above statements is/are correct?

A.1 and 2

B.3 only

C.2 and 3

D.2 only

Answer:

The correct answer is C.

Quiz: Standard Costing Use

For which of the following activities would standard costing NOT be used?

A.Valuing inventories

B.Determining expenses for reporting to shareholders

C.Quoting for contracts

D.Identifying opportunities for cost reductions

Answer:

The correct answer is B.

Quiz: Sales Variances
Overto Co budgeted to sell 100,000 units of product Liz. The budgeted selling price was $14 per unit. 110,000 units of the Liz were sold and sales revenue was $1,528,000.
Using a flexed budget approach, what were the sales variances?
A.Sales volume $140,000 favourable, Sales price $12,000 adverse
B.Sales volume $128,000 favourable, Sales price $0
C.Sales volume $0, Sales price $128,000 favourable
D.Sales volume $0, Sales price $12,000 adverse
Answer:
The correct answer is D.
Flexing the budget means that expected revenue = 110,000 units * $14 = $1,540,000
Actual sales revenue was $1,528,000, an adverse variance of $12,000
Since the budget has been flexed to the sales volume of 110,000 units, the adverse variance must be solely due to sales price.

Quiz: Materials Variance
The following budgeted and actual levels of activity relate to product ISN.

	Budgeted Units	Actual Units
Sales	12,000	15,000
Production	14,000	16,000

The budgeted sales price of product ISN was $10 per unit and the budgeted cost per unit was $8, including $3 of materials. Actual expenditure on materials was $44,400.
Using a flexed budget approach, what was the total materials variance?
A.$3,600 favourable
B.$600 favourable
C.$2,400 adverse
D.$8,400 adverse
Answer:
The correct answer is A.
For costs, the budget is flexed to the actual production level of 16,000 units.
Standard material costs = 16,000 units * $3 = $48,000
Actual costs are less than standard, indicating a favourable variance.
Variance = $48,000 – $44,400 = $3,600

Quiz: Fixed Overhead Expenditure
A company operates a standard marginal costing system. Last month actual fixed overhead expenditure was 2% below budget and the fixed overhead expenditure variance was $1,250.
What was the actual fixed overhead expenditure for last month?
A.$61,250

B.$62,475
C.$62,500
D.$63,750
Answer:
The correct answer is A.
Budgeted overhead − actual overhead = $1,250 (this is the fixed overhead expenditure variance)
Budgeted overhead = $1,250/0.02 = $62,500 (because actual overhead was $1,250 below budget, and 2% below budget)
Actual overhead = $62,500 − $1,250 = $61,250

Quiz: Labour Rate Variance
Moonstar budgeted to manufacture 2,000 units of a product but made 2,100 units. The standard labour cost per unit was $80 (4 hours at $20 per hour). Employees worked 8,100 hours although they were paid for 8,300 hours. The actual labour cost was $164,000.
What was the labour rate variance for Moonstar?
A.$4,000 adverse
B.$2,000 adverse
C.$2,000 favourable
D.$4,000 favourable
Answer:
The correct answer is C.

	$
Actual amount paid	164,000
Hours paid at standard rate (8,300 * $20)	166,000
	2,000 Favourable

Quiz: Fixed Overhead Capacity Variance
Moony budgeted to make 50,000 units of its sole product, the koa. Fixed overheads are absorbed on the basis of $8 per hour for 2 labour hours.
The actual production of the koa was 52,000 units, which took 102,500 labour hours to manufacture. Total fixed overheads were $810,000.
What was the fixed overhead capacity variance?
A.$10,000 adverse
B.$12,000 favourable
C.$20,000 favourable
D.$32,000 favourable
Answer:
The correct answer is C.

	Hrs	
Actual labour hours	102,500	
Budgeted labour hours (50,000 * 2 hr)	100,000	
Difference	2,500	
	$	
* Standard rate per hour	8	

20,000 Favourable

Note: for the fixed overhead capacity variance, having more actual labour hours than budgeted leads to a favourable variance, as the firm has increased capacity to absorb fixed overheads.

Quiz: Sales Volume Variance

Darwin Co budgeted to sell 25,000 units of its product, the ala. The budgeted selling price per unit was $20, the budgeted contribution per unit was $12 and the budgeted profit per unit was $9.

The actual sales of the koa were 26,500 units and the sales revenue was $551,000.

What was the sales volume variance, using marginal costing principles?

A.$13,500 favourable
B.$18,000 favourable
C.$21,000 favourable
D.$30,000 favourable

Answer:

The correct answer is B.

	Hrs
Actual sales	26,500
Budgeted sales	25,000
Difference	1,500
	$
× Standard contribution per unit	12
	18,000 Favourable

Quiz: Adverse Materials Usage Variance

Which of the following is unlikely to be an explanation for an adverse materials usage variance?

A.Stricter quality control
B.Bulk discount
C.Cheaper material being purchased
D.Change in mix of materials

Answer:

The correct answer is B. Bulk discount is most likely to result in a favourable materials price variance, not the usage variance.

Quiz: Sales Mix Variance

The following sales were budgeted for the year:

	Product X	Product Y	Product Z
Demand (units)	1,000	2,000	3,000
Selling price	$15	$20	$30
Profit per unit	$2	$5	$2

Actual sales for the year were as follows:

Units sold   1,100   2,050   2,800
Sales value $17,050 $38,950 $86,800
Profit $3,080 $10,455 $6,160
What is the sales mix variance?
A.$2,292 Adverse
B.$1,845 Favourable
C.$200 Favourable
D.$50 Favourable
Answer:
The correct answer is C.

	Actual sales actual mix units	Actual sales standard mix units (Working)	Difference (actual – standard) units	Standard margin $	variance $
X	1,100	991.67	108.33	2	216.66
Y	2,050	1,983.33	66.67	5	333.34
Z	2,800	2,975.00	(175.00)	2	(350.00)
	5,950	5,950	0		200 Favourable

WORKING
X 5,950 × 1/6 = 991.67
Y 5,950 × 2/6 = 1,983.33
Z 5,950 × 3/6 = 2,975

Quiz: Materials Mix Variance
A company has a process in which the standard mix for 9 litres of output is as follows:
                                $
4.0 litres of D at $9 per litre   36.00
3.5 litres of E at $5 per litre   17.50
2.5 litres of F at $2 per litre   5.00
                                58.50
Actual materials used were as follows:
                                $
4,300 litres of D at $9 per litre   38,700
3,600 litres of E at $5.5 per litre 19,800
2,100 litres of F at $2.2 per litre 4,620
                                63,120
What is the materials mix variance for the period?
A.$2,370 favourable
B.$2,400 favourable
C.$2,370 adverse
D.$2,400 adverse
Answer:
The correct answer is D.

The materials mix variance for the period was:

	Actual Q Actual mix (litres)	Standard Q Standard mix (W)	Difference (litres)	Standard cost per litre	Mix variance ($)
D	4,300	4,000	(300)	9	(2,700)
E	3,600	3,500	(100)	5	(500)
F	2,100	2,500	400	2	800
	10,000	10,000	0		(2,400)

The mix variance is $2,400 adverse

WORKING

D: 10,000 * 4/10 = 4,000

E: 10,000 * 3.5/10 = 3,500

F: 10,000 * 2.5/10 = 2,500

Quiz: Materials Yield Variance

The standard cost of a 10 litre tin of metal paint is as follows:

	$
5 litres of A @ $6 per litre	30.00
3 litres of B @ $4 per litre	12.00
2 litres of C @ $9 per litre	18.00

During the period, 1,020 tins were produced which required:

5,400 litres of A

3,200 litres of B

1,900 litres of C

What is the materials yield variance for the period?

A.$700 favourable

B.$570 adverse

C.$1,100 adverse

D.$1,800 adverse

Answer:

The correct answer is D.

Standard cost per tin = $30 + $12 + $18 = $60

Actual input = 5,400 + 3,200 + 1,900 = 10,500 litres

	Units	
10,500 litres should yield (10,500/10)	1,050	
Actual output	1,020	
Difference	30	Adverse
	$	
Standard cost per unit	60	
Yield variance	1,800	Adverse

Quiz: Sales Quantity Variance

Freddo sells three related products, X, Y and Z. The current period budget and actual sales are:

Products

Budget   X   Y   Z
Unit sales   400   260   140
Price $40 $50 $80
Contribution $16 $25 $48
Actual
Unit sales   450   350   200
Price $36 $55 $90
Contribution $10 $30 $56

What is the sales quantity variance?
A.$4,905 favourable
B.$4,910 favourable
C.$5,930 favourable
D.$6,560 favourable
Answer:
The correct answer is A.

Budgeted sales = 400 + 260 + 140 = 800 units

Actual sales = 450 + 350 + 200 = 1,000 units

Product	Actual sales in budgeted mix	Budgeted sales	Difference	Standard contribution	Sales quantity variance
	(units)	(units)	(units)	$	$
X	500	400	100	16	1,600
Y	325	260	65	25	1,625
Z	175	140	35	48	1,680
	1,000	800	200		4,905
					favourable

Actual sales Budgeted mix
A: 1,000 * 400/800 = 500
B: 1,000 * 260/800 = 325
C: 1,000 * 140/800 = 175

Quiz: Favourable Materials Yield Variance
Which TWO of the following could explain a favourable materials yield variance?
1. Discount available on materials
2. Higher quality material used
3. Lower quality material used
4. Less spillage
A.1 and 2
B.1 and 3
C.2 and 4

D.3 and 4

Answer:

The correct answer is C. Higher quality material should result in less waste and greater yield. Discount relates to price, not to yield variances.

Quiz: Adverse Material Planning Price Variance

Darch Co plans to produce 3,000 units of Product H. Each unit is budgeted to use 5 kg of materials. Darch Co's normal supplier charges $4 per kg but is unable to supply the materials needed for the planned production of Product H. Instead Darch Co uses an alternative supplier that charges 10% more per kg. Darch Co purchases 15,500 kg of materials from the alternative supplier for the 3,000 units, costing $71,300.

What is the adverse material planning price variance for Product H?

A.$2,200

B.$3,100

C.$6,000

D.$6,200

Answer:

The correct answer is D.

	$
Actual quantity × Original standard price	
(15,500 * $4)	62,000
Actual quantity × Revised standard price	
(15,500 * $4 * 110%)	68,200
Planning price variance	6,200

Quiz: Adverse Material Operational Price Variance

Watton Co plans to produce 5,000 units of Product C. Each unit is budgeted to use 6 kg of materials. Watton Co's normal supplier charges $8 per kg, but for this order Watton Co has had to use a different supplier that charged 5% more per kg. Watton Co purchased 31,200 kg of materials from the new supplier, costing $272,400.

What is the adverse material operational price variance for Product C?

A.$10,320

B.$12,480

C.$20,400

D.$23,800

Answer:

The correct answer is A.

	$
Actual quantity * Actual price	272,400
Actual quantity * Revised standard price	
(31,200 * $8 * 105%)	262,080
Operational price variance	10,320

Quiz: Problems with Planning and Operational Variances

Which of the following are possible problems of introducing a system of planning and operational variances?

1. Operational managers will claim that all favourable variances are due to external causes beyond their control.

2. Supervisors will be resistant to the system as they will be held responsible for poor standard setting.

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is C. Operational managers may blame external causes for adverse variances and take credit for favourable variances. Supervisors are unlikely to be held responsible for poor standard setting.

Quiz: Labour Operational Efficiency Variance

Goalby Co's biggest customer has recently placed a one-off, urgent order for 10,000 units. Each unit requires 4 hours of labour budgeted at $25 per hour. Goalby Co's board decided to pay labour a premium of 20% for work done on this order, in order to ensure that it meets the customer's deadline. 39,200 labour hours were spent on the order, costing $1,254,400.

What is the labour operational efficiency variance for the order?

A.$20,000 favourable

B.$24,000 favourable

C.$24,000 adverse

D.$25,600 favourable

Answer:

The correct answer is A.

	Hrs
Actual hours worked	39,200
Standard hours for actual output	
(10,000 * 4 hr)	40,000
Difference (favourable as actual hours are less than standard hours)	800
At standard rate per hour	$25
Labour operational efficiency variance (favourable)	$20,000

Quiz: Market Share Variance

Riley Co normally achieves a 25% market share and budgeted sales of 40,000 units for the last year. Because of favourable economic conditions, the actual market size was 180,000 units and Riley Co sold 42,000 units. The sales price per unit is $15 and the contribution per unit is $5.

What is the market share variance for Riley Co?

A.$10,000 favourable

B.$30,000 favourable

C.$15,000 adverse
D.$45,000 adverse
Answer:
The correct answer is C.

	Hrs
Actual sales quantity	42,000
Revised budgeted quantity	
(Actual market size * Budgeted market share)	45,000
Difference (adverse as actual sales are less than revised budgeted sales)	3,000
At standard contribution per unit	$5
Market share variance (adverse)	$15,000

Quiz: Monitoring Quality with NFPIs
Many organisations use non-financial performance indicators (NFPIs).
Which of the following NFPIs is MOST suitable for monitoring quality?
A.Throughput volume per time period
B.New customers per time period
C.Number of customer complaints
D.Number of transactions per customer
Answer:
The correct answer is C. This is the only one of the measures that considers the underlying quality. It could be argued that B is a result of quality, as new customers may be attracted by good quality, but C is more closely related.

Quiz: Return on Capital Employed
The following ratios have been calculated for a company:
Gross profit margin   42%
Operating profit margin   28%
Gearing (debt/equity) 40%
Asset turnover 65%
What is the return on capital employed for the company?
A.11.2%
B.16.8%
C.18.2%
D.27.3%
Answer:
The correct answer is C. ROCE can be calculated by multiplying the operating profit margin by the asset turnover. 28% * 65% = 18.2%

Quiz: Quality of Key Performance Indicators
Which of the following is not a necessary quality of a key performance indicator?
A.Measurable
B.Financially quantifiable

C.Relevant
D.Specific
Answer:
The correct answer is B. Some key performance indicators will be non-financial indicators.

Quiz: Improving financial position
The following methods have been suggested to improve Litpan's financial position.
1. Selling off old inventory at a discount
2. Obtaining a long-term loan from the bank
3. Taking 10 days longer each month to pay Litpan's main supplier
Which of the suggested actions would improve Litpan's quick ratio?
A.1 and 2 only
B.1 and 3 only
C.2 and 3 only
D.1, 2 and 3
Answer:
The correct answer is A.

Quiz: Net Profit Margin
The following figures have been taken from Fraser's statement of profit or loss.

	$000
Revenue	8,000
Gross profit	3,600
Profit before interest and tax	2,000
Profit before tax	1,600
Profit after tax	1,200

Which of the following is Fraser's net profit margin?
A.45.0%
B.25.0%
C.20.0%
D.15.0%
Answer:
The correct answer is D.
Net profit margin = (Profit after tax/Revenue) * 100% = ($1,200,000/$8,000,000) * 100% = 15%

Quiz: Objective of the Initiative
A local authority has introduced an initiative which is intended to "achieve greater output for each unit of input".
What is the objective of the initiative?
A.Quality improvement
B.Efficiency
C.Effectiveness

D.Economy
Answer:
The correct answer is B. Efficiency means getting more output for a given unit of input.

Quiz: Fitzgerald and Moon Model Dimensions
The Fitzgerald and Moon building block model provides six dimensions under which performance in service industries can be measured.
Which of the following is NOT one of the six dimensions?
A.Resource allocation
B.Quality of service
C.Staff satisfaction
D.Flexibility
Answer:
The correct answer is C.

Quiz: Characteristics of a Service
Which of the following is NOT a typical characteristic of a service?
A.Each service provided has unique physical features.
B.Each service is provided when the customer wants it.
C.Each service is consumed when it is produced
D.Each service only exists when it is being experienced by the customer.
Answer:
The correct answer is A. Each service may be unique but many services do not have physical features.

Quiz: External Pressures
The following are examples of pressures that a hospital might face:
1. Fewer doctors qualifying
2. Increased medicine prices
3. Stricter government targets in relation to waiting lists
4. Shortage of beds for seriously ill patients
Which of the above are external pressures?
A.1 and 4
B.2 and 3 only
C.1, 2 and 3
D.2, 3 and 4
Answer:
The correct answer is C.

Quiz: Advantage of the Balanced Scorecard
Which of the following is an advantage of the balanced scorecard?
A.It provides a clear ranking of performance measures.
B.It encourages managers to focus on the financial aspects of performance.
C.It encourages managers to take a short-term view of performance.

D.It considers internal and external issues.
Answer:
The correct answer is D.

Quiz: Plastics Division's Residual Income
The plastics division of Ladmar has just reported a divisional return on capital employed of 30% for the last 12 months. The capital employed in the plastics division is $1,200,000. The company's overall return on capital employed is 18%, and the overall cost of capital is 14%. The plastics division's cost of capital is 13%.
What is the plastic division's residual income?
A.$144,000
B.$192,000
C.$204,000
D.$360,000
Answer:
The correct answer is C.
The divisional profit is $1.2m * 30% = $360,000
Imputed interest is $1.2m * 13% = $156,000
Therefore, residual income = $360,000 – $156,000 = $204,000

Quiz: Investment Centre Manager
Which one of the following individuals is most likely to be an investment centre manager?
A.The sales manager
B.The maintenance department manager
C.A portfolio manager
D.The manager of a factory, who has the authority to buy new machinery
Answer:
The correct answer is D. A investment centre manager has a large amount of autonomy, and can make decisions as well as being responsible for costs and revenues. Option D appears to be the one that is closest to this.

Quiz: Performance Measurement of Divisions
Isnardi Co has two divisions, Division A and Division B. Division A has established seven years ago, Division B was established three years ago. The machinery used by the two divisions is identical. Isnardi Co's board uses Residual Income (RI) and Return on Investment to appraise both divisions, but is concerned that these methods may unduly favour one or other division
Which of the following statements is correct in relation to measuring the performance of both divisions?
A.Both methods will favour Division A
B.Both methods will favour Division B
C.ROI will favour Division A, RI will favour Division B
D.RI will favour Division A, ROI will favour Division B
Answer:

The correct answer is A. This is because performance for Division A will be assessed on a lower value for assets. The accumulated depreciation is higher, as the assets have been depreciated for longer.

Quiz: Return on Investment for Division D
Division D currently has $2,000,000 of net assets included in its accounting records on 31 December 20X2 and is showing an operating profit of $280,000. No entries have yet been made for depreciation.
However, the accounting records need to be amended for transactions in relation to non-current assets that took place on 30 December 20X2. A machine with net realisable value of $100,000 was sold for $125,000 and replaced with a machine costing $300,000. A full 20% depreciation charge is charged on machinery in the year of purchase, but no charge is made in the year of sale.
What is the Return on Investment for Division D?
A.10.5%
B.12.5%
C.11.3%
D.15.2%
Answer:
The correct answer is B.
Revised profit = $280,000 + $25,000 (Profit on sale of old machinery) - $60,000 (Depreciation charge on new machinery) = $245,000
Revised assets = $2,000,000 - $100,000 (Old machinery) + $300,000 (New machinery) - $300,000 (cash paid for new machinery) – $60,000 (Depreciation charge on new machinery) + $125,000 (Cash on sale of old machinery) = $1,965,000
ROI = ($245,000/$1,965,000) * 100% = 12.5%

Quiz: Non-Financial Performance Measures
The performance measures that Wickens Co uses include the following.
1. Orders received
2. Staff turnover
3. Quick ratio
4. Receivables days
Which of the measures are non-financial measures?
A.1 and 2
B.3 and 4
C.1 and 3
D.2 and 4
Answer:
The correct answer is A.

Quiz: Transfer Pricing and Profit Maximization
In relation to transfer pricing, which of the following statements is/are correct?

1. Negotiated transfer prices will always maximise total profit.
2. Market based transfer prices will always encourage internal transfers.
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:
The correct answer is C.
(1) is incorrect as negotiated prices will depend on the negotiating skills of divisional managers.
(2) is incorrect as market based prices provide no incentive to buy internally, as items can be bought as cheaply externally.

Quiz: Minimum Transfer Price for Kb
Division R is currently manufacturing a product called the Ja and is operating at full capacity.
Division S currently pays an external supplier $650 for product Kb, but wishes Division R to manufacture and supply Product Kb.
Cost details for the two products are shown below. The same grade and quantity of labour and material is used for each product.

	Ja	Kb
	$	$
Selling price	700	
Direct materials	120	120
Direct labour	230	230
Variable overhead	80	80
Apportioned fixed overheads	60	50

What is the minimum transfer price that Division R would be prepared to accept for the Kb?
A.$430
B.$650
C.$700
D.$750
Answer:
The correct answer is C.
Division R is operating at full capacity, so use an opportunity cost approach:
Transfer price = Marginal cost of making the Kb + Contribution foregone from not making the Ja
Transfer price = ($120 + $230 + $80) + ($700 − $120 − $230 − $80) = $700

Quiz: Opportunity Cost in Transfer Pricing
1. In what circumstances is a selling division likely to consider opportunity cost when negotiating a transfer price?
2. An external market exists.
The division has no spare capacity.
A.1 only
B.2 only
C.Neither 1 or 2

D.Both 1 and 2
Answer:
The correct answer is D.

Quiz: Maximum Payment for Component
Division T is currently negotiating to buy a component from Division V. The external market price of the component is $100. Division T plans to use the component to manufacture a product with selling price of $200 and variable costs (other than the cost of the component) of $90.
What is the maximum amount Division T will be prepared to pay to Division V for the component?
A.$90
B.$100
C.$110
D.$200
Answer:
The correct answer is B. The lower of market price ($100) and contribution excluding cost of component ($200 – $90 = $110)

Quiz: Advantages of Full Cost Plus Transfer Pricing
Which of the following are advantages of a full cost plus transfer pricing policy?
1. It covers all costs of the selling division.
2. The fixed costs of the selling division become the variable costs of the buying division.
3. It fixes a fair price if the selling division has spare capacity.
4. The mark-up discourages dysfunctional decision-making.
A.1 only
B.2 only
C.1 and 2
D.3 and 4
Answer:
The correct answer is A. Fixed costs becoming variable costs is not an advantage. The fixed cost plus price is not a fair price with spare capacity, as it does not reflect the marginal cost to the selling division. The mark-up may encourage dysfunctional decision-making if it encourages the buying division to buy externally.

Quiz: Big Data Pyramid
The chief executive of Truston Stores, a retail group, needs to make major strategic decisions about its future, including how many stores to keep open and ways to expand its online presence. He wishes to make maximum use of big data when considering future strategies. Truston Stores has employed data analysts to analyse the retail environment and broader social and economic trends. The chief executive wants the analysts to supply him with details of how trends in shopper preferences appear to be affecting the footfall of customers in stores over time.

Which level of the big data pyramid corresponds to the details required by the chief executive?

A.Data

B.Information

C.Knowledge

D.Wisdom

Answer:

The correct answer is C.

Tutorial note: The request is about specific trends affecting the stores, which takes it beyond a request for information. However, the analysts are not required to use what they produce to make forecasts or contribute to strategic decision-making, which means that what they provide is not yet wisdom.

Quiz: Breach of Confidential Information

A company's board of directors was recently embarrassed when a very unhappy junior human resources employee emailed details of their salaries to the entire company.

An investigation revealed that the human resources director had lent his username and password to the junior employee so that routine maintenance of the human resources database could be conducted whilst the director was on vacation. During the director's vacation, the junior employee had used the director's username and password to access the board's salary records.

Which of the following controls could have helped to prevent this breach of confidential information?

A.Monitoring the database system logs on a daily basis to see what information is being accessed

B.Building levels of access into the database so that only senior staff have access to board records

C.Keeping all the human resource records for salaries on a separate server

D.Having a policy of regularly updating the passwords required to access the system

Answer:

The correct answer is A.

Tutorial note: Monitoring usage and access on a regular basis would have revealed that the HR director's account was being accessed while he was on vacation and that confidential information was being looked at and copied. The data breach could then have been investigated immediately and the individual identified sooner, preventing the sensitive information from being divulged to everyone in the company.

The other options would have been ineffective in this instance as the HR director shared his confidential account details with the junior employee.

Quiz: Technologies and Systems

Which of the following statements regarding technologies and systems are correct?

1.Networked computers can save costs by sharing hardware, software and data

2.An intranet provides quick, effective communication with suppliers

3.Wireless networks allow businesses to expand with less disruption than wired networks
4.The internet can be used to monitor and measure customer interest
A.1 and 2
B.1 and 4
C.1, 3 and 4
D.2, 3 and 4
Answer:
The correct answer is C.
Tutorial note: (1) is correct – networked computers can share hardware (e.g. printers) and software (e.g. an accounting package) and data. (3) is correct – adding additional cabling to a wired network can be disruptive and costly. Wireless networks do not need additional cabling and new users can be added relatively easily. (4) is correct – for example, monitoring social media to gauge customer interest.
(2) is incorrect – an intranet is a private internal network for sharing information within the organisation. An extranet would be used to communicate with suppliers.

Quiz: Printing Setup Costs
Curtis runs a printing business. He estimates that his printing machine will need to be set-up 200 times per month, at a monthly total cost of $80,000. Item 2145 has to be printed in batches of 50 copies, where each batch requires the machine to be set-up twice. Curtis expects the annual demand for item 2145 to be 5,000 copies.
What amount should be charged to each copy of item 2145 for set-up costs (to the nearest $)?
$
Answer:
The correct answer is 16.
WORKING
Activity rate is $80,000/200 = $400
cost per copy is ($400 × 2)/50 = $16

Quiz: Warehousing Cost Calculation using ABC
Meadow Co uses an activity-based costing system. The budgeted costs for warehousing for the next six months are $356,014, of which $215,414 is regarding handling receipts of materials. The balance is for the issue of goods to production. In the same period, it is expected that there will be 3,700 receipts and 2,500 issues. On the first day of operations for the period, the company processed 14 receipts and 6 issues. What is the warehousing cost for the first day of operations for the period? A. $337.44 B. $815.08 C. $1,148.43 D. $1,152.52
Answer:
The correct answer is D. WORKING Activity Total cost Driver Units of cost driver $ 140,600 Issue of goods (bal) no. of issues 2,500 Handling receipts no. of receipts 215,414 3,700 356,014 Warehouse cost on first day of operations for the period: (6 issues × 56.24) 337.44 (14 receipts × 58.22) 815.08 1,152.52 Cost per unit of 56.24 58.22

Activity	Total cost	Driver	Units of cost driver
	$		
	140,600		
Issue of goods	(bal)	no. of issues	2,500
Handling receipts		no. of receipts	
215,414	3,700		
	356,014		
Warehouse cost on first day of operations for the period:			
		(6 issues * 56.24)	
		337.44	
		(14 receipts * 58.22)	
		815.08	
815.08			
Total cost			1,152.52

Quiz: Machine Set-Up Cost Calculation

RS Co has recently introduced an activity-based costing system. RS Co manufactures two products, details of which are given below:

	Product R	Product S
Budgeted production per year (units)	80,000	60,000
Batch size (units)	100	50
Machine set-ups per batch	3	3
Processing time per unit (minutes)	3	5

The budgeted annual costs for two activities are as follows:

	$
Machine set-up	180,000
Processing	108,000

What is the budgeted machine set-up cost per unit of Product S?

A.$1.50
B.$1.80
C.$30
D.$150

Answer:

The correct answer is B.

WORKING

Number of machine set-ups for the period (80,000/100 × 3) + (60,000/50 × 3) = 2,400 + 3,600 =6,000

Cost driver rate = $180,000/6,000 = $30 per set up

Total set-up costs = $30 × 3,600 = $108,000

Set up cost per unit = $108,000/60,000 = $1.80

Quiz: Activity-Based Costing Overview

The following statements have been made about activity-based costing (ABC)

1.ABC recognises that some overhead costs do not depend directly on the volume of output

2.The cost of implementing activity based costing may exceed the benefits for some businesses

Which of the above statements is/are true?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is D.

Tutorial note: ABC recognises the drivers that cause overhead costs to vary. These drivers are not always directly related to the volume of output (e.g. the number of machine set ups depends on how often managers decide to perform different production runs). The costs of implementing ABC are high – for businesses with a limited product range, the benefits may not be sufficient to justify these costs.

Quiz: Overhead Cost Per Unit

The budgeted overheads of Nambro Co for the next year have been analysed as follows:

	$000
Purchase order processing costs	450
Production run set up costs	180
Machine running costs	640

It is anticipated that machines will run for 32,000 hours, 6,000 purchase orders will be processed and there will be 450 production runs.

One of the company's products is produced in batches of 500. Each batch requires a separate production run, 30 purchase orders and 750 machine hours.

Using Activity-Based Costing, what is the overhead cost per unit of the product?

A.$0.99

B.$1.59

C.$35.30

D.$495.00

Answer:

The correct answer is C.

WORKING

Cost pool	$	Volume of cost driver	Cost per unit of cost driver
Purchase order	450,000	6,000	$75
Set up	180,000	450	$400
Machine running	640,000	32,000	$20

Therefore batch cost:		$
Purchase order	$75 × 30	2,250
Set up	$400 × 1	400
Machine running	$20 × 750	15,000

17,650

Therefore, cost per unit = $17,650/500 = $35.30

Quiz: ABC Cost Comparison

The following statements have been made about Activity-Based Costing (ABC):

1.Introducing ABC will always reduce costs in the short term

2.If the cost of a product or service using both ABC and absorption costing is the same, there will be no benefit to be gained from adopting ABC

Which of the statements is/are correct?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is C.

Tutorial note: (1) is incorrect as some costs will be fixed in the short term. For such costs, it will only be possible to achieve a reduction in the long term.

(2) is incorrect as ABC will provide a greater insight into the causes of costs. This will allow managers to exercise greater control of costs by focusing attention on managing the causes of costs.

Quiz: Distribution Cost Calculation

Themens Co uses activity-based costing. The budgeted distribution costs for the next year are:

	$
Transport costs	2,631,200
Order processing	1,573,000
Total distribution costs	4,204,200

It is estimated that 325,000 orders will be processed in the next year and that the delivery vehicles will travel 1,495,000 km.

A customer has indicated that 138 orders, each requiring an average journey of 122 km, will be placed next year.

What is the distribution cost for this customer (to the nearest $)?

A.$1,785

B.$30,299

C.$38,891

D.$47,342

Answer:

The correct answer is B.

WORKING

The total cost is analysed into two cost pools, as follows:

Cost pool	Cost driver	CPU of cost driver
Transport	km travelled	$1.76 ($2,631,200/1,495,000)

Processing   orders processed $4.84 ($1,573,000/325,000)
The cost to be quoted is therefore:
Per order   Transport   122 km at $1.76 per km = $214.72
             Processing $4.84
             Total 219.56
For 138 orders, the cost is $30,299.28.

Quiz: Overhead Cost per Unit
A company manufactures two products, C and D, for which the following information is available:

	Product C	Product D
Budgeted production (units)	1,000	4,000
Labour hours per unit/in total	8	10
Number of production runs required	13	15
Number of inspections during production	5	3
Total production set up costs	$140,000	
Total inspection costs	$80,000	
Other overhead costs	$96,000	

Other overhead costs are absorbed based on labour hours per unit.
What is the budgeted overhead cost per unit of product D using activity-based costing?
Answer:
The correct answer is 46.25.
WORKING
Set-up costs per production run = $140,000/28 = $5,000
Cost per inspection = $80,000/8 = $10,000
Other overhead costs per labour hour = $96,000/48,000 = $2
Overheads costs of product D:
                                    $
Set-up costs (15 × $5,000)   75,000
Inspection costs (3 × $10,000)   30,000
Other overheads (40,000 × $2)   80,000
                             185,000
Overhead cost per unit = 185,000/4,000 = $46.25

Quiz: ABC and Traditional Costing Systems
Which THREE of the following statements about activity-based costing (ABC) and traditional costing systems (absorption costing and marginal costing) are correct?
A.No over-absorption or under-absorption of overheads can occur under ABC
B.ABC is useful for businesses which have high overheads in their cost structure
C.ABC is not suitable for use in businesses that provide services
D.Marginal costing understates the true cost of a product when compared to ABC
E.ABC is better than absorption costing in understanding what causes costs to be incurred

F.Both ABC and marginal costing treat all fixed costs as product costs

Answer:

The correct answer is B, D and E.

Tutorial note: As ABC leads to a rational absorption of overheads, it is particularly useful when overheads are high in the overall cost structure of a business. ABC gives a better reflection of the true cost of a product unlike marginal costing which computes a lower cost (or variable costs only). ABC helps to understand what really drives costs whereas absorption costing absorbs costs based on generic or blanket factors.

The other statements are not correct. If budgeted and actual levels of activity differ, overhead over- or under-absorption may occur under ABC just as under absorption costing. ABC can be applied to both manufacturing and service industry (and is particularly relevant in service industries where overheads account for a significant share of the total cost). Marginal costing treats all fixed costs as period costs (i.e. relating to a specific time period), not product costs.

Quiz: Throughput Contribution per Hour

A company operates a throughput accounting system. The details per unit of Product C are:

Selling price $28.50

Material cost $9.25

Labour cost $6.75

Overhead costs $6.00

Time on bottleneck resource 7.8 minutes

What is the throughput contribution per hour for Product C?

A.$50.00

B.$122.85

C.$121.15

D.$148.08

Answer:

The correct answer is D.

WORKING

Throughput contribution per unit = Selling price – material costs = $28.50 – $9.25 = $19.25.
Therefore, return per hour = ($19.25/7.8) * 60 = $148.08

Quiz: Throughput Accounting Priority

A company produces three products D, E and F. The statement below shows the selling price and product costs per unit for each product, based on a traditional absorption costing system:

	Product D	Product E	Product F
	$	$	$
Selling price	32	28	22
Variable costs			
Direct material	10	8	6
Direct labour	6	4	4
Variable overhead	4	2	2

Fixed overhead cost 9 6 6
Total product cost 29 20 18
Profit 3 8 4
Additional information:
Demand per period (units) 3,000 4,000 5,000
Time in Process A (minutes) 20 25 15
Each product is produced using Process A, which has a maximum capacity of 2,500 hours per period.
If a throughput accounting approach is used, what will be the ranking of products, in order of priority, for the profit maximising product mix?
A.D, E, F
B.E, D, F
C.F, D, E
D.D, F, E
Answer:
The correct answer is D.
WORKING

	D	E	F
Throughput contribution per unit	$22	$20	$16
Units of limiting factor (minutes)	20	25	15
Throughput contribution per unit of limiting factor	$1.10	$0.80	$1.07
Ranking		1st	3rd	2nd

Quiz: Life Cycle Costs
Which of the following costs would be included in the life cycle costs of a product?
1.Planning and concept design costs
2.Proto-type testing costs
3.Distribution and customer service costs
A.1, 2 and 3
B.1 and 3 only
C.2 and 3 only
D.1 and 2 only
Answer:
The correct answer is A.
Tutorial note: You may have been unsure whether to include distribution and customer service costs, as these are not production costs. However, lifecycle costing is designed to include all costs relating specifically to a product over its life, so distribution and customer service costs should be included.

Quiz: Target Costing
Which costing approach identifies ways of making an acceptable profit margin on the market price of a product or service?

A.Activity-based costing
B.Benchmarking
C.Life-cycle costing
D.Target costing
Answer:
The correct answer is D.

Quiz: Target Cost Reduction
Hera Co is developing a new product using a target costing approach. The initial assumption was that a sales volume of 200,000 units could be achieved at a selling price of $25 per unit.
However, market research indicates that to achieve a sales volume of 200,000 units, the selling price should be $23.50.
Hera Co wishes to obtain an average profit margin of 20% on sales.
The following data has been estimated for the product:
Direct material $10.45 per unit
Hourly production volume 20 units
Direct labour cost $64 per hour
Variable overheads $82 per hour (absorbed on a direct labour hour basis)
Fixed costs to produce 200,000 units are estimated to be $680,000.
What reduction in the cost per unit is required to achieve the target cost per unit?
A.$0.38
B.$1.15
C.$1.88
D.$2.35
Answer:
The correct answer is D.
WORKING

Selling price	$23.50	Estimated costs:	$
Less 20% margin	$4.70	Materials	10.45
Target cost	$18.80	Labour ($64/20)	3.20
		Variable o/heads ($82/20)	4.10
		Fixed costs	
		($680,000/200,000)	3.40

Total cost 21.15
Reduction required = 21.15 − 18.8 = $2.35

Quiz: Cost Reduction for Target Margin
Caward Co is planning to introduce a new product. The company seeks to obtain a 25% margin on all products. The direct cost of the new product is $124.50 per unit and the overhead cost is $91.20 per unit. Market research indicates that the likely selling price should be $265.00.
What cost reduction must be made to achieve the target cost?
A.$4.62

B.$16.95
C.$22.60
D.$88.95
Answer:
The correct answer is B.
WORKING

		$
Current cost	Direct cost	124.50
	Overheads	91.20
	Total cost	215.70

Target cost $265, less 25% margin 198.75
Cost gap 16.95

Quiz: Life-Cycle Costing Statements
The following statements have been made about life-cycle costing:
1.It helps forecast a product's profitability over its entire life
2.It takes into account a product's total costs over its entire life
3.It focuses on the production of monthly profit statements throughout a product's entire life
Which of the statements are true?
A.1 and 2
B.1 and 3
C.2 and 3
D.2 only
Answer:
The correct answer is A.
Tutorial note: (3) is not correct as lifecycle costing does not have to be performed on a monthly basis.

Quiz: Environmental Management Accounting
The following statements have been made about environmental management accounting:
1.It provides information mainly for external parties
2.It may include physical information about quantities of scarce resources used
Which of the above statements is/are true?
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:
The correct answer is B.
Tutorial note: EMA provides information primarily for internal decision making, so (1) is not true. It may contain both physical information about quantities of resources used as well as monetary information – so statement (2) is true.

Quiz: Theory of Constraints

Which of the following statements about the theory of constraints is NOT true?

A.It focuses on removing bottlenecks in production to improve throughput

B.Non-bottleneck resources should be operated at full capacity

C.It can be used in manufacturing and service organisations

D.It aims to reduce delays in meeting customer orders

Answer:

The correct answer is B.

Tutorial note: Non-bottleneck resources should operate at the maximum throughput of the bottleneck resource. Operating them any faster would result in tying up resources in incomplete work-in-progress.

Quiz: Bottleneck Identification

A product is manufactured in three consecutive processes; preparation, machining and polishing. The time taken per unit and the total hours available per week are as follows:

Process	Preparation	Machining	Polishing
Hours per unit	2	4	3
Total hours available	100,000	220,000	120,000

Demand for the product is 50,000 units per week.

Which, if any, of the processes is the bottleneck?

A.Preparation

B.Machining

C.Polishing

D.None of the processes

Answer:

The correct answer is C.

Tutorial note: The best approach is to calculate how many units per week can be produced by each of the three processes.

WORKING

Process	Preparation	Machining	Polishing
Total hours available	100,000	220,000	120,000
Hours per unit	2	4	3
Maximum weekly output	50,000	55,000	40,000

Polishing has the lowest output per week of 40,000 units. Since this is less than demand of 50,000 units, it represents a bottleneck.

Quiz: Return per Hour

X Co uses a throughput accounting system. Details of product A, per unit, are as follows:

Selling price $320

Material costs $80

Conversion costs $60

Time on bottleneck resource 6 minutes

What is the return per hour for product A?

A.$40

B.$2,400

C.$30

D.$1,800

Answer:

The correct answer is B.

WORKING

($320 − $80)/(6/60) = $2,400

Quiz: Environmental Cost Accounting Techniques

The following are types of management accounting techniques:

1.Flow cost accounting

2.Input/output analysis

3.Life-cycle costing

4.Activity-based costing

Which of the above techniques could a company use to account for its environmental costs?

A.1 and 3 only

B.2 and 3 only

C.1, 2 and 3 only

D.1, 2, 3 and 4

Answer:

The correct answer is D.

Tutorial note: These are all techniques that can be used in environmental management accounting.

Quiz: Throughput Accounting Ratio

A company manufactures a product that requires four hours per unit of machine time. Machine time is a bottleneck resource as there are only 10 machines that are available for 12 hours per day, five days per week. The product has a selling price of $130 per unit, direct material costs of $50 per unit, labour costs of $40 per unit and factory overhead costs of $20 per unit. These costs are based on weekly production and sales of 150 units.

What is the throughput accounting ratio (TPAR) for the product (to two decimal places)?

A.1.33

B.2.00

C.0.75

D.0.31

Answer:

The correct answer is A.

WORKING

Return per factory hour = ($130 − $50)/4 hours = $20
Factory costs per hour = $20 + $40/4 = $15
TPAR = $20/$15 = 1.33

Quiz: Closing Target Cost Gap
S Company is a manufacturer of multiple products and uses target costing. It has been noted that Product P currently has a target cost gap, and the company wishes to close this gap.
Which of the following may be used to close the target cost gap for product P?
A.Use overtime to complete work ahead of schedule
B.Substitute current raw materials with cheaper versions
C.Raise the selling price of P
D.Negotiate cheaper rent for S Company's premises
Answer:
The correct answer is B.
Tutorial note: The cost per unit could be reduced by using cheaper materials. However, care is needed to ensure that this did not compromise the quality of the product. Using overtime would most likely increase the cost per unit.
Target costing is based on the assumption that it is not feasible to raise the selling price. Its purpose is to increase the margin in a competitive market where the price is already determined by the market.
Negotiating cheaper rent would reduce the overall costs, but this is a non-production cost and is not specific to product P.

Quiz: Lifetime Costs
The following costs arise in relation to the production of a new product:
1.Research and development costs
2.Design costs
3.Testing costs
4.Advertising costs
5.Production costs
In calculating the lifetime costs of the product, which of the above items would be EXCLUDED?
A. 1, 2 and 3
B. 2 and 3 only
C. 4 and 5
D. None of these costs
Answer:
The correct answer is D.

Quiz: Target Cost Calculation

The selling price of Product X is set at $550 for each unit, and sales for the coming year are expected to be 800 units. A return of 30% on the investment of $500,000 in Product X will be required in the coming year.

What is the target cost for each unit of Product X?

A.$385.00

B.$165.00

C.$187.50

D.$362.50

Answer:

The correct answer is D.

WORKING

Return: $500,000 × 30% = $150,000

Total sales revenue: $550 × 800 = $440,000

Therefore total cost = $440,000 − $150,000 = $290,000

Unit cost = $290,000/800 = $362.50

Quiz: Target Costing Description

Which of the following statements describes target costing?

A.It calculates the expected cost of a product and then adds a margin to it to arrive at the target selling price

B.It allocates overhead costs to products by collecting the costs into pools and sharing them out according to each product's usage of the cost driving activity

C.It identifies the market price of a product and then subtracts the desired profit margin to arrive at the target cost

D.It identifies different markets for a product and then sells that same product at different prices in each market

Answer:

The correct answer is C.

Quiz: Environmental Cost Accounting

The following statements have been made about environmental cost accounting:

1.The majority of environmental costs are already captured in a typical organisation's accounting system

2.Input/output analysis divides material flows in an organisation into three categories: material flows; system flows; delivery and disposal flows

Which of the above statements is/are true?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is A.

Tutorial note: (2) is incorrect because input/output analysis does not divide material flows into the three categories described. It is flow cost accounting that does this

Quiz: Lifecycle Cost Per Unit
Cam Co manufactures webcams and is about the launch a new version of its product, the Webcam X, for which the following information is available:
Projected lifetime sales volume   50,000 units
Product development costs (already incurred) $1,250,000
Marketing costs $1,750,000
Manufacturing costs per unit, based on the prototype, are as follows:

	$
Direct material	40
Direct labour	26
Machine costs	21
Quality control costs	10
Rework costs	3

Total manufacturing costs per unit 100
The procurement officer has stated that the materials can be sourced from another supplier, reducing direct material costs by 10%.
What is the lifecycle cost per unit?
A.$121
B.$131
C.$156
D.$160
Answer:
The correct answer is C.
WORKING

	$
Direct material	36
Direct labour	26
Machine costs	21
Quality control costs	10
Rework costs	3
Development costs (1,250,000/50,000)	25
Marketing costs (1,750,000/50,000)	35

Lifecycle cost per unit 156

Quiz: Environmental Management Accounting
A road haulage company has decided to adopt environmental management accounting and to include an analysis of its environmental costs in its monthly management reports under four cost categories. One of the significant costs of the company is fuel for the trucks.
Which category would be the most appropriate for the fuel costs?

A.Conventional costs
B.Potentially hidden costs
C.Contingent costs
D.Image and relationship costs
Answer:
The correct answer is A.
Tutorial note: Conventional costs are costs that have some environmental relevance such as costs of scarce resources, such as fuel.

Quiz: Internal Failure Costs
Which of the following should be categorised as internal failure costs by a producer of bulk chemicals?
1.Fines payable to the government for pollution more than prescribed limits
2.Costs of disposing of a toxic waste that is a by-product of the production process. This toxic waste is carefully collected in containers in the factory as it comes out of the process
3.Salaries and other costs of a pollution monitoring team that monitors the emissions to ensure they are below the permitted limits
4.Filtering equipment used to reduce emissions into the atmosphere to reduce emissions below legal limits voluntarily
A.2 only
B.1, 2 and 4
C.2 and 3
D.1 and 3
Answer:
The correct answer is A.
Tutorial note: Internal failure costs are costs incurred on cleaning up environmental waste and pollution before it has been released into the environment. Only item (2) is an example of this. Applying this particular classification (Hansen and Mendova) to the other items: a fine is an external failure cost as the pollution had been released; cost of employing the pollution management team is a detection cost; and filtering equipment is a prevention cost.

Quiz: Target Costing Statements
Which TWO of the following statements about target costing are true?
A.It cannot be used in services industries
B.It aims to achieve an acceptable margin in markets where a competitive market determines the selling price
C.It can be used in conjunction with lifecycle costing to achieve an acceptable lifecycle cost
D.It helps companies to achieve the sales price at which profits are maximised
Answer:
The correct answers are B and C.
Tutorial note: Target costing is not a pricing method and it can be used in service industries where standard services are produced (e.g. nights in a hotel room).

Quiz: Just-in-Time Purchasing

Which of the following is/are necessary for the successful operation of a just-in-time purchasing system?

1.Long-term contracts with suppliers

2.A reliable forecast of the level of demand

3.An effective quality assurance programme

A.2 only

B.1 and 3 only

C.2 and 3 only

D.1, 2 and 3

Answer:

The correct answer is D.

Tutorial note: Long-term contracts are required to ensure loyalty so that suppliers will deliver on time. A reliable forecast of demand is necessary – otherwise production will not match customer demand, which is the main objective of just in time.

A quality assurance programme is needed to ensure that there are no defective products – if there are, this will delay production so the organisation will not achieve just in time.

Quiz: Theory of Constraints

Which of the following statements is NOT consistent with the theory of constraints?

A.There is no inventory of work in progress or finished good held

B.Raw materials are converted into sales as quickly as possible

C.Operations prior to the bottleneck operate at the same level as the bottleneck

D.Conversion costs and investment costs are kept to a minimum

Answer:

The correct answer is A.

Tutorial note: According to the theory of constraints, a small amount of buffer inventory may need to be maintained before the bottleneck activity so that the bottleneck never has to be slowed down or delayed. Holding no inventory is inconsistent with this.

Inventory buffers may need to be maintained at the work-in-progress level to maximise throughput at the bottleneck activity (i.e. to minimise the effect of long lead times on the bottleneck) or as finished goods (to alleviate logistics bottlenecks that may affect sales).

The priority is maximising throughput (sales less truly "variable" costs), which may involve minimising (although not necessarily eliminating) inventory.

Quiz: Environmental Failure Costs

Which of the following should be categorised as environmental failure costs by an airline company?

1.Compensation payments to residents living close to airports for noise pollution caused by their aircraft

2.Air pollution due to the airline's carbon emissions from their aircraft engines
3.Penalties paid by the airline to the government for breaching environmental regulations
A.2 only
B.1, 2 and 3
C.1 and 3 only
D.2 and 3 only
Answer:
The correct answer is B.
Tutorial note: Environmental failure costs may be internal (e.g. treating toxic waste before it is discharged into the environment) or external (e.g. cleaning up spillage outside the company). These costs can be financial (e.g. compensation and penalties) or societal (e.g. air pollution).

Quiz: Minimum Production Required
A company has a target mark-up of 25% and sells into a competitive market where the market price is $120 per unit. The company's current costs per unit are $46 for variable costs and $60 for fixed costs, and it has a budgeted output of 10,000 units.
What is the minimum production required to close the target cost gap?
A.11,042 units
B.11,778 units
C.12,000 units
D.13,636 units
Answer:
The correct answer is C.
Market price $120
Target cost ($120/125%) $96
Variable cost per unit $46
Therefore maximum fixed cost $50
Current budgeted fixed cost (10,000 units * $60) $600,000
Minimum production to absorb $600,000at $50/unit is 12,000 units.

Quiz: Lifecycle Profit Per Customer
A bank has developed a new type of account called the Gold Account. Development and advertising costs were $50,000.
At the start of each of the next four years, 1,000 customers are expected to open a Gold Account and to pay the bank $300 each year that they use it. Of the 1,000 customers who open a Gold Account, 500 are expected to close the account after one year and 500 after two years.
The bank estimates it will cost $400 per customer to administer the Gold Account in the customer's first year reducing to $50 per customer in the second year.
Ignoring the time value of money, what is the lifecycle profit per customer of the Gold Account?
A.$8.33
B.$12.50
C.$16.67

D.$25.00
Answer:
The correct answer is B.
WORKING
The account will run for 4 years:
Year 1 1,000 new customers
Year 2 1,000 new customers 500 from year 1
Year 3 1,000 new customers 500 from year 2
Year 4 1,000 new customers 500 from year 3
                                            500 from year 4
Total   4,000   2,000

Profit over the life cycle:

                                                                    $000
First year customers 4,000 * ($300 fee – $400 cost) (400)
Second year customer 2,000 * ($300 fee – $50 cost) 500
Development and advertising costs   (50)
Total profit 50
Over   4,000 customers
Lifecycle profit per customer $12.50

Quiz: Cost Per Unit
Maribela Co makes a range of products and sells them online. It uses activity-based costing to allocate costs to its products. Its two most successful products are ABC1 and ABC2 but it makes approximately 20 other products in its factory. The company processes and despatches 12 million orders each year over its entire product range.
Information relating to ABC1 and ABC2 is as follows:
                                  ABC1   ABC2
Sales volume (units)   10 million   2.4 million
Average order size (units) 8   1.2
The total packing and despatching cost pool for Maribela Co is $18m each year.
What is the packing and despatching cost per unit of ABC1 (to two decimal places)?
A.$5.54
B.$1.50
C.$0.69
D.$0.19
Answer:
The correct answer is D.
WORKING
The cost driver for the packing and despatching cost pool is the number of orders. Therefore, the cost per unit of cost driver = $18m/12m orders = $1.50 per order.
There are 8 units of ABC1 in an order, therefore the cost per unit is $1.50/8 units = $0.1875.

Quiz: Environmental Cost of Cleaning Contaminated Soil

A company grows different types of tea leaves and blends them together. The tea leaves are picked by hand because too many leaves were damaged and wasted when picking machines were used. The tea leaves are then dried and processed and any waste produced is recycled. The company regularly tests its tea for contaminants, in line with food safety legislation. It recently identified that one tea plantation contained high levels of contaminated soil after the use of a new pesticide.

Identify the environmental cost classification of cost incurred to clean contaminated soil

A.PREVENTION

B.DETECTION

C.INTERNAL FAILURE

D.EXTERNAL FAILURE

Answer:

The correct answer is D.

Tutorial note:Cost incurred to clean contaminated soil is an external failure cost because it is the result of discharging contaminants into the external environment.

Quiz: Staff Cost for Picking Leaves by Hand

A company grows different types of tea leaves and blends them together. The tea leaves are picked by hand because too many leaves were damaged and wasted when picking machines were used. The tea leaves are then dried and processed and any waste produced is recycled. The company regularly tests its tea for contaminants, in line with food safety legislation. It recently identified that one tea plantation contained high levels of contaminated soil after the use of a new pesticide.

Identify the environmental cost classification of staff cost for picking leaves by hand

A.   PREVENTION

B.   DETECTION

C.   INTERNAL FAILURE

D.   EXTERNAL FAILURE

Answer:

The correct answer is A.

Tutorial note: Staff cost for picking leaves by hand is a prevention cost because it prevents the wasted caused by the picking machines damaging too many leaves.

Quiz: Environmental Cost of Recycling Waste

A company grows different types of tea leaves and blends them together. The tea leaves are picked by hand because too many leaves were damaged and wasted when picking machines were used. The tea leaves are then dried and processed and any waste produced is recycled. The company regularly tests its tea for contaminants, in line with food safety legislation. It recently identified that one tea plantation contained high levels of contaminated soil after the use of a new pesticide.

Identify the environmental cost classification of costs involved in the recycling of waste
A. PREVENTION
B. DETECTION
C. INTERNAL FAILURE
D. EXTERNAL FAILURE
Answer:
The correct answer is C.
Tutorial note: Costs involved in the recycling of waste is an internal failure cost because it is waste created by the business but dealt with by the company so that it is not released into the environment.

Quiz: Environmental Cost of testing tea for contaminants
A company grows different types of tea leaves and blends them together. The tea leaves are picked by hand because too many leaves were damaged and wasted when picking machines were used. The tea leaves are then dried and processed and any waste produced is recycled. The company regularly tests its tea for contaminants, in line with food safety legislation. It recently identified that one tea plantation contained high levels of contaminated soil after the use of a new pesticide.
Identify the environmental cost classification of cost incurred for testing tea for contaminants
A. PREVENTION
B. DETECTION
C. INTERNAL FAILURE
D. EXTERNAL FAILURE
Answer:
The correct answer is B.
Tutorial note: Cost incurred for testing tea for contaminants is a detection cost of ensuring that the company complies with legislation.

Quiz: Internal Failure Costs
Which TWO of the following activities are environmental INTERNAL failure costs?
A.Quality control inspections to monitor pollution levels in water leaving a production process
B.Water purification treatment to clean waste water before it leaves the factory
C.Fitting of carbon filters to machine processes to reduce carbon emissions
D.Power usage measuring system to monitor energy consumption within the factory
E.Payment of fines for breaching environmental regulations in the industry
F.Insulation of heating pipes in the factory to reduce heat loss
G.Public relations costs to remedy reputational damage caused by accidental river pollution
H.Capturing and recycling of waste exhaust gases to generate energy
Answer:
The correct answer is B and H.
Tutorial note: INTERNAL failure costs relate to failures that are identified and dealt with within the organisation before the external environment is affected. Payment of fines for breaching

environmental regulations and costs to remedy reputational damage caused by accidental river pollution are examples of external failure costs.

Prevention costs aim to avoid pollution or wastage occurring (e.g. heat insulation and measures to reduce carbon emissions). Detection costs are incurred in ensuring compliance with internal standards and external regulations (e.g. quality control inspections monitoring energy consumption).

External failure costs relate to pollution which has affected the outside environment.

Quiz: Normal and Abnormal Losses

A company's actual production figures for a batch of products are as follows:

	Kg	$
Material	2,000	10,000
Labour and overhead		26,000
	2,000	36,000
Normal loss 10%		(200)
	1,800	36,000
Abnormal loss	(100)	(2,000)
Good output	1,700	34,000

In terms of environmental cost categorisations, how would the normal and abnormal losses be described?

A. Normal loss = Potentially hidden costs   Abnormal loss = Conventional costs
B. Normal loss = Potentially hidden costs   Abnormal loss = Contingent costs
C. Normal loss = Conventional costs   Abnormal loss = Contingent costs
D. Normal loss = Contingent costs   Abnormal loss = Conventional costs

Answer:

The correct answer is A.

Tutorial note: Normal loss costs are spread over good units of production, losing their identity and so potentially hidden. Abnormal losses are reported separately like conventional costs of material, energy etc. (The numbers given in the question were provided for illustration only and not required to answer the question.)

Quiz: Target Costing Sequence

Match the stages required to the correct step number to describe the sequence used when operating target costing.

There are 6 steps when operating target costing. They are following：

1.Cost the product
2.Determine the profit margin
3.Set the selling price
4.Use functional and value analysis
5.Identify the cost gap
6.Develop the product concept

Which is the correct sequence used when operating target costing.

A. 6 3 2 1 5 4
B. 6 3 1 2 5 4
C. 3 2 1 5 6 4
D. 3 2 1 6 5 4
Answer:
The correct answer is A.
Tutorial note: Whereas traditional pricing techniques such as cost-plus, start with production costs and add on a required mark-up or margin to arrive at the selling price, target costing starts with ascertaining the selling price that the market would accept.
Once a product concept has been developed, the company will take this to the market and use the feedback gathered to set the selling price. The company will then apply its required profit margin to this selling price to calculate the target production cost. This is the maximum cost that can be incurred and still earn the required margin. This target cost is then compared to the calculated cost of production and any cost gap is identified. The company must then use techniques such as functional and value analysis in order to close the cost gap.

Quiz: Environmental Cost of Production Run
Zul Co manufactures a single product, the Zoot, which is made from a mix of two chemicals: A and B. The company accounts for environmental costs using input/output analysis.
Chemical A costs $1,000 per tonne and chemical B costs $1,500 per tonne. Any chemicals which are wasted in the production process must be disposed of at a cost of $250 per tonne.
June's production run used 10 tonnes of chemical A and 50 tonnes of chemical B. Total output of Zoot was 54 tonnes.
What is the environmental cost of June's production run?
A.$7,000
B.$1,500
C.$8,500
D.$10,000
Answer:
The correct answer is D.
WORKING
First calculate the inputs:

	Input (tonnes)	Cost per tonne	Total cost
Chemical A	10	$1,000	$10,000
Chemical B	50	$1,500	$75,000
	60		$85,000

As the total output was 54 tonnes, wastage was 6 tonnes (60 – 54).
The environmental cost includes the cost of the 6 tonnes wasted plus the cost of its disposal.
Cost of chemicals wasted ((6/60) * 85,000) = $8,500
Cost of disposal (6 * $250) = $1,500
Total cost of wastage $10,000

Quiz: Relevant Cost of Material X

Albrecht has received a request to make a special version of one of its products. This special version will use 2,000 units of material X.

Albrecht no longer uses material X, but there are 2,000 units left in inventory purchased at $4.00 per unit. The current purchase price is $4.75 per unit. Albrecht believes it could sell material X for $3.00 per unit. However, material X is similar to material Y that is currently in use by Albrecht and can be purchased for $6.50 per unit. It could use material X in place of material Y – however, it would cost $2.75 per unit to modify material X so that it could be used in place of material Y.

What is the relevant cost per unit of material X for the manufacture of the special version?

A.$3.00

B.$3.75

C.$4.00

D.$4.75

Answer:

The correct answer is B.

Tutorial note: The relevant cost of material X is the opportunity cost as it is not used regularly.

WORKING

Option 1 – sell it for $3.00 per unit.

Option 2 – use as substitute for material Y. Relevant cost is the saving per kg unit of material Y ($6.5) less the cost of modifying each unit of material X so it can be used in place of Y ($2.75) = $3.75.

Option 2 has the higher benefit, so this is what Albrecht would do with the 2,000 units of material X if they are not used on the contract. This is therefore the opportunity cost.

Quiz: Definition of Opportunity Cost

 "The value of a benefit sacrificed in favour of an alternative course of action."

Which term is best described by the definition above?

A.Incremental cost

B.Opportunity cost

C.Relevant cost

D.Variable cost

Answer:

The correct answer is B

Tutorial note: Opportunity cost – "The value of the benefit sacrificed when one course of action is chosen, in preference to an alternative

Quiz: Total Relevant Cost of Labour for the Contract

A contract is under consideration which requires 600 labour hours to complete. There are 350 hours of spare labour capacity. The remaining hours for the contract can be found either by weekend overtime working paid double the normal rate of pay or by diverting labour from the manufacture of product QZ. If the contract is undertaken and labour is diverted, sales of

product QZ will be lost. Product QZ takes three labour hours per unit to manufacture and makes a contribution of $12 per unit. The normal rate of pay for labour is $9 per hour.

What is the total relevant cost of labour for the contract?

A.$1,000

B.$2,250

C.$3,250

D.$4,500

Answer:

The correct answer is C.

WORKING

The relevant cost of the 350 hours of spare capacity is zero. There are two options to obtain the remaining 250 hours:

(1) divert labour from product QZ. The relevant cost is the direct labour cost plus the opportunity cost. This is 250 hours at [$9 per hour + the opportunity cost ($12/3) per hour] = $3,250

(2) weekend overtime work at double the normal hourly rate. The relevant cost of this is $4,500 (250 * $18).

(1) has the lowest relevant cost.

Quiz: Sunk Cost of the Project

Park Co is developing a number of new products. New legislation means that one of these products will not be viable unless additional expenditure, estimated at $450,000, is undertaken. This amount excludes $200,000 which is the estimate of the contribution potentially lost through the delay to another project due to the transfer of resources.

To date $4.7 million has been spent on the project. It is estimated that before the change in legislation, $2.1 million was required to bring the product to the launch stage.

What is the sunk cost of the project?

A.$200,000

B.$450,000

C.$2,100,000

D.$4,700,000

Answer:

The correct answer is D.

Tutorial note: A sunk cost is a cost which has been incurred and cannot be recovered.

Quiz: Relevant Cost of Using the Machine

A machine is no longer used by a company. It could be sold now for net proceeds of $300. Its only other use is on a short-term contract which is under consideration. The variable running costs of the machine during the contract period would be $400. On completion of the contract, the machine would have no realisable value and cost $150 to dismantle and remove.

What is the total relevant cost of using the machine on the contract?

$

Answer:
The correct answer is 850.
WORKING

	$
Loss of sale proceeds	300
Running costs	400
Costs of dismantling and removing machine	150
	850

Quiz: Relevant Cash Flow
Which of the following best describes the term relevant cash flow?
A.The benefit which would have been obtained from the best alternative foregone
B.The difference in future operating cash flows resulting from a decision
C.A future cash flow that cannot be avoided
D.All cash flows, including financing cash flows, arising from a project
Answer:
The correct answer is B.
Tutorial note: Benefit obtained from best alternative foregone describes opportunity costs, which are a type of relevant cost.
If the cash flow is unavoidable, it is not relevant.
All cash flows from a project may include non-incremental and unavoidable cash flows which are not relevant.

Quiz: Total Relevant Cost of Materials
A company is evaluating a project that requires two types of material (T and V).
Data relating to the material requirements for the project are as follows:

Material type	Quantity needed	Quantity currently in inventory	Original cost of quantity in inventory	Current purchase price	Current resale price
	kg	kg	$/kg	$/kg	$/kg
T	500	100	40	45	44
V	400	200	55	52	40

The company regularly uses material T in normal production. Material V is no longer in use by the company and has no alternative use within the business.
What is the total relevant cost of materials for the project?
A.$40,400
B.$40,900
C.$43,400
D.$43,900

Answer:

The correct answer is B.

WORKING

Material T is used regularly in the business so the replacement cost is relevant. This is the current purchase price of $45.

Material V is not used regularly by the business and 400kg are needed. The relevant cost of the 200kg in inventory is its opportunity cost, which is the current resale price of $40. The other 200kg will have to be bought at the current purchase price of 52.

	$
T (500 * 45)	22,500
V (200 * 40) + (200 * 52)	18,400
Total relevant cost	40,900

Quiz: True Statements About Short-Term Decisions

Indicate, by clicking on the relevant boxes in the table below, whether each of the statements made about short-term decisions are true or false.

The following statements have been made about short-term decisions.

1.Joint costs are relevant in decisions about whether to sell a joint product at the split-off (separation) point or after further processing

2.The relevant costs and revenues in decisions relating to the operating of internal service departments or the use of external services, are the differential costs between the two options

Which of the above statements is/are true?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is B.

Tutorial note: Joint costs are not relevant to the further processing decision because they have already been incurred (i.e. are sunk). (The relevant costs are the incremental revenues from selling after further processing and the incremental costs of further processing.)

Quiz: Relevant Cost of Material B for Special Order

A company has received a special order for which it is considering using material B which it has held in its inventory for some time. This inventory of 945 kg was bought at $4.50 per kg. The special order requires 1,500 kg of material B. If the inventory is not used for this order, it would be sold for $2.75 per kg. The current price of material B is $4.25 per kg.

What is the total relevant cost of material B for the special order?

A.$4,957.50

B.$6,375.00

C.$4,125.00

D.$6,611.25

Answer:

The correct answer is A.

WORKING

Cost of the quantity to be bought = (1,500 − 945) × $4.25 = $2,358.75

Opportunity cost of quantity in hand = 945 × $2.75 = $2,598.75

Total relevant cost = $4,957.50

Quiz: Components to Buy In

A business makes two components which it uses to produce one of its products. Details are:

	Component A	Component B
Per unit information:	$	$
Buy in price	14	17
Material	2	5
Labour	4	6
Variable overheads	6	7
General fixed overheads	4	3
Total absorption cost	16	21

The business wishes to maximise contribution and is considering whether to continue making the components internally or buy in from outside.

Which components should the company buy in from outside in order to maximise its contribution?

A.A only

B.B only

C.Both A and B

D.Neither A nor B

Answer:

The correct answer is B.

Tutorial note: The marginal costs of making A and B are $12 and $18 per unit, respectively. Marginal cost is the relevant cost for the make or buy decision since the fixed costs will be incurred anyway. Therefore, it is cheaper to make A ($12 marginal cost vs $14 buy in cost) but it is cheaper to buy in B ($17 buy in cost vs $18 make cost).

Quiz: Relevant Costs for Picking and Packaging Fruit

The Fruit Company (F Co) currently grows fruit which customers pick themselves from the fields before paying. F Co is concerned that a large number of customers are eating some of the fruit whilst picking it and are therefore not paying for all of it. As a result, it has to decide whether to hire staff to pick and package the fruit instead.

Which THREE of the following are relevant to the decision?

A.The total sales value of the fruit currently picked and paid for by customers

B.The cost of growing the fruit

C.The cost of hiring staff to pick and package the fruit

D.The total sales value of the fruit if it is picked and packaged by staff instead

E.Time spent by existing managers, who are on fixed salaries, supervising the staff

F.The cost of baskets used by customers and staff

Answer:

The correct answers are A, C and D.

Tutorial note: The cost of growing fruit and picking it into baskets is not relevant since it is not affected by the decision. The time spent by existing managers is not affected by the decision since existing managers are on fixed salaries.

Quiz: Total Relevant Cost of Labour for Additional Order

B Co operates a production process which generates a contribution of $4 per hour. Wages are paid at $7 per hour and labour is fully utilised. During busy periods workers are offered the chance to work overtime, which is paid at $10 per hour. However, workers are currently refusing to work overtime because of an industrial dispute. B Co has just received an additional order which must be fulfilled immediately which will require 10 hours of labour to fulfil.

What is the total relevant cost of labour for the additional order?

$

Answer:

The correct answer is 110.

Tutorial note: When there is no spare capacity, the general rule is that the relevant cost is the opportunity cost calculated as normal cost PLUS the contribution foregone (which is equivalent to lost revenue less variable costs saved). The cost of overtime would be relevant, if cheaper, but is a distractor here as no overtime is available.

WORKING

Opportunity cost is $7 (normal wage per hour) + $4 (contribution per hour) = $11 per hour. The total cost of 10 hours required is $110.

Quiz: Relevant Total Cost per Hour

A company is making product P with the following cost card:

	$	$
Selling price		100
Material	25	
Labour	30	
Variable overheads	20	
Fixed overheads		10
		(85)
Profit		15

Each unit of P takes one hour to make and the available labour and machinery are fully used in its current production of P. The company is considering making a new product, Q, but would have to divert labour and machine use from product P.

What is the relevant total cost per hour for labour and variable overheads which should be included in the cost of product Q?

$

Answer:

The correct answer is 75.

Tutorial note: The relevant cost of diverting labour from existing production (i.e. when working at full capacity) is the variable cost of a labour hour + opportunity cost (i.e. the contribution foregone for every hour diverted).

WORKING

The relevant cost of labour is $55 ($30 standard cost + ($15 + $10) contribution).

The total relevant cost of labour and variable overheads is therefore $75 ($55 + $20 variable overheads).

Quiz: Total Relevant Cost of Material Z

A company needs 400kg of material Z to fulfil a customer order in one month's time.

It currently has no material Z in inventory. The current purchase price of material Z is $20 per kg and this is expected to rise to $24 per kg in one month's time. Material Z is perishable and normally 20% of stored material is lost per month.

The company expects to have 200kg of material Y in inventory in one month's time with no alternative use other than to sell it for scrap for $18 per kg. The 200kg of material Y could be converted into 200kg of material Z in one month's time at a cost of $4 per kg. Material Y is not perishable.

What is the total relevant cost of material Z to fulfil the customer order?

$

Answer:

The correct answer is 9200.

Tutorial note: The total relevant cost is the lowest cost of the three options: (1) buy now and store for a month, (2) buy in one month's time or (3) convert material Y.

WORKING

Cost per kg:

1)   Buy Z now and store, allowing for loss ($20/(1 − 20%)) $25
2)   Buy Z in one month's time $24
3)   Convert material Y
        ($18 scrap proceeds foregone + $4 conversion cost) $22

Therefore convert material Y available (200kg) and buy remainder (200kg) in one month's time.

The total relevant cost is (200kg × $22) + (200kg × $24) = $9,200

Quiz: Revised Total Divisional Net Loss

Lauda Co has two divisions with the following results in the table below:

	Division A	Division B
	$m	$m
Sales revenue	1,000	1,240
Variable costs	400	500
Contribution	600	740
Divisional fixed costs	650	600

Allocated Head Office costs   50   150
Divisional net loss   (100)   (10)
If a division is shut down, then Lauda Co will avoid all the division's specific costs and half of the Head Office costs allocated to the division.
What will be the revised total divisional net loss if Lauda Co chooses to shut down Division A? (in millions)
Answer:
The correct answer is 35 millions .
WORKING

Lost revenue   (1,000m)
Saved variable costs 400m
Saved divisional fixed costs 650m
Saved allocated Head Office costs (50%)   25m
Overall saving 75m
Current total divisional net loss ($100m + $10m) = (110m)
Revised total divisional net loss (35m)

Quiz: Products for Further Processing
Product L, M, and S are produced by Division A, as outputs of a process at the split-off point.
They may be sold externally, or transferred to Division B for further processing.
In November, Division A's output was as follows:

Product	Kg
L	1,200
M	1,400
S	1,800

The market selling prices per kg for the products, both at split-off point and after further processing, are as follows:

	$		$
L	5.60	LX	6.70
M	6.50	MX	7.90
S	6.10	SX	6.80

The specific costs for each of the individual further processes are:
Variable cost of $0.50 per kg of LX
Variable cost of $0.70 per kg of MX
Variable cost of $0.80 per kg of SX
Which of the products should be further processed in Division B in order to optimise the profit for the company?
A.L only
B.L and M
C.L and S
D.S and M
Answer:

The correct answer is B.

WORKING

Comparing the incremental revenue from further processing to the variable cost per unit of further processing:

	Incremental revenue	Less variable cost	Profit/(loss)	Further process?
L	(6.7 – 5.6) = 1.1	$0.5	$0.6	Yes
M	(7.9 – 6.5) = 1.4	$0.7	$1.4	Yes
S	(6.8 – 6.1) = 0.7	$0.8	($0.1)	No

Process should further process L and M, since incremental revenue from further processing will exceed incremental costs. However, it should not further process S as incremental costs exceed incremental revenue in S's case.

Quiz: Break-Even Number of Pizzas

Mario operates a small business that makes pizzas and delivers them within a two-mile radius. The variable cost incurred to make and deliver one pizza is $2.15. The average price charged is $6.50 per pizza, including delivery.

Mario estimates the annual fixed costs of his business are $40,000, including salaries of $24,000.

What is the break-even number of pizzas per year for Mario's business (to the nearest unit)?

A.3,678

B.6,154

C.9,195

D.18,605

Answer:

The correct answer is C.

WORKING

Contribution per unit: $6.50 – $2.15 = $4.35

Break-even = Fixed costs/contribution per unit = $40,000/$4.35 = 9,195.4i.e.

9195 to the nearest unit.

Quiz: Budgeted Break-Even Sales Volume

A division manufacturing a single product which sells for $325 has the following unit cost structure:

	$
Direct materials	95
Direct labour	78
Variable overheads	56
Share of fixed costs	45
Total cost	274

In the coming period, the budgeted production volume is 10,000 units.

What is the budgeted break-even sales volume (to nearest unit)?

units

Answer:
The correct answer is 4,688 .
WORKING
Break-even point =
Total budgeted fixed costs = Budgeted cost per unit × budgeted production = 45 * 10,000 = $450,000
Contribution per unit = Selling price − variable costs = 325 − (95 + 78 + 56) = $96
Therefore, break-even point = 450,000/96 = 4,687.5 units i.e. 4,688 units

Quiz: Margin of Safety Ratio
Graytun Co has a production capacity of 280,000 units per year. The budgeted sales volume for the next year is 256,000 units and the break-even volume is 167,000 units.
What is the margin of safety ratio?
A.31.8%
B.34.8%
C.53.3%
D.65.2%
Answer:
The correct answer is B.
WORKING
Margin of safety ratio =
= (256,000 − 167,000)/256,000 = 34.8%

Quiz: Volume of Sales Required at New Selling Price
Benown Co manufactures a single product which has a variable cost of $17 and currently sells for $30. The budgeted sales volume is 25,000 units per month and the budgeted fixed costs are $250,000 per month. The divisional manager is considering reducing the price to $27 to increase sales. He also wishes to increase the monthly profit by 10%.
What volume of sales is required at the new selling price to increase profit by 10%?
A.19,559
B.32,250
C.33,250
D.43,250
Answer:
The correct answer is C.
WORKING
Current selling price $30
Current variable cost $17
Current contribution $13
Sales volume   25,000
Total contribution $325,000 (25,000 * $13)
Fixed Costs $250,000

Profit $75,000 ($325,000 – $250,000)
New contribution $10 ($27 – $17)
Target profit $82,500 ($75,000 + 10%)
Target contribution $332,500 ($82,500 + $250,000)
Sales volume   33,250 ($332,500/$10)

Quiz: Percentage Increase in Sales
Jim Bowen has been trading for the last six months as a fast food retailer. His average
contribution sales (C/S) ratio for that period was 33%, on sales of $120,000. His total fixed
expenses were $25,800. He is considering employing an extra member of staff as he anticipates
an increase in business. The cost of the new employee will be $18,000 per year. To stimulate
sales, Jim will also reduce his C/S ratio to 30%.
What percentage increase in sales is needed for Jim to earn the same net profit in the next six
months as he earned in the first six months?
A.10%
B.21.5%
C.35%
D.60%
Answer:
The correct answer is C.
WORKING
                                $
Sales   120,000
Contribution (33%)   39,600
Less Fixed costs   25,800
Existing profit   13,800
In the following six-month period, contribution margin (C/S ratio) will fall to 30%. Fixed costs will
increase to $34,800 (25,800 + ½ * 18,000). Target profits required are 13,800.
Revenue required to achieve a target profit =
Therefore, required revenue = (13,800 + 34,800)/0.3 = 162,000. This represents a 35% increase
over the first six months of the year.

Quiz: Planned Activity Level
A company manufactures one product which it sells for $40 per unit. The product has a
contribution to sales ratio of 40%. Monthly total fixed costs are $60,000. At the planned level of
activity for next month, the company has a margin of safety of $64,000 expressed in terms of
sales value.
What is the planned activity level (in units) for next month?
A.3,100
B.4,100
C.5,350
D.7,750

Answer:
The correct answer is C.
WORKING
Contribution per unit (40 * 0.40) = 16
Breakeven point (60,000/16) = 3,750 units
Margin of safety (64,000/40) = 1,600 units
Planned activity level 5,350 units

Quiz: Break-Even Chart
A break-even chart for a company is depicted as follows:
(Description of the chart: The chart shows two lines: one for 'Sales revenue' and another for 'Total costs' as the number of units increases. Sales revenue: This line starts at zero and increases steadily as more units are sold.
Total costs: This line also starts at zero but rises more quickly at first. After a certain point, it slows down and runs parallel to the sales revenue line, keeping a consistent gap between them.)

Which one of the following statements is consistent with the above chart?
A.Both selling price per unit and variable cost per unit are constant
B.Selling price per unit is constant but variable cost per unit increases for sales over 4,000 units
C.Variable cost per unit is constant but the selling price per unit increases for sales over 4,000 units
D.Selling price per unit increases for sales over 4,000 units and there is an increase in the total fixed costs at 4,000 units
Answer:
The correct answer is A.
Tutorial note: Selling price per unit remains constant, since the total revenue line is a straight line. Variable cost per unit is represented by the gradient of the total cost line. This is also constant, which means that the variable cost per unit is also constant.
The increase in total costs at 4,000 units is an increase in fixed costs – this could be because at this level of activity it is necessary to invest in more production capacity.

Quiz: Weighted Average Contribution to Sales Ratio
A company makes and sells three products, R, S and T. Extracts from the weekly profit statements are as follows:

	R	S	T	Total
	$	$	$	$
Sales	10,000	15,000	20,000	45,000
Variable cost of sales	4,000	9,000	10,000	23,000
Fixed costs*	3,000	3,000	3,000	9,000
Profit	3,000	3,000	7,000	13,000

* general fixed costs absorbed using a unit absorption rate

If the mix of products produced and sold is changed to: R 20%, S 50%, T 30% what effect would this have on the weighted average contribution to sales ratio?

A.It would increase
B.It would decrease
C.It would remain unchanged
D.It cannot be determined without more information

Answer:

The correct answer is B.

WORKING

Current mix:

	R	S	T	Total
	$	$	$	$
Sales	10,000	15,000	20,000	45,000
Variable cost of sales	4,000	9,000	10,000	23,000
Contribution	6,000	6,000	10,000	22,000
Individual C/S ratio	60%	40%	50%	

Existing C/S ratio is 22,000/45,000 = 0.489 or 48.9%

New mix:

	R	S	T	Total
	$	$	$	$
Sales(20:50:30)	9,000	22,500	13,500	45,000
Contribution	5,400	9,000	6,750	21,150

New C/S ratio = 21,150/45,000 = 0.47 (or 47%). This is lower.

Alternative approach

C/S ratios are: R 60%, S 40%, and T 50%

Now = $22,000/$45,000 = 0.489

New = (0.6 * 0.2) + (0.4 * 0.5) + (0.5 * 0.3) = 0.47

Quiz: Break-Even Sales Revenue

The following information is available for a manufacturing company which produces multiple products:

1.The product mix ratio
2.Contribution to sales ratio for each product
3.General fixed costs
4.Method of apportioning general fixed costs

Which of the above are required in order to calculate the break-even sales revenue for the company?

A.1, 2 and 3
B.1, 2 and 4
C.1, 3 and 4
D.2 and 3 only

Answer:

The correct answer is A.

Tutorial note: The method of apportioning general fixed costs is not required to calculate the break-even sales revenue.

Quiz: Margin of Safety in Units
A company makes a single product which it sells for $2 per unit.
Fixed costs are $13,000 per month.
The contribution/sales ratio is 40%.
Sales revenue is $62,500.
What is the margin of safety (in units)?
A.15,000
B.16,250
C.30,000
D.31,250
Answer:
The correct answer is A.
WORKING
Sales = $62,500
Break-even sales = $13,000/0.4 = $32,500
Margin of safety (sales revenue) = $30,000
Margin of safety (units) $30,000/$2 =15,000 units.

Quiz: Break-Even Point in Sales Revenue
Mabel Co manufactures and sells tables and chairs in a standard mix of one table to four chairs.
The following information is available:

Product	Table	Chair
Variable cost per unit ($)	120	16
Contribution to sales ratio	0.4	0.6

Annual fixed costs are $100,000.
What is the break-even point in sales revenue (to the nearest $00)?
A.$178,600
B.$200,000
C.$204,500
D.$210,500
Answer:
The correct answer is C.
Tutorial note: To calculate break-even revenue in a multi-product situation, divide the annual fixed costs by the weighted average C/S ratio.
WORKING

Selling price = Variable cost/(1 – C/S ratio):

	$	$
Table	$120/(1-0.4)	200

Chair $16/(1-0.6)   40
Variable cost   120   16
Contribution   80   24
Weighted average C/S ratio = (1 * $80 + 4 * $24)/(1 * $200 + 4 * $40) = $176/$360 = 0.489.
Therefore, break-even revenue is $100,000/0.489 = $204,545

Quiz: Margin of Safety Percentage
The standard costs and revenues of Log Co's only product are as follows:

Sales price $60 per unit
Direct materials $12 per unit
Direct labour $15 per unit
Variable production overhead $3 per unit
Fixed production overhead $15 per unit
Profit $15 per unit
Fixed overheads are absorbed on budgeted production and sales of 10,000 units per year. Sales staff receive a sales commission of 5% of sales revenue.
What is Log Co's margin of safety (to the nearest %)?
A.80%
B.55%
C.50%
D.44%
Answer:
The correct answer is D.
WORKING
Budgeted fixed costs (10,000 units * $15 per unit) = $150,000
Contribution per unit ($60 – $12 – $15 – $3 – $3) = $27
Therefore break-even point = $150,000/$27 = 5,556 units
Margin of safety = (Budgeted sales units – break-even sales units)/Budgeted sales units = (10,000 – 5,556)/10,000 = 44%.
Tutorial note: The 5% sales commission is a variable cost related to the sales price.

Quiz: Operating Gearing Ratio
Logan Co has an operating gearing ratio of 33.33%. Its sales are currently $100m and its operating profit is $20m.
Operating gearing is calculated by dividing fixed costs by variable costs.
What will its operating profit be if its sales increases by 15%?
Answer:
The correct answer is 26.
WORKING
Total cost ($100m sales less $20m profit) = $80m
Operational gearing (fixed cost/variable cost) is 33.33%, i.e. ratio of 1:3

Therefore, fixed cost (¼ * $80m) = 20m

Variable cost 60m

Therefore, contribution before increase in sales ($100m – $60m)   = 40m

New contribution after 15% increase in sales (1.15 * $40m) = 46m

New operating profit ($46m – $20m fixed cost) = 26m

Quiz: Break-even Revenue for Production

A company makes two products with the following characteristics:

	Product X	Product Y
Contribution to sales ratio.	0.3	0.5
Selling price per unit	$3.00	$4.80
Maximum demand	8,000 units	3,000 units

Fixed costs are $9,000.

What is the minimum revenue required for production to break even?

A.$20,400

B.$25,800

C.$29,400

D.$24,000

Answer:

The correct answer is A.

WORKING

	Product X	Product Y
Contribution per unit (C/S ratio * selling price)	0.3 * $3.00 = $0.90	0.5 * $4.80 = $2.40
Break-even point (Fixed costs/contribution per unit)	$9,000/$0.90 = 10,000 units	$9,000/$2.40 = 3,750 units
Maximum demand	8,000 units	3,000 units

It is not possible to break even selling only one product; the product with the highest contribution per unit would be produced first (i.e. Y), up to its maximum demand, to cover the fixed costs as quickly as possible:

Total contribution from Y (3,000 units * $2.40)   = $7,200

Contribution required from X to break even ($9,000 – $7,200) = $1,800

Production of product X will therefore be ($1,800/$0.90)= 2,000   units

Sales revenue at break even:

	$000
Product X (2,000 units * $3.00)	6,000
Product Y (3,000 units * $ 4.80)	14,400
	20,400

Quiz: Photocopier Model Selection

Double Co provides a photocopying service for clients at a price of $0.10 per copy. It needs to choose which of two new photocopier models to rent. The costs of each photocopier model are given in the following table:

Photocopier model	S	T
Annual rental cost	$10,000	$8,000
Cost per copy	$0.03	$0.05

What is the minimum number of copies per year at which model S would be preferred to model T?

A.100,001
B.142,857
C.160,000
D.150,000

Answer:

The correct answer is A.

Tutorial note: Although not presented in the traditional way, this question requires the calculation of a breakeven point – the point at which the total costs of the two models would be the same.

WORKING

Let x = the number of copies.

The total cost of model S = $10,000 + 0.03x

The total cost of model T = $8,000 + 0.05x

Breakeven between the two models will occur where 10,000 + 0.03x = 8,000 + 0.05x

Therefore x = 2,000/0.02 = 100,000

At 100,000 copies, Double Co would be indifferent to the model chosen, but for any copies above 100,000, model S would be preferred as it has the lower variable cost per copy.

Quiz: Traditional Contribution Approach

A company produces three products, D, E and F. The statement below shows the selling price and product costs per unit for each product, based on a traditional absorption costing system:

	D	E	F
Selling price per unit	32	28	22
Variable costs per unit			
Direct material		10	8	6
Direct labour	6	4	4
Variable overhead	4	2	2
Fixed cost per unit	9	6	6
Total product cost	29	20	18

Additional information:

	D	E	F
Time in process A (minutes)	20	25	15

Process A time is limited to 2,500 hours per period.

If a traditional contribution approach is used, what will be the ranking of products, in order of priority, in order to maximise profit?

A.D, E, F

B.E, D, F
C.F, D, E
D.D, F, E
Answer:
The correct answer is C.
WORKING

	D	E	F
Contribution per unit	$12	$14	$10
Units of limiting factor (minutes)	20	25	15
Contribution per unit of limiting factor.	$0.60	$0.56	$0.667
Ranking		2nd	3rd	1st

Quiz: Product Selection for Maximum Profit
Ardvec makes four products which sell in roughly equal volume. Data in respect of each product is shown below:

Per unit	Economy	Standard	Premium	Deluxe
Selling price	$28	$32	$37	$40
Variable cost	$13	$16	$20	$22
Direct labour hours	0.17	0.22	0.28	0.31

In the coming period, a shortage of direct labour means that Ardvec can only manufacture three products.
In order to maximise short term profit which product should NOT be produced?
A.Economy
B.Standard
C.Premium
D.Deluxe
Answer:
The correct answer is D.
WORKING

Per unit	Economy	Standard	Premium	Deluxe
Selling price	$28	$32	$37	$40
Variable cost	$13	$16	$20	$22
Contribution per unit	15	16	17	18
Direct labour hours per unit	0.17	0.22	0.28	0.31
Contribution per labour hour	88.24	72.72	60.71	58.06
Therefore, ranking	1st	2nd	3rd	4th

Since only three products can be made, the Deluxe would be dropped.

Quiz: Outsourcing Statements
The following statements have been made about outsourcing:

1.Outsourcing an activity always leads to short-term cost savings

2.Outsourcing an activity normally reduces the risk of under-utilising the resources used in undertaking the activity internally

Which of the above statements is true/false?

Statement 1 Statement 2

A.True   False

B.False   True

C.True   True

D.False   False

Answer:

The correct answer is B.

Tutorial note: Outsourcing often leads to cost savings in the longer run, but there are situations where companies may outsource activities for reasons of quality even though the cost of outsourcing may be higher – so it is not always true that outsourcing leads to short term cost savings. Statement 1 is therefore incorrect.

If an activity is performed internally the organisation may incur additional fixed costs that it would not otherwise incur (e.g. salaries of staff performing the activity). There is therefore a risk that resources, such as staff, may not be fully utilised. Statement 2 is correct. One of the advantages of outsourcing is that the organisation only pays for the goods or services provided.

Quiz: Linear Programming Problem

The following graph relates to a linear programming problem:

Description of the graph: The chart shows three lines labeled (1), (2), and (3): Line (1): Starts higher on the y-axis and slopes downward, crossing the x-axis. Line (2): Starts lower than Line (1), also slopes downward, crosses Line (1), and then crosses the x-axis further to the right. Line (3): A dashed curve starting at the origin (0,0), curving upward to intersect both Line (1) and Line (2).)

The objective is to maximise contribution and the dotted line on the graph depicts this function. There are three constraints which are all of the "less than or equal to" type which are depicted on the graph by the three solid lines labelled (1), (2) and (3).

At which intersection is contribution maximised?

A.Constraints (1) and (2)

B.Constraints (2) and (3)

C.Constraints (1) and (3)

D.Constraint (1) and the x-axis

Answer:

The correct answer is D.

Tutorial note: This represents the point in the feasible region that is furthest from the origin.

Quiz: Optimal Mix of Production:

A company manufactures and sells two products (X and Y) which have contributions per unit of $8 and $20 respectively. The company aims to maximise profit. Two materials (G and H) are

used in the manufacture of each product. Both materials are in short supply; only 1,000 kg of G and 1,800 kg of H are available next period. The company holds no inventory and it can sell all the units produced.

The management accountant has drawn the following graph accurately showing the constraints for materials G and H:

(Description of the graph: The chart shows the relationship between two products, Product Y and Product X, in terms of their material content: Product X (units) is on the horizontal axis, ranging from 0 to 150 units. Product Y (units) is on the vertical axis, ranging from 0 to 100 units. There are two lines: Material H: Starts at around 90 units of Product Y and decreases linearly as Product X increases. Material G: Starts at around 100 units of Product Y and decreases more steeply than Material G, ending around 125 units of Product X. This chart indicates that as more of Product X is produced using either material, less of Product Y can be produced.)

What is the optimal mix of production (in units) for the next period?

	Product X	Product Y
A.	0	90
B.	50	60
C.	60	50
D.	125	0

Answer:

The correct answer is A.

WORKING

Total contribution from:

A 90 units of Y (90 * $20) = $1,800

B 50 units of X + 60 units of Y (50 * 8) + (60 * 20) = $1,600

C 60 units of X + 50 units of Y (60 * 8) + (50 * 20) = $1,480

D 125 units of X (125 * 8) = $1,000

Optimal mix is the one giving the highest total contribution ($1,800)

Tutorial note: The best approach here is to calculate the total contribution for each option given in the question rather than trying to use the graph to solve.

Quiz: Limiting Factors in Production

A company manufactures two products (L and M) using the same material and labour. It holds no inventory. Information about the variable costs and maximum demands are as follows:

	Product L	Product M
	$ per unit	$ per unit
Material($4 per litre)	13	19
Labour ($7 per hour)	35	28
	Units	Units
Maximum monthly demand	6,000	8,000

Each month 50,000 litres of material and 60,000 labour hours are available.

Which one of the following statements is correct?

A.Material is a limiting factor but labour is not a limiting factor

B.Material is not a limiting factor but labour is a limiting factor

C.Neither material nor labour is a limiting factor
D.Both material and labour are limiting factors
Answer:
The correct answer is D.
WORKING
Material required to meet maximum demand:
6,000 * (13/4) + 8,000 * (19/4) = 57,500 litres
Material available: 50,000 litres
So material is a limiting factor
Labour required to meet maximum demand:
6,000 * (35/7) + 8,000 * (28/7) = 62,000 hours
Labour available: 60,000 hours
So labour is a limiting factor

Quiz: Maximising Profits with Limited Labour Hours
A company has the following production planned for the next four weeks. Figures reflect the full capacity level of operations. Output is planned to meet the maximum demand per product.

Product	A	B	C	D
	$ per unit	$ per unit	$ per unit	$ per unit
Selling price	160	214	100	140
Raw material cost	24	56	22	40
Direct labour cost	66	88	33	22
Variable overhead cost	24	18	24	18
Fixed overhead cost	16	10	8	12
Profit	30	42	13	48
Planned output	300	125	240	400
Direct labour hours per unit	6	8	3	2

Only 2,160 direct labour hours will be available for production for the next four weeks rather than the usual 4,320 hours.
Which product or products should be produced if profits are to be maximised over the next four weeks?
A.D and A
B.B and D
C.D only
D.B and C
Answer:
The correct answer is A.
WORKING

Product	A	B	C	D
Selling price per unit	$160.	$214.	$100	$140
Raw material cost	$24	$56	$22	$40
Direct labour cost at $11 per hour	$66	$88	$33	$22
Variable overhead cost		$24	$18	$24	$18

Contribution per unit	$46	$52	$21	$60
Direct labour hours per unit	6	8	3	2
Contribution per labour hour	$7.67	$6.50	$7	$30
Rank	2	4	3	1
Normal monthly hours (total units * hours per unit)	1,800	1,000	720	800

Only 2,160 labour hours will be available.

Therefore make all of D, then 1,360 hours' worth of A (2,160 – 800 hrs).

Quiz: Shadow Price of Material B

C Co uses material B, which has a current market price of $0.80 per kg. In a linear program, where the objective is to maximise profit, the shadow price of material B is $2 per kg. The following statements have been made:

1. Contribution will be increased by $2 for each additional kg of material B purchased at the current market price

2. The maximum price which should be paid for an additional kg of material B is $2

3. Contribution will be increased by $1.20 for each additional kg of material B purchased at the current market price

4. The maximum price which should be paid for an additional kg of material B is $2.80

Which of the above statements is/are correct?

A. 2 only

B. 2 and 3

C. 1 and 3

D. 1 and 4

Answer:

The correct answer is D.

Tutorial note: (2) is wrong as it reflects the common misconception that the shadow price is the maximum price which should be paid, rather than the maximum extra over the current purchase price. (3) is wrong but could be thought to be correct if (2) was wrongly assumed to be correct.

Quiz: Objective Functions and Constraint Statements

Highfly Co manufactures two products, X and Y, and any quantities produced can be sold for $60 per unit and $25 per unit respectively. Variable costs per unit are as follows:

	Product X	Product Y
	$	$
Materials (at $5 per kg)	15	5
Labour (at $6 per hour)	24	3
Other variable costs	6	5
Total	45	13

Next month, only 4,200 kg of material and 3,000 labour hours will be available. The company aims to maximise its profits each month.

Highfly Co will use a linear programming model to establish an optimum production plan. In the model x is the number of units of product X and y is the number of units of product Y.
Which of the following objective functions and constraint statements (relating to material and labour respectively) is correct?

Objective function   Material constraint   Labour constraint

A.60x + 25y   3x + y ≤ 4,200   4x + 0.5y ≤ 3,000

B.15x + 12y   3x + y ≥ 4,200   4x + 0.5y ≥ 3,000

C.15x + 12y   3x + y ≤ 4,200   4x + 0.5y ≤ 3,000

D.60x + 25y   3x + y ≥ 4,200   x + 0.5y ≥ 3,000

Answer:

The correct answer is C.

WORKING

Contribution for X = $15 ($60 − $45)

Contribution for Y = $12 ($25 − $13)

Objective function = 15x + 12y

Constraints:

Material = 3x + y ≤ 4,200 (as X uses 3 kg of material (15/5), Y uses 1 kg (5/5))

Labour = 4x + 0.5y ≤ 3,000 (as X uses 4 labour hrs (24/6), Y uses 0.5 hrs (3/6))

Quiz: Graphical Linear Programming

Which of the following statements about graphical linear programming with the objective of maximising profit is true?

1.If a resource constraint line does not pass through the optimum point on the graph, then the shadow price of that resource is zero

2.The shadow price is the maximum amount a company should pay for one more unit of a scarce resource

3.The slope or gradient of the objective function depends on the amount of resources available to the organisation

A.1 only

B.1 and 2 only

C.2 and 3 only

D.1, 2 and 3

Answer:

The correct answer is A.

Tutorial note: A resource with a constraint line that does not pass through the optimum point on the graph has a shadow price of zero; another unit of that resource will not change the optimum solution or the contribution earned.

The shadow price is the maximum premium amount that a company should be prepared to pay (i.e. in addition to its existing cost).

The slope or gradient of an objective function to maximise profit depends on the unit contributions of each product.

Quiz: Production Ranking

A manufacturing company uses machine C, which is operational for five hours a day to manufacture four products: W, X, Y and Z. Factory costs are $150,000 per day. The company uses throughput accounting and its objective is to maximise profits.

Information relating to these products is as follows:

Product	Production rate per machine hour (units)	Selling price per unit $	Material cost per unit $	Conversion cost per unit $
W	200	350	120	40
X	500	190	95	25
Y	400	270	160	20
Z	350	215	75	35

If the company is not able to increase the availability of machine C's operational hours, what is the production ranking of product Y?

A.First
B.Second
C.Third
D.Fourth

Answer:

The correct answer is D.

Tutorial note: As the products are all produced in the same factory, the cost per machine hour will be the same across all the products so they can be ranked on their throughput return per machine hour (otherwise they should be ranked on their throughput accounting ratio).

WORKING

Product	Production rate per machine hour	Throughput per unit (selling price–material cost per unit) $	Throughput per machine hour $	Ranking of products
W	200	(350 – 120)=230	46,000	3rd
X	500	(190 – 95)=95	47,500	2nd
Y	400	(270 – 160)=110	44,000	4th
Z	350	(215 – 75)=140	49,000	1st

Quiz: Price Elasticity of Demand

A shopkeeper finds that if he sets the price of a particular product at $9.00 per unit he sells, on average, 150 units of the product per month. However, at a price of $10.00 per unit, he sells an average of 110 units per month.

What is the price elasticity of demand for the product?

A.0.42
B.2.40

C.0.27
D.0.11
Answer:
The correct answer is B.
WORKING
Proportional change in quantity demanded = 40/150 * 100 = −26.6%
Proportional change in price = 1/9 * 100 = 11.1%
PED = −26.6/11.1 = −2.40
Tutorial note: By convention PED is stated without the minus sign.

Quiz: Minimum Price for Overseas Order
Posquade Co produces a single product. Budgeted sales volume for the next three month period is 50,000 units. Production capacity is 18,000 units per month. The following per unit information is available:

	$	$
Selling price		160
Variable cost	80	
Fixed overheads		33
		113
Profit		47

A potential overseas customer has requested a price for an initial order of 3,000 units over the next three months.
Assuming that Posquade Co wishes to ensure that short-term profit is not reduced if the enquiry becomes an order, what is the minimum price per unit that should be quoted?
A.$80
B.$113
C.$146
D.$160
Answer:
The correct answer is A.
Tutorial note: The minimum price is the relevant cost. Capacity is 54,000 per quarter (18,000 × 3). Domestic sales are 50,000 per quarter – so there is spare capacity of 4,000 units per quarter. The potential order from the overseas customer can be satisfied without any loss of domestic sales so there is no opportunity cost. The relevant cost is therefore the incremental cost, being the variable cost per unit.

Quiz: Selling Price Calculation
The cost per unit of a product manufactured by Arbor Co is:

	$
Direct material	12
Direct labour	17
Direct overheads	7

Share of fixed costs   12
Total cost   48
Arbor uses marginal cost plus pricing.
If Arbor seeks a 40% margin on sales, what is the selling price of the product?
A.$50.40
B.$60.00
C.$67.20
D.$80.00
Answer:
The correct answer is B.
WORKING
Variable (or marginal) cost is $36 per unit.
A margin of 40% means that cost is 60% of selling price.
Selling price is $36 * 100/60 = $60.

Quiz: Sales Pricing Policies
The following statements have been made about sales pricing policies.
Which Two of the following statements is true?
A.Market skimming will lead to a constant price throughout the product's life
B.Cost plus pricing will lead to profit being maximised
C.If the price elasticity of demand is greater than one, increasing the price of a product will reduce revenue.
D.Penetration pricing is appropriate when launching a new product into a competitive market.
Answer:
The correct answer is CD.
Tutorial note: In market skimming the initial high price is later reduced. Cost plus pricing ignores the market, so is not likely to maximise profits. The economist's model (marginal cost = marginal revenue) is the method that aims to maximise profits.

Quiz: Price Elasticity of Demand Calculation
If a 6% fall in price causes a 9% increase in demand for a particular item, what is its price elasticity of demand?
A.More than one
B.Positive but less than one
C.Zero
D.Between zero and minus one
Answer:
The correct answer is A.
WORKING
PED = % change in Q/% change in P = 9%/−6% = −1.5

Tutorial note: Although PED is almost invariable negative (due to the "inverse" relationship between price and quantity) it is usually stated without the minus sign. Therefore, more than one is the only appropriate answer.

Quiz: Marginal Cost Calculation

A company sells its product at $20 per unit in order to achieve its objective of maximising profits. Selling price ($P) is related to quantity sold (Q) by the following equation:

P = 30 − 0.0002Q

Assuming there are no opening or closing inventories, what is the marginal cost of production at the optimum level of output?

A.$0
B.$10
C.$15
D.$20

Answer:

The correct answer is B.

WORKING

P = 30 − 0.0002Q = 20

Therefore, 10 = 0.0002Q

So Q = 50,000.

MR = 30 − 0.0004Q = 30 − (50,000 * 0.0004) = $10

At optimum output level MC = MR, therefore MC = $10.

Quiz: Profit Maximisation Level

Edmonds Co has established its cost and demand functions. Total cost at various levels of output and the selling price that will achieve these levels of demand are as follows:

Production/sales (units)	Total cost $000	Selling price $ per unit
1,000	500	350
2,000	550	300
3,000	625	250
4,000	725	200
5,000	850	150
6,000	1,000	100

At what level of demand is profit maximised?

A.2,000
B.3,000
C.4,000
D.5,000

Answer:

The correct answer is B.

WORKING

Production	1,000	2,000	3,000	4,000	5,000	6,000
Revenue ($000)		350	600	750	800	750	600
Costs ($000)	500	550	625	725	850	1,000
Profit ($000)	(150)	50	125	75	(100)	(400)

Quiz: Demand Curve Description

Abel Co currently sells its major product line for $25, at which price monthly demand is 4,000 units. Market research has suggested that a cut in price of $1 would increase monthly sales by 800 units and that the demand curve is linear.

If P denotes selling price in $ and Q monthly demand in thousands of units, which of the following correctly describes the demand curve?

A.P = 30 − 0.00125Q

B.P = 30 − 1.25Q

C.P = 24 − 0.8Q

D.P = 24 − 800Q

Answer:

The correct answer is A.

WORKING

Demand curve is of the form P = a − bQ

b = −1/800 = −0.00125; a = 25 + (0.00125 * 4,000) = 30

Demand curve is P = 30 − 0.00125Q

Quiz: Price Strategy Identification

A company has entered two different new markets.

In market A, it is initially charging low prices so as to gain rapid market share while demand is relatively elastic.

In market B, it is initially charging high prices so as to earn maximum profits while demand is relatively inelastic.

Which price strategy is the company using in each market?

A.Penetration pricing in market A and price skimming in market B

B.Price discrimination in market A and penetration pricing in market B

C.Price skimming in market A and penetration pricing in market B

D.Price skimming in market A and price discrimination in market B

Answer:

The correct answer is A.

Quiz: Effect of Pricing Policy Change

A manufacturing company prices its product to give a mark-up of 100% on variable cost. If the selling price is increased by 50%, quantity sold is expected to be reduced by 40% but the variable cost per unit is expected to remain unchanged.

What will be the effect on revenue and total contribution of the change in pricing policy?

Revenue   Total contribution
A.Increase   Decrease
B.Decrease   Increase
C.Increase   Increase
D.Decrease   Decrease
Answer:
The correct answer is B.
WORKING
Assume a current selling price and number of unit sold, for example, 100 units at $100 each:

	Current $	Revised $
Sales	(100 * $100)=10,000	(60 * $150)=9,000
Variable cost	(100 * $50)=5,000	(60 * $50)=3,000
Contribution	5,000	6,000

Quiz: Marginal Revenue Calculation
 Product C currently sells 8,000 units per year at a price of $50 per unit. Market research shows that an increase in price of $2 would decrease annual sales by 800 units.
What is the marginal revenue at an output level of 6,000 units (to the nearest $)?
Answer:
The correct answer is 40.
Tutorial note: In the marginal revenue exam formula, MR = a − 2bQ, a is the price at which the demand (Q) would be zero, and b is the change in P/the change in Q.
WORKING
b = 2/−800 = −0.0025
a = 50 + (8,000 * 0.0025) = 70
MR = 70 − (2 * 0.0025)Q = 70 − 0.005Q.
At the given quantity of 6,000, MR = 70 − (0.005 * 6,000) = $40.

Quiz: Membership Fee Decision
The committee of a new golf club is setting the annual membership fee. The number of members depends on the membership fee charged and economic conditions. The forecast annual cash inflows from membership fees are shown below:

	Membership fee			
	$600	$800	$900	$1,000
Economic conditions:				
Low	360	400	360	320
Average		480	440	405	380
High	540	480	495	420

Applying the minimax regret criterion, what fee would be set by the committee?
A.$600
B.$800

C.$900
D.$1,000
Answer:
The correct answer is A.
WORKING
Table of regrets (opportunity cost):

	Membership fee			
	$600	$800	$900	$1,000
Economic conditions:				
Low	40	0	40	80
Average	0	40	75	100
High	0	60	45	120
Maximum regret	40	60	75	120

Therefore, a price of $600 will lead to the lowest maximum regret.

Quiz: Expected Values
The following statements have been made about expected values:
1.Expected value is of limited use for decisions regarding outcomes which will be repeated often
2.Using expected value in decision making can lead to the worst possible outcome being ignored
3.The reliability of expected value calculations is heavily influenced by the accuracy of the probabilities assigned to outcomes
Which of the statements are correct?
A.1, 2 and 3
B.1 and 2 only
C.1 and 3 only
D.2 and 3 only
Answer:
The correct answer is D.
Tutorial note: Expected value is most useful for decisions that are repeated often since the expected value is an average that would be expected if a decision were to be repeated many times, so statement (1) is incorrect.

Quiz: minimax regret criterion
NG is deciding which of four potential venues should be used to stage an entertainment event. Demand for the event may be low, medium or high depending on weather conditions on the day. The management accountant has estimated the contribution that would be earned for each of the possible outcomes and has produced the following regret matrix:

	Regret Matrix			
Venue	Ayefield	Beefield	Ceefield	Deefield
Demand				
Low	$0	$200,000	$300,000	$450,000

Medium $330,000 $110,000 $0 $150,000

High $810,000 $590,000 $480,000 $0

If the company applies the minimax regret criterion, which venue would be chosen?

A.Ayefield

B.Beefield

C.Ceefield

D.Deefield

Answer:

The correct answer is D.

WORKING

Maximum regret if Ayefield venue is chosen is $ 810,000

Maximum regret if Beefield venue is chosen is $ 590,000

Maximum regret if Ceefield venue is chosen is $ 480,000

Maximum regret if Deefield venue is chosen is $ 450,000

Therefore if NG wants to minimise the maximum regret it should stage the entertainment event at the Deefield venue.

Quiz: Value of Perfect Information

FP can choose from three mutually exclusive projects. The net cash flows from the projects will depend on market demand. All of the projects will last for only one year. The forecast net cash flows and their associated probabilities are given below:

Market demand	Weak	Average	Good
Probability	0.30	0.50	0.20
Project A	400	500	600
Project B	300	350	400
Project C	500	450	650

FP can commission a forecast that would tell it with certainty what demand conditions will be before the decision is made about which project to invest in.

What is the maximum amount that FP should pay for the forecast?

A.$530

B.$505

C.$25

D.$0

Answer:

The correct answer is C.

Tutorial note: The maximum amount that FP should pay is equal to the value of perfect information. This is the expected value (EV) with perfect information less EV without information.

WORKING

EV without information

Project A ($400 * 0.3) + ($500 * 0.5) + ($600 * 0.2) = $490

Project B ($300 * 0.3) + ($350 * 0.5) + ($400 * 0.2) = $345

Project C ($500 * 0.3) + ($450 * 0.5) + ($650 * 0.2) = $505

Therefore, without perfect information, Project C would be chosen, as it has the highest EV, $505.

EV with perfect information

If forecast predicts	Choose	Outcome	Probability
Weak demand	Project C. 500	0.3	
Average demand	Project A. 500	0.5	
Good demand	Project C. 650	0.2	

EV with perfect information is (500 * 0.3) + (500 * 0.5) + (650 * 0.2) = $530
Therefore, value of perfect information is = ($530 – $505) = $25

Quiz: Expected value of the decision
A company is considering whether to develop and market a new product. The cost of developing the product is estimated to be $150,000. There is a 70% probability that the development will succeed and a 30% probability that the development will be unsuccessful.
If the development is successful, the product will be marketed. There is a 50% chance that the marketing will be very successful and the product will make a profit of $250,000. There is a 30% chance that the marketing will be reasonably successful and the product will make a profit of $150,000 and a 20% chance that the marketing will be unsuccessful and the product will make a loss of $80,000. These profit and loss amounts take account of the $150,000 development cost.
What is the expected value of the decision to develop and market the product?
A.$154,000
B.$107,800
C.$62,800
D.$4,000
Answer:
The correct answer is C.
WORKING
The following decision tree shows all profit and loss outcomes after deducting the $150,000 development costs:
Node A -> successful development -> Node B -> very successful marketing $250,000
Node A -> successful development -> Node B -> reasonable successful $150,000
Node A -> successful development -> Node B -> unsuccessful marketing ($80,000)
Node A -> unsuccessful development -> ($150,000)

EVB = 154,000 ((250,000 * 50%) + (150,000 * 30%) + (−80,000 * 20%))
EVA = (154,000 * 70%) + (−150,000 * 30%) = 62,800
Therefore the EV of the decision to market the product is $62,800.

Quiz: Decision based on expected value criterion
Tree Co is considering employing a sales manager. Market research has shown that a good sales manager can increase profit by 30%, an average one by 20% and a poor one by 10%. Experience has shown that the company has attracted a good sales manager 35% of the time, an average one 45% of the time and a poor one 20% of the time.

The company's normal profits are $180,000 per year and the sales manager's salary would be $40,000 per year.

Based on the expected value criterion, which of the following represents the correct advice which Tree Co should be given?

A.Do not employ a sales manager as profits would be expected to fall by $1,300

B.Employ a sales manager as profits will increase by $38,700

C.Employ a sales manager as profits are expected to increase by $100

D.Do not employ a sales manager as profits are expected to fall by $39,900

Answer:

The correct answer is A.

WORKING

New profit figures before salary paid:

Good manager: $180,000 * 1.3 = $234,000

Average manager: $180,000 * 1.2 = $216,000

Poor manager: $180,000 * 1.1 = $198,000

EV of profits = (0.35 * $234,000) + (0.45 * $216,000) + (0.2 * $198,000) = $81,900 + $97,200 + $39,600 = $218,700

Deduct salary cost and EV with manager = $178,700

Therefore, do not employ manager as profits will fall by $1,300.

Quiz: decision criterion of minimax regret

The Mobile Sandwich Co prepares sandwiches which it delivers and sells to employees at local businesses each day.

Demand varies between 325 and 400 sandwiches each day. As the day progresses, the price of the sandwiches is reduced and, at the end of the day, any sandwiches not sold are thrown away. The company has prepared a regret table to show the amount of profit which would be foregone each day at each supply level, given the varying daily levels of demand.

Regret table

		Daily supply of sandwiches (units)		
		325	350	375	400
	325	$0	$21	$82	$120
Daily demand	350	$36	$0	$44	$78
for sandwiches (units)	375	$82	$40	$0	$34
	400	$142	$90	$52	$0

Applying the decision criterion of minimax regret, how many sandwiches should the company decide to supply each day?

A.325

B.350

C.375

D.400

Answer:

The correct answer is C.

WORKING

Maximum regret at each supply level:
At 325: $142
At 350: $90
At 375: $82
At 400: $120
The minimum regret is $82 at 375

Quiz: Bagnall Co Budgeting Approach:
The finance function of Bagnall Co has been asked to oversee the production of the company's budgets for the forthcoming year. In its initial instructions to the company's various divisions the finance function has stressed that once budgets for next year have been formally agreed steps will be taken to maintain their ongoing relevance by undertaking a monthly review of budgets for forthcoming months in the light of performance in earlier months.
Which of the following best describes this approach to budgeting?
A.Flexible budget
B.Incremental budget
C.Zero-based budget
D.Rolling budget
Answer:
The correct answer is D.
Tutorial note: Rolling budgeting means that as each month goes by, the budgets for the months ahead are reviewed and, if necessary, revised so that they remain relevant for the remainder of the budget period.

Quiz: Flexible Budget Characteristics
Which THREE of the following statements about a flexible budget are correct?
A.It allows managers to plan for alternative contingencies
B.It makes no differentiation between fixed and variable costs
C.It assists in identifying limiting factors
D.It provides useful control information
E.Managers constantly change the budget if it is too hard to achieve
F.At the end of the period it is restated to reflect the actual level of activity
Answer:
The correct answers is A, C and D.
Tutorial note: A flexible budget is a series of budgets based on different activity levels; it is therefore necessary to distinguish fixed and variable costs.

Quiz: Amelpa Co Maintenance Cost Allocation
Amelpa Co manufactures a range of industrial products. The budgeted costs of the maintenance section for the current 12 month period have been analysed as follows:
$
Routine maintenance 151,000

Production line set up 42,000

Total   193,000

The budget was prepared on the basis that there will be 720 set ups and that 10,080 machine hours will be worked. The company has received an enquiry for an order which requires three set ups and will take 56 machine hours.

How much (to the nearest $) should be included in the cost of the order in respect of maintenance costs?

A.$804

B.$1,014

C.$1,072

D.$4,106

Answer:

The correct answer is B.

WORKING

Set up $42,000/720 set ups = $58.33 per set up * 3 set ups = $175

Routine $151,000/10,080 hours = $14.98 per hour * 56 hours = $839

Total = $1,014

Quiz: Igloo Co Sales Performance Adjustment

Igloo Co had budgeted for sales of $30.9m within a market worth $61.8m. When the budget was drafted, it was assumed that inflation would be 3%. After the end of the budget period, it was discovered that inflation had been 2% and that the market had been worth $65m.

What is the sales revenue figure which should be used when assessing company performance (to one decimal place)?

Answer:

The correct answer is 32.5 .

WORKING

Sales forecast adjusted for inflation only: $30.9m * 1.02/1.03 = $30.6m

$61.8m market worth would have included inflation of 3%, so adjusting this for actual 2% inflation; $61.8 * 1.02/1.03 = $61.2m

Market growth was $65m/$61.2m = 1.0621 (i.e. 6.21%)

Therefore, company performance should be assessed against: $30.6m * 1.0621 = $32.5m

Tutorial note: Alternatively, consider that the budget was to achieve 50% of the market ($30.9m/$61.8m * 100) and 50% of the actual market size is $32.5m (50% * $65m).

Quiz: Budget Type Statements

The following statements have been made about different types of budgets:

1.An annual budget that can be broken down into monthly budgets, which differ depending on the number of working days in each month, is called a flexible budget.

2.An annual budget set before the start of a year based on estimated sales and production volumes is called a fixed budget.

Which of the above statements is/are true?

	Statement 1	Statement 2
A.	True	False
B.	False	True
C.	False	False
D.	True	True

Answer:

The correct answer is B.

Tutorial note: (1) is incorrect. A flexible budget is essentially a series of flexed budgets. A number of flexed budgets are prepared at the start of the year, based on different activity levels (e.g. where fixed costs are "stepped"). At the end of the year, actual results are compared against the budget whose activity is closest to the actual activity level.

Quiz: X Co Budgetary Control Type

X Co uses rolling budgeting, updating its budgets on a quarterly basis. After carrying out the last quarter's update to the cash budget, it projected a forecast cash deficit of $400,000 at the end of the year. Consequently, the planned purchase of new capital equipment has been postponed. Which of the following types of control is the sales manager's actions an example of?

A.Feedforward control

B.Negative feedback control

C.Positive feedback control

D.Double loop feedback control

Answer:

The correct answer is A.

Tutorial note: This is an example of feedforward control as the manager is using a forecast to assist in making a future decision.

Quiz: Zero-Based Budgeting Statements

The following statements have been made about zero based budgeting:

1.Employees will focus on eliminating wasteful expenditure

2.Short-term benefits could be emphasised over long-term benefits

Which of the above statements is/are true?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is D.

Tutorial note: (1) is true – ZBB focusses on only including costs relating to activities that the organisation wishes to continue to perform. Costs will not be included in the budget simply because they were in previous years' budgets.

(2) is true. Budgets are mainly financial, and management may focus on increasing budgeted profits by removing expenses on activities that may benefit the organisation in the longer term.

Quiz: Budget System Change Costs
 The following statements have been made about changing budgetary systems:
1.The costs of implementation may outweigh the benefits
2.Employees will always welcome any new system which improves planning and control within the organisation
Which of the above statements is/are true?
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:
The correct answer is A.
Tutorial note: (1) is true as it is possible that the costs of a new budgetary system may outweigh the benefits. (2) is not true. Employees are likely to resist new budgetary systems as they may involve additional work, and may be viewed as managers trying to achieve greater control.

Quiz: Bright Co Rolling Budget Estimate
Bright Co produces quarterly rolling budgets and had forecast the costs of material purchases for the next four quarters (Q1, Q2, Q3 and Q4). Purchases for Q1 were budgeted to be $220,000 and it was anticipated that the cost of materials would rise at a rate of 2% per quarter.
At the end of Q1:
Actual material purchases were recorded at $210,000. This was due to a change of material supplier during the quarter.
A revised estimate for the increase in material purchase costs was made. The rise was now predicted to be only 1% per quarter.
The budget was updated.
What estimate for total annual material purchases should be recorded in the updated budget?
A.$852,684
B.$861,211
C.$896,754
D.$1,071,211
Answer:
The correct answer is B.
Tutorial note: When using rolling budgets, two things happen at the end of an accounting period (month or quarter):
the remaining budget for the year is updated based on the actual results and the up to date information available, and
a further accounting period (month or quarter) is added.
In this way there will always be a full year's budget available.
WORKING
The total annual material purchases will be the sum of the next four quarters (i.e. Y1 Q2, Q3 and Q4) plus the first quarter of the following year (Y2 Q1). The budgets for these quarters will have

been updated based on the actual material purchases from Q1 ($210,000) and the predicted cost increase of 1%.

	Y1 Q1 Actual	Y1 Q2 Budget	Y1 Q3 Budget	Y1 Q4 Budget	Y2 Q4 Budget
Material purchases	$210,000	$212,100	$214,221	$216,363	$218,527

The total annual material purchases figure in the updated rolling budget would therefore be $212,100 + $214,221 + $216,363 + $218,527 = $861,211

Quiz: Parma Co Budget Preparation Method

Parma Co requires all divisions to prepare their own budgets and these are then approved by head office. The current managing director of Parma Co believes that it would be better if all budgets for the divisions are prepared centrally at head office, and divisional managers told that they must aim to achieve them.

Which of the following is an advantage of non-participative budgeting as compared to participative budgeting?

A.It increases motivation

B.It is less time consuming

C.It increases acceptance

D.The budgets produced are more attainable

Answer:

The correct answer is B.

Tutorial note: In comparison to participative budgeting, an advantage of non-participative budgeting is that it should be less time consuming, as less collaboration will be required in order to produce the budgets.

Quiz: Variable Cost Calculation

The budgeted costs for a company at different levels of output are as follows:

Output	Total costs $000
24,000 units	304
30,000 units	352
35,000 units	392

The variable cost per unit will reduce by 5% for output levels above 40,000 units. The reduced cost per unit will apply to all units. Fixed costs will increase by $30,000 for output levels above 38,000 units.

What are the budgeted total costs (to the nearest $000) for an output level of 45,000?

$ 000

Answer:

The correct answer is 484.

WORKING

Using the high-low method to separate fixed and variable costs:

Variable cost per unit = ($392,000 − $304,000)/(35,000 − 24,000) = $8 per unit

Fixed costs = $304,000 – (24,000 * $8) = $112,000

At 45,000 units
Variable costs (45,000 * $8 * 0.95) = $342
Fixed costs ($112,000 + $30,000) = $142
Total costs $484

Quiz: Hightech Variable Overhead Cost
Hightech is a computer hardware repair company. The total overhead costs and labour hours booked to jobs for the last two months have been:

	April	May
Total overhead costs	$107,980	$101,050
Total labour hours	2,560	2,350

What is the variable overhead cost per labour hour?
A.$33.00
B.$42.18
C.$42.57
D.$43.00
Answer:
The correct answer is A.
WORKING
Using the high-low method, variable cost per hour = ($107,980 – $101,050)/(2,560 – 2,350) = $33 per hour

Quiz: Demdisc Overhead Calculation
Demdisc manufactures computer equipment. Data extracted from the budget for three months is shown below:

	Month 1	Month 2	Month 3
Total overheads	$442,500	$439,060	
Machine hours	7,500	7,420	7,150

What will be the budgeted total overheads for Month 3?
A.$421,850
B.$422,463
C.$423,083
D.$427,450
Answer:
The correct answer is D.
WORKING
Based on month 1 & 2, use high low method to find variable overheads:
Increase in overheads = $3,440
Increase in hours = 80

Variable cost per hour: $3,440/80 = $43
Fixed cost = $442,500 – (7,500 * $43)
or $439,060 – (7,420 × $43) = $120,000
Therefore, 7,150 hours at $43 = $307,450 + $120,000 = $427,450

Quiz: Cost Estimate for Stepped Fixed Costs
A company is estimating its costs based on past information. The total costs incurred at different levels of output were as follows:
Output Total costs
(units) $
160,000   2,420,000
185,000   2,775,000
190,000   2,840,000
Using the high-low method to separate total costs into their fixed and variable elements the company has now established that there is a stepped increase in fixed costs of $30,000 when output reaches 180,000 units. Inflation is ignored.
What estimate of total costs should be made for an output of 175,000 units?
A.$2,645,000
B.$2,275,000
C.$2,615,000
D.$2,630,000
Answer:
The correct answer is C.
WORKING
Cost before stepped increase = $2,840,000 – $30,000 = $2,810,000
Variable cost per unit = ($2,810,000 – $2,420,000)/(190,000 – 160,000) = $390,000/30,000 = $13
Fixed costs at 190,000 units = $2,840,000 – (190,000 * $13) = $370,000
Total costs at 175,000 units = (175,000 * $13) + ($370,000 – $30,000) = $2,615,000

Quiz: Flexed Production Overhead Budget
When the budget for the three months to 30 April was prepared, the expected level of production was 20,000 units and the budgeted production overhead was $178,400. This included $42,000 of fixed costs, with the remainder estimated to vary with the level of production.
Actual production in the three months to 30 April was 21,220 units.
What is the flexed production overhead budget for the three months to 30 April?
A.$144,720.40
B.$186,720.40
C.$189,282.40
D.$231,282.40
Answer:

The correct answer is B.
WORKING

$

Total overheads   178,400
Fixed costs   42,000
Variable costs 136,400   or $6.82 per unit produced
At production level of 21,220, variable costs are $144,720.40
Therefore total costs are $186,720.40

Quiz: Learning Curve Theory
Which of the following is an assumption of learning curve theory?
A.The reduction in unit time will follow a predictable pattern
B.Unit time will decrease at an increasing rate
C.The time required to do a task will vary randomly each time the task is repeated
D.Learning will not be transferred from one worker to the next
Answer:
The correct answer is A.
Tutorial note: The decrease in time per unit decreases, not increases, as production increases.

Quiz: Learning Curve Time Calculation
A 75% learning curve has been determined to be appropriate for a particular task. (For a learning rate of 75% the value of the index of learning b is -0.4150375.) The initial timing of the person performing that job was 50 minutes.
If the task needs to be performed 500 times, how many minutes of work will be required (to nearest minute)?
A.3,184 minutes
B.1,896 minutes
C.1,379 minutes
D.636 minutes
Answer:
The correct answer is B.
WORKING
Calculating the cumulative average time per unit for 500 times, using the formula:
Y = a* x raised to the power of b:
a = 50 minutes, x = 500, b = −0.4150375
Y = 3.791. This is the cumulative average time per job.
Therefore total time for 500 = 500 * 3.791 = 1,895.5 minutes.

Quiz: Learning Rate Calculation
A hair stylist performed a new haircut for the first time in 50 minutes.
What is the learning rate if it took the stylist 35 minutes to complete a second haircut?
A.15%

B.30%

C.70%

D.85%

Answer:

The correct answer is D.

WORKING

Cumulative average for two times = ½ (50 + 35) = 42.5

Therefore, as cumulative output doubled (from 1 to 2 units), cumulative average time fell to 85% (42.5/50).

Quiz: Assembly Time Analysis:

Big Tech Co assembles desktop computers. The work is very labour intensive, and the first time a member of staff assembles a computer, it takes 100 minutes. A learning rate of 95% occurs, but this only applies to the first n units of production.

The management accountant has recorded the total time taken by a new member of staff to assemble the first 25 units of output. Extracts from his table are as follows:

Cumulative output (units)	Cumulative total time (minutes)
13	1,074.6
14	1,151.6
15	1,227.6
16	1,303.6
…	…
20	1,607.5
21	1,683.5
22	1,759.5

A steady state is reached at the nth unit of output, and all subsequent units take the same amount of time to assemble as the nth unit.

What is the value of n (in units)?

Answer:

The correct answer is 15 .

Tutorial note: All subsequent units take the same time as the nth unit. It is therefore necessary to calculate the "incremental time" for each unit to find at what point the incremental time per unit becomes constant.

WORKING

Cumulative Output (units)	Cumulative total time (minutes)	Incremental time (minutes)
13	1,074.6	
14	1,151.6	77
15	1,227.6	76
16	1,303.6	76
…	…	
20	1,607.5	

| 21 | 1,683.5 | 76 |
| 22 | 1,759.5 | 76 |

The 16th unit took the same time as the 15th unit, meaning that the value of n is 15.

Quiz: Learning Rate Consistency

General Autos is a car manufacturer. Historically, when a new model of car was introduced a learning rate of 80% applied. However, a new model has just been introduced, and a slower learning rate of has been experienced.

Whether the following statements are consistent with the change in the rate of learning

1. The factory producing the new model is much more automated than it was for previous models

2. Due to new working practices, staff have to perform much more complex tasks

Statement 1   Statement 2
A. CONSISTENT   NOT CONSISTENT
B. NOT CONSISTENT CONSISTENT
C. CONSISTENT   CONSISTENT
D. NOT CONSISTENT NOT CONSISTENT

Answer:

The correct answer is A.

Tutorial note: More automated factories produce less scope for learning, so lead to slower learning rates; this could be one factor in the slower rate. More complex processes give more scope for learning so should lead to a faster learning rate.

Quiz: High-Low Method Application

The following table shows the number of clients who attended a particular accountancy practice over the last four weeks and the total costs incurred during each of the weeks:

Week	Number of clients	Total cost $
1	400	36,880
2	440	39,840
3	420	36,800
4	460	40,000

Applying the high low method to the above information, which of the following could be used to forecast total cost ($) from the number of clients expected to attend (where x = the expected number of clients)?

A. 7,280 + 74x

B. 16,080 + 52x

C. 3,200 + 80x

D. 40,000/x

Answer:

The correct answer is B.

WORKING
460 − 400 = 60 clients
$40,000 − $36,880 = $3,120
VC per unit = $3,120/60 = $52
Therefore FC = $40,000 − (460 * $52) = $16,080

Quiz: Learning Curve Calculation for new engineer
Tech World is a company which manufactures mobile phone handsets. Based on past experience, when a new design engineer is employed, there is a learning curve with a 75% learning rate which exists for the first 15 jobs.
Note: At the learning rate of 75%, the learning factor (b) is equal to −0.415.
A new design engineer has just completed his first job in five hours.
How long would it take the design engineer to complete the sixth job?
Answer:
The correct answer is 1.442 .
WORKING
Using Y = a * x raised to the power of b
Average time for 6 jobs: 5 * 6 raised to the power of −0.415 = 2.377 hours
Total time required for 6 jobs = 6 * 2.377 hours = 14.262 hours ⋯ ①
Average time for 5 jobs: 5 * 5 raised to the power of −0.415 = 2.564 hours
Total time required for 5 jobs = 5 * 2.564 hours = 12.820 hours ⋯ ②
Time required for 6th job = ① − ② = 14.262 − 12.820 = 1.442 hours

Quiz: Sales Forecasting
A company uses a multiplicative time series model to forecast sales. The trend in sales is linear and is described by the equation: Trend = 400 + 10 T, where T = 1 denotes the first quarter of 20X6, T = 2 denotes the second quarter of 20X6 etc.
The average seasonal variations are as follows:

Quarter	1	2	3	4
% Variation	−30	+ 40	+ 10	−20

What is the sales forecast for the third quarter of 20X7?
A.423 units
B.480 units
C.517 units
D.3,157 units
Answer:
The correct answer is C.
WORKING
Forecast = Trend × Seasonal = (400 + 10T) * S = (400 + (10 × 7)) * 1.1 = 517 units

Quiz: Correlation Coefficient Interpretation

If the coefficient of determination between two variables is 0.96, which of the following can be stated with certainty?

A.The variables are strongly positively correlated

B.The variables are strongly negatively correlated

C.The variables have little correlation between them

D.None of the above

Answer:

The correct answer is D.

Tutorial note: If the coefficient of determination is 0.9604, the correlation coefficient is $\sqrt{0.96}$ = +0.98 or −0.98. This shows the variables are strongly correlated, but not whether the correlation is positive or negative.

Quiz: Linear Regression in Cost Estimation

Which TWO of the following statements about the use of linear regression analysis in cost estimation are true?

A.It provides more accurate estimates than the high low technique

B.It can only be used to estimate variable cost

C.It assumes that cost behaviour is linear

D.It only takes into account two observations of cost and output

Answer:

The correct answers is A and C.

Tutorial note: The fixed cost will be estimated also (at the point of intercept on the y axis). It is the high-low method that uses only two observations.

Quiz: Learning Rate Calculation for new product

A company has started production of a new product and has found that the first 10 units of production took 120 hours. The next 30 units produced took a further 150 hours.

What was the learning rate?

A.56.25%

B.66.7%

C.75%

D.80%

Answer:

The correct answer is C.

WORKING

	Cumulative output (units)	Cumulative total time (hours)	Incremental time (hours)
1st batch	10	120	
Next 3 batches	40	270	150

The cumulative average time per batch is 67.5 hours (270/4) and cumulative output has doubled twice (from 10 to 20 units and from 20 to 40). So, expressing this as an equation and then solving to find the learning rate, r:

$67.5 = 120r^2$.

$67.5/120 = r^2$

$0.5625 = r^2$

$\sqrt{0.5625} = r$

$0.75 = r$

Therefore, the learning rate is 75%.

Quiz: Linear Regression in Forecasting

Which TWO of the following statements about forecasting based on simple linear regression are correct?

A. It can account for the effect of multiple independent variables

B. It assumes that historical data is a reliable guide to the future

C. It is not suitable when the variables show strong negative correlation

D. Cost forecasts using extrapolation are less accurate than those using interpolation

Answer:

The correct answers is B and D.

Tutorial note: One assumption of simple linear regression is that the dependent variable is only affected by one independent variable; it cannot deal with multiple independent variables. Another assumption is that what happened in the past (as reflected in historical data) will continue in the future.

Simple linear regression is suitable when there is correlation between two variables; this can be positive or negative correlation. Interpolation (i.e. forecasting within the range of the original data) is more reliable than extrapolation (i.e. forecasting outside the range of the original data).

Quiz: Correlation Analysis

A company wants to know whether there is a correlation between the number of labour hours worked (x) and the value of factory overheads (y). The following figures have been calculated:

Σx	89
Σy	1,063
Σx^2	1,047
Σy^2	150,251
Σxy	12,475
n	8

Which of the following statements, if any, is/are correct?

1. The correlation coefficient is 0.9 (to one decimal place)

2. 90% of the variation in factory overheads is explained by changes in the number of labour hours worked

A. 1 only

B.2 only
C.Both 1 and 2
D.Neither 1 nor 2
Answer:
The correct answers is A.
Tutorial note: The correlation coefficient (r) must be calculated to decide if statement (1) is correct.
The formula for this is given on the formula sheet:
r = (nΣxy − ΣxΣy)/ √ [(nΣx²–(Σx)²)(nΣy²–(Σy)²)]
WORKING
Top line: nΣxy − ΣxΣy = (8 * 12,475) – (89 * 1,063) = 5,193
Bottom line: √ [nΣx²–(Σx)²][nΣy²–(Σy)²] = √ [(8 x 1,047 – 89²)(8 * 150,251 – 1,063²)] = √ (455 * 72,039) = 5,725
Therefore r = 5,193/5,725 = 0.907 = 0.9 to one decimal place. Statement 1 is correct.
Statement 2 relates to the coefficient of determination (r²).
r² = 0.9² = 0.81 = 81%. This means that 81% of the variation in factory overheads is explained by the change in the number of labour hours worked and therefore statement 2 is incorrect.

Quiz: Basic Standard Definition
What is a basic standard?
A.A standard set at an ideal level, which makes no allowance for normal losses, waste and machine downtime
B.A standard which assumes an efficient level of operation, but which includes allowances for factors such as normal loss, waste and machine downtime
C.A standard which is kept unchanged over a period of time
D.A standard which is based on current price levels
Answer:
The correct answer is C.
A standard which is kept unchanged over a period of time

Quiz: Management by Exception
Which of the following best describes "management by exception"?
A.Using management reports to highlight exceptionally good performance, so that favourable results can be built upon to improve future outcomes
B.Sending management reports only to those managers who are able to act on the information contained within the reports
C.Focusing management reports on areas which require attention and ignoring those which appear to be performing within acceptable limits
D.Appointing and promoting only exceptional managers to areas of responsibility within the organisation
Answer:
The correct answer is C.

Focusing management reports on areas which require attention and ignoring those which appear to be performing within acceptable limits

Quiz: Flexed Budgets
The following statements have been made about flexed budgets.
1.The flexed budget is prepared at the same level of activity as actual output
2.The difference between the flexed budget profit and the actual profit shows the effect on profit of operating at a level of activity that differs from the expected level
Which of the above statements is true/false?
Statement 1   Statement 2
A.True   False
B.False   True
C.True   True
D.False   False
Answer:
The correct answer is A.
Tutorial note: The effect on profit of operating at a different level of activity to the one budgeted is the difference between the flexed budget profit and the originally budgeted profit (not the actual profit).

Quiz: Standard Costing Systems
The following statements have been made about different types of standards in standard costing systems:
1.Basic standards provide the best basis for budgeting because they represent an achievable level of productivity
2.Ideal standards are short-term targets and useful for day-to-day control purposes
Which of the above statements is/are true?
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:
The correct answer is C.
Tutorial note: Basic standards are long run underlying averages. They may be useful for comparing performance over time, but will not be useful for budgeting as they are likely to be too easy to achieve, therefore not stretching the managers.
An ideal standard assumes perfect operating conditions. As these are not likely to occur the standard will not be achievable, therefore not useful for monitoring day to day performance.

Quiz: Fixed Overhead Expenditure Variance

Hurst Co budgeted to produce 16,000 units of a product and sell 15,000 units. There was no opening inventory. The standard cost per unit of the product is as follows:

	$
Direct materials	20
Direct labour	15
Variable production overheads	5
Fixed production overheads	10
	50

Standard selling price 80

Actual production was 18,500 units and 17,000 units were sold. Actual fixed production overheads were $165,000.

What was the fixed overhead expenditure variance for the period?

A.$15,000 adverse
B.$5,000 adverse
C.$5,000 favourable
D.$20,000 favourable

Answer:

The correct answer is B.

WORKING

Budgeted fixed overhead expenditure = $10 * 16,000 = $160,000

Expenditure variance = Actual expenditure − budgeted expenditure = $165,000 − $160,000 = $5,000 adverse

Quiz: Ideal Standards

Which of the following are consequences of using ideal standards?

1.Variance analysis is likely to produce adverse results
2.Demotivation of staff usually becomes a problem
3.Allowances for normal efficiency levels are made
4.Standards can become more useful for long-term targets

A.1 and 2 only
B.1, 2 and 3
C.1, 2 and 4
D.3 and 4

Answer:

The correct answer is C.

Tutorial note: Ideal standards assume perfect operating conditions, with no allowance for wastage or idle time. This is likely to result in adverse variances, therefore (1) is correct. Setting standards at a higher level than is likely to be achieved can demotivate, therefore (2) is correct. Ideal standards can be useful for setting long-term targets as efforts are made to reduce inefficiencies in processes over time, therefore 4 is correct.

(3) is incorrect as it describes an attainable standard.

Quiz: Sales Volume Contribution Variance
The budgeted selling price of one of C's range of chocolate bars was $6.00 per bar. At the beginning of the budget period market prices of cocoa increased significantly and C decided to increase the selling price of the chocolate bar by 10% for the whole period. C also decided to increase the amount spent on marketing and as a result actual sales volumes increased to 15,750 bars which was 5% above the budgeted volume. The standard contribution per bar was $2.00. However, a contribution of $2.25 per bar was actually achieved.
How much was the favourable sales volume contribution variance for the period?
A.$1,500.00
B.$1,687.50
C.$3,750.00
D.$3,937.50
Answer:
The correct answer is A.
WORKING
Sales volume contribution variance = (15,750 – 15,000) * $2.00 = $1,500 Favourable
Budgeted sales were 15,750/1.05 = 15,000 units

Quiz: Material Price Variance
Which one of the following is UNLIKELY to be the reason for an adverse material price variance?
A.The budget incorporated an assumption of price inflation of 4% and the actual rate is 6%
B.To reduce waste, a higher grade of material has been purchased
C.A major supplier has introduced a discount scheme which had not been planned for
D.An inexperienced purchase clerk ordered materials from four different suppliers
Answer:
The correct answer is C.
Tutorial note: A discount scheme that has not been planned for – this would mean that actual price was less than expected, leading to a favourable price variance. All other options would most likely lead to an adverse price variance.

Quiz: Adverse Material Usage Variance
Which one of the following is most likely to be the explanation for an adverse material usage variance?
A.A major supplier of material has reduced the rate of trade discount
B.Rates of pay have been increased
C.Quality standards have been increased
D.Unforeseen material price rises have been incurred
Answer:
The correct answer is C.
Tutorial note: The supplier reducing the rate of trade discount and unforeseen material price rises would affect the price variance, not the usage variance. The increase in pay rates would relate to labour variances rather than materials. An increase in quality standards would lead to

the rejection of poor-quality materials (as a more significant proportion of materials introduced into production are deemed unsatisfactory).

Quiz: Favorable Labour Efficiency Variance
Which one of the following is most likely to be the reason for a favourable labour efficiency variance?
A.An ideal standard was used as part of a quality improvement programme
B.A shortage of skilled staff meant that more trainees had been recruited
C.Lower grade material was purchased
D.Staff have recently been trained in material handling techniques
Answer:
The correct answer is D.
Tutorial note: If staff have been trained in material handling, they will be more efficient in this activity, leading to improved productivity.

Quiz: Material and Labour Efficiency Variance
Nujig Co reduced its quality specification for raw materials. The lower quality of materials meant that a batch of products had to be reworked.
Which is the most likely effect on the variances for materials usage and labour efficiency.
Materials usage Labour efficiency
A.Adverse   Favourabe
B.Adverse   Adverse
C.Favourabe   Favourabe
D.Favourabe   Adverse
Answer:
The correct answer is B.
Tutorial note: Reworking of a batch would mean that more labour was used than expected, and the original materials used were probably wasted leading to an overuse of materials.

Quiz: Fixed Production Overhead Capacity Variance
A manufacturing company operates a standard absorption costing system. Last month 25,000 production hours were budgeted and the budgeted fixed production overhead cost was $125,000. Last month the actual hours worked were 24,000 and the standard hours for actual production were 27,000.
What was the fixed production overhead capacity variance for last month?
A.$5,000 adverse
B.$5,000 favourable
C.$10,000 adverse
D.$10,000 favourable
Answer:
The correct answer is A.

WORKING
Capacity variance:
Actual hours   24,000
Budgeted hours   25,000
Under capacity (hours)   1,000
* standard overhead absorption rate (125,000/25,000) = 5
Capacity variance (adverse) 5,000

Quiz: Labour Efficiency Variance
XYZ uses standard costing. It assembles a component for which the following standard data is available:
Labour hours per assembly   24
Labour cost per hour $8
Last month 850 assemblies were made, there was no rate variance and an adverse efficiency variance of $4,400 arose.
How many labour hours were actually worked?
Answer:
The correct answer is 20,950.
WORKING
Actual labour hours Not given
Standard hours for actual output (850 * 24) = 20,400
Excess hours worked (variance is adverse) Not given
× standard rate per hour 8
Labour efficiency variance 4,400
Working "backwards":
Excess hours used (4,400/8) = 550
Therefore, actual hours worked (20,400 + 550) = 20,950

Quiz: Adverse Material Price Variance
The standard direct material cost per unit for a product is calculated as follows:
10.5 litres at $2.50 per litre
Last month the actual price paid for 12,000 litres of material used was 4% above standard and the direct material usage variance was $1,815 favourable. No inventory of material is held.
What was the adverse direct material price variance for last month?
A.$1,000
B.$1,200
C.$1,212
D.$1,260
Answer:
The correct answer is B.
WORKING
Adverse price variance (0.04 * 2.50 * 12,000) = $1,200

Quiz: Fixed Overhead Expenditure for a company

A company operates a standard marginal costing system. Last month its actual fixed overhead expenditure was 10% above budget resulting in a fixed overhead expenditure variance of $36,000.

What was the actual expenditure on fixed overheads last month?

A.$324,000

B.$360,000

C.$396,000

D.$400,000

Answer:

The correct answer is C.

WORKING

Let x   = Budgeted expenditure

1.1x– x = 36,000

x   = 360,000

1.1 x   = 396,000 = Actual expenditure ($)

Quiz: Sales Price Variance for a company

Last month a company budgeted to sell 8,000 units at a price of $12.50 per unit. Actual sales last month were 9,000 units giving total sales revenue of $117,000.

What was the sales price variance for last month?

A.$4,000 favourable

B.$4,000 adverse

C.$4,500 favourable

D.$4,500 adverse

Answer:

The correct answer is C.

WORKING

                                                            $

Actual sales at standard selling price 112,500

(9,000 * $12.50)

Actual sales at actual selling price   117,000

Sales price variance 4,500 favourable

Quiz: Direct Labour Rate Variance for a company

A company operating a standard costing system has direct labour standards per unit for one of its products: 4 hours at $12.50 per hour

Last month when 2,195 units of the product were manufactured, the actual direct labour cost for the 9,200 hours worked was $110,750.

What was the direct labour rate variance for last month?

A.$4,250 favourable
B.$4,250 adverse
C.$5,250 favourable
D.$5,250 adverse
Answer:
The correct answer is A.
WORKING
            $ Variance ($)
Actual cost   110,750
                    4,250 F Rate
Actual hours at standard rate
(9,200 * 12.50) = 115,000

Quiz: Material Usage Variance for the period
The standard raw material cost for a unit of production is 2 kg at $4.00 per kg. Purchases for a period were 13,000 kg at an actual cost of $4.50 per kg. Raw material inventory, which is valued at standard cost, increased by $8,000 in the period. Budgeted production for the period was 6,000 units but actual production was only 5,000 units.
What was the raw material usage variance for the period?
A.$4,000 favourable
B.$12,000 adverse
C.$12,000 favourable
D.$4,000 averse
Answer:
The correct answer is D.
WORKING
Actual production should have used 10,000 kg (5,000 * 2). Raw material inventory increased by 2,000 kg ($8,000/$4), so 11,000 kg of the 13,000 purchased went into production. The material usage variance is therefore (10,000 kg – 11,000 kg) * $4 = $4,000 Adverse.

Quiz: Materials Mix Variance for a manufacturing company
A company manufactures a fruit flavoured drink base by mixing two liquids (X and Y). The standard cost card for 10 litres of the drink concentrate is:
                        $
Liquid X 5 litres   @ $16 per litre   80
Liquid Y 6 litres   @ $25 per litre   150
       11 litres   230
The company does not hold any inventory. During the last period the company produced 4,800 litres of the drink base. This was 200 litres below the budgeted output. The company purchased 2,200 litres of X for $18 per litre and 2,750 litres of Y for $21 per litre.
What was the total materials mix variance for the period?
A.$150 adverse

B.$450 adverse
C.$150 favourable
D.$450 favourable
Answer:
The correct answer is B.
WORKING

	Actual Q used litres	Actual Q standard mix litres	litres	Difference $	Standard $	margin variance $
X	2,200	(4,950 * 5/11)=2,250		50	16	800
Y.	2,750	(4,950 * 6/11)=2,700		(50)	25	(1,250)
	4,950	4,950				450A

Quiz: Materials Price Variance for Gough Co
Gough Co manufactures a product with a standard material cost as follows:

	$
Material X 2 kg at $1.00	2
Material Y 6 kg at $1.50	9
	11

Actual production of 1,010 units required the following material purchases:
Material X 2,200 kg $2,530
Material Y. 6,080 kg. $9,050
There were no opening and closing inventories and no substitutes for materials X and Y.
What is the total materials price variance?
A.$470 adverse
B.$400 adverse
C.$260 adverse
D.$195 adverse
Answer:
The correct answer is C
WORKING

Materials price	$
2,200 * $1.00 – $2,530	330 A
6,080 * $1.50 – $9,050	70 F
Price variance	260 A

Quiz: Yield Variance for Gough Co
Gough Co manufactures a product with a standard material cost as follows:

	$
Material X 2 kg at $1.00	2
Material Y. 6 kg at $1.50	9

11

Actual production of 1,010 units required the following material purchases:

Material X   2,200 kg $2,530
Material Y   6,080 kg $9,050

What is the total yield variance for the period?

A.A favourable variance of $275
B.An adverse variance of $275
C.A favourable variance of $470
D.An adverse variance of $470

Answer:

The correct answer is B.

WORKING

8,280 kg of input should yield (at standard 8 kg per unit) 1,035 units
Actual output 1,010
Deficit 25 units
Standard cost of 1 unit   11
Yield variance (adverse) 275

Quiz: Sales Mix Variance for Wig

Wig's monthly absorption costing variance analysis report includes a sales mix variance, which indicates the effect on profit of actual sales mix differing from the budgeted sales mix. The following data is available:

	Product RR		Product SS	
	$	$	$	$
Selling price		12		11
Less Variable cost	6		2	
Fixed cost	2		3	
		(8)		(5)
Standard net profit per unit		4		6
July sales (units)				
Budget		3,000		6,000
Actual		2,000		8,000

What is the favourable sales mix variance for July ?

Answer:

The correct answer is 2,667.

WORKING

	Actual sales actual mix units	Actual sales standard mix units (W)	Difference units $	Standard margin $	variance
RR	2,000	(10,000 * 3/9) 3,333.33	(1,333.33)	4	(5,333.32)
SS	8,000	(10,000 * 6/9) 6,666.67	1,333.33	6	7,999.98
	10,000	10,000	2,666.67		

Quiz: Favourable Mix Variance for Magic Drinks

Magic Drinks makes a popular soft drink by mixing two ingredients – soda water and a special syrup. Soda water is inexpensive; the special syrup is expensive. The standard mix for the drink is 80% soda water and 20% special syrup.

During the recent financial period, the company recorded a favourable mix variance.

The following statements have been made about the favourable mix variance.

1.Less syrup was used than the standard mix

2.The quality of the product may be below standard

Which of the above statements is/are true?

A. 1 only

B. 2 only

C. Neither 1 nor 2

D. Both 1 and 2

Answer:

The correct answer is D.

Tutorial note: A favourable mix variance means that the actual mix would have used less of the expensive ingredient (syrup). Although a "cheaper" mix saves money, the quality of the product may have suffered.

Quiz: Adverse Yield Variance for Chemical X

Chemical X is made by combining two materials in a special process. It is normal for 10% of the volume of materials input to be lost during the process and this has been reflected in the expected yield of chemical X. In the most recent period, an adverse yield variance was recorded.

What is the most likely cause of the adverse yield variance?

A.Staff received training on reducing waste as part of a total quality management program

B.The cost of the materials input increased due to a fall in supply on world commodity markets

C.The selling price of Chemical X fell due to competitors developing a substitute product

D.A thermostat attached to the process was faulty which led to a machine overheating resulting in an abnormal loss

Answer:

The correct answer is D.

Tutorial note: A faulty thermostat would lead to an adverse yield variance because a greater proportion of inputs is wasted.

Staff training on waste reduction should, if anything, lead to a favourable yield variance as there should be less waste. Increased cost of materials would affect the materials price variance, but not the yield. The fall in selling price would affect the sales price variance but not the yield.

Quiz: Production Manager's Bonus

A food production company has recently employed a new production manager. The production manager's remuneration includes a bonus that is linked to the monthly cost variances including the materials price, yield and mix variances.

The following statements have been made about linking the production manager's bonus to these variances.
1.The production manager will be motivated to improve the quality of output
2.The production manager will look for ways to reduce waste

	Statement 1	Statement 2
A.	True	False
B.	False	True
C.	True	True
D.	False	False

Answer:

The correct answer is B.

Tutorial note: The manager may be tempted to reduce the quality of the product by using a higher proportion of the cheaper input which would lead to a favourable mix variance, but would most likely impair the quality of the output.

Quiz: Sales Quantity Contribution Variance

The following budgeted data for a particular period was available for a company selling two products:

	Sales price Per unit	Variable cost per unit	Sales volume in units
Product A	$20	$8	15,840
Product B.	$24	$11	10,560

The actual results for the period were as follows:

	Sales price per unit	Variable cost per unit	Sales volume in units
Product A	$22	$8	14,200
Product B	$26	$11	12,500

What is the total sales quantity contribution variance for the period?

A.$3,720 favourable
B.$3,720 adverse
C.$4,320 favourable
D.$4,320 adverse

Answer:

The correct answer is A.

WORKING

	Actual sales in std mix	Standard sales in std mix	Difference (units)	Standard contribution	Variance
Product A	16,020	15,840	180F	$12	$2,160F
Product B.	10,680	10,560	120F	$13	$1,560F
Sales quantity contribution variance					$3,720F

Quiz: Materials Mix Variance statements

The following statements have been made about the materials mix variance for a company manufacturing different products using the same type of material (measured in kg):

1.The mix variance can be calculated by taking the difference between the actual quantity in the standard mix and the actual quantity in the actual mix, then multiplying it by the actual cost per kg

2.The mix variance arises because there is a difference between what the input should have been for the output achieved and the actual output

Which of the above statements is/are correct?

A.Neither 1 nor 2

B.Both 1 and 2

C.1 only

D.2 only

Answer:

The correct answer is A.

Tutorial note: (1) is incorrect as the difference between actual quantity in standard mix and the actual quantity in the actual mix is valued at the standard cost per kg, not the actual cost. (2) is incorrect as that is the definition of the yield variance.

Quiz: Favourable or Adverse Variance for chemical A and B

To produce 19 litres of product X requires a standard input mix of 8 litres of chemical A and 12 litres of chemical B.

Chemical A has a standard cost of $20 per litre and chemical B has a standard cost of $25 per litre.

During September, 1,850 litres of product X were produced 900 litres of chemical A and 1,100 litres of chemical B (i.e. 2,000 litres in total).

The actual costs of chemicals A and B were at the standard cost of $20 and $25 per litre respectively.

For the total materials mix variance and total materials yield variance, was there a favourable or adverse result in September?

A.The total mix variance was adverse and the total yield variance was favourable

B.The total mix variance was favourable and the total yield variance was adverse

C.Both variances were adverse

D.Both variances were favourable

Answer:

The correct answer is B.

Tutorial note: 2,000 litres of input should produce 1,900 litres of output (2,000 × 19/(8 + 12), so the yield variance is adverse as actual output was lower (1,850). The actual mix is 9A:11B rather than the standard 8A:12B, so a greater proportion of chemical A, which is cheaper, means the mix variance must be favourable. The following working is shown for completeness, but is quite unnecessary.

WORKING

Materials	AM AQ	SP	SM AQ	SP	SM SQ	SP

A	900	18,000	800	16,000	779	15,580
B	1,100	27,500	1,200	30,000	1,168	29,200
Total		T1 =45,500		T2=46,000		T3=44,780

SM: A = 0.4 and B = 0.6
1.AQSM: A = 0.4 * 2,000 = 800 litres; B = 0.6 * 2,000 = 1,200 litres
2.SQSM: A = 0.4 * 1,947 = 779 litres; B = 0.6 * 1,947 = 1,168 litres
Actual production of 1,850 litres requires an input of 1,947 litres (1,850/0.95) in total of A and B. Therefore, SQ = 1,947 litres.
Mix variance is given by: T2 – T1 = $500 favourable
Yield variance is given by: T3 – T2 = $1,220 adverse

Quiz: Sales Quantity Variance caused by a lower proportion
A company sells two products and has calculated the following information relating to sales variances:
Sales mix variance = $1,000
Sales price variance = $200 F
Sales volume variance = $1,400 A
There is no indication whether the sales mix variance is adverse or favourable but it was caused by a lower proportion of the more profitable item being sold.
What is the sales quantity variance?
A.$400 favourable
B.$200 adverse
C.$400 adverse
D.$2,400 adverse
Answer:
The correct answer is C.
Tutorial note: The sales mix variance "was caused by a lower proportion of the more profitable item has been sold"; lower profitability means it must be an adverse variance.
WORKING
Sales volume variance = Sales mix variance + sales quantity variance
Therefore, sales quantity variance = Sales volume variance $1,400A – sales mix variance $1,000A = $400 adverse

Quiz: Total Material Yield Variance for Vibrant Co
Vibrant Co manufactures and sells paints. Business Unit A of the company makes a paint called Micra using three key materials: R, S and T.
At the end of period 1, a total material cost variance of $4,900 adverse was correctly recorded for Micra.
The following information relates to Micra for period 1:

Material	Standard cost per litre	Actual cost per litre.	Actual usage
	$	$	litres
R	63	62	1,900

S	50	51	2,800
T	45	48	1,300

The standard ratio of mixing material R, material S and material T is 30:50:20.

The material price variance for Micra has been correctly calculated as $4,800 adverse.

What is the total material yield variance for Micra for period 1?

A.$800 favourable

B.$700 favourable

C.$800 adverse

D.$900 adverse

Answer:

The correct answer is B.

Tutorial note: It is not possible to calculate the yield variance directly because actual output is not given. It is therefore necessary to consider the relationship between the materials variances. Total material cost variance ($4,900A given) = Material price variance ($4,800A given) + material usage variance (balancing figure $100A). There is now sufficient information to calculate the yield variance as the difference between the material usage variance and the material mix variance (to be calculated).

WORKING

Material	Standard ratio	Actual quantity in std mix (AQSM)	Actual quantity in actual mix (AQAM)	Variance (litres)	Standard cost per litre $	Variance $
R	30%	1,800	1,900	100 A	63	6,300 A
S	50%	3,000	2,800	200 F	50	10,000 F
T	20%	1,200	1,300	100 A	45	4,500 A
Total		6,000	6,000	0		800 A

Material usage variance ($100A) = Material mix variance ($800A) + material yield variance ($700F – the balancing figure).

Quiz: Total Favourable Yield Variance

The standard material input for making 100 kg of a product is as follows:

80 kg of material Z at $5 per kg	$400
45 kg of material Y at $9 per kg	$405
Total	$805

During the last period, 5,000 kg of Z costing $4.80 per kg and 2,500 kg of Y costing $9 per kg were used to produce 6,200 kg of product.

What was the total favourable yield variance?

Answer:

The correct answer is 1610.

WORKING

7,500 kg of material should have produced 6,000kg (7,500/125 * 100)

But did produce   6,200kg

Difference (is favourable) 200kg

× standard cost $8.05 ($805/100)
Yield variance (200 * $8.05) $1,610 favourable

Quiz: Sales Mix Variance statements
Which of the following statements is NOT true about a sales mix variance?
A.If actual sales revenues from two products are in the same ratio as the budgeted sales revenues there is no measurable sales mix variance
B.If all products have the same budgeted margin there is no measurable sales mix variance
C.If actual sales volumes are in the same ratio as the budgeted sales volumes there is no measurable sales mix variance
D.If the actual sales volumes of all products are 10% above the budgeted sales volumes, there is no measurable sales mix variance
Answer:
The correct answer is A.
Tutorial note: This statement is not true because the sales mix variance is based on the difference in sales volume (i.e. units) as a result of changes in the proportions of each product sold, not sales revenue. The proportion of sales revenue can stay the same, but this can hide a change in the volume of units sold. The other statements are true.

Quiz: Labour Rate Planning Variance for DB manufacturing
DB manufactures and sells e-readers. The standard labour cost per unit of the product is $7. Each unit takes 0.5 hours to produce at a labour rate of $14 per hour. The budgeted production for August was 20,000 units.
The Production Director subsequently reviewed the market conditions that had been experienced during August and determined that market labour rates were $17.50 per hour. The actual production was 22,000 units. Actual labour hours worked were 11,400 hours at $15.50 per hour.
DB calculates labour rate planning variances based on actual hours paid.
What was the labour rate planning variance during August?
A.A favourable variance of $17,100
B.A favourable variance of $39,900
C.An adverse variance of $17,100
D.An adverse variance of $39,900
Answer:
The correct answer is D.
WORKING
Actual hours at original standard rate (11,400 * 14) $159,600
Actual hours at revised standard rate (11,400 * 17.5) $199,500
Labour planning rate variance $39,900
The variance is adverse, because revising the standard increases the standard cost.

What is meant by "budgetary slack"?

A.The lead time between the preparation of the functional budgets and the approval of the master budget by senior management

B.The difference between the budgeted output and the actual output

C.The difference between budgeted capacity utilisation and full capacity

D.The intentional over estimation of costs and/or under estimation of revenue in a budget

Answer:

The correct answer is D.

Operation B, in a factory, has a standard time of 15 minutes. The standard rate of pay for operatives is $10 per hour. The budget for a period was based on carrying out the operation 350 times. It was subsequently realised that the standard time for Operation B included in the budget did not incorporate expected time savings from the use of new machinery from the start of the period. The standard time should have been reduced to 12 minutes.

Operation B was actually carried out 370 times in the period in a total of 80 hours. The operatives were paid $850.

What was the operational labour efficiency variance?

A.$60 adverse

B.$75 favourable

C.$100 adverse

D.$125 adverse

Answer:

The correct answer is A.

WORKING

Actual time for 370 operations was 80 hours

Revised standard time per operation = 12 minutes = 0.2 hours

Revised expected time for actual operations = 370 * 0.2 = 74 hours

Operational labour efficiency variance = (80 − 74) * $10 = $60 adverse

The following data relates to Product Z and its raw material content for September:

Budget

Output	11,000 units of Z

Standard materials content 3 kg per unit at $4.00 per kg

Actual

Output	10,000 units of Z

Materials purchased and used 32,000 kg at $4.80 per kg

It has now been agreed that the standard price for the raw material purchased in September should have been $5 per kg.

What was the adverse materials planning price variance for September?
A.$6,000
B.$30,000
C.$32,000
D.$33,000
Answer:
The correct answer is C.
WORKING
Planning price variance = 32,000 * ($4.00 – $5.00) = $32,000 adverse

Quiz: Market Size and Market Share Variance
Gonav makes satellite navigation systems for cars. Budgeted sales for the financial year just ended were 900,000 units, based on an expected market size of 9 million units. The actual market size was lower than expected due to the increased use of navigation apps on smart phones. The total market was only 6 million units. Gonav made sales of 700,000 units.
The sales volume variance will be analysed into market size and market share variances.
Whether the market size variance and market share variance are favourable or adverse.

Market size variance	Market share variance
A. ADVERSE	FAVOURABLE
B. ADVERSE	ADVERSE
C. FAVOURABLE	FAVOURABLE
D. FAVOURABLE	ADVERSE

Answer:
The correct answer is A.
Tutorial note: The total market size is less than expected, so this would have an adverse effect on the sales volume. The actual market share achieved was 11.67% (700,000/6m). This is higher than the budgeted market share of 10%, so the market share variance would be favourable.

Quiz: Revising the Standard
At the start of the year, the standard material cost of a product was estimated. The actual cost incurred during the recent month was higher than this, and the purchasing manager is suggesting that the standard should be revised. He has suggested two reasons why the standard should be revised:
1.A delay in placing some orders led to the supplier charging a premium for express delivery services. The delay was caused by poor organisation in the purchasing department
2.Market prices of the material in question have risen by 10% on world commodity markets
Which of the above would be valid reasons for revising the standard?
A.1 only
B.2 only
C.Neither 1 nor 2
D.Both 1 and 2
Answer:

The correct answer is B.

Tutorial note: A standard should not be revised to hide poor operational performance. The first reason given relates to poor organisation in the purchasing department. Since this is an operational matter, the standard should not be revised in respect of this. The increase in the market prices is outside of the control of the company, so it would be reasonable to revise the standard for this.

Quiz: Variance Analysis in JIT and TQM

Research has shown that variance analysis is less relevant in the modern environment of just-in-time production (JIT) and total quality management (TQM).

A company's production manager has made the following statements:

1.A JIT system relies on long-term contracts with suppliers and so the material price variance is less relevant

2.The main focus of TQM is quality, while the main focus of variance analysis is cost reduction

Which of the above statements is/are true?

A. 1 only

B. 2 only

C. Neither 1 nor 2

D. Both 1 and 2

Answer:

The correct answer is D.

Tutorial note: Statement 1 is correct: Under a JIT system, a company relies on good relationships with its suppliers. Ensuring deliveries from suppliers are obtained when required and of the quality required is critical to the success of a JIT system. Companies will therefore not shop around for cheaper supplies on a regular basis and will experience stable material prices, meaning that the material price variance is less relevant.

Statement 2 is correct: The focus of TQM is quality, getting things right first time and continuous improvement. This is at odds with standard costing and variance analysis where the focus is on cost reduction, with no consideration of quality.

Quiz: Non-Financial Performance Indicators

Smithson Co is an insurance company. Recently there has been concern that too many quotations have been sent to clients either late or containing errors. The department concerned has responded that they are understaffed, and a high proportion of current staff have recently joined the department. The performance of this department is to be carefully monitored.

Which TWO of the following non-financial performance indicators would be an appropriate measure to monitor and improve the department's performance?

A.Percentage of quotations found to contain errors when checked

B.Average time staff have worked in the department

C.Actual staff employed as a percentage of the quota for the department

D.Percentage of budgeted number of quotations actually issued

Answer:

The correct answers are A and C.

Tutorial note: Percentage of budgeted number of quotations actually issued relates to increasing the number of quotations, but does not consider whether they were late or incorrect or the alleged underlying problem of too few staff. Although increasing the experience of staff is desirable (as measured by the average time in the department), setting this as a target may have the unintended consequence of halting recruitment of required new staff.

Quiz: Effect of Long-Term Loan on Financial Ratios

Which is the appropriate effect of raise a long term loan to finance the purchase of non-current assets on a company's current ratio and level of financial gearing (measured using carrying values)

Effect on current ratio	Effect on financial gearing
A.NO EFFECT	INCREASE
B.NO EFFECT	DECREASE
C.DECREASE	INCREASE
D.INCREASE	INCREASE

Answer:

The correct answers are A.

Tutorial note: The new loan increases the level of debt, leading to an increase in the gearing ratio, but has no effect on current assets or current liabilities since it is used to purchase non-current assets.

Quiz: Effect of Reducing Closing Inventory

Which is the appropriate effect of reduce the value of closing inventory on a company's current ratio and level of financial gearing (measured using carrying values)

Effect on current ratio	Effect on financial gearing
A.NO EFFECT	INCREASE
B.NO EFFECT	DECREASE
C.DECREASE	INCREASE
D.INCREASE	INCREASE

Answer:

The correct answers are C.

Tutorial note: The reduction in inventory means that current assets will be reduced, leading to a fall in the current ratio. Net assets will also fall, reducing the carrying value of equity and therefore increasing gearing. (Alternatively, lower closing inventory leads to higher cost of sales, lower profit, lower retained earnings, lower equity and higher gearing.)

Quiz: Return on Capital Employed for Grippa Co

In the last financial year, the net profit margin of Grippa Co was 14.7% and asset turnover was 2.3 times.

What was the company's return on capital employed for the financial year?

A.29.3%
B.14.7%
C.33.8%
D.6.4%
Answer:
The correct answer is C.
WORKING
ROCE = Net profit margin * Asset turnover or 14.7% * 2.3 = 33.8%

Quiz: Incentive Scheme for Product Quality
Yobo Co manufactures a wide range of products. There is considerable variation in the profit per unit sold of each product. The managing director is planning to introduce an incentive scheme for production employees. The objective of the incentive scheme is to improve product quality. On which of the following should the incentive scheme be based in order to improve product quality?
A.Production volume
B.Sales revenue
C.Levels of rework
D.profitability
Answer:
The correct answer is C.
Tutorial note: A scheme based on production volume will not encourage a focus on quality. Indeed, such a scheme may lead to a deterioration in quality. Sales revenue and profitability and not directly controlled by production activities, and are therefore irrelevant targets for production staff.

Quiz: Measure for Improving Customer Satisfaction
Cawlin Co provides a call centre service on behalf of a number of retailers. Operatives receive calls from customers who are experiencing problems in operating the products they have bought from the retailers. The managing director is seeking improved customer satisfaction. Customer satisfaction is measured by the number of customers who receive advice which leads to the correct operation of their equipment at the first point of contact. It has been suggested by the human resource manager that an incentive scheme should be introduced.
Which of the following targets is the most appropriate measure for the incentive scheme?
A.A reduction in the time taken to answer incoming calls
B.A decrease in the number of calls referred to a supervisor
C.A reduction in the average time taken to process each call
D.An increase in the number of calls processed
Answer:
The correct answer is B.
Tutorial note: The manager wants to increase the number of calls that are solved at the first point of contact – so decreasing the number of calls referred is most relevant to this.

Quiz: Performance Measure for Product Quality

Lukers Co is structured on a functional basis. Two of the departments are purchasing and production. The directors wish to improve product quality, and are considering the introduction of an incentive scheme.

Which of the following performance measures would be an appropriate basis for the incentive scheme?

A.Company profit

B.Favourable material price variances

C.Volume of products returned by customers

D.Share price

Answer:

The correct answer is C.

Tutorial note: This is the only measure that directly measures the quality of the product.

Quiz: Quick Ratio Calculation for Binny Co

Binny Co has annual sales of $960,000 and a current ratio of 3.2:1. All of its sales are for cash and are priced at a mark-up on cost of 50%. The average cash balance is $40,000 and the inventory holding period is 90 days.

Assuming 360 days in a year, what is Binny Co's quick ratio (acid test ratio)?

A.0.53

B.0.64

C.0.80

D.1.56

Answer:

The correct answer is B.

Tutorial note: As there are no receivables, the quick ratio is simply the cash balance/current liabilities. Current liabilities are not known but can be calculated from the current ratio by calculating current assets = Inventory (W) + cash ($40,000).

WORKING

Cost of sales based on 50% mark-up (100/150 * $960,000) = $640,000

Gives inventory based on holding period (90/360 * $640,000) = $160,000

Therefore, current assets ($160,000 + $40,000) = $200,000

Current ratio 3.2:1

Current liabilities ($200,000/3.2) = $62,500

Quick ratio ($40,000/$62,500) = 0.64

Quiz: New Current Ratio After Selling Inventory

Mouse Co has a current ratio of 1.6:1. Inventory represents 30% of its current assets. Mouse Co has no positive cash balances but does have an overdraft.

If it sells half of its inventory for cash at a mark-up of 100% and uses the proceeds to reduce its overdraft, what will its current ratio be (to two decimal places)?

Answer:

The correct answer is 2.62.

Tutorial note: The first step in answering this question is to work out how the existing current ratio of 1.6:1 has been calculated.

WORKING

The current assets including inventory are 1.6 and the current liabilities are 1.

Inventory represents 30% of the current assets, so 1.6 * 30% = 0.48. Other current assets are therefore 1.6 – 0.48 = 1.12.

The existing current ratio can therefore be show as:

((Inventory 0.48) + (other current assets 1.12))/(current liabilities 1) = 1.6:1

If half of the inventory is sold for a mark-up of 100%, 0.24 of the inventory is sold for 0.48. The cash received for the sale is used to reduce the overdraft, therefore this is deducted from the current liabilities total of 1.

This means that after the sale, the current ratio will be:

((Inventory 0.48 – 0.24) + (other current assets 1.12))/(current liabilities 1 – 0.48) = 2.615, rounded to 2.62.

Quiz: Efficiency in Resource Utilization

What do the following statements apply to?

 - The relationship between utilisation of resources (inputs) and the output produced by those resources.

 - Getting more output from each unit of input, or getting the same amount of output with fewer resources improves this relationship.

A.Economy

B.Efficiency

C.Effectiveness

D.Value-for-money

Answer:

The correct answer is B.

Tutorial note: Economy focuses on cost per unit of input not on outputs per unit of input. Effectiveness looks at how well the organisation provides the service it aims to produce. Value for money covers all "3Es".

Quiz: Customer Perspective in Balanced Scorecard

Which TWO of the following measures could most suitably be used to assess the customer perspective of the balanced scorecard approach for an insurance company?

A.New insurance products introduced in the period

B.Training expenditure on sales representatives

C.Average time to settle insurance claims

D.Percentage of policy renewals

Answer:

The correct answers are C and D.

Tutorial note: New insurance products would come within the learning and growth perspective, as would) spending on training.

Quiz: Fitzgerald and Moon's Building Block Model

The following statements have been made about Fitzgerald and Moon's Building Block Model:

1. It was developed for measuring the performance of services businesses
2. It contains four perspectives for measuring the performance of a business

Which of the above statements is/are true?

A. 1 only
B. 2 only
C. Neither 1 nor 2
D. Both 1 and 2

Answer:

The correct answer is A.

Tutorial note: (2) is incorrect – the Building Block Model contains six dimensions of performance measurement. It is the Balanced Scorecard that has four perspectives.

Quiz: Value for Money Performance Measures

A hospital management team assess performance using value for money. The following performance measures are reported by surgical departments:

1. The number of patients who need to be re-admitted following surgery
2. The staff cost of each surgical procedure

Which element of value for money is assessed by each measure?

(Select your answer using the rectangular buttons)

	(1)	(2)
A.	Economy	Efficiency
B.	Efficiency	Effectiveness
C.	Effectiveness	Efficiency
D.	Effectiveness	Economy

Answer:

The correct answer is D.

Tutorial note: Number of patients that need to be re admitted following surgery is a measure of how good the surgery was (i.e. the effectiveness). Staff cost of each procedure is a measure of economy.

Quiz: Balanced Scorecard statements

The following statements have been made about the balanced scorecard:

1. It focuses solely on non-financial performance measures
2. It looks at both internal and external matters concerning the organisation

Which of the above statements is/are true?

A.1 only

B.2 only

C.Neither 1 nor 2

D.Both 1 and 2

Answer:

The correct answer is B.

Tutorial note: The balances scorecard includes both financial and non-financial performance measures, so (1) is incorrect.

It does attempt to look at external matters – for example, measures may include benchmarks, showing how the organisation is performing compared to competitors.

Quiz: Direct Staff Cost

Core Care Trust is a public sector health and care home for the elderly. Income is received on a contract basis from the local government authority. Care workers are mainly full-time staff but occasionally temporary staff from a local employment agency must be brought in, at great expense, to fill staff rota gaps.

There is a regulatory body monitoring the work done by care homes known as CHQC which sets targets for the standard of care expected.

It is generally regarded that residents spend a much happier time whilst in a care home if they are able to establish long-lasting relationships with care home staff providing their direct care.

The six performance measures below are used by the management of Core Care Trust to monitor performance as part of the value for money framework.

Match the performance measures to the elements of the value for money framework which they are measuring.

Which element of value for money is assessed by direct staff cost as a percentage of contract income.

A.Economy

B.Efficiency

C.Effectiveness

Answer:

The correct answer is A.

Tutorial note:

Economy considers whether resources are acquired at the required quality for the lowest price.

Efficiency links inputs and outputs and considers whether the maximum outputs are obtained given the level of inputs.

Effectiveness measures outputs in terms of whether overall objectives have been met.

Quiz: Temporary Staff Usage

Core Care Trust is a public sector health and care home for the elderly. Income is received on a contract basis from the local government authority. Care workers are mainly full-time staff but

occasionally temporary staff from a local employment agency must be brought in, at great expense, to fill staff rota gaps.

There is a regulatory body monitoring the work done by care homes known as CHQC which sets targets for the standard of care expected.

It is generally regarded that residents spend a much happier time whilst in a care home if they are able to establish long-lasting relationships with care home staff providing their direct care.

The six performance measures below are used by the management of Core Care Trust to monitor performance as part of the value for money framework.

Match the performance measures to the elements of the value for money framework which they are measuring.

Which element of value for money is assessed by temporary staff usage (hours) as a percentage of total staff hours

A.Economy

B.Efficiency

C.Effectiveness

Answer:

The correct answer is B.

Tutorial note:

Economy considers whether resources are acquired at the required quality for the lowest price.

Efficiency links inputs and outputs and considers whether the maximum outputs are obtained given the level of inputs.

Effectiveness measures outputs in terms of whether overall objectives have been met.

Quiz: Food Cost per Meal

Core Care Trust is a public sector health and care home for the elderly. Income is received on a contract basis from the local government authority. Care workers are mainly full-time staff but occasionally temporary staff from a local employment agency must be brought in, at great expense, to fill staff rota gaps.

There is a regulatory body monitoring the work done by care homes known as CHQC which sets targets for the standard of care expected.

It is generally regarded that residents spend a much happier time whilst in a care home if they are able to establish long-lasting relationships with care home staff providing their direct care.

The six performance measures below are used by the management of Core Care Trust to monitor performance as part of the value for money framework.

Match the performance measures to the elements of the value for money framework which they are measuring.

Which element of value for money is assessed by food cost per meal served to residents

A.Economy

B.Efficiency

C.Effectiveness

Answer:

The correct answer is A.

Tutorial note:
Economy considers whether resources are acquired at the required quality for the lowest price.
Efficiency links inputs and outputs and considers whether the maximum outputs are obtained given the level of inputs.
Effectiveness measures outputs in terms of whether overall objectives have been met.

Quiz: CHQC's Designated Standard of Care
Core Care Trust is a public sector health and care home for the elderly. Income is received on a contract basis from the local government authority. Care workers are mainly full-time staff but occasionally temporary staff from a local employment agency must be brought in, at great expense, to fill staff rota gaps.
There is a regulatory body monitoring the work done by care homes known as CHQC which sets targets for the standard of care expected.
It is generally regarded that residents spend a much happier time whilst in a care home if they are able to establish long-lasting relationships with care home staff providing their direct care.
The six performance measures below are used by the management of Core Care Trust to monitor performance as part of the value for money framework.
Match the performance measures to the elements of the value for money framework which they are measuring.
Which element of value for money is assessed by achieving the CHQC's designated standard of care for the elderly
A.Economy
B.Efficiency
C.Effectiveness
Answer:
The correct answer is C.
Tutorial note:
Economy considers whether resources are acquired at the required quality for the lowest price.
Efficiency links inputs and outputs and considers whether the maximum outputs are obtained given the level of inputs.
Effectiveness measures outputs in terms of whether overall objectives have been met.

Quiz: Number of Voids
Core Care Trust is a public sector health and care home for the elderly. Income is received on a contract basis from the local government authority. Care workers are mainly full-time staff but occasionally temporary staff from a local employment agency must be brought in, at great expense, to fill staff rota gaps.
There is a regulatory body monitoring the work done by care homes known as CHQC which sets targets for the standard of care expected.
It is generally regarded that residents spend a much happier time whilst in a care home if they are able to establish long-lasting relationships with care home staff providing their direct care.

The six performance measures below are used by the management of Core Care Trust to monitor performance as part of the value for money framework.

Match the performance measures to the elements of the value for money framework which they are measuring.

Which element of value for money is assessed by number of voids (the number of empty beds as a percentage of total

A.Economy

B.Efficiency

C.Effectiveness

Answer:

The correct answer is B.

Tutorial note:

Economy considers whether resources are acquired at the required quality for the lowest price.

Efficiency links inputs and outputs and considers whether the maximum outputs are obtained given the level of inputs.

Effectiveness measures outputs in terms of whether overall objectives have been met.

Quiz: Staff Turnover

Core Care Trust is a public sector health and care home for the elderly. Income is received on a contract basis from the local government authority. Care workers are mainly full-time staff but occasionally temporary staff from a local employment agency must be brought in, at great expense, to fill staff rota gaps.

There is a regulatory body monitoring the work done by care homes known as CHQC which sets targets for the standard of care expected.

It is generally regarded that residents spend a much happier time whilst in a care home if they are able to establish long-lasting relationships with care home staff providing their direct care.

The six performance measures below are used by the management of Core Care Trust to monitor performance as part of the value for money framework.

Match the performance measures to the elements of the value for money framework which they are measuring.

Which element of value for money is assessed by staff turnover

A.Economy

B.Efficiency

C.Effectiveness

Answer:

The correct answer is C.

Tutorial note:

Economy considers whether resources are acquired at the required quality for the lowest price.

Efficiency links inputs and outputs and considers whether the maximum outputs are obtained given the level of inputs.

Effectiveness measures outputs in terms of whether overall objectives have been met.

Quiz: ROI and RI

Melton Co has many divisions which it evaluates using Return on Investment (ROI) and Residual Income (RI) measures. The Mowbray division has net assets of $24m at 30 September 20X4. In the year to 30 September 20X4 it earned profit before interest and tax of $3.6m. The appropriate cost of capital for the Mowbray division is 12%. It is company policy to use capital as the end of the year for the calculation of ROI and RI.

During the year to 30 September it paid interest of $0.6m.

What are the ROI and RI for the year to 30 September 20X4?

(Select your answer using the rectangular buttons)

	ROI	RI
A.	12.5%	$0.12m
B.	12.5%	$0.72m
C.	15.0%	$0.72m
D.	15.0%	$3.00m

Answer:

The correct answer is C.

WORKING

ROI = $3.6m/$24m = 15.0%

RI = $3.6m – ($24m * 12%) = $0.72m

Quiz: Performance Measures for Tom Hopkin

Tom Hopkin is responsible for managing the volume, quality and cost of production within his responsibility centre.

A new management accountant has suggested that the following performance measures should be included in assessing Tom's performance:

1.Return on investment

2.Materials usage variances

3.Percentage of products that are defective after inspection

Which of the above performance measures would be appropriate for measuring Tom's performance?

A.1 and 2 only

B.1 and 3 only

C.2 and 3 only

D.1, 2 and 3

Answer:

The correct answer is C.

Tutorial note: Tom has responsibility for production, which implies cost, but not for revenue. Therefore any measures that include profit would not be appropriate for measuring Tom's performance, so (1) would not be appropriate. Material usage is likely to be within Tom's control so (2) is appropriate. (3) is a measure of quality, which Tom is also responsible for.

Quiz: Residual Income Statements

In relation to residual income, which of the following statements is correct?
A.Residual income is calculated by adding back depreciation and deducting the notional interest charge
B.Residual income eliminates the effect of accounting policies from the assessment of performance
C.Residual income assesses divisional income based on the carrying value of the investment which has been made
D. Residual income does not take the risk of specific projects into account
Answer:
The correct answer is C.
Tutorial note: Residual income is calculated by deducting a notional interest charge from divisional profit (which is calculated after depreciation).
The notional interest charge is based on the accounting (carrying or "book") value of net assets.
The use of accounting values means that accounting policies will influence residual income.
The imputed interest charge can be separately calculated for each project to reflect the risk associated with each project.

Quiz: Residual Income After Project
The Northern division of Gemas Co currently earns a return on investment of 15.5%, based on capital employed of $2,680,000. The divisional management team has decided to implement a project which will require an investment of $320,000. The project is expected to generate a profit of $53,000 per year. The Northern division's cost of capital is 13%.
What will be the residual income of the division after the project is implemented?
A.$67,000
B.$78,400
C.$120,000
D.$468,400
Answer:
The correct answer is B.
WORKING

	$	$
Capital employed before project	2,680,000	
Current profit (ROI of 15.5%)		415,400
Profit from project		53,000
Profit including project		468,400
Investment in project	320,000	
Capital employed after project	3,000,000	
Imputed cost of capital at 13%		390,000
Residual income		78,400

Quiz: ROI Method Statements

Which of the following statements about the return on investment method of performance measurement are true?

1.It enables comparison of performance of divisions which are not of common size
2.Managers' decisions will be congruent with the goals of the organisation
3.It does not take account of the risk of project investments being undertaken
4.Managers will be encouraged to invest in projects with higher returns

A.1, 2 and 3
B.1, 2 and 4
C.1, 3 and 4
D.2, 3 and 4

Answer:

The correct answer is C.

Tutorial note: (1) is true – ROI is a percentage measure so divisions of different sizes can be compared.

(2) is not true – ROI can lead to goal incongruent decisions, for example where a manager rejects a project because it yields a lower ROI than the manager's existing ROI, even if the return on the project exceeds the company's hurdle ROI.

(3) is true. ROI measures the return, but not the risk of a project.

(4) is true, since a project with a higher return would increase the ROI, so would be attractive to the manager of a division.

Quiz: Return on Investment for a company

A company has capital employed of $300,000 and cost of capital of 10% per year. Its residual income is $45,000.

What is the company's return on investment?

A.5%
B.10%
C.15%
D.25%

Answer:

The correct answer is D.

WORKING

Working backwards from residual income, the profit can be calculated as follows:

Residual income   45,000
Add back imputed interest (300,000 * 10%) = 30,000
Divisional profits 75,000

Therefore, return on investment = 75,000/300,000 = 25%

Quiz: Performance Measures for Branch Managers

John is the manager of a branch of a fast food restaurant. He is responsible for purchasing, hiring staff and managing the staff rotas for each shift. He is also responsible for advertising. He cannot make investment decisions.

Which of the following performance measures would be appropriate for assessing John's performance?

1.Residual income

2.Customer satisfaction rankings

3.Contribution

A.2 only

B.1 and 2

C.1 and 3

D.2 and 3

Answer:

The correct answer is D.

Tutorial note: Controllability principle means that managers should only be judged on things within their control. Since John cannot make investment decisions, any performance measure which takes into account the value of capital invested would not be appropriate.

Quiz: ROI vs. Residual Income

Currently, each division of Wescon Co is required to generate a return on investment (ROI) of at least 20%. The bonus paid to divisional managers increases in direct proportion to the ROI achieved by their division.

The ROI of the Eastern division has been above 25% for several years.

The head office management are considering replacing ROI with residual income (RI). The imputed interest charge would be calculated using carrying values and an interest rate of 20%, with bonuses paid on any RI generated by the division.

A project with a projected ROI of 21.5% is currently being considered.

What decision will be made using RI and ROI?

(Select your answer using the rectangular buttons)

	RI	ROI
A.	Reject	Accept
B.	Accept	Reject
C.	Accept	Accept
D.	Reject	Reject

Answer:

The correct answer is B.

Tutorial note: As the project will earn a return in excess of the required return it would be accepted using RI. However, as the return is below the current ROI, it will reduce overall ROI, and for that reason, would be rejected using ROI.

Quiz: Control in Investment Centres

The following are some of the areas which require control within a division:

1.Generation of revenues

2.Investment in non-current assets

3.Investment in working capital

4.Apportioned head office costs

Which of the above does the manager have control over in an investment centre?

A.1, 2 and 3 only

B.3 and 4 only

C.1, 2 and 4 only

D.1, 2, 3 and 4

Answer:

The correct answer is A.

Tutorial note: An investment centre manager has control over all aspects of his division, so (1), (2) and (3). However he would not have control over head office costs (4).

Quiz: ROI and RI for Divisions

A company has two divisions. The divisions are identical in terms of the number and type of machines they have and the operations they carry out. However, one division was set up four years ago and the other was set up one year ago. Head office appraises the division using both return on investment (ROI) and residual income (RI).

Which of the following statements is correct in relation to the outcome of the appraisal for each division?

A.Both ROI and RI will favour the older division

B.ROI will favour the older division, but RI will treat each fairly

C.RI will favour the newer division and ROI will favour the older division

D.Both RI and ROI will favour the newer division

Answer:

The correct answer is A.

Tutorial note: ROI = Divisional profit/capital employed × 100% and RI = Divisional profit – imputed interest (i.e. capital employed * cost of capital).

Assume both divisions generate the same profit (as they are virtually identical). Both divisions have the same assets –but the older division will have recognised more depreciation, as it is three years older; reducing its capital employed.

The lower capital employed will give the older division an artificially high ROI compared to the newer division. Likewise, the imputed interest for the older division will be smaller; giving it a higher RI than the newer division.

Quiz: Management Bonus Increase

Which of the following could lead to an increase in management bonus, without benefitting the organisation?

1.A manager holds on to heavily depreciated assets in order to avoid heavy investment in the period

2.A manager in a manufacturing division uses absorption costing and builds up high levels of inventory

3.A sales manager changes their fixed target to a relative target based on market share

A.1 and 2 only

B.1, 2 and 3
C.1 only
D.2 and 3 only
Answer:
The correct answer is A.
Tutorial note: For each statement, there are two matters to be considered; first, whether management bonus could increase and secondly (if yes), whether the organisation will benefit. (1) gives a low figure for capital employed which, in turn, gives a higher figure for ROI and so increases a bonus. However, old assets are likely to have higher running costs, making the organisation less profitable than it might be otherwise.

An increase in inventory levels under absorption costing (2) will carry forward more production overheads to the next period and so increase profit and bonuses linked to profit. However, this would only benefit the company if all the inventory can be sold. The cost of obsolescence would reduce profitability.

Setting a relative target on market share (3) will benefit the organisation. When the market increases, more sales should be expected in absolute terms. This adds controllability, since the sales manager could not be held responsible for a rise (or a fall) in the overall market.

Quiz: ROI Calculation for Damon Co's divisions
Summary financial information for one of Damon Co's divisions for the last year is shown below:

	$000
Revenue	18,000
Variable costs	(9,600)
Divisional fixed operating costs	(2,760)
Apportioned head office costs	(2,160)
Interest charges	(200)
Tax	(700)
Net profit	2,580

The average value of the division's total assets less current liabilities for the last year was $22.8m.
Damon Co assesses the return on investment of its divisions on the basis of controllable profit.
What is the division's return on investment for the last year?
A.11.3%
B.15.3%
C.20.8%
D.24.7%
Answer:
The correct answer is D.
Tutorial note: Because the company measures ROI on controllable costs, operating profit needs to exclude the apportioned head office costs.
WORKING
ROI = Operating profit/Capital employed = $(18,000 − 9,600 − 2,760)/$22,800 = 24.7%

Quiz: Expected ROI

At the start of the year, a division has non-current assets of $4million and makes no additions or disposals during the year. Depreciation is charged at a rate of 10% per year on all non-current assets held at the end of the year.

Working capital is $0.5m at the start of the year although this is expected to increase by 20% by the end of the year. The division's budgeted profit after depreciation is $1.2m.

What is the division's expected return on investment for the year, based on average capital employed?

A.27.6%

B.26.4%

C.18.4%

D.31.6%

Answer:

The correct answer is A.

WORKING

Opening capital employed: $4m + $0.5m = $4.5m

Closing capital employed: ($4m * 0.9) + ($0.5 * 1.2) = $3.6m + $0.6 = $4.2m

Average capital employed = $4.35m

Profit after depreciation = $1.2m

Therefore ROI = $1.2m/$4.35m = 27.6%

Quiz: Statements about Divisional Performance Measures

Return on investment (ROI) and residual income (RI) are commonly used divisional performance measures.

Match the following statements about the advantages and disadvantages of the performance measures to whether they apply to ROI only, RI only or both.

Statement 1: Improving due to the use of carrying value in asset valuation

Statement 2: In the short-term it can conflict with net present value (NPV) indicators

Statement 3: Always increases when new investments earn returns greater than the cost of capital

Statement 4: Facilitates the comparisons of managerial performance in divisions of different sizes

Answer:

Statement 1: Improving due to the use of carrying value in asset valuation - applies to both residual income (RI) and return on investment (ROI). Consider the calculations for both:

RoI = PBIT/Capital employed; RI = PBIT - (capital employed * imputed cost of capital)

The lower the carrying value, the lower the capital employed and the higher both measures will be. This statement relates to both.

Statement 2: In the short-term it can conflict with net present value (NPV) indicators - applies to both residual income (RI) and return on investment (ROI). Projects with positive NPVs would increase shareholder wealth and should be undertaken. The conflict with RI/ROI and NPV can

come where managers are reluctant to invest in projects with positive NPVs as these investments would cause RI and ROI to reduce (due to the increase in assets).

Statement 3: Always increases when new investments earn returns greater than the cost of capital - applies to residual income (RI) only. RI will always improve if returns exceed the cost of capital, however ROI may not increase if the existing return is very high.

Statement 4: Facilitates the comparisons of managerial performance in divisions of different sizes - applies to return on investment (ROI) only. ROI being a relative measure is good for comparing divisions of different sizes, whereas RI, as an absolute measure, does not.

Quiz: Optimal Transfer Pricing

Division A supplies other divisions within the company with component parts. There are other suppliers in the market supplying virtually identical products with known prices, and Division A also supplies third-party companies.

From the viewpoint of the company as a whole, what is the optimal basis for the transfer price for components sold by Division A to other divisions within the company?

A. Full cost plus a profit margin

B. Marginal cost

C. Market price

D. Market price less marketing costs

Answer:

The correct answer is D.

Tutorial note: The optimal transfer price is marginal cost plus opportunity cost. Since Division A also sells to external customers, the opportunity cost would be the contribution per unit from external sales. The marginal cost would be the variable cost per unit, which is the same as the variable cost of goods sold to external customers. This means that the market price equals the marginal cost plus the opportunity cost. However, since there are savings on marketing costs, these should be deducted.

Quiz: Budget Profit of Machining Centre

The manufacturing process of Rowl Co involves two stages, each of which is carried out in a separate profit centre.

All output from the machining profit centre is transferred immediately to the assembly profit centre, and the production flow is balanced. The budgeted sales volume is 120,000 units at a price of $26 per unit. Budgeted costs are:

	Machining	Assembly
Variable costs	$6 per unit	$4 per unit
Fixed costs	$525,000	$350,000

The transfer price is set at variable cost, plus 150%.

What is the budget profit of machining centre.

Answer:

The correct answer is 555,000.

WORKING

Per unit   Machining   Assembly
Variable cost $6 $4
Transfer cost $15 $15
Selling price $26
Contribution $9 $7 ($26 – ($4 + $15))
* 120,000 units $1,080,000 $840,000
Less: Fixed costs $525,000 $350,000
Profit $555,000 $490,000

Quiz: Budget Profit of Assembly Centre
The manufacturing process of Rowl Co involves two stages, each of which is carried out in a separate profit centre.
All output from the machining profit centre is transferred immediately to the assembly profit centre, and the production flow is balanced. The budgeted sales volume is 120,000 units at a price of $26 per unit. Budgeted costs are:
                Machining   Assembly
Variable costs $6 per unit $4 per unit
Fixed costs $525,000 $350,000
The transfer price is set at variable cost, plus 150%.
What is the budget profit of machining centre.
Assembly
Answer:
The correct answer is 490,000.
WORKING
Per unit   Machining   Assembly
Variable cost $6 $4
Transfer cost $15 $15
Selling price $26
Contribution $9 $7 ($26 – ($4 + $15))
* 120,000 units $1,080,000 $840,000
Less: Fixed costs $525,000 $350,000
Profit $555,000 $490,000

Quiz: Budgeted Profit for Design and Production Departments
Admedia Co provides an advertising design and production service. The production department is the only customer of the design department; all design work is transferred from the design department to the production department at full cost plus 40%.
The production department then completes the project for delivery to external clients.
The production department charges external clients $90 per hour of work.
For a specific project, Admedia has budgeted that 7,000 hours will be charged to clients. The budgeted costs are:
                Design   Production

Variable costs $29 per hour $35 per hour
Fixed costs $56,160 $172,000
Hours   2,400   7,000
What is the budgeted profit for the two departments for this project?
(Select your answer using the rectangular buttons)

	Design	Production
A.	$22,464	$87,240
B.	$50,304	$36,936
C.	$27,840	$115,560
D.	$50,304	$213,000

Answer:
The correct answer is B.
WORKING

		$
Design	Variable costs ($29 * 2,400 hours)	69,600
	Fixed costs	56,160
		125,760
	Profit = 40% mark up	50,304
	Cost to production section	176,064
Production	Variable costs ($35 * 7,000)	245,000
	Fixed costs	172,000
	Total costs	
	(245,000+172,000+176,064)	593,064
	Revenue ($90 * 7,000 hours)	630,000
	Profit	36,936

Quiz: Transfer Pricing and Goal Congruence
Which of the following statements about transfer pricing is correct?
A.Head office managers should never be involved in transfer pricing decisions
B.The market price will always be the most appropriate transfer price
C.The transfer price will not affect divisional profits
D.The transfer price should promote goal congruence
Answer:
The correct answer is D.
Tutorial note: To say head office managers should never be involved is incorrect. It may be desirable to leave divisional managers to negotiate alone, but there will often be situations where head office managers will need to become involved to ensure that negotiations run smoothly.
The market price may be the most appropriate transfer price if the selling division is operating at full capacity. This will not always be the case however, and if the selling division has spare capacity, using the market price may lead to goal incongruence.

Quiz: Internal Transfer Pricing Below Market Price

Two divisions within an organisation have autonomy to decide whether to trade with each other or not, and to negotiate transfer prices. The selling division sells its output externally at the external market price, and there is sufficient external demand to ensure that the selling division could sell all that it can produce to external customers. A transfer price has been agreed between the two divisions that is below the external market price.

Which of the following is the MOST LIKELY reason for making internal transfers at less than the external selling price of the selling division?

A.Head office has imposed the transfer price

B.The management of the selling division is seeking to restrict the quantity produced

C.Some additional costs incurred on external sales are not incurred on internal transfers.

D.The transfer price has been set to allow the buying division to compete through lower prices

Answer:

The correct answer is C.

Tutorial note: It is quite common for an adjusted transfer price to be used where the market price is taken and adjusted to reflect savings that are made on internal transfers.

Quiz: Statements about Transfer Pricing

Which of the following statements about transfer pricing is correct?

A.Cost-based transfer prices encourage the transferring division to control costs

B.A transferring division's profit can be maximised at a transfer price below market price

C.Market-based transfer prices always maximise overall company profits

D.The basis used to calculate transfer price will not affect overall company profits

Answer:

The correct answer is B.

Tutorial note: If a cost plus price is used, the transferring (selling) division has no incentive to reduce its costs.

Market prices may lead to goal incongruence and hence will not always maximise overall company profits.

Quiz: Minimum Transfer Price Accepted

Division Sell is operating at full capacity producing component XBD2 which it sells externally for $8.00 per unit. The variable cost of production is $5 per unit. Another internal division, Division Buy is negotiating a transfer price for purchasing component XBD2 from Division Sell. Because of saved transport costs, the variable cost of producing component XBD2 for Division Buy would be $4.50 per unit.

What is the minimum transfer price that Division Sell should accept for transferring component XBD2 to Division Buy?

A.$4.50 per unit

B.$5.00 per unit

C.$7.50 per unit

D.$8.00 per unit

Answer:

The correct answer is C.

WORKING

The minimum transfer price would be the marginal cost plus the opportunity cost for Division Sell of supplying the components to Division Buy.

Marginal cost is the variable cost, which is $4.50 for internal transfers.

The opportunity cost is the lost contribution on external sales, which is $3 per unit ($8 − $5)

So minimum transfer price is $7.50 (4.50 + 3).

Quiz: Transfer Price Calculation for Desired Profit

A company has budgeted to produce 30,000 units of a product in one of its divisions. Total costs for the division are expected to be:

Direct materials $52,000

Direct labour $77,000

Overheads (40% variable)$28,000

What transfer price per unit will generate a desired divisional profit of 10% on sales (to two decimal places)? (Answer in $ to two decimal places in the Answer box)

Answer:

The correct answer is 5.81.

WORKING

Costs of the division: $52,000 + $77,000 + $28,000 = $157.000

Transfer value required for 10% margin: $157,000/0.9 = $174,444

Check: ($174,444 - $157,000)/$174,444 = 0.1 or 10%

Number of units = 30,000

Transfer price per unit: $174,444/30,000 = $5.81

Quiz: Profit Impact of Selling the Components

Oxco has two divisions, A and B. Division A makes a component for air conditioning units that it can only sell to Division B. It has no other outlet for sales.

Current information relating to Division A is as follows:

Marginal cost per unit$100

Transfer price of the component $165

Total production and sales of the component each year 2,200 units

Specific fixed costs of Division A per year $10,000

Cold Co has offered to sell the component to Division B for $140 per unit. If Division B accepts this offer, Division A will be shut down.

If Division B accepts Cold Co's offer, what will be the effect on profits per year for the Oxco group?

A.Increase of $65,000

B.Decrease of $78,000

C.Decrease of $88,000

D.Increase of $55,000

Answer:
The correct answer is B.
WORKING
Increase in variable costs from buying in (2,200 units * $40 ($140 – $100)) = $88,000
Less the specific fixed costs saved if A is shut down = ($10,000)
Decrease in profit = $78,000

Quiz: Transfer Price for Profit Margin
Conference Co has a divisionalised structure. One of its divisions, Division X, sells all its output
to other divisions within the company.
Division X's annual budgeted output and costs are as follows:
Units sold 1,050
Direct materials $22,500
Direct labour $45,350
Overheads (40% variable) $37,150
What transfer price per unit will result in a profit margin of 20% for Division X (to the nearest
$)? (Answer in $ in the Answer box)
Answer:
The correct answer is 125.
WORKING
The divisions total cost is $105,000 (22,500 + 45,350 + 37,150).
To earn a profit margin of 20%, transfer price per unit = $(105,000/(1 – 20%)/1,050 = $125.

Quiz: Transfer Pricing Objectives
Which TWO of the following bases for setting a transfer price are most likely to result in goal
congruent behaviour by BOTH the selling and receiving divisions?
A.Opportunity cost
B.Market price
C.Actual cost
D.Standard full cost plus
Answer:
The correct answer is A and B.
Tutorial note: Goal congruence is the primary objective of a transfer pricing system (i.e. the
decisions of divisional managers are in the best interests of the organisation as a whole).
When the transfer price is based on opportunity cost (i.e. variable cost plus opportunity cost)
and the selling division can sell externally, the opportunity cost will be the contribution lost
from selling internally rather than externally. This transfer price ensures that anything in excess
of this will incentivise the seller to sell. The buyer's maximum price is the lower of divisional net
revenue and market price. Anything lower than this will incentivise the buyer to buy.
When the transfer price is equal to the market price, neither the buyer nor the seller will pay
more or sell for less than for an external purchase or sale. (The transfer price may be slightly
less if savings can be made from reduced distribution or packaging costs internally.)

Actual cost methods could pass the cost of inefficiencies from the seller to the buyer; incentivising the seller, but not the buyer. The buyer may buy externally (a dysfunctional decision) when it would be goal congruent to buy internally. Standard full cost plus would similarly incentivise the seller.

Quiz: Minimum Transfer Price for Division A

Product S is produced by Division A, and may be sold externally, or transferred to Division B for further processing.

The market selling price per kg of Product S is $6.10. Product S can be further processed by Division B into Product SX, and be sold to external markets for $6.80. The variable cost to further process Product S into product SX is $0.80.

Division A and Division B have been set up as profit centres, in which their managers are evaluated on the profits of their division.

External demand for Product S is only 1,500 kg per month, but 1,800 kg per month are produced since Division A operates at full capacity in order to meet demand for the other joint products of the process. Any unsold kg of Product S are scrapped at the end of the month.

Division B wishes to buy 500 kg per month of Product S from Division A.

What is the minimum transfer price that Division A would accept for 500 kg of Product S?

A.$0
B.$1,220
C.$1,360
D.$3,050

Answer:

The correct answer is B.

WORKING

Minimum transfer price is the marginal cost plus the opportunity cost per kg.

Production of Product S is limited to 1,800 kg per month, but maximum demand is 1,500. Division B wishes to buy 500 kg of Product S. This means that Division A will lose 200 kg of external sales, and must be compensated for this. The minimum that it will accept for these is the external market price.

For the remaining 300 kg, the marginal cost is zero (1,800 units will be produced anyway and disposed of if not used) and the opportunity cost is also zero.

Therefore, minimum transfer price:

>1,220

	$
First 200 kg @ $6.1	1,220
Next 300 kg @ 0	0
Minimum transfer price	1,220

Quiz: Transfer Pricing Policy

The management of Process Co has decided that in order to simplify the accounting, all products transferred from Division A to Division B will be charged using a transfer price equal to

the variable costs of production. Division A will be required to supply as many kg as Division B wishes to buy at this price but will be allowed to sell any surplus kg externally.

Which of the following objectives of a good transfer pricing system is achieved by this transfer pricing policy?

A.Autonomy

B.Goal congruence

C.Fair evaluation of divisional performance

D.None of the above

Answer:

The correct answer is D.

Tutorial note: None of the objectives of transfer pricing would be achieved by this policy. Autonomy is breached by requiring the management of Division A to supply as many units to Division B as they wish, therefore taking away the ability of the managers of Division A to make their own production and selling decisions. Goal congruence may well not be achieved – Division C can buy all three products at variable cost, which is likely to be below the market price that Division A could sell them for. This may lead to the wrong decisions being made (e.g. Division C might buy Product S and further process it into SX, even though this would reduce overall profits of the company since the incremental revenue of processing product S is less than the further processing costs).

Case: Implementation and Evaluation of EPOS and ERPS in XYZ Stores

XYZ Stores operates a chain of 10 convenience stores: three larger stores in Bigton and seven in nearby towns. The current information systems in each store are very basic. The larger stores have three cash registers and the smaller stores only one or two that record the value of sales transactions, but which are not linked to head office systems. The directors are considering investing in a new system whereby the cash registers would be replaced with computerised Electronic Point of Sale (EPOS) cash registers that use bar code readers to record details of each sale. The EPOS cash registers will be linked to a new enterprise resource planning system (ERPS) at head office. All sales transactions from the EPOS cash registers will be posted to the ERPS database so that sales are automatically recorded in the accounting module. The inventory control module will also be updated as each sale takes place so that the company will have up to the minute information about inventory levels at each store. This will allow the stores to avoid stock outs, since new orders can be placed with suppliers when inventory levels are approaching their re order level. The IT manager of XYZ Stores has suggested that the company should also buy a reporting programme that can analyse the information in the ERPS database and provide reports to the directors. The reports would include summaries of sales by store and product categories (e.g. soft drinks, snacks, toiletries and newspapers). The programme can also provide data visualisations, such as bar charts, line charts and pie charts. It includes a "drill down" facility whereby users can click on a particular number in the report to see a more detailed analysis. Managers can also design their own reports using this programme.

Question 1. Which of the following is a main characteristic of an ERPS? A. Ability to compute "what-if" scenarios and outcomes from input variables B. An information system responsible for capturing and processing data C. A system that records the relationship between the enterprise and customers D. Shared access to multiple simultaneous users with real-time information
Answer:
The correct answer is D. Tutorial note: A decision support system (DSS) provides for "what if" scenarios. An information system responsible for capturing and processing data characterises a transaction processing system (TPS). A customer relationship management system (CRM) records the relationship between the enterprise and customers.

Question 2. New purchase orders will be placed with suppliers when the inventory levels recorder in the inventory module in the ERPS system reaches the re order levels Which of the following best describes the decision to reorder inventory? A. A strategic decision B. A tactical decision C. A planning decision D. An operational decision
Answer:
The correct answer is D.Tutorial note: This is a decision relating to the day-to-day running of the business and would therefore be categorised as an operational decision in Anthony's model.

Question 3. Identify by selecting the relevant boxes in the table below, whether each of the following statements relating to the new system is true or false.
Statement 1: The continuous updating of inventory records whenever a sale is made is an example of batch processing
Statement 2: The cost associated with the EPOS terminals are examples of direct data capture costs
Statement 3: The ERPS will enable the sharing of information across the organisation
Statement 4: An ERPS is an alternative to a management information system
Answer:
Statement 1: False
Statement 2: True
Statement 3: True
Statement 4: False
Tutorial note: Continuous updating of inventory records is an example of real time processing. In batch processing, transactions are collected and processed in discrete runs. An ERPS is a type of management information system, not an alternative to it.

Question 4. Details of a reporting programme that the IT manager suggested are included above. What is this reporting programme is an example of? A. An open system B. A decision support system C. An executive information system D. A transactions processing system
Answer:
The correct answer is C. Tutorial note: An executive information system provides summarised information to executives of an organisation and many contain the features of the reporting programme described.

Question 5. Match the following information needs to the most appropriate data visualisation.
Information Data visualisation Monthly sales of all ten stores for a year Select one V Quarterly sales of the Bigton stores for a year Total sales of each of the Bigton stores for the month v The proportion of revenue earned by each product category for a month

Information	Data visualisation
Monthly sales of all ten stores for a year	
Quarterly sales of the Bigton stores for a year	
The proportion of revenue earned by each product category for a month	

Answer:

	Data visualisation
Monthly sales of all ten stores for a year	Table
Quarterly sales of each of the Bigton stores for a year	Compound bar chart
Total sales of each of the Bigton stores for the month	Simple bar chart
The proportion of revenue earned by each product category for a month	Pie chart

Tutorial note: A simple bar chart is used to present a single data series over multiple periods or multiple data series (e.g. total sales of each of three stores) over a single period (e.g. a month). A compound bar charts is used to present multiple data series over multiple periods (e.g. four quarters in a year). A pie chart is a visualisation of proportions for a single period. None of the charts would be suitable to show the amount of numerical data for monthly sales for all ten stores, which would be best summarised in a table.

Case: Evaluating the Impact of Activity-Based Costing on Pricing Strategies at BBB
Brick By Brick (BBB) provides a range of building services, including garage conversions (GC) and extensions to properties (EX). BBB has a policy to price all jobs at budgeted total cost plus 50%. Overheads are currently absorbed on a labour hour basis. However, BBB has found that it has fewer GC contracts than expected, and it believes that this is because the current overhead absorption method apportions an excessive amount of overheads to GC, leading to a price that is uncompetitive. The company is now considering moving to an activity based cost approach. You are provided with the following data relating to the total overheads incurred in GCs and EXs:

Overhead category	Annual overheads	Activity driver	Total number of activities
Supervision	90,000	Site visit	500
Planning	70,000	Planning documents	250
Property related	240,000	Labour hours	40,000
	400,000		

A typical GC costs $3,500 in materials and takes 300 labour hours to complete. A GC requires only one site visit by a supervisor and needs only one planning document to be raised. In all cases, labour is paid $15 per hour.
Question 1. What is the sales price for a typical GC, using the current method of absorbing overheads?
Answer:
The correct answer is $16500.
WORKING

Price per unit using absorption cost plus 50%:	

		$
Materials		3,500
Labour (300 * 15)		4,500
Overheads (300 * ($400,000/40,000))		3,000
Total cost		11,000
Plus mark-up (50%)		5,500
Current price		16,500

Question 2. What is the cost of a GC using activity-based costing?
Answer:
The correct answer is $10,260.

		$
Materials		3,500
Labour (300 * 15)		4,500
Overheads:		
Supervisors (1 * 180)		180
Planners (1 * 280)		280
Property related (300 * 6)		1,800
Total cost		10,260

Cost per unit of driver for each activity:
Supervisors: 90,000/500 = $180 per site visit
Planners: 70,000/250 = $280 per planning document

Question 3. A typical EX costs $8,000 in materials and takes 500 hours of labour to complete. Each EX requires six site visits and five planning documents. What price should be quoted for a typical EX, using a 50% mark-up on the activity-based cost?
Answer:
The correct answer is $31470.

Cost per unit of a typical EX using activity based costing:		
		$
Materials		8,000
Labour (500 * 15)		7,500
Overheads:		
Supervisors (6 * 180)		1,080
Planners (5 * 280)		1,400
Property related (500 * 6)		3,000
Total cost		20,980
Therefore quoted price at 50% mark-up (20,980 * 150%)		31,470

Question 4. The following statements have been made about activity-based costing at BBB:
1) The usefulness of activity-based costing depends on the identification of appropriate cost drivers
2) Activity-based costing would lead a clearer understanding of what drives costs at BBB

Which of the above statements is/are true? A. 1 only B. 2 only C. Neither 1 nor 2 D. Both 1 and 2
Answer:
The correct answer is D. Tutorial note: An essential exercise in implementing activity-based-costing would be the identification and measurement of appropriate cost drivers. When implemented correctly, ABC would help organisations manage and reduce costs. In BBB's case, it may be identified that GC incurs significantly less cost in supervision and planning compared to EX.

Question 5. Which of the following statements regarding environmental activity-based costing are correct? 1. Environment-related costs can be allocated directly to a cost centre 2. Costs categorised as environment-driven costs tend to be hidden in overheads 3. Environmental costs are considered from the design stage of a product through to decommissioning at the end of its life B. 1 and 2 C. 1 and 3 D. 2 and 3
Answer:
The correct answer is B. Tutorial note: (3) is a feature of environmental life-cycle costing.

Case: Evaluating Costing Methods for Accurate Procedure Pricing at Beckley Hill Hospital
Beckley Hill (BH) is a private hospital carrying out two types of procedures on patients. Each type of procedure incurs the following direct costs:

Procedure	A	B
	$	$
Surgical time and materials	1,200	2,640
Anaesthesia time and materials	800	1,620

Total overhead costs are $17,606,352. BH currently calculates the overhead cost per procedure by dividing the total overhead cost by the number of procedures, which are as follows:

| Procedure | A | B |
| Number of procedures | 14,600 | 22,400 |

The finance director at BH is considering implementing activity based costing. He has obtained an analysis of BH's total overheads for the last year and some additional data, all of which is shown below:

Cost	Cost driver	$
Administrative costs	Administrative time per procedure	1,870,160
Nursing costs	Length of patient stay	6,215,616
Catering costs	Number of meals	966,976
General facility costs	Length of patient stay	8,553,600
Total overhead costs		17,606,352

Procedure	A	B
Number of procedures	14,600	22,400
Administrative time per procedure (hours)	1	1.5
Length of patient stay per procedure (hours)	24	48

| Average number of meals required per patient | 1 | 4 |

The length of patient stay per procedure cannot be reduced as this includes the amount of time patients need to recover.

Question 1. What is the total cost of Procedure B using the current method of calculating overhead cost per procedure (to the nearest $)? A. $476 B. $786 C. $4,736 D. $5,046

Answer:

The correct answer is C.

WORKING

Cost per procedure	$
Surgical time and materials	2,640
Anaesthesia time and materials	1,620
Overhead costs (W)	476
Total cost per unit	4,736
WORKING	
Total overhead costs	$17,606,352
Total procedures (A (14,600) + B (22,400))	37,000
Therefore, cost per procedure	$476

Question 2. Using activity-based costing, what is the cost driver rate for nursing costs (per patient hour)? A. $4.36 B. $167.99 C. $128.95 D. $12.35

Answer:

The correct answer is A.

WORKING

Procedure	A	B	Total
Number	14,600	22,400	
Length of patient stay (hours)	24	48	
Therefore, patient hours	350,400	1,075,200	1,425,600

Cost driver rate (Nursing costs per hour): $6,215,616/1,425,600 = $4.36

Question 3. Using activity-based costing, what is the administrative cost per Procedure A (to two decimal places)?

Answer:

The correct answer is $ 38.80

WORKING

Procedure	A	B	Total
Administrative time per procedure	1	1.5	
Number of procedures	14,600	22,400	
Therefore, administrative time	14,600	33,600	48,200

Cost per adminstrative hour = $1,870,160/48,200 = $38.80

Adminstrative cost per procedure A = $38.80 * 1 hour =$38.80

Question 4. The management accountant has suggested that rather than going to the expense of implementing activity based costing, the hospital should continue to use absorption costing to charge overheads to the procedures, but should reconsider what is the most appropriate basis for absorbing overhead costs. What would be the most appropriate basis for BH to use in

absorption costing? A. Number of procedures B. Administrative time (hours) C. Length of patient stay (hours) D. Number of meals
Answer:
The correct answer is C. Tutorial note: It can be seen from the analysis of activities that Nursing Costs and General Facility costs account for 83% of total overhead (14,769,216/17,606,352). Since the activity based analysis identified the length of patient stay as being the driver of these costs, using this as the basis of an absorption costing rate would provide the most appropriate method of charging overheads.

Question 5. The following statements have been made in relation to activity-based costing: 1) A cost driver is a factor which causes a change in the cost of an activity 2) Traditional absorption costing tends to under-estimate overhead costs for high volume products Which of the above statements is/are true? A. 1 only B. 2 only C. Neither 1 nor 2 D. Both 1 and 2
Answer:
The correct answer is A. Tutorial note: (2) is not true as traditional absorption costing tends to over allocate costs to high volume products, not under allocate them.

Case: Life-Cycle Costing Analysis for Nuclear and Wind Power Stations at Volt Co
Volt Co generates and sells electricity. It operates two types of power station: nuclear and wind. The costs and output of the two types of power station are detailed below:
Nuclear station: A nuclear station can generate 9,000 gigawatts of electricity in each of its 40 years of useful life. Operating costs are $486m per year. Operating costs include a provision for depreciation of $175m per year to recover the $7,000m cost of building the power station. Each nuclear station has an estimated decommissioning cost of $12,000m at the end of its life. The decommissioning cost relates to the cost of safely disposing of spent nuclear fuel.
Wind station: A wind station can generate 1,750 gigawatts of electricity per year. It has a life-cycle cost of $55,000 per gigawatt and an average operating cost of $40,000 per gigawatt over its 20-year life.
Question 1. What is the life-cycle cost per gigawatt of the nuclear station (to the nearest $000)?
Answer:
The correct answer is $ 87000 (to the nearest $000).
WORKING

	$m
Operating cost ($486m * 40 years)	19,440
Decommissioning cost	12,000
Total life-cycle costs	31,440
Total gigawatts (9,000 * 40 years)	360,000
Life-cycle cost per gigawatt ($31,440m/360,000 gigawatts)	$87,333

Question 2. Which of the following will decrease the total life-cycle cost of a nuclear station? 1. Increasing the useful life of the station 2. Reducing the decommissioning cost A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2
Answer:

The correct answer is B. Tutorial note: If the useful life of the nuclear station is increased, the operating cost will be incurred every year and so increase the total life-cycle costs. Statement (1) is not correct. If the decommissioning cost is reduced, the total life-cycle costs will decrease. Statement (2) is correct.

Question 3. How would the disposal cost of spent nuclear fuel be categorised in environmental management accounting (EMA)? A. A prevention cost B. A detection cost C. An internal failure cost D. An external failure cost
Answer:
The correct answer is C. Tutorial note: The disposal cost of the spent nuclear fuel is incurred by Volt Co as a result of its activities; it is disposed of in a safe manner to ensure that it does not become a cost borne by society as a whole.

Question 4. If Volt Co sets a price to earn an operating margin of 40% over the life of a wind station, what will be the total lifetime profit per station (to the nearest $m)? A. $35m B. $408m C. $560m D. $933m
Answer:
The correct answer is B.
WORKING
Selling price per gigawatt (cost $40,000/(1 - 40%)	$66,667
Lifetime profit per gigawatt ($66,667 - $55,000)	$11,667
Total lifetime profit (1,750 gigawatts * $11,667 * 20 years)	$408.345m

Question 5. Which of the following are benefits of life-cycle costing for Volt Co? 1. It facilitates the designing out of costs at the product development stage 2. It can encourage better control of operating costs over the life cycle 3. It gives a better understanding of the causes of overhead costs 4. It provides useful data for short-term decision-making A. 1, 2 and 3 B. 1 and 2 only C. 1 and 4 D. 2, 3 and 4
Answer:
The correct answer is B. Tutorial note: (1) and (2) are benefits of life-cycle costing. (3) is a benefit of activity-based costing and (4) is a benefit of relevant costing.

Case: Life-Cycle Costing and Strategic Planning for Midhurst Co's New Air Conditioning Unit Midhurst Co manufactures air conditioning units and is considering an investment in a new unit that will be used in modern office buildings. Advances in technology mean that this unit is more sensitive to changes and variations in temperature and therefore it can regulate airflow and heating more efficiently. Midhurst Co's competitors currently do not have an equivalent product that can offer these features. Midhurst Co expects to sell 10,000 units over the predicted five-year life cycle of the unit. The finance director has just prepared the initial costings for the unit as follows:
| | $000 |
| Research and development costs | 6,200 |

Design costs	33,450
Marketing costs	177,685
Variable production cost per unit	42
Fixed production cost	98,470
Variable distribution cost per unit	9
Fixed distribution cost	10,300
Variable selling cost per unit	4
Fixed selling cost	7,790
Administration cost	23,450

The finance director plans to use life-cycle costing to measure the profitability of the new product. The chief executive has asked for more information about life-cycle costing, as she is not sure whether it is the right method to use. The production director has reviewed the costings in detail and suggested a couple of changes. He is enthusiastic about the product and believes that modifications could be made to prolong the product's life but wonders when the best time would be to make changes to the product.

Question 1. According to the life-cycle costing method, which TWO of the following statements regarding the stages of the life-cycle are true? A. At the introduction stage, further capital expenditure will be needed as production capacity will need to increase to meet demand B. The maturity stage occurs when the market has reached saturation point and bought enough of the product C. The majority of a product's life-cycle costs are determined by decisions which are made at the design and development stage D. The growth stage, when sales will have reached their peak and become stable, will be the most profitable stage
Answer:
The correct answer is A,C. Tutorial note: These statements are correct as capital expenditure is likely to increase at the introduction stage and the majority of a product's costs are determined at the outset. Reaching a saturation point defines the decline stage of the product lifecycle and stability defines the maturity stage.

Question 2. What is the cost per unit for the new air conditioning unit using life-cycle costing (to the nearest $)? A.$35,740 B.$51,847 C.$88,390 D.$90,735
Answer:
The correct answer is D.
WORKINGS
Cost per unit using life-cycle costing = Total cost over the full life-cycle of the product /Number of units to be produced over the life-cycle = $907,345,000/10,000 = $90,735
*Total cost (in $000s) = $6,200 + $33,450 + $177,685 + ($42 * 10,000) + $98,470 + ($9 * 10,000) + $10,300 + ($4 * 10,000) + $7,790 + $23,450 = $907,345

Question 3. The production director has suggested the following change for the costing of the new unit:
Currently material costs are 20% of the variable production costs per unit. One of the materials used is stainless steel which is budgeted at $2,000 per unit but an alternative corrosion-resistant

metal costing 25% less can be used. The production director believes a 15% discount can be negotiated for the remainder of the materials.

What would be the revised material cost per unit (to the nearest whole $)?

Answer:

The correct answer is $ 6940

WORKING

Current variable material cost = 20% * $42,000 = $8,400 per unit

Revised variable material cost = (85% * ($8,400 - $2,000)) + (75% * $2,000) = $6,940

Question 4. The production director has also asked about the implications for production planning if the company wishes to extend the product's life-cycle. At what stage of the life-cycle is the unit most likely to undergo product development? A. Introduction B. Growth C. Maturity D. Decline

Answer:

The correct answer is C. Tutorial note: Normally, product development occurs at the maturity phase in order to extend the profitable stage of the life-cycle. This is usually done by adding enhancements or new features.

Question 5. The chief executive wants to be briefed on the advantages of using life-cycle costing. Which of the following statements relating to the advantages of life-cycle costing are correct? 1. It draws management's attention to all costs related to a product which other costing methods usually treat as period costs 2. It focuses on measuring a product's costs from concept to withdrawal rather than reviewing costs on a period by period basis 3. It focuses on what consumers are prepared to pay for a product and establishes cost budgets based on an expected selling price 4. It aids understanding of the relationship between decisions at the design stage and the cost of other functions, such as marketing A. 2, 3 and 4 only B. 1, 2 and 4 only C. 1 and 3 only D. 1, 2, 3 and 4

Answer:

The correct answer is B. Tutorial note: (3) is an advantage of target costing and not life-cycle costing.

Case: Target Costing Challenges and Strategic Planning for Darask Co's D-Paad Launch

Darask Co is a global consumer electronics manufacturer. It sells its own brand of smartphones, computers and personal entertainment devices. It uses target costing.

D-Paad - Feasibility study results The board of Darask Co has conducted a feasibility study in order to decide whether or not to launch a new device, the D-Paad, in 20X9. The D-Paad will have a three-year life cycle, over which a total of 80 million units will be sold. The variable manufacturing and selling cost of the D-Paad is currently estimated at $123 per unit. The total fixed product cost, including investment and overheads, is budgeted to be $3,360m over the whole life cycle. The initial estimate of the selling price included in the feasibility study for the D-Paad was calculated to ensure a profit mark-up of 60%.

D-Paad - Market research analysis The board decided to commission some market research to determine the price customers would be willing to pay for the D-Paad. Sales volumes and sales prices were estimated for the various stages of the D-Paad's product life cycle as follows:

	Sales volume (millions)	Sales price ($/unit)
Introduction	8	425
Growth	14	300
Maturity	56	220
Decline	2	120

Based on the market analysis, the board has approved the development of the D-Paad as long as the total product cost, including manufacturing, investment and overheads, does not exceed $13,000m.

Retail outlets

The board of Darask Co is also considering the opening of some retail outlets which will be located in major cities around the world. The outlets, as well as selling Darask Co's products, will also hold free-of-charge surgeries where the product users can seek help on how to use their devices and have their devices repaired. The board has been discussing whether it is possible to use target costing in relation to the retail outlets. The following statements have been made:

Director X: Target costing cannot be used because it is difficult to estimate target selling prices for services

Director Y: Target costing is most useful when what is being developed has a high degree of variability such as developing new services

Director Z: Target costing when developing new services is difficult because services are intangible and measuring a unit of service is not always possible

Question 1. Which of the following statements about the use of target costing at Darask Co is/are correct? 1. It relies on just-in-time processes in order to work 2. It can be used alongside life cycle costing and planning A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2
Answer:
The correct answer is B. Tutorial note: (1) is incorrect as, although just-in-time (JIT) is often associated with cost reduction and performance improvement, it is not a requirement for target costing, as long as there is scope to reduce costs sustainably in other ways. (2) is correct; target costing, life cycle costing and planning are not mutually exclusive alternatives.

Question 2. What was the initial selling price of the D-Paad from the feasibility study results (to the nearest whole $)?
Answer:
The correct answer is $ 264
WORKING

The correct answer is $		264	
WORKING			
		$m	
Variable cost ($123 * 80m)			9,840
Fixed cost (given)			3,360
		13,200	

| Mark-up | * 1.6 |
| | | 21,120 |

Initial selling price is therefore £21.120m/80m units = $264 per unit

Question 3. Based on the market research analysis, what is the total cost gap of the D-Paad, if Darask Co wants to achieve a target profit margin of 45%? A. $1,912m B. $3,928m C. $9,072m D. $11,088m

Answer:

The correct answer is A.

WORKING

| The correct answer is A. |
| WORKING |
	Sales units	Sales price	Revenue
(millions)	S	Sm	
Introduction	8	425	3,400
Growth	14	300	4,200
Maturity	56	220	12,320
Decline	2	120	240
Target revenue	80		20,160
Target cost (balancing figure)			(11.088)
Target profit (45% * $20, 160m)			9,072

Cost gap = $13,000m - $11,088m = $1,912m

Question 4. The following proposals have been made in order to close the cost gap of the D-Paad: 1. Introduce 24-hour working in the factories where the D-Paad is made in order to increase production and build inventory 2. Incorporate quality assurance inspections into the manufacturing processes to reduce faulty units 3. Increase the sales and marketing spend in order to boost the sales volumes of the D Paad Which of these proposals is/are likely to reduce the cost gap? A. 1 and 2 B. 2 and 3 C. 2 only D. 1 and 3

Answer:

The correct answer is C. Tutorial note: Increasing capacity and building inventory are non-value adding activities unless the additional production can be sold. So not (1). Boosting marketing spend to sell more units may be tempting but it does not address the cost gap. Quality assurance inspections eliminate waste and reduce cost so is the only potential option to reduce the cost gap.

Question 5. In relation to the use of target costing for the retail outlets, which of the directors' statements is/are correct? A. X, Y and Z B. Y and Z only C. X and Y only D. Z only

Answer:

The correct answer is D. Tutorial note: Director X is wrong as it is possible to estimate target selling prices for services (many organisations do) even if target costs may be more difficult to establish. Director Y is also wrong because a high degree of variability makes it difficult to determine a target that can be achieved through cost reduction. Designing costs out of a new

mobile phone can be done because it is a standardised product; once designed, the cost reduction can be realised. However, if a service is variable, what is required to fulfil each customer's needs is less obvious, so a target cost can be difficult to meet. Director Z is correct as services are intangible and determining a service unit is not always possible.

Case: Evaluating the Financial Impact of Sunday Trading for Bits and Pieces Retail Store
Bits and Pieces (B&P) operates a retail store selling spares and accessories for the car market. The store has previously only opened for six hours per day, six days per week for the 50 working weeks in the year, but B&P is now considering also opening for trading on Sundays. Average daily sales from Monday through to Saturday is $10,000 per day with an average gross profit margin of 70%. Sunday revenues are expected to be 60% more than the average daily revenues for the other days. B&P buys all its goods from one supplier. This supplier gives a 5% discount on all purchases if annual spend exceeds $1,000,000. The store will have to be supervised by a manager, currently employed by the company and paid an annual salary of $80,000. If he works on a Sunday, he will take the equivalent time off during the week when the assistant manager is available to cover for him at no extra cost to B&P. He will also be paid a bonus of 1% of the extra sales generated by Sunday trading. The store will have to be lit at a cost of $30 per hour and heated at a cost of $45 per hour. The heating will come on two hours before the store opens in the 25 "winter" weeks to make sure it is warm enough for customers to come in at opening time. The store is not heated in the other weeks. It is the company policy that gross profit is stated after deducting the costs of the goods sold. Staff costs, energy and rental costs are not deducted from sales in determining gross profit. The store employs four employees (in addition to the manager). They each work five days a week, and are paid $200 per week. They all currently work on Saturdays and take a day off in lieu of this during the week. If Sunday trading is introduced, two of the existing staff will work on Sundays instead of Saturdays and be paid a premium of $30 each. Two part-time employees will be hired for $20 each per Saturday and $30 each per Sunday.

Question 1. By how much will the introduction of Sunday trading increase annual gross profit?
A. $350,000 B. $560,000 C. $572,000 D. $617,000
Answer:
The correct answer is D.
WORKINGS
(1) Increase in gross profit

Additional revenue	$
(16,000 per day (10,000 + 60%) * 50 days)	800,000
Additional cost of sales (GP margin is 70%)	(240,000)
Less additional supplier discounts (W2)	57,000
Additional gross profit from Sunday opening	617,000

(2) Additional supplier discounts
Annual revenue without Sunday opening = 6 * 50 * 10,000 = $3,000,000

Annual purchases without Sunday opening = $900,000
Therefore, the company would not qualify for the discount.
Annual purchases with Sunday opening (900,000 + 240,000) = $1,140,000
Over $1,000,000 so discount given on all purchases = 5% * $1,140,000 = $57,000

Question 2. What will be the annual relevant cost of the manager for Sunday trading? A. $0 B.
$8,000 C. $13,333 D. $21,333
Answer:
The correct answer is B.
WORKING
Manager's cost: The salary is fixed, so the only additional cost of the manager working on
Sunday is the bonus, being 1% of the additional revenue: (1% * ($10,000 + 60%) * 50 Sundays) =
$8,000

Question 3. What is the annual relevant cost of lighting and heating the stores for Sunday
trading ?
Answer:
The correct answer is $ 18,000
WORKING

Lighting (6 hours * $30 per hour * 50 days)	9,000
Heating (8 hours * $45 per hour * 25 days)	9,000
Total	18,000

Question 4. Annual rent of the store is $450,000. The annual relevant cost of rent for Sunday
trading is zero. Why is the relevant cost of rent zero? A. It is an uncontrollable cost B. It is not an
opportunity cost C. It is not an incremental cost D. It is a notional cost
Answer:
The correct answer is C. Tutorial note: Annual rent is not relevant because it does not increase
(i.e. is not incremental).

Question 5. What is the annual relevant cost of the labour for Sunday trading? A. $7,000 C.
$10,000 D. $12,000
Answer:
The correct answer is B.
WORKING
The relevant cost is the incremental cost:

	$
Premium paid to existing staff (2 * 30 * 50 weeks)	3,000
Replacement staff on Saturday (2 * 20 * 50 weeks)	2,000
Temporary staff for Sundays (2 * 30 * 50 weeks)	3,000
	8,000

Case: Analysis of Ceasing Tumble Dryer Production and Pricing Strategies for Stay Clean

Stay Clean manufactures and sells a small range of kitchen equipment. Specifically, the product range contains a dishwasher (DW), a washing machine (WM) and a tumble dryer (TD). The TD is of a rather old design and has for some time generated negative contribution. It is widely expected that in one year's time the market for this design of TD will cease, as people switch to a washing machine that can also dry clothes after the washing cycle has completed. Stay Clean is trying to decide whether or not to cease the production of TD now or in 12 months' time when the new combined washing machine/drier will be ready. To help with this decision the following information has been provided:

1) The normal selling prices, annual sales volumes and total variable costs for the three products are as follows:

	DW	WM	TD
	$	$	$
Selling price per unit	200	350	80
Material cost per unit	70	100	50
Labour cost per unit	50	80	40
Contribution per unit	80	170	-10
Annual sales (units)	5,000	6,000	1,200

2) It is thought that some of the customers that buy a TD also buy a DW and a WM. It is estimated that 5% of the sales of WM and DW will be lost if the TD ceases to be produced.

3) All the direct labour force currently working on the TD will be made redundant immediately if TD is ceased now. This would cost $6,000 in redundancy payments. If Stay Clean waited for 12 months, the existing labour force would be retained and retrained at a cost of $3,500 to enable them to produce the new washing/drying product. Recruitment and training costs of labour in 12 months' time would be $1,200 in the event that redundancy takes place now.

4) Stay Clean operates a just in time (JIT) policy and so all material cost would be saved on the TD for 12 months if TD production ceased now. Equally, the material costs relating to the lost sales on the WM and the DW would also be saved. However, the material supplier has a volume based discount scheme in place as follows:

Total annual expenditure ($)	Discount
0-600,000	0%
600,001-800,000	1%
800,001-900,000	2%
900,001-960,000	3%
960,001 and above	5%

Stay Clean uses this supplier for all its materials for all the products it manufactures. The figures given above in the cost per unit table for material cost per unit are net of any discount Stay Clean already qualifies for.

5) The space in the factory currently used for the TD will be sublet for 12 months on a short-term lease contract if production of TD stops now. Rental income will be $12,000.

6) The supervisor (currently classed as an overhead) supervises the production of all three products spending approximately 20% of his time on the TD production. He would continue to be fully employed if the TD ceases to be produced now.

Required: (a) Calculate whether or not it is worthwhile ceasing to produce the TD now rather than waiting 12 months. (b) Explain two pricing strategies that could be used to improve the financial position of the business in the next 12 months assuming that the TD continues to be made in that period. (c) Briefly describe two issues that Stay Clean should consider if it decides to outsource the manufacture of one of its future products.

Answer:
(a) Decision to cease to produce the TD
The relevant costs of the decision to cease the manufacture of the TD are needed:

Cost or revenue	Note	$
Lost revenue	(1)	(96,000)
Saved labour cost	(2)	48,000
Lost contribution from other products	(3)	(118,500)
Redundancy and recruitment costs	(4)	(3,700)
Supplier payments saved	(5)	88,500
Sublet income		12,000
Supervisor	(6)	0
Net cash flow		(69,700)

Conclusion: It is not worthwhile ceasing to produce the TD now.
Note 1: All sales of TD will be lost for the next 12 months (1,200 units * $80 = $96,000)
Note 2: All normal labour costs will be saved at 1,200 units * $40 = $48,000
Note 3: Related product sales will be lost. This will cost the business 5% * ((5,000u * $150) + (6,000u * $270)) = $118,500 in contribution (material costs are dealt with separately below)
Note 4:

If TD is ceased now:	
Redundancy cost	(6,000)
Retraining saved	3,500
Recruitment cost	(1,200)
Total cost	(3,700)

Note 5: Supplier payments:

	DW	WM	TD	Net cost	Discount	Gross cost
$	$	$	$	level	$	
Current buying cost	350,000	600,000	60,000	1,010,000	5%	1,063,158
Loss of TD			(60,000)	(60,000)	5%	(63,158)
Loss of related sales at cost	(17,500)	(30,000)		(47,500)	5%	(50,000)
New buying cost				921,500	3%	950,000
Difference in net cost				88,500		

Note 6: There will be no saving or cost as the supervisor will continue to be fully employed.
Alternative approach

Cash flow	Note	S
Lost contribution - TD	(7)	12,000
Lost contribution - other products	(8)	(71,000)
Redundancy and recruitment	(4)	(3,700)
Lost discount	(9)	(19,000)

Sublet income			12,000
Supervisor	(6)	0	
Net cash flow			(69,700)

Note 7: There will be a saving on the contribution lost on the TD of 1,200 units * $10 per unit = $12,000

Note 8: The loss of sales of other products will cost a lost contribution of 5% ((5,000 * $80) + (6,000 * $170)) = $71,000

Note 9:

	DW	WM	TD	Total (net)	Discount	Total gross
Current buying cost	350,000	600,000	60,000	1,010,000	5%	1,063,158
Saved cost	(17,500)	(30,000)	(60,000)			
New buying cost	332,500	570,000	0	902,500	5%	950,000
				921,500	3%	950,000
Lost discount				(19,000)		

(b) Pricing strategies

Complementary pricing

Since the washing machine and the tumble dryer are products that tend to be used together, Stay Clean could link their sales with a complementary price. For example, they could offer customers a discount on the second product bought, so if they buy (say) a TD for $80 then they can get a WM for (say) $320. Overall then Stay Clean makes a positive contribution of $130 (320 + 80 - 180 - 90).

Product line pricing

All the products tend to be related to each other and used in the utility room or kitchen. Some sales will involve all three products (e.g. if customers are upgrading their utility room or kitchen). A package price could be offered and as long as Stay Clean make a contribution on the overall deal then they will be better off.

(c) Outsourcing decision Outsourcing requires consideration of a number of issues (only 2 required):

· The cost of manufacture should be compared to cost of buying in from the outsourcer. If the outsourcer can provide the same products more cheaply then it is perhaps preferable.

· The reliability of the outsourcer should be assessed. If products are delivered late then the ultimate customer could be disappointed. This could damage the goodwill or brand of the business.

· The quality of work that the outsourcer produces needs to be considered. Cheaper products can often be at the expense of poor quality of materials or assembly.

· The loss of control over the manufacturing process can reduce the flexibility that Stay Clean has over current production. If Stay Clean wanted, say, to change the colour of a product then at present it should be able to do that. Having contracted with an outsourcer this may be more difficult or involve penalties.

Case: Relevant Cost Analysis for Telephone Co's Contract Pricing Decision

The Telephone Co (T Co) specialises in the provision of telephone systems for commercial clients. There are two parts to the business:

· installing telephone systems in businesses, either first time or replacement installations;

· supporting the telephone systems with annually renewable maintenance contracts.

T Co has been approached by a potential customer, Push Co, to install a telephone system in its new offices. Although the job is not a particularly large one, T Co is hopeful of future business in the form of replacement systems and support contracts for Push Co. T Co is therefore keen to quote a competitive price for the job. The following information should be considered:

1. One of the salesmen has already been to visit Push Co, to give them a demonstration of the new system, together with a complimentary lunch, the costs of which totalled $400.

2. The installation is expected to take one week to complete and would require three engineers, each of whom is paid a monthly salary of $4,000. The engineers have just had annual contracts renewed with T Co. One of the engineers has spare capacity, but the other two would have to be moved from contract X in order to complete this one. Contract X generates a contribution of $5 per engineer hour. There are no other engineers available to continue with Contract X if these two engineers are taken off the job. It would mean that T Co would miss its contractual completion deadline on Contract X by one week. As a result, T Co would have to pay a one-off penalty of $500. Since there is no other work scheduled for their engineers in one week's time, it will not be a problem for them to complete Contract X at this point.

3. T Co's technical advisor would also need to dedicate eight hours to the job. He is working at full capacity, so he would have to work overtime in order to do this. He is paid an hourly rate of $40 and is paid for all overtime at a premium of 50% above his usual hourly rate.

4. Two visits would need to be made by the site inspector to approve the completed work. He is an independent contractor who is not employed by T Co, and charges Push Co directly for the work. His cost is $200 for each visit made.

5. T Co's system trainer would need to spend one day at Push Co delivering training. He is paid a monthly salary of $1,500 but also receives commission of $125 for each day spent delivering training at a client's site.

6. 120 telephone handsets would need to be supplied to Push Co. The current cost of these is $18.20 each, although T Co already has 80 handsets in inventory. These were bought at a price of $16.80 each. The handsets are the most popular model on the market and frequently requested by T Co's customers.

7. Push Co would also need a computerised control system called "Swipe 2". The current market price of Swipe 2 is $10,800, although T Co has an older version of the system, "Swipe 1", in inventory, which could be modified at a cost of $4,600. T Co paid $5,400 for Swipe 1 when it ordered it in error two months ago and has no other use for it. The current market price of Swipe 1 is $5,450, although if T Co tried to sell the one it has, it would be deemed to be "used" and therefore only worth $3,000.

8. 1,000 metres of cable would be required to wire up the system. The cable is used frequently by T Co and it has 200 metres in inventory, which cost $1.20 per metre. The current market price for the cable is $1.30 per metre.

9. There are four weeks in each month and the standard working week is 40 hours.

Required: (a) Prepare a cost statement, using relevant costing principles, showing the minimum cost that T Co should charge for the contract. Your answer should show how each cost has been derived and why each of the costs above has been included or excluded from your cost statement. (b) Explain the relevant costing principles used in part (a) and explain the implications of the minimum price that has been calculated in relation to the final price agreed with Push Co.

Answer:

(a) Cost statement

	$	Note
Lunch	0	1
Engineers' costs	500	2
Technical advisor	480	3
Site visits	0 0	4
Training costs	125	5
Handsets	2,184	6
Control system	7,600	7
Cable	1,300	8
Total cost	12,189	

Notes

Note 1: Lunch

This past cost is a "sunk cost" and should therefore be excluded from the cost statement. It has already arisen and is therefore not incremental.

Note 2: Engineers' costs

Since one of the engineers has spare capacity, the relevant cost of his hours is Nil. This is because relevant costs must arise as a future consequence of the decision, and since his wage will be paid regardless of whether he now works on the contract for Push, it is not an incremental cost. The situation for the other two engineers is slightly different. Their time is currently fully utilised and earning a contribution of $5 per hour each. This is after deducting their hourly cost which, given a salary of $4,000 per month each, is $25 per hour ($4,000/4 * 40). However, in one week's time - when they would otherwise be idle - they can complete Contract X and earn the contribution anyway. Therefore, the only relevant cost is the penalty of $500 that will be payable for the delay on Contract X.

Note 3: Technical advisor

Since the advisor would have to work overtime on this contract, the relevant cost is the overtime rate of $60 ($40 * 1.5) per hour. This would total $480 for the whole job.

Note 4: Site visits

This is a cost paid directly by Push to a third party. Since it is not a relevant cost for T Co, it has been excluded.

Note 5: Training costs

Since the trainer is paid a monthly salary irrespective of what work he does, this element of his cost is not relevant to the contract, since it is not incremental. However, the commission of $125 will arise directly as a consequence of the decision and must therefore be included.

Note 6: Handsets

Although T Co has 80 of the 120 handsets required already in inventory, they are clearly in regular use in the business. Therefore, if the 80 are used on this contract, they will simply need to be replaced again. Consequently, th relevant cost for both the 40 that need to be bought and the 80 already in inventory is the current purchase price of $18.20 each. 120 * $18.20 = $2, 184.

Note 7: Control system

The historic cost of Swipe 1, $5,400, is a "sunk" cost and not relevant to this decision. However, since T Co could se it for $3,000 if it did not use it for this contract, the $3,000 is an opportunity cost here. The current market price for Swipe 1 of $5,450 is totally irrelevant to the decision as T Co has no intention of replacing Swipe 1, since it was bought in error. In addition to the $3,000, there is a modification cost of $4,600, bringing the total cost of converting Swipe 1 to $7,600. This is still a cheaper option than buying Swipe 2 for $10,800; therefore T Co would choose to de the modification to Swipe 1. The cost of $10,800 of a new Swipe 2 system is therefore irrelevant now.

Note 8: Cable

The cable is in regular use by T Co, therefore all 1,000 metres should be valued at the current market price of $1.30 per metre. The $1.20 per metre is a sunk cost and not relevant. Tutorial note: Over half the marks given in this question were for providing explanations for how each cost was treated. Such explanations do not need to be long, but they should be sufficient. Comments such as "this was not a relevant cost" are not sufficient. Where the relevant cost of an item is zero it needs to be included in the costing statement with a zero value, rather than being left out altogether.

(b) Relevant costing principles

Relevant costs are those costs that change as a result of making a particular decision. In simple terms, a relevant cost is a future cash flow arising as a direct consequence of a decision. In order for a cost to be relevant to a decision, it must therefore meet all three of these criteria:

Future - any costs which have already been incurred are regarded as "sunk" costs and will prevent a cost from being considered relevant.

Cash flow - the cost must be a cash flow and not just an accounting adjustment, such as a provision for a debt or depreciation. Also, cash flows that are the same for all alternatives are not relevant.

Direct consequence - this criterion means that the cash flow must be incremental. For example, if a cost has already been committed to, it will arise irrespective of whether the decision goes ahead. It will not therefore meet the "direct consequence" criterion. Opportunity cost - this is the value of the best alternative that is foregone as a result of making a decision. In the case of the telephone system that Push needs for the contract, the foregone sales proceeds of $3,000 are an example of an opportunity cost since, by using the system for this contract, Push foregoes these sales proceeds.

Tutorial note: Candidates were not required to write this much detail for the available marks.

Implications of minimum price calculated

The cost calculated in (a) is a starting point only, showing the minimum cost that could be charged to the customer. If T Co charged this price, it would be no better or worse off than if it did not carry out the work (i.e. it would make no profit or loss). This means that T Co would not

be rewarded for the risk that it takes in completing the work, unless some kind of a mark-up is also incorporated. Also, other costs that are not incremental to the decision now, have been incurred (e.g. $400 lunch). Ideally, therefore, T Co should seek to recover them. It could also be that, for example, in one week's time, when the engineers are busy completing the delayed contract X, another opportunity comes up that T Co has to reject because the engineers are busy on Contract X. Therefore, with hindsight, it would be seen that there was an opportunity cost associated with using the engineers on this work and delaying contract X. Furthermore, none of the business's overheads have been considered in the cost statement and, in the long term, these would need to be covered. It is clear, therefore, that the relevant cost calculated in (a) is only a starting point for T Co to use when deciding how to price the contract. The purpose of accepting contracts is to make profit and increase shareholder wealth. This will only be done if a price higher than the relevant cost of the contract is charged. In setting this price, however, T Co also needs to give consideration to the fact that it hopes to attract future work from Push. The price needs to be attractive enough for the customer to return in the future.

Case: Outsourcing Decision for Key Components: Make-or-Buy Analysis and Strategic Considerations

Robber Co manufactures control panels for burglar alarms, a very profitable product. Every product comes with a one-year warranty offering free repairs if any faults arise in this period. It currently produces and sells 80,000 units per year, with production of them being restricted by the short supply of labour. Each control panel includes two main components - one key pad and one display screen. At present, Robber Co manufactures both of these components in-house. However, the company is currently considering outsourcing the production of keypads and/or display screens. A newly established company based in Burgistan is keen to secure a place in the market, and has offered to supply the keypads for the equivalent of $4.10 per unit and the display screens for the equivalent of $4.30 per unit. This price has been guaranteed for two years. The current total annual costs of producing the keypads and the display screens are:

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

Notes:
1. Materials costs for keypads are expected to increase by 5% in six months' time; materials costs for display screens are only expected to increase by 2%, but with immediate effect.
2. Direct labour costs are purely variable and not expected to change over the next year.
3. Heat and power costs include an apportionment of the general factory overhead for heat and power as well as the costs of heat and power directly used for the production of keypads and display screens. The general apportionment included is calculated using 50% of the direct

labour cost for each component and would be incurred irrespective of whether the components are manufactured in-house or not.

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

5. 60% of depreciation and insurance costs relate to an apportionment of the general factory depreciation and insurance costs; the remaining 40% is specific to the manufacture of keypads and display screens.

Required: (a) Advise Robber Co whether it should continue to manufacture the keypads and display screens in-house or whether it should outsource their manufacture to the supplier in Burgistan, assuming it continues to adopt a policy to limit manufacture and sales to 80,000 control panels in the coming year. (b) Robber Co takes 0-5 labour hours to produce a keypad and 0-75 labour hours to produce a display screen. Labour hours are restricted to 100,000 hours and labour is paid at $1 per hour. Robber Co wishes to increase its supply to 100,000 control panels (i.e. 100,000 each of keypads and display screens). Advise Robber Co how many units of keypads and display panels should be manufactured and/or outsourced in order to minimise its costs. (c) Discuss the non-financial factors that Robber Co should consider when making a decision about outsourcing the manufacture of keypads and display screens.

Answer:
(a) Make or buy decision

(All working amounts in $000)	Keypads	Display screens
Variable costs	$	$
Materials ($160 * 6/12) + ($160 * 1.05 * 6/12)	164,000	
($116 * 1.02)		118,320
Direct labour	40,000	60,000
Machine set-up costs		
($26 - $24) * 500/400	27,500	
($30 - $6) * 500/400		30,000
	231,500	208,320
Attributable fixed costs		
Heat and power ($64 - $20)/($88 - $30)	44,000	58,000
Fixed machine costs	4,000	6,000
Depreciation and insurance ($84/$96 * 40%)	33,600	38,400
	81,600	102,400
Total incremental costs of making in-house	313,100	310,720
Cost of buying (80,000 * $4.10/$4.30)	328,000	344,000
Total saving from making	14,900	33,280

Robber should therefore make all of the keypads and display screens in-house. Tutorial note: It is assumed that the fixed set-up costs only arise if production takes place.

Alternative method

Relevant costs	Keypads	Display screens
Direct materials	$	$
(1/2 * $160) + (1/2 * $160 * 1.05)	164,000	
$116 × 1.02		118,320
Direct labour	40,000	60,000
Heat and power		
$64-(50% * $40)	44,000	
$88-(50% * $60)		58,000
Machine set up costs: Avoidable fixed costs	4,000	6,000
Activity related costs (WORKING)	27,500	30,000
Avoidable depreciation and insurance costs: 40% * $84/$96	33,600	38,400
Total relevant manufacturing costs	313,100	310,720
Relevant cost per unit:	3.91375	3.884
Cost per unit of buying in	4.1	4.3
Incremental cost of buying in	0.18625	0.416

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

WORKING

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

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

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

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

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

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

(b) Make or buy - higher production level

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

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

Total labour hours available = 100,000.

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

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

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

(c) Non-financial factors

· The company offering to supply the keypads and display screens is a new company. This would make it extremely risky to rely on it for continuity of supplies. Many new businesses fail within the first year of starting and without these two crucial components, Robber would be unable to meet demand for sales of control panels. Robber would need to consider whether there are any other potential suppliers of the components. This would be useful both as a price comparison now and also to establish the level of dependency that would be committed to if this new supplier is used. If the supplier were to go out of business, would any other company be able to step in? If so, at what cost?

· The supplier has only agreed to these prices for the first two years. After this, it could put up its prices dramatically. By this stage, Robber would probably be unable to begin easily making its components in house again, as it would probably have sold off its machinery and committed to larger sales of control panels.

· The quality of the components could not be guaranteed. If they turn out to be poor quality, this will give rise to problems in the control panels, leading to future loss of sales and high repair costs under warranties for Robber. The fact that the supplier is based overseas increases the risk of quality and continuity of supply, since it has even less control of these than it would if it was a UK supplier.

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

Case: Evaluation of Incremental Cash Flows and Strategic Considerations for Belton Park Resort's January Operations

Belton Park Resort is a new theme park resort located in the country of Beeland. The resort is made up of a theme park, a hotel and an indoor water park. The resort opened two months ago and is already very popular. As all theme parks in Beeland are required, by law, to shut down in the colder month of January because of the risk of accidents, Belton Park Resort must decide whether to shut down the whole resort or just the theme park. It could choose to keep open the hotel and/or the water park. Since Belton Park Resort has not been open for long, there is limited historical data available about costs and revenues. However, based on the last two months, the following average monthly data is available:

Number of rooms	120
Average room rate per night	$100
Average occupancy rate per month	90%
Average nightly spend on extras* per room	$20
Contribution margin for extras	60%
Water park	
Number of visitors per month	12,000
Admission price per visitor	$21

| Average spend on extras per visitor | $12 |
| Contribution margin for extras | 60% |

*Extras include anything purchased by the customer not included in the room rate or admission price. Management estimates that, for January, the average room rate per night would need to decrease by 30% and the admission price for the water park by 20%. With such reductions, it is estimated that an occupancy rate of 50% would be achieved for the hotel and that the number of visitors to the water park would be 52% lower than current levels. The average nightly spend on extras per room of $20 at the hotel and $12 per customer at the water park is expected to remain unchanged. The running costs for the hotel and water park for each of the last two months are as follows:

	Notes	Hotel	Water park
		$	$
Staff costs	1	120,000	75,600
Maintenance costs	2	14,600	6,000
Power costs	3	20,000	18,000
Security costs	4	13,600	8,000
Water costs	5	12,900	12,100

Notes:

(1) Staff costs

Permanent staff Included in the staff costs for the hotel are the annual salaries for the hotel manager and head chef which are $30,000 and $24,000, respectively. These are both permanent members of staff who are paid for the full year regardless of their working hours. The water park employs one permanent member of staff, the manager, on a salary of $24,000 who is also paid for the full year regardless of his working hours.

Temporary staff

The remaining staff costs relate to temporary staff who are only paid for the hours they work. If the hotel stays open in January, half of these staff members will continue to work their current hours because their jobs are largely unaffected by guest occupancy rates. However, the other half of the staff will work proportionately less hours to reflect the 50% occupancy rate in January as opposed to the 90% occupancy rate of the last two months. At the water park, the temporary staff's working hours will fall according to the number of visitors; hence a fall of 52% would be expected for January.

(2) Maintenance costs

Maintenance is undertaken by a local company, Techworks, which bills Belton Park Resort for all work carried out each month. If the hotel and water park are closed, Techworks will instead be paid a flat fee for the month of $4,000 for the hotel and $2,000 for the water park.

(3) Power costs

Electricity

Belton Park Resort pays a fixed monthly charge for electricity of $8,000 for the hotel and $7,000 for the water park, all year round.

Gas

The gas charges relate to heating and include a fixed charge of $2,200 per month for the hotel and $1,500 per month for the water park. The remainder of the gas charges is based solely on usage and would be expected to increase by 50% in January because of the colder weather.

(4) Security costs

If the hotel and water park close, no changes will be made to the current arrangements for security whilst the premises are empty.

(5) Water costs

It is estimated that water costs for the hotel would fall to $6,450 for the month if it remains open in January. However, the water costs for the water park would be expected to remain at their current level. If the hotel and water park were closed, all water would be turned off and no charges would arise.

Required: (a) Calculate the incremental cash flows, for the month of January (31 days), if Belton Park Resort decides to keep open: 1. the hotel; 2. the water park. In each case, state whether it should remain open or should close. (b) Discuss any other factors which Belton Park Resort should consider when making the decision in part (a).

Answer:

(a) Incremental cash flows

(i) Hotel

Room revenue		$	
Number of rooms	120		
Number of nights	31		
Total room nights	3,720		
Occupancy rate	50%		
Total nights occupied	1,860		
Rate per night	$70		
Total room revenue			130,200
Extras' contribution			
Total nights occupied	1,860		
Contribution per night	$12.00		
Total extras contribution			22,320
Total cash inflows			152,520

Incremental running costs

		$		
Staff costs		120,000		
Less: manager's salary		(2,500)		
Less: chef's salary		(2,000)		
		115,500		
50% normal hours			57,750	
50% at reduced hours × 50/90			32,083	
Maintenance costs:				
If open	14,600			
If closed			(4,000)	
Incremental cost			10,600	
Power costs:				
Electric				
Gas - fixed charge	00			

Gas - variable ($20,000 - $10,200) * 1.5		14,700
Security		0
Water		6,450
Total cash outflows		121,583
Total incremental cash flows		30,937

(ii) Water park

Visitor revenue		$
Number of visitors	5,760	
Admission cost	$16.80	
Admission revenue		96,768
Extras' contribution		
Number of visitors	5,760	
Contribution per visitor	$7.20	
Total contribution		41,472
Total cash inflows		138,240

Incremental running costs

	$
Staff costs:		
Manager		0
Other staff ($75,600 - $2,000) × 48%		35,328
Maintenance costs:		
If open	6,000	
If closed		(2,000)
Incremental cost		4,000
Power costs:		
Electric	$0	
Gas - fixed charge	$0	
Gas - variable ($18,000 - $8,500) * 1.5		14,250
Security		0
Water		12,100
Total cash outflows		65,678
Total incremental cash flows		72,562

Conclusion Based on these figures, both of them should stay open because the incremental cash flows are both positive.

(b) Other factors to be considered
As regards the estimates calculated, these have been based on very limited data and should be approached with caution. The calculations are based on the first two months' of opening only and, consequently, it is difficult to say how accurate they are likely to be. In addition, the basis of estimating the revised occupancy rates for the hotel, for example, has not been given. If these estimates are too optimistic, the actual results could be far worse. The figures suggest that both the water park and the hotel should stay open. Given that this is a new business and

therefore it is still building up its customer base, this would seem like a wise decision anyway, even if the calculations had shown that the estimated incremental cash flows were not as positive as this. Similarly, if Belton Park were to close either the hotel or the water park, they would invariably lose some valuable staff who might seek out other jobs after the closure. These staff might not be available again when the hotel and water park reopened in February. The interdependency of the two sets of projections has not been taken into account in the calculations either. Since the incremental cash flows suggest that both the hotel and the water park should stay open, it is not a big problem. However, if they had shown, for example, that the water park alone should close, the effect that this could have on the number of hotel visitors would also need to be taken into account. Many visitors may be attracted to the hotel because it has a water park. Tutorial note: There are many factors which could have been discussed here and would be given credit.

Case: Impact of Cost Changes and Break-Even Analysis for Pico's Products

Pico makes two products - P1 and P2 - budgeted details of which are as follows:

	P1	P2
	$	$
Selling price	10.00	8.00
Cost per unit:		
Direct materials	3.50	4.00
Direct labour	1.50	1.00
Variable overhead	0.60	0.40
Fixed overhead	1.20	1.00
Profit per unit	3.20	1.60
Budgeted production and sales for the following year are:		
Product P1		10,000 units
Product P2		8,000 units

The fixed overhead costs for P1 relate to apportionment of general overhead costs only. However the fixed overhead for P2 also includes specific fixed overheads totalling $2,500.

Question 1. If only product P1 were to be made, how many units (to the nearest unit) would need to be sold in order to achieve a profit of $60,000 each year?

Answer:

The correct answer is 17614 units.

WORKING Number of units required to make target profit = fixed costs + target profit/contribution per unit of P1.

Fixed costs = ($1.2 * 10,000) + ($1 * 8,000) - $2,500 = $17,500.

Contribution per unit of P1 = $3.20 + $1.20 = $4.40.

($17,500 + $60,000)/$4.40 = 17614 units

Question 2. If both products were sold in the budgeted mix, what would be the break-even revenue? A. $52,288 B. $44,293 C. $50,620 D. $45,751

Answer:
The correct answer is C.
WORKING
Break even revenue = Budgeted fixed cost /Weighted average C/S ratio
Weighted average C/S ratio = Budgeted contribution/Budgeted revenue

	P1	P2
S	$	
Profit per unit	3.20	1.60
Add fixed cost per unit	1.20	1.00
Contribution per unit	4.40	2.60
Budgeted sales	10,000	8,000
Total contribution	44,000	20,800
Budgeted contribution	64,800	

Budgeted revenue = (10 * 10,000) + (8 * 8,000) = 164,000
Weighted average C/S ratio = 64,800/164,000 = 39.51%
Total fixed cost = (1.2 * 10,000) + (1 * 8,000) = 20,000
Break even revenue = 20,000/39.51% = $50,620

Question: 3. The production manager has reviewed the budgets and suggested the following changes: 1) Material cost per unit of P1 should be $4.00 per unit due to a change in supplier 2) Fixed cost of P2 will be reduced by $2,500 due to a change in the production process What impact would each of these changes have on the break-even revenue? (Select your answer using the rectangular buttons)

  Change 1   Change 2
A. Increase   Decrease
B. Decrease   Increase
C. Increase   Increase
D. Decrease   Decrease
Answer:
 The correct answer is A. Tutorial note: (1) reduces contribution per unit of P1, meaning that a higher revenue is needed in order to generate sufficient contribution to cover fixed costs. (2) since fixed costs are lower, less contribution (and therefore revenue) is required to cover them, which reduces break even revenue.

Question 4. Which TWO of the following are lines that would appear in a break-even chart? A. Total revenue B. Total costs C. Total profit D. Total contribution
Answer:
The correct answers are A and B. Tutorial note: A break-even chart usually only shows total revenue and total cost lines (although sometimes fixed costs and variable costs are also shown).

Case: Multi-Product Break-Even Analysis and Profit Calculation

Nerville makes and sells a range of three gardening products. Budgeted data for the next year is as follows:

Product	E375	F294	G142
$	$	$	
Selling price per unit	250	300	170
Variable cost per unit	130	135	110
Contribution per unit	120	165	60
Fixed cost per unit	30	38	17
Profit per unit	90	127	43
Budgeted sales volume (units)	20,000	17,000	16,000
Maximum demand (units)	22,000	19,000	18,000
Machine hours per unit	1.5	2	0.5

Budgeted fixed overheads are $1,518,000.

The following multi-product break even chart has been drawn based on the assumption that Nerville is able to sell the product in order of contribution to sales (C/S) ratios, up to the point of maximum demand for each product, starting with the highest ranking product:

(description of the chart:The chart is a line graph showing the relationship between revenue and profit. Vertical Axis (Y-axis): Labeled 'Profit' with increments of $1000. Horizontal Axis (X-axis): Labeled 'Revenue' with increments of $1000. Line: Starts at the origin (0,0) and rises to the right, indicating that profit increases as revenue increases.Break Even Revenue: Located at the origin, indicating no profit or loss. Product 1: Marked higher on the line, showing that Product 1 generates both revenue and profit.The graph illustrates a positive correlation between revenue and profit for Product 1, making it useful for understanding financial performance.)

The point marked "Product 1" shows revenue and profit at the point where only the product with the highest C/s ratio isbeing sold and sales volume is the maximum demand for that product.

Question 1. Based on the budgeted sales mix, what is the break-even revenue (to the nearest $000)? A. $3,156,000 B. $3,241,000 C. $2,839,000 D. $4,188,000
Answer:
The correct answer is A.
WORKING

WORKING		
Product	E375	F294	G142
Selling price per unit	$250	$300	$170
Budgeted sales volume (units)	20,000	17,000	16,000
= Budgeted revenue ($000)	5,000	5,100	2,720
= Total budgeted revenue $12,820,000			
Contribution per unit	120	165	60
Budgeted sales volume (units)	20,000	17,000	16,000
Budgeted contribution ($000)	2,400	2,805	960
= Total budgeted contribution $6,165,000			

Weighted average C/S ratio = Total budgeted contribution/Total budgeted revenue = 6,165,000/12,820,000 = 0.481
Break even revenue = Budgeted fixed cost/Weighted average C/S ratio = 1,518,000/0.481 = $3,155,925 (i.e. $3,156,000)

Question 2. What is the profit at the point marked "Product 1" on the chart? A. $3,135,000 B. $1,617,000 C. $1,122,000 D. $2,640,000
Answer:
The correct answer is B.
WORKING
The products are sold in order of C/S ratio.

Product	E375	F294	G142
Contribution per unit	120	165	60
Selling price per unit	250	300	170
Therefore, C/S ratio	0.48	0.55	0.38

Product 1 is therefore Product F294.
Maximum demand for F294 is 19,000 units. At the point on the P/V chart marked Product 1, Nerville is selling 19,000 units of F294 only.
Contribution = 19,000 * 165 = $3,135,000
Profit = 3.135.000 - 1.518.000 = $1.617.000

Question 3. Assuming Product F294 has the highest C/S ratio, what amount of revenue corresponds to the point of break-even revenue on the chart? A. $1,518,000 B. $2,760,000 C. $3,157,000 D. $3,162,500
Answer:
The correct answer is B.
WORKING

Product	E375	F294	G142
Contribution per unit	120	165	60
Machine hours per unit	1.5	2.0	0.5
Contribution per machine hour	80	82.5	120
Ranking	3	2	1

Question 5. Which of the following statements regarding cost volume profit analysis are correct? 1. It assumes that selling prices remain constant 2. It ignores non production costs 3. It ignores economies of scale that affect the cost per unit 4. It assumes that fixed costs remain fixed throughout the range of sales volumes being considered in the analysis A. 1 and 2 only B. 1, 2 and 3 C. 2, 3 and 4 D. 1, 3 and 4
Answer:
The correct answer is D. Tutorial note: (2) is incorrect. Variable selling and other costs should be taken into account.

Case: Analyzing the Breakeven Points and Financial Implications for Alka Hotel's Seasonal and Project-Based Decisions

The Alka Hotel is situated in a major city close to many theatres and restaurants. The Alka Hotel has 25 double bedrooms and it charges guests $180 per room per night, regardless of single or double occupancy. The hotel's variable cost is $60 per occupied room per night. The Alka Hotel is open for 365 days a year and has a 70% budgeted occupancy rate. Fixed costs are budgeted at $600,000 a year and accrue evenly throughout the year. During the first quarter (Q1) of the year the room occupancy rates are significantly below the levels expected at other times of the year with the Alka Hotel expecting to sell 900 occupied room nights during Q1. Options to improve profitability are being considered, including closing the hotel for the duration of Q1 or adopting one of two possible projects as follows:

Project 1 - Theatre package

For Q1 only the Alka Hotel management would offer guests a "theatre package". Couples who pay for two consecutive nights at a special rate of $67.50 per room night will also receive a pair of theatre tickets for a payment of $100. The theatre tickets are very good value and are the result of long negotiation between the Alka Hotel management and the local theatre. The theatre tickets cost the Alka Hotel $95 a pair. The Alka Hotel's fixed costs specific to this project (marketing and administration) are budgeted at $20,000. The hotel's management believes that the theatre package will have no effect on their usual Q1 customers, who are all business travellers and who have no interest in theatre tickets, but will still require their usual rooms.

Project 2 - Restaurant

There is scope to extend the Alka Hotel and create enough space to operate a restaurant for the benefit of its guests. The annual costs, revenues and volumes for the combined restaurant and hotel are illustrated in the following graph:

(description of the chart: The chart is a breakeven analysis for combined restaurant and hotel operations. Horizontal Axis (X-axis): Represents the number of occupied rooms, ranging from 0 to 8,000. Vertical Axis (Y-axis): Represents money in dollars, ranging from 0 to $2,000. There are three lines on the chart: Sales Line: This line starts at the origin (0,0) and slopes upwards, showing that sales increase as the number of occupied rooms increases. Total Cost Line: This line also slopes upwards but starts above the origin, indicating that there are fixed costs even when no rooms are occupied. Fixed Cost Line: This is a horizontal line that remains constant regardless of the number of occupied rooms. The point where the Sales line intersects with the Total Cost line is the breakeven point, marked at approximately 5,161 occupied rooms. Beyond this point, the area is labeled Margin of Safety, indicating profitability.)

Note: The graph does not include the effect of the theatre package offer.

Required: (a) Using the current annual budgeted figures, and ignoring the two proposed projects, calculate the breakeven number of occupied room nights and the margin of safety as a percentage. (b) Ignoring the two proposed projects, calculate the budgeted profit or loss for Q1 and explain whether the hotel should close for the duration of Q1. (c) Calculate the breakeven point in sales value of Project 1 and explain whether the hotel should adopt the project. (d) Using the graph, quantify and comment upon the financial effect of Project 2 on the Alka Hotel. Note: There are up to four marks available for calculations.

Answer:

(a) Breakeven and margin of safety

Breakeven point (in occupied room nights) = Fixed cost/contribution per room
$600,000/($180 -$60) = 5,000 occupied room nights
Margin of safety = (Budgeted room occupancy - breakeven room occupancy)/budgeted room occupancy
Total rooms available per year: 365 days * 25 rooms = 9,125 rooms
Budgeted occupancy level: 9,125 * 70% = 6,387.5 rooms
Margin of safety: (6,387.5 - 5,000)/6,387.5 = 21.72%

(b) Budgeted profit or loss for Q1

	$
Contribution (900 rooms * $120)	108,000
Fixed costs (($600,000/12) * 3)	(150,000)
Loss	(42,000)

Explanation
The Alka Hotel should not close in Q1. The fixed costs will still be incurred and closure would result in lost contribution of $108,000. This in turn would result in a decrease in annual profits of $108,000. In addition, the hotel could lose customers at other times of the year, particularly their regular business customers, who may perceive the hotel as being unreliable.

(c) Breakeven point (in sales value) of Project 1

	$
Sales value of two room nights (2 * $67.50)	135
Sales value of a pair of theatre tickets	100
	235
Variable cost of two room nights (2 * $60)	(120)
Variable cost of a pair of theatre tickets	(95)
Contribution	20
C/S ratio (20/235)	8.51%
Breakeven point in revenue ($20,000/0.0851)	$235,000

Tutorial note: Alternative calculation:

Contribution per theatre package sold	$20
Breakeven point in theatre packages ($20,000/$20)	1,000
Breakeven point in revenue (1,000 * $235)	$235,000

Explanation
The unit contribution per theatre package is low and it requires a large number of sales to break even. Each theatre package would require two room nights to be sold which would mean 2,000 room nights needed in Q1 to break even. The available rooms for Q1 are only 2,281.25 (9,125/4) and the Alka Hotel has already sold 900 rooms, so there is insufficient capacity. Based on this, Project 1 is not viable at the quoted prices.

(d) Financial effect of Project 2

Project 2 will cause the fixed costs of the hotel to rise from $600,000 per year to $800,000 per year for the hotel and restaurant combined. This is an annual increase of $200,000. Revenue per occupied room will rise from $180 to $250 ($2,000,000/8,000 rooms) which reflects the extra guest expenditure in the restaurant. The total cost predicted at a level of 8,000 occupied rooms is $1,560,000 which means the variable costs must be $760,000 ($1,560,000 - $800,000 fixed costs). This is a variable cost per occupied room of $95 which is an increase of $35. This reflects the variable costs of the restaurant. As a result of these changes, the breakeven point has increased from 5,000 to 5,161 occupied rooms so the hotel needs to sell more room nights to cover costs. However, budgeted occupancy is now 7,300 occupied room nights which gives 80% occupancy (7,300/9,125). This gives a margin of safety of 2,139 occupied room nights or 29%. This is an increase on the current position and the hotel's position appears safer. At 7,300 occupied room nights the Alka Hotel's budgeted profit is $331,500 (7,300 * ($250-$95)-$800,000.

Case: Financial Viability Analysis of Replacing Café with Crèche at Health Nuts Fitness Centre
The following scenario relates to five requirements. Health Nuts is a fitness centre, offering "pay-as-you-go" gym facilities. It has a fully fitted gym with the capacity to accommodate 200 users at one time. It also has 100 car parking spaces and an onsite cafe, both of which are only for customers using the gym. The fitness centre has shower facilities for customers and Health Nuts provides all customers with a clean towel to use on entry. It is open 360 days a year, from 7.00am until 9.00pm. Customers pay $8.40 for access to the gym for one hour plus unlimited time in the cafe. If customers want to use the car park, they have to pay an additional $1 per visit and 80% of visiting customers use the car park. Health Nuts has been monitoring the number of customers attending throughout each day for the month of June, which was considered to be an average month, and for which Health Nuts was open for 30 days. It has determined that the average number of customers per day is 330 with 40 of these customers attending during the time of 9.00am to 5.00pm. The total costs of the fitness centre for June, excluding the cafe, have also been recorded and analysed as follows:

| Fixed costs per month | $48,000 |
| Variable cost per customer | $1.20 |

On average, half of the customers also used the cafe in June; with an average spend per customer of $2.20. Of this spend, 60% related to drinks, which have a profit margin of 60%, and the remainder related to food items, which have a profit margin of 40%. The specific fixed costs associated with running the cafe are $3,600 for the month.
Créche proposal
After reviewing all of the above information, the manager of Health Nuts has put together a proposal to close the cafe at the fitness centre and convert it into a creche for children. This would mean that parents could leave their children in the creche whist they use the fitness centre between the hours of 9.00am and 5.00pm only. The charge for the creche would be $4 per child, per hour. Initial research suggests that customers have an average of two children each. The creche is expected to attract new customers and increase the average number of customers between 9.00am and 5.00pm by 300%. Only these new customers will use the

creche facilities. Car park usage is expected to continue to be 803/0. The fixed costs associated with running the creche are estimated to be $8,000 per month with a variable cost of $0.50 per child, per hour.

Required: (a) Calculate both the number of customers Health Nuts needs to break even and the margin of safety as a percentage for the month of June for: (i) The gym; and (ii) The café. (b) Explain what each of your calculations in (a) tells Health Nuts about the performance of the gym and the café. (c) Calculate the budgeted total weighted average contribution/sales (C/S) ratio and the budgeted profit per month for Health Nuts if it closes the café and opens a creche instead. (d) Advise Health Nuts, considering both financial and non-financial factors, whether it should replace the café with a creche and whether the calculations in part (c) provide enough information to make such a decision.

Answer:

(a) Breakeven number or customers and margin of safety

(i) Gym

Break-even point		
Average sales revenue per customer	$	
Gym entry	8.40	
Car park expected value (0.8 * $1)	0.80	
	9.20	
Variable cost	1.20	
Contribution per customer	8.00	
Total fixed costs	48,000	
BEP (in customers)	6,000	
Margin of safety		
Total number of customers per day	330 (80 + 40 + 20 + 90)	
Number of days in the month	30	
Total customers for June	9,900	
Margin of safety (in customers)	3,900 (9,900 - 6,000)	
Margin of safety (%)	39.39% (3,900/9,900)	

(ii) Café

Break-even point		
Average contribution per customer:	$	
Drinks	0.792 ($2.20 * 60% * 60%)	
Food	0.352 ($2.20 * 40% * 40%)	
	1.144	
Total fixed costs	3,600	
BEP (in customers)	3,147 ($3,600/$1.144)	
Margin of safety		
Total customers for June	4,950	
Margin of safety (in customers)	1,803 (4,950 - 3,147)	
Margin of safety (%)	36.43% (1,803/4,950)	

(b) Performance of gym and café

The gym needs 6,000 customers per month and the café needs 3,147 customers per month in order to cover its fixed costs. Each $1 of contribution after this point generates profit. Whether or not these figures are particularly high can be gauged by comparing them to the expected (or, in this case, actual) customers in one month and this is where the margin of safety is useful. Both the margin of safety for the gym and the café are quite similar, at approximately 39% and 36% respectively. This tells Health Nuts the extent to which it can feel confident about covering its fixed costs and making a profit. In this instance, its margin of safety is such that, even if its customer numbers went down by over one third it could still cover its fixed costs.

(c) Budgeted total weighted average C/S ratio and budgeted profit

Total sales and contribution from gym		
Original number of customers	330	
New customers	120	
Total number of customers per day	450	
Number of days in the month	30	
Total customers for the month	13,500	
	$	
Entry fee	8.40	
Car park	0.80	
	9.20	
Total sales from gym entry/car park	124,200	
Contribution per customer	$	
Sales revenue	9.20	
Less: variable cost	1.20	
	8.00	
Total contribution	108,000	
Total sales and contribution from creche		
Total customers using the créche per day	120	
Number of days in the month	30	
Total customers for the month	3,600	
Number of children per customer	2	
Total number of children per month	7,200	
	$	
Price per child	4.00	
Total sales from créche	28,800	
Contribution per customer	$	
Sales revenue	4.00	
Less: variable cost	0.50	
	3.50	
Total contribution	25,200	
Total contribution from gym and créche	133,200	
Total sales from gym and créche	153,000	
Weighted average C/S ratio	87.06%	
Budgeted profit per month with créche		

	$
Total contribution from gym and créche	133,200
Less: total fixed costs	56,000
Budgeted profit	77,200

(d) Whether café should be replaced with a crèche

	$
Total contribution from gym	79,200
Total contribution from café	5,663
	84,863
Less total fixed costs	51,600
Profit for June	33,263

With the creche, profit will increase from $33,263 to $77,200 per month, an increase of $43,937. Therefore, from a purely financial point of view, the creche would seem like a good idea. However, there are various other factors that need to be taken into account: Details of how much the conversion from the café to the creche will cost has not been provided. The investment would need to be appraised using a discounted cash flow technique like net present value to assess its financial viability. The research for the revised customer numbers is only initial. Is this data realistic and can it be relied on? There is no information about how Health Nuts got this research. The opening of a creche could put off other customers, who want to exercise in a child-free environment, from using the gym during the day. There is no indication that Health Nuts have taken this into account. Similarly, closing the café could upset many other customers at all times of day and lead to the loss of their business. The calculations so far performed are not therefore enough to make this decision.

Case: Optimal Production Strategy and Throughput Accounting for Yam Co

Yam Co is involved in the processing of sheet metal into products A, B and C using three processes, pressing, stretching and rolling. Information about the three products (per metre) is as follows:

	Product A	Product B	Product C
	$	$	$
Selling price	70.0	60.0	70.0
Variable costs:			
Materials	3.0	2.5	10.0
Labour	10.0	10.0	15.0

Other factory costs are all fixed and total $17,975,000 per year. Raw material for the sheet metal is first pressed then stretched and finally rolled. The factory manager has provided the following data:

Pressing per metre

| | Product A | Product B | Product C |
| Hours | 0.50 | 0.50 | 0.40 |

There are 225,000 hours of pressing time available each year. This has been identified as the limiting factor. Maximum demand for each product is 200,000 metres per year. Yam Co employs 700,000 labour hours per year, which is sufficient to meet maximum demand. Labour is paid $10 per hour. Due to agreements with the unions, Yam Co is committed to paying for this amount of labour in full.

Question 1. How many metres of each product should be made per year in order to maximise contribution per hour of pressing time?

	Product A	Product B	Product C
A.	200,000	200,000	25,000
B.	200,000	200,000	200,000
C.	200,000	90,000	200,000
D.	450,000	0	0

Answer:

The correct answer is C.

WORKING

	Product A	Product B	Product C
Selling price	70	60	70
Raw materials	3	2.5	10
Labour	10	10.0	15
Contribution per unit	57	47.5	45
Pressing time per unit	0.5	0.5	0.4
Contribution per hour of pressing time	114	95	112.5
Ranking	1 st	3rd	2nd

Production plan - given 225,000 hours per year

	Hours
200,000 metres of Product A (max demand)	100,000
200,000 metres of Product C (max demand)	80,000
90,000 metres of Product B (with remaining hours)	45,000
	225,000

Question 2. Match each product to the order in which it should be manufactured to ensure that throughput contribution is maximised.

Produce first

Produce second

Produce third

Answer:

Produce first	Product C
Produce second	Product A
Produce third	Product B

Tutorial note: Decision should be based on throughput return per hour of scarce resource.

WORKING

	Product A	Product B	Product C

Selling price	70	60	70	
Raw materials	3	2.5	10	
Throughput contribution per unit	67	57.5	60	
Pressing time per unit	0.5	0.5	0.4	
Throughput contribution per hour				
of pressing time	134	115	150	
Ranking	2nd		1st	

Question 3. The throughput return per factory hour for Product C has been calculated as $150. What is the throughput accounting ratio for Product C (to two decimal places)?
Answer:
The correct answer is 1.35
WORKINGS
(1) Factory cost per hour
Total fixed costs are $17,975,000 plus the labour cost. Labour costs $10 per hour for each of the 700,000 hours, a cost of $7,000,000.
Total fixed cost is therefore $24,975,000
Fixed cost per bottleneck (pressing) hour is $24,975,000/225,000 = $111 per hour.
(2) Throughput accounting ratio = Return per hour/Factory cost per hour = $150/$111 = 1.35

Question 4. Yam Co also makes a fourth product, product D. Product D has a throughput accounting ratio of less than one and the management accountant has stated that under no circumstances should product D be made. Are each of the following statements regarding ceasing production of Product D true or false?
Statement 1: Many of the fixed costs relating to Product D may not be avoided even if production is ceased
Statement 2: Demand for other products may be adversely affected by ceasing production of Product D
Statement 3: The throughput accounting ratio of product D could be improved by increasing the time spent on the bottleneck resource
Statement 4: It may be possible to increase the selling price of product D and this would increase the throughput accounting ratio
Answer:
Many of the fixed costs relating to Product D may not be avoided even if production is ceased	TRUE	
Demand for other products may be adversely affected by ceasing production of Product D	TRUE	
The throughput accounting ratio of product D could be improved by increasing the time spent on the bottleneck resource		FALSE
It may be possible to increase the selling price of product D and this would increase the throughput accounting ratio	TRUE	

Question 5. Indicate, by selecting the relevant box in the table below, whether each of the following statements about the Theory of Constraints is true or false.

Statement 1: It is essential that labour idle time on non-bottleneck resources is minimised
Statement 2: Throughput is maximised by reducing the impact of bottlenecks
Answer:

| It is essential that labour idle time on non-bottleneck resources is minimised | | FALSE | |
| Throughput is maximised by reducing the impact of bottlenecks | | TRUE | |

Case: Optimal Suit Production Strategy and Resource Allocation for Cut and Stitch

Cut and Stitch (CS) make two types of suits using skilled tailors (labour) and a delicate and unique fabric (material). Both the tailors and the fabric are in short supply and so the accountant at CS has correctly produced a linear programming model to help decide the optimal production mix. The model is as follows:

Variables:

Let W = the number of work suits produced

Let L = the number of lounge suits produced

Objective is to maximise contribution: C = 48W + 40L

Subject to:

Constraints

Tailors' time: $7W + 5L \leqslant 3,500$ (hours) - this is line T on the diagram

Fabric: $2W + 2L \leqslant 1,200$ (metres) - this is line F on the diagram

Production of work suits: $W \leqslant 400$ - this is line P on the diagram

On the diagram provided the accountant has correctly identified OABCD as the feasible region and point B as the optimal point where contribution is maximised.

(description of the chart: a two-dimensional graph with axes labeled 'W' (horizontal) and 'L' (vertical). Mark intervals of 200 units up to 800 on 'W' and up to 1000 on 'L'. Draw the line T on the chart intersecting at 500 on the horizontal W axis and intersecting at 700 on the vertical L axis. Draw the line F on the chart intersecting at 600 on the horizontal W axis and intersecting at 600 on the vertical L axis. Draw the line P on the chart perpendicular to the horizontal W axis, intersecting at 400.

Point O is at origin (0, 0); Point A on L-axis at 600; Point B is the intersection point of Line T and Line F, intersecting at around W=300, L=340; Point C is the intersection point of Line T and Line P, intersecting at around W=400, L=180. Point E is the intersection point of Line F and Line P, intersecting at around W=400, L=240. Label B as "Optimal point". Title chart "CS - Production Plan".)

Question 1. How many work suits would be produced at the optimal point B?
Answer:
The correct answer is 250
WORKING
Solving the two equations given for F and T:
7W + 5L = 3,500
2W + 2L = 1,200
(2W + 2L) * 2.5 = 5W + 5L = 3,000

(7W + 5L) - (5W + 5L) = 2W = 500

Therefore W = 250

At the point of optimal contribution, produce 250 work suits Tutorial note: While not necessary for answering this question the calculation continues below to show the quantity of lounge suits produced at the optimal point, for the purpose of learning. Substituting W = 250 in the fabric equation produces: 2 * 250 + 2L = 1,200; 2L = 700; L = 350

Question 2. A sample contribution line has been drawn in the diagram above. This is the dotted line which passes through the point where W = 200, L = 0. What is the value of contribution along this line?

Answer:

The correct answer is 9600.

WORKING

Contribution is given by the equation C = 48W + 40L

The contribution line passes through the point where W = 200, L = 0

At this point C = (48 * 200) + (40 * 0) = 9,600

Question 3. Which of the scarce resources are fully utilised at the optimal point B? A. Fabric B. Tailors' time C. Demand for work suit D. Fabric and tailors' time

Answer:

The correct answer is D. Tutorial note: Point B lies on the intersection of lines T and F, meaning that at this point, all available tailors' hours (line T) and all available fabrics (line F) are being utilised.

Question 4. Each work suit uses 2 metres of fabric and each lounge suit uses 2 metres of fabric. The standard cost of fabric is $5 per metre. The shadow price for fabric has been worked out and found to be $10 per metre. If an extra 20 metres of fabric becomes available at $5 per metre, what will the maximum increase in contribution be? A. Increase of $300 B. Increase of $200 C. Increase of $100 D. No change

Answer:

The correct answer is B. Tutorial note: By definition, a shadow price is the amount by which contribution will increase if an extra metre of fabric becomes available at the standard price. WORKING: $10 * 20 = $200

Question 5. Identify, by selecting the relevant boxes in the table below, whether each of the following statements regarding the graphical method to solve linear programmes is true or false.

Statement 1: It can only be used to solve programmes with two variables (e.g. two products)

Statement 2: It can only be used to solve problems with two constraints

Statement 3: It assumes that the objective function (e.g. contribution) is a linear function

Statement 4: There will always be one unique solution (e.g. production plan)

Answer:

| 1. It can only be used to solve programmes with two variables (e.g. two products) | TRUE |
|

2. It can only be used to solve problems with two constraints		FALSE
3. It assumes that the objective function (e.g. contribution) is a linear function	TRUE	
4. There will always be one unique solution (e.g. production plan)		FALSE

Tutorial notes: 1. The graphical method can only deal with two variables. Other methods (outside of the syllabus of PM) are available for dealing with more than one product. 2. In this scenario there are three constraints. 3. Contribution per unit is assumed to be constant throughout the range (i.e. linear). 4. If the gradient of the contribution function is the same as the gradient of one of the constraints, there may be a range of possible values of output that maximise contribution.

Case: Optimizing Production and Resource Allocation for Cara Co's Seebach and Herdorf Products

Cara Co makes two products, the Seebach and the Herdorf. To make a unit of each product the following resources are required:

	Seebach	Herdorf
Materials ($100 per kg)	5 kg	7 kg
Labour hours ($45 per hour)	2 hours	3 hours
Machine hours ($60 per hour)	3 hours	2 hours

Fixed overheads are $300,000 each month. The contribution per unit made on each product is as follows:

	Seebach	Herdorf
Contribution ($ per unit)	250	315

The maximum demand each month is 4,000 units of Seebach and 3,000 units of Herdorf. The products and materials are perishable and inventories of raw materials or finished goods cannot be stored. Cara Co has a legally binding obligation to produce a minimum of 2,000 units of Herdorf in each of months 1 and 2. There is no minimum production required in month 3. The manufacturing manager is planning production volumes and the maximum availability of resources for months 1, 2 and 3 are as follows:

Month	1	2	3
Materials (kg)	34,000	42,000	35,000
Labour (hours)	18,000	12,000	24,000
Machine (hours)	18,000	19,000	12,000

For month 3 the following linear programming graph has been produced:

(Create a chart with a grid background. On the horizontal axis, label it "Seebach (S)" with values ranging from 0 to 14,000 in increments of 2,000. On the vertical axis, label it "Herold (H)" with values ranging from 0 to 10,000 in increments of 2,000. Draw three descending straight lines starting from different points on the vertical axis and intersecting at various points along both axes. Label the first line as "250S + 315H" starting near the 2,500 mark on the vertical axis and intersecting the horizontal axis at 4,000 mark. Label the second line as "3S + 2H = 12,000," tarting near the 6,000 mark on the vertical axis and intersecting the horizontal axis at 4,000 mark. The third line should be labeled "5S + 7H = 35,000,"

starting near the 5,000 mark on the vertical axis and intersecting the horizontal axis near the 7,000 mark. The fourth line should be labeled "2S + 3H = 24,000," starting at 8,000 mark on the vertical axis and intersecting the horizontal axis at 12,000 mark. Line H is the horizontal line intersecting the vertical axis at 3,000 mark. Line S is the vertical line intersecting with horizontal axis at 4,000 mark. Ensure all lines are solid and clearly labeled for clarity.)

Question 1. What is/are the limiting factor(s) in month 1? A. Materials, labour hours and machine hours B. Materials and machine hours only C. Materials only D. Labour hours only
Answer:
The correct answer is C.
WORKING

	Seebach	Herdorf	Total required	Available
Material (kg)	20,000	21,000	41,000	34,000
Labour (hours)	8,000	9,000	17,000	18,000
Machine hours	12,000	6,000	18,000	18,000

There is sufficient labour hours and machine hours to meet maximum demand but there is a shortage of material, so material is the only limiting factor in month 1.

Question 2. The production manager has identified that the only limiting factor in month 2 is labour hours. What is the production volume for Herdorf for month 2 (to the nearest whole unit)?
Answer:
The correct answer is 2000 units. Tutorial note: Labour is the only limiting factor in month 2.
WORKING

	Seebach	Herdorf
Contribution per unit ($)	250	315
Labour hours per unit	2	3
Contribution per labour hour ($)	125	105
Ranking	1st	2nd

The optimum plan would have been to produce Seebach first up to its maximum demand. However, a minimum of 2,000 units of Herdorf must be produced. The remaining 6,000 hours (12,000- (2,000 * 3 hours) will be used to produce 3,000 units of Seebach (6,000 hours/2 hours). There are no more hours available to make any more products, so the production volume for Herdorf for month 2 is 2,000 units.

Question 3. If the shadow price for month 2 is $125 per labour hour, which of the following statements is/are correct? 1. The production manager would be willing to pay existing staff a maximum overtime premium of $125 per hour for the next 2,000 hours 2. The production manager would be willing to pay a maximum of $170 per hour for an additional 2,000 hours of temporary staff time A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2
Answer:
The correct answer is C. Tutorial note: The shadow price is the contribution from having one extra unit of limited resource available; it represents the maximum premium worth paying to acquire that extra resource. A shadow price of $125 per labour hour means that Cara Co would

be willing to pay $125 overtime premium per hour for the next 2,000 hours. The maximum hourly rate Cara Co would be willing to pay would therefore be $170 ($45 + $125).

Question 4. What is the maximum profit which can be earned in month 3? A. $1,080,000 B. $1,145,000 C. $1,380,000 D. $1,445,000
Answer:
The correct answer is B. Tutorial note: To identify the optimum point on the graph, consider an iso-contribution line (i.e. a line parallel to 250S + 315H) that is furthest from the origin but within the feasible region. This is where the machine hours constraint (3S + 2H = 12,000) intersect the demand constraint for Herdorf (H = 3,000). Clearly at this point H = 3,000.
WORKING
At the optimum point, 2S + (3 * 3,000) = 24,000. Therefore S = 2,000 (i.e. 24,000 - 9,000)/3).

	$000
Maximum contribution ($250 × 2,000 units) + ($315 × 3,000 units)	1,445
Less fixed costs	(300)
Maximum profit	1,145

Question 5. Which of the following interpretations of the linear programming graph produced for month 3 is/are correct? 1. Even if demand for either product increases, labour will be a slack variable if no other resources change 2. If more machine hours were made available in month 3, they would be used initially to make Herdorfs. A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2.
Answer:
The correct answer is A. Tutorial note: A variable is slack when more resource is available than required. From the graph, the optimal solution is where the machine constraint intersects maximum demand for H. (2) is therefore incorrect; if more machine hours become available, they would be used to make Seebach. The labour constraint (2S + 3H= 24,000) is well beyond the feasible region and not a binding constraint. Even if demand increases for both products, labour would still be a slack variable if no other resources change. Only (1) is correct.

Case: Resource Optimization and Contribution Analysis for Home Electrics Co's Divisions
Home Electrics Co manufactures electrical appliances for domestic use. It is made up of two divisions. Small Appliances division Two of the products manufactured by the Small Appliances division are the Blender (Product B) and the Toaster (Product T). The standard cost cards per unit for each of the products is as follows:

	B	T
S	$	
Selling price	80	120
Direct materials ($5 per kg)	10	15
Direct labour ($7 per hour)	21	35
Variable overheads	12	18
Fixed overheads	8	10

| Profit | 29 | 42 |

In the first quarter of the year the supply of materials was restricted to 2,000 kg per month. This was due to a global shortage. It is now April and it has been identified that material will continue to be limited to 2,000 kg per month but also labour hours will be restricted to 3,200 hours per month. The management accountant has supplied formulas for the production constraints as follows:

Materials: $2B + 3T = 2000$

Labour: $3B + 5T = 3200$

Large Appliances division

This division also manufactures two products; a Freezer (Product F) which earns a contribution of $150 per unit and a Dishwasher (Product D) which earns a contribution of $200 per unit. Both products use the same resources, several of which are in short supply. In April only 4,000 labour hours, 2,500 kg of material and 3,200 machine hours will be available. The management accountant has applied linear programming and defined the following constraints:

Materials	$4F + 6D = 2500$
Labour	$10F + 8D = 4000$
Machine time	$5F + 10D = 3200$
Demand for D	250

Labour and machine time have been identified as the binding constraints and an optimum production plan of 240 units of F and 200 units of D has been calculated.

Question 1. What is the contribution per unit of limiting factor for Product T in the first quarter of the year (to the nearest whole $)?

Answer:

The correct answer is $17 to the nearest $.

Tutorial note: The limiting factor for Product T in the first quarter was kg of direct materials.

Selling price	$120
Variable cost (15+35+18)	$ 68
Contribution ($120 - $68)	$52
Material required per unit	3 kg
Contribution per kg ($52/3)	$17.33

Question 2. Using simultaneous equations, what is the total contribution to be earned from Products B and T in April? A. $28,400 B. $35,600 C. $62,000 D. $77,200

Answer:

The correct answer is B.

WORKING

| Materials | $2B + 3T = 2,000$ | (1) |
| Skilled Labour | $3B + 5T = 3,200$ | (2) |

To solve simultaneously, multiply (1) by 5 and (2) by 3 to give:

| $10B + 15T = 10,000$ | (3) |
| $9B + 15T = 9,600$ | (4) |

Deducting (4) from (3) gives $1B = 400$.

Substituting $B = 400$ in any of the equations, for example, in (1):

(2 * 400) + 3T = 2,000
Therefore, T = (2,000 - 800)/3 = 400
Contribution of B ($80-$10-$21 -$12) = $37
Contribution of T ($120- $15-$35-$18) =$52
Total contribution ($37 * 400) + ($52 * 400) = $35,600

Question 3. Which of the following statements about the use of linear programming to resolve limiting factor problems are true? 1. The linear programming method helps to identify the optimum selling price for a product 2. Slack occurs when more than the maximum available of the limited resource is required A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2
Answer:
The correct answer is D. Tutorial note: Linear programming identifies the optimum number of units of each product to manufacture, not the optimum selling price. Slack occurs when less resource is required than is available.

Question 4. What would be the shadow price of material in the Large Appliances division (to the nearest whole $)?
Answer:
The correct answer is $ 0 Tutorial note: There are three constraints for the Large Appliances division (labour hours, material and machine hours) of which labour and machine time have been identified as binding. As material is not a binding constraint, it will have a shadow price of $0.

Question 5. Which of the following statements about the linear programming method in the Large Appliances division are true? 1. Product D has a slack value 2. Contribution of $76,000 will be earned from the optimum production plan 3. Labour and machine time intersect at the optimum point if shown on a graph A. 1, 2 and 3 B. 2 and 3 only C. 1 and 3 only D. 2 only
Answer:
The correct answer is A. Tutorial note: At the optimum solution, demand for D is 250, but output is 200. Product D has unfulfilled demand at the optimum solution, so it has a slack value. So (1) is true. The total contribution from the optimum production plan is (240 * $150) + (200 * $200) = $76,000. So (2) is true. As labour and machine time are the binding constraints, the optimum point will be their point of intersection on a linear programming graph. So (3) is true.

Case: Pricing Strategy Analysis for the Launch of Heat Co's Energy Buster
Heat Co specialises in the production of a range of air conditioning appliances for industrial premises. It is about to launch a new product, the "Energy Buster", a unique air conditioning unit which is capable of providing unprecedented levels of air conditioning using a minimal amount of electricity. The technology used in the Energy Buster is unique so Heat Co has patented it so that no competitors can enter the market for two years. The company's development costs have been high and it is expected that the product will only have a five-year life cycle. Heat Co is now trying to ascertain the best pricing policy that it should adopt for the

Energy Buster's launch onto the market. Demand is very responsive to price changes and research has established that, for every $15 increase in price, demand would be expected to fall by 1,000 units. If the company set the price at $735, only 1,000 units would be demanded. The costs of producing each air conditioning unit are as follows:

	$	
Direct materials	42	
Labour	12	(1.5 hours at $8 per hour. See note below)
Fixed overheads	6	(based on producing 50,000 units per year)
Total cost	60	

Note: The first air conditioning unit took 1.5 hours to make and labour cost $8 per hour. A 95% learning curve exists, in relation to production of the unit, although the learning curve is expected to finish after making 100 units. Heat Co's management have said that any pricing decisions about the Energy Buster should be based on the time it takes to make the 100th unit of the product. The learning co-efficient, b = - 0.0740005. All other costs are expected to remain the same up to the maximum demand levels.

Required: (a) (i) Establish the demand function for air conditioning units. (ii) Calculate the marginal cost for each air conditioning unit after adjusting the labour cost as required by the note above. (iii) Determine the optimum price and quantity to maximise profits. (b) Explain what is meant by a "penetration pricing" strategy and a "market skimming" strategy and discuss whether either strategy might be suitable for Heat Co when launching the Energy Buster.

Answer:

(a) Optimum price and quantity

(I) Establish the demand function b = change in price/change in quantity = $15/1,000 = 0.015. We know that if price = $735, quantity = 1.000 units. Establish "a" by substituting these values for P. Q and b into the demand function:

735 = a - 0.015Q

15 + 735 =a

Therefore a = 750.

Demand function is therefore P = 750 - 0.015Q

Tutorial note: This given in the exam formulae sheer.

(II) Establish marginal cost The labour cost of the 100" unit needs to be calculated as follows:

Formula = y = a * x raised to the power of b

a = 1.5

Therefore, if x = 100 and b= -0.0740005, y = 1.5 * 100 raised to the power of -0.0740005 = 1.0668178

Therefore cost per unit = 1.0668178 * $8 = $8.5345

Total cost for 100 units = $853.45.

If x=99, y =1.5 * 99 raised to the power of -0.0740005 = 1.0676115

Therefore cost per unit = $8.5408

Total cost for 99 = $845.55

Therefore cost of 100" unit = $853.45 - $845.55 = $7.90.

Therefore total marginal cost = $42 + $7.90 = $49.90.

Fixed overheads have been ignored as they are not part of the marginal cost.

(III) Optimum price and quantity

Tutorial note: The optimum price is where marginal revenue equates to marking cost.

MR = a-2bQ

MR = 750 - 0.03Q

Equating MC and MR:

49.90 = 750 - 0.03Q

0.03Q = 700.1

Q = 23,337

Therefore the optimum price is: P = 750 - (0.015 * 23,337) = $399.95 (i.e. $400)

(b) Penetration pricing

With penetration pricing, a low price would initially be charged for the Energy Buster. The idea behind this is that the price will make the product accessible to a larger number of buyers and therefore the high sales volumes will compensate for the lower prices being charged. A large market share would be gained and possibly, the Energy Buster might become accepted as the only industrial air conditioning unit worth buying.

Circumstances that would favour a penetration pricing policy .

· Highly elastic demand for the Energy Buster (i.e. the lower the price, the higher the demand). The preliminary research does suggest that demand is elastic.

· If significant economies of scale could be achieved by Heat, higher sales volumes would result in sizeable reductions in costs. This is not the case here, since learning ceases at 100 units.

· If Heat was actively trying to discourage new entrants into the market. In this case, new entrants cannot enter the market anyway, because of the patent.

· If Heat wished to shorten the initial period of the Energy Buster's life cycle so as to enter the growth and maturity stages quickly. We have no evidence that this is the case for Heat, although it could be.

From the above, it can be seen that this could be a suitable strategy in some respects but it is not necessarily the best one.

Market skimming

With market skimming, high prices would initially be charged for the Energy Buster rather than low prices. This would enable Heat to take advantage of the unique nature of the product and so maximise sales from those customers who like to have the latest technology as early as possible.

Conditions most suitable for this strategy

· The product is new and different. This is indeed the case with the Energy Buster.

· The product has a short life cycle and high development costs that need to be recovered quickly. The life cycle is fairly short and high development costs have been incurred.

· Since high prices attract competitors, barriers to entry are needed to deter competitors. In Heat's case, there is a barrier, since it has obtained a patent for the Energy Buster.

· The strength and sensitivity of demand are unknown. Again, this is not the case here.

Once again, the Energy Buster meets only some of the conditions which would suggest that although this strategy may be suitable the answer is not clear cut. The fact that high development costs have been incurred and the life cycle is fairly short are fairly good reasons to

adopt this strategy. However, although demand curve data is available, its reliability is not known; a skimming strategy may be a safer option.

Case: Strategic Pricing and Revenue Optimization for ALG Co's New Product Launch
ALG Co is launching a new, innovative product onto the market. The product's expected life is three years. Given the high level of development costs which have been incurred, ALG Co wants to ensure that it sets its price at the right level and has therefore consulted a market research company to help it do this. The research, which relates to similar but not identical products launched by other companies, has revealed that at a price of $60, annual demand would be expected to be 250,000 units. However, for every $2 increase in selling price, demand would be expected to fall by 2,000 units and for every $2 decrease in selling price, demand would be expected to increase by 2,000 units.
The demand curve can be expressed in the form P = a - bQ, as shown in the exam formula sheet.
A forecast of the annual production costs which would be incurred by ALG Co in relation to the new product are as follows:

Annual production (units)	200,000	250,000	300,000	350,000
	$	$	$	$
Direct material	2,400,000	3,000,000	3,600,000	4,200,000
Direct labour	1,200,000	1,500,000	1,800,000	2,100,000
Overheads	1,400,000	1,550,000	1,700,000	1,850,000

Question 1. What are the values of a and b in the demand curve, given the information above? (Select your answer using the rectangular buttons) a b A 60 0.001 B 31 1,000 C D 310 0.001
Answer:
The correct answer is D.
WORKING
Using the formula b = ΔP/ΔQ gives 2/2,000 = 0.001
Therefore P = a - 0.001Q
Find value for "a" by substituting in the known price and demand relationship from the question, matching P" and Q" accordingly.
60 = a - (0.001 * 250,000)
60 = a - 250
310 = a
Therefore P = 310 - 0.001Q
Tutorial note: Δ is a mathematical notation for change. Ignore the minus sign as it is already reflected in the formula P = a - bx.

Question 2. What is the price elasticity of demand at a price of $60? A. Its value is 0.24 and demand is elastic B. Its value is 0.24 and demand is inelastic C. Its value is 4.16 and demand is elastic D. Its value is 4.16 and demand is inelastic Answer:
The correct answer is B.

WORKING

Price elasticity of demand is =% change in quantity demanded/% change in price
At a price of $60, annual demand would be 250,000 units. However, for every $2 increase in selling price, demand would be expected to fall by 2,000 units and for every $2 decrease in selling price, demand would be expected to increase by 2,000 units.
% change in quantity demanded = (2,000/250,000) * 100 = 0.8%
% change in price = (2/60) * 100 = 3.33%
Therefore, price elasticity of demand = 0.8%/3.33% = 0.24
Since this is less than one, demand in inelastic which means unresponsive. Changes in price lead to only small changes in demand.

Question 3. What is the variable cost per unit (to the nearest $)?
Answer:
The correct answer is $21
Material cost = $2,400,000/200,000 = $12 per unit
Labour cost = $1,200,000/200,000 = $6 per unit
Variable overhead cost using high-low method: ($1,850,000 - $1,400,000)/(350,000 - 200,000) = $3 per unit
Therefore total variable cost per unit = $21

Question 4. At what level of output would ALG Co maximise revenue? A. Where marginal cost = marginal revenue B. Where marginal revenue = zero C. By producing to the maximum capacity D. At the point where price elasticity of demand = 0
Answer:
The correct answer is B. Tutorial note: Revenue is maximised where marginal revenue = zero. This is not the point where profit is maximised - profit is maximised where marginal cost = marginal revenue. (C) may be correct in a competitive market where the company is a price taker. However, this is not the case with ALG as the company has a downward sloping demand curve for its products.

Question 5. The sales director believes that a high price should be charged at launch so that those customers prepared to pay a higher price for the product can be "skimmed off" first. In which TWO of the following situations would market skimming be an appropriate strategy for the initial launch of a product? A. ALG Co has an innovative product B. Competitors have just launched a similar product C. Demand for the product is inelastic D. Many substitute products exist
Answer:
The correct answers are A, C.
Tutorial note: Having an innovative product is a good reason to use market skimming as some people would be prepared to pay a higher price for a product that is new. Also, if demand for a product is inelastic, charging a high price would not lead to a large fall in demand. Therefore, market skimming might be appropriate. Market skimming would not be appropriate in the other two situations: Charging a high price for a product when competitors have just launched a similar product would most likely lead to potential customers switching to the competitor's

product. Similarly, charging a high price for a product when many substitute products exist would most likely lead to potential customers switching to the substitute product.

Case: Pricing Strategy and Profit Maximization for TR Co's Parapain and New Anti-Malaria Drug
TR Co is a pharmaceutical company which researches, develops and manufactures a wide range of drugs. One of these drugs, "Parapain", is a pain relief drug used for the treatment of headaches and until last month TR Co had a patent on Parapain which prevented other companies from manufacturing it. The patent has now expired and several competitors have already entered the market with similar versions of Parapain, which are made using the same active ingredients. TR Co is reviewing its pricing policy in light of the changing market. It has carried out some market research in an attempt to establish an optimum price for Parapain. The research has established that for every $2 decrease in price, demand would be expected to increase by 5,000 batches, with maximum demand for Parapain being one million batches. Each batch of Parapain is currently made using the following materials:
Material Z: 500 grams at $0.10 per gram
 Material Y: 300 grams at $0.50 per gram
Each batch of Parapain requires 20 minutes of machine time to make and the variable running costs for machine time are $6 per hour. The fixed production overhead cost is expected to be $2 per batch for the period, based on a budgeted production level of 250,000 batches. The skilled workers who have been working on Parapain until now are being moved onto the production of TR Co's new and unique anti-malaria drug which cost millions of dollars to develop. TR Co has obtained a patent for this revolutionary drug and it is expected to save millions of lives. No other similar drug exists and, whilst demand levels are unknown, the launch of the drug is eagerly anticipated all over the world. Agency staff, who are completely new to the production of Parapain and cost $18 per hour, will be brought in to produce Parapain for the foreseeable future. Experience has shown there will be a significant learning curve involved in making Parapain as it is extremely difficult to handle. The first batch of Parapain made using one of the agency workers took 5 hours to make. However, it is believed that an 80% learning curve exists, in relation to production of the drug, and this will continue until the first 1,000 batches have been completed. TR Co's management has said that any pricing decisions about Parapain should be based on the time it takes to make the 1,00th batch of the drug. Note: The learning co-efficient, b = -0.321928
Required: (a) Calculate the optimum (profit-maximising) selling price for Parapain and the resulting annual profit which TR Co will make from charging this price. Note: If P = a - bQ, then MR = a - 2bQ (b) Discuss and recommend whether market penetration or market skimming would be the most suitable pricing strategy for TR Co when launching the new antimalaria drug.

Answer:
(a) Optimum (profit-maximising) selling price
Step 1: Establish the demand function
b = change in price/change in quantity
b = $2/5,000 batches = 0.0004

The maximum demand for Parapain is one million batches, so where P = 0, Q = 1,000,000, so "a" is established by substituting these values for P and Q into the demand function:

0 = a - (0.0004 * 1,000,000)

0 = a - 400

Therefore a = 400

Demand function is therefore: P = 400 - 0.0004Q

Step 2: Establish the marginal cost

		Total
$		
Material Z	500 g * $0.10	50
Material Y	300 g * $0.50	150
Labour	(WORKING)	6.60
Machine running cost	(20/60) * $6.00	2
Total marginal cost per batch		208.60

Tutorial note: Fixed overheads are not included marginal cost.

WORKING

Labour cost

The labour cost of the 1,000th batch needs to be calculated as this is the basis TR Co will determine the price for Parapain:

Using the learning curve formula: Y = a * x raised to the power of b

Where a (the cost for the first batch) = 5 hours * $18 = $90

If X = 1,000 batches and b = -0.321928, Y = 90 * 1,000 raised to the power of -0.321928 = 9.73774

Total cost for 1,000 batches = $9,737.74

If X = 999 batches, Y= 90 * 999 raised to the power of -0.321928 = 9.74088

Total cost for 999 batches = $9,731.14

Therefore the cost of the 1,000 batches ($9,737.74 - $9,731.14) = $6.60

Step 3: Establish the marginal revenue function: MR = a - 2bQ

Equate MC and MR and insert the values for "a" and "b" from the demand function in step 1.

208.60 = 400 - (2 * 0.0004 * Q)

Step 4: Solve the MR function to determine optimum quantity, Q

208.60 = 400 - 0.0008Q

0.0008Q = 191.4

Q = 239,250 batches

Step 5: Use the demand function find P

Substitute the value of Q (from step 4) into the demand function (step 1) and calculate the corresponding optimum price:

P = 400 - (0.0004 * 239,250)

P = $304.30

Step 6: Calculate profit

Revenue (239,250 batches * $304.30) = $72,803,775

Variable costs (239,250 batches * $208.60) = (49,907,550)

Fixed costs (250,000 batches * $2) = (500,000)

Profit = $22,396,225

(b) Most suitable pricing strategy

Market penetration pricing

With penetration pricing, a low price would initially be charged for the anti-malaria drug. The ideology behind this is that the price will make the product accessible to a larger number of buyers and therefore the high sales will compensate for the lower prices being charged. The anti-malaria drug would rapidly become accepted as the only drug worth buying, i.e. it would gain rapid acceptance in the marketplace. The circumstances which would favour a penetration pricing policy are: · · · Highly elastic demand for the anti-malaria drug, i.e. the lower the price, the higher the demand. There is no evidence that this is the case.

· If significant economies of scale could be achieved by TR Co so that higher sales volumes would result in sizeable reductions in costs. It cannot be determined if this is the case here.

· If TR Co was actively trying to discourage new entrants into the market, however in this case, new entrants cannot enter the market anyway due to the patent.

· If TR Co wished to shorten the initial period of the drug's life-cycle so as to enter the growth and maturity stages quickly but there is no evidence the company wish to do this.

Market skimming pricing

With market skimming, high charges would initially be charged for the anti-malaria drug rather than low prices. This would enable TR Co to take advantage of the unique nature of the product. The most suitable conditions for this strategy are:

· The product has a short life cycle and high development costs which need to be recovered. There is no information about the drug's life cycle but development costs have been high.

· Since high prices attract competitors, there needs to be barriers to entry if competitors are to be deterred. In TR Co's case it has a patent for the drug and also the high development costs could act as a barrier.

· Where high prices in the early stages of a product's life cycle are expected to generate high initial cash flows, this will help TR Co recover the high development costs it has incurred. Recommendation Given the unique nature of the drug and the barriers to entry, a market skimming pricing strategy would appear to be the far more suitable pricing strategy. Also, whilst there is demand curve data, it is unknown how reliable this data is, in which case a skimming strategy may be the safer option.

Case: Pricing Strategy and Demand Elasticity Analysis for Skulpt Co's GSA Product

Skulpt Co is a manufacturer of electronic goods. One electronic device it produces and sells is the GSA. There are between 30 to 50 other suppliers of similar, but not identical, devices in Skulpt Co's markets. Each producer enjoys varying levels of customer and brand loyalty. The current selling price for the GSA is $250 and Skulpt Co's directors are considering a reduction in price to $230. Market research commissioned by the company has suggested that the price elasticity of demand for the GSA is 1.25. The same market research suggests that the price (P) schedule and marginal revenue (MR) schedule for the GSA in its current markets are as follows:

$P = 450 - 0.2Q$

MR = 450 - 0.4Q

Production and selling costs for one GSA are as follows:

	Cost per unit
	$
Variable production cost	30
Variable selling and distribution cost	24
Fixed production cost	40
Fixed selling and distribution cost	18
	112

New customer order

A new customer, LOK Co, has approached Skulpt Co with a bespoke, one-off order of 5,000 units of the GSA. The units will be produced in Skulpt Co's factory along with all of its usual production and delivered to LOK Co using Skulpt Co's usual distribution channels. The order is considered bespoke as LOK Co has requested some additional finishing in the production process which will generate an extra production cost of $6 per unit. The units must also be delivered using a special packaging costing $2 per unit. The special packaging will be paid for and supplied by LOK Co. The variable production cost of the GSA includes the current purchase price of $7 per unit for an electronic chip. As the GSA is a popular product the chips are in constant use and Skulpt Co has sufficient inventory of these chips to satisfy LOK Co's order. The chips in inventory were purchased several months ago at a discounted rate of $5 each. A mark-up of 20% is usually added for all one-off orders.

New market

Skulpt Co wants to sell to the country of Harekish which now allows the sale of the GSA, following a change in its laws. Skulpt Co's objectives are to:

· Set a minimum acceptable price which is most likely to discourage new entrants; and

· Shorten the initial period of the product life cycle in Harekish to reach the growth and maturity stages quickly.

Question 1. Which of the following factors is LEAST likely to be considered by Skulpt Co when setting its prices in its home market? A. Customer demand B. Manufacturing costs C. Competitors' prices D. Currency in its home market

Answer:

The correct answer is D. Tutorial note: The question asks about setting the price in the home market, and which of the factors would have the LEAST impact. Since there are no currency issues to consider when looking only at the home market, this is the least likely concern when setting the price in the home country. Customer demand is driven largely by price and so would be a key factor in setting the price. Manufacturing costs must be covered in the long run and so are also a key factor in setting prices. Competitors' prices are also a key factor. In this market, although the products are not identical, any large deviations in prices between competitors will see some customers move to the cheaper products when they are similar.

Question 2. Which of the following statements about the price elasticity of demand for the GSA is true? A. Its demand is price elastic and revenue will increase if the price is decreased to $230 B. Its demand is price elastic and revenue will decrease if the price is decreased to $230 C. Its

demand is price inelastic and revenue will increase if the price is decreased to $230 D. Its demand is price inelastic and revenue will decrease if the price is decreased to $230
Answer:
The correct answer is A. Tutorial note: If demand is price elastic the percentage of units demanded changes at a greater rate than the price per unit. If the price goes down the number of units sold (demanded) goes up by a greater amount, so the revenue will increase: Although unnecessary to answer the question correctly, this can be proved by comparing the revenue earned at the current price of $250 and the revenue earned at the lower price of $230.
Current price = $250

Price schedule:	$P = 450 - 0.2Q$
P = $250:	$250 = 450 - 0.2Q$
Rearrange and solve for Q:	$0.2Q = 450 - 250$
	$0.2Q = 200$
	$Q = 1,000$
Revenue at P = $250 and Q = 1,000:	$1,000 * 250 = $250,000$
Reduced price = $230	
Price schedule:	$P = 450 - 0.2Q$
P= $230:	$230 = 450 - 0.2Q$
Rearrange and solve for Q:	$0.2Q = 450 - 230$
	$0.2Q = 220$
	$Q = 1,100$
Revenue at P = $230 and Q = 1,100:	$1,100 * 230 = $253,000$

Reducing the price from $250 to $230 will lead to an increase in revenue from $250,000 to $253,000.

Question 3. What is the profit-maximising price for the GSA (to the nearest whole $)?
Answer:
The correct answer is $ 252
Tutorial note: Profit, P, is maximised when marginal revenue (MR) = marginal cost (MC).

In questions like this, variable cost can be substituted for MC.	$450 - 0.4Q$
MC	$30 + 24 = 54$
Equate MR = MC	$54 = 450 - 0.4Q$
Rearrange and solve for Q:	$0.4Q = 450 - 54$
$0.4Q = 396$	
$Q = 990$	
Use Q = 990 in price equation	$P = 450 - (0.2 * 990)$
Solve for P	$P = 252$

Question 4. What is the minimum price per unit which could be set by Skulpt Co in respect of LOK Co's order of the GSA (to the nearest whole $)?
Answer:
The correct answer is $60

Tutorial note: A minimum price requirement relates to relevant costs (i.e. future incremental costs which will only be incurred if the contract for LOK Co is fulfilled). In this question, the best approach is to consider each cost and decide whether it is relevant to the one-off order.
WORKING
Production and selling costs: The full cost per unit is $112, but the only relevant costs are the variable costs ($30 production and $24 selling and distribution). The fixed costs will not change. Other costs: The extra finishing required will incur additional production costs of $6 per unit that would not be incurred if the order is not fulfilled. The $2 additional packaging will be paid for and supplied by LOK Co so should not be included in the minimum price. The $7 electronic chip cost is already included in the variable cost of $30 so should not be double counted. The mark-up of 20% should not be included in the calculation of the minimum price. The minimum price is therefore (30 + 24 + 6) = $60.

Question 5. Which TWO of the following pricing strategies are most appropriate for Skulpt Co in order to achieve its objectives in relation to selling the GSA in Harekish? A. Transfer pricing B. Market skimming C. Market penetration D. Relevant cost pricing E. Price discrimination by product version F. Complementary product pricing
Answer:
The correct answer is C,D.
Tutorial note: Skulpt Co's objectives are to discourage new entrants and shorten the initial period of the product life cycle. Market penetration pricing involves setting an initially low price in order to grow the customer base quickly. This would allow Skulpt Co to shorten the initial period of the product life cycle and reach the growth and maturity stages quickly. Using a relevant costing approach would result in arriving at the minimum price for the GSA which would fit with objective of setting a minimum acceptable price to discourage new entrants. Market skimming involves setting an initially hight price which can be lowered at a later stage. This would not assist Skulpt Co in meeting its objectives. Skulpt Co is following a price discrimination strategy but based on location rather than product version. Transfer pricing and complementary product pricing are not suitable for Skulpt Co's objectives.

Case: Pricing Strategy Analysis for Stow Hotel: Decision-Making under Uncertainty
The managers of Stow Hotel are trying to decide on their pricing strategy for the next financial year. Occupancy levels depend on the price charged, and the managers are trying to decide between charging $180, $200 or $220 per day. The variable costs of running the hotel are uncertain, due to fluctuation in the prices of food and energy. Costs may be high, most likely or low. The management accountant has produced a profit table (payoff matrix) summarising the possible levels of contribution for each price charged:

State of variable cost	$180	$200	$220
	$	$	$
High	1,339	1,378	1,313
Most likely	1,496	1,509	1,418
Low	1,733	1,706	1,575

The probabilities of variable cost levels occurring at the high, most likely and low levels are estimated as 0.1, 0.6 and 0.3 respectively.

Question 1. Match the fee that should be chosen using the maximax and maximin decision rules.
Answer:

Decision rule	Fee
Maximax	$180
Maximin	$200

Tutorial note: A fee of $180 gives the highest potential return, so would be chosen under maximax. The minimum returns for each fees strategy are: $1,339 for $180, $1,378 for $200 and $1,313 for $220. A fee of $200 therefore has the highest minimum return, so would be chosen under maximin.

Question 2. What are the expected values of contribution for each fee strategy?

	$180	$200	$220
A	1,496	1,509	1,418
B	1,551	1,555	1,455
C	1,522	1,531	1.435
D	1,473	1,489	1,402

Answer:
The correct answer is B.
WORKING
Expected value for each fee strategy is calculated by multiplying each potential outcome by its probability and summing these:
$180: (1,339 * 0.1) + (1,496 * 0.6) + (1,733 * 0.3) = $1,551
$200: (1,378 * 0.1) + (1,509 * 0.6) + (1,706 * 0.3) = $1,555
$220: (1,313 * 0.1) + (1,418 * 0.6) + (1,575 * 0.3) = $1,455

Question 3. The management accountant started to calculate a "table of regrets" but did not complete it. The table is missing the regrets for the low level of variable costs:

State of variable cost	$180	$200	$220
High	39	0 0	65
Most likely	13	0	91
Low	?	?	?

What are regrets for each fee strategy for the low level of variable costs?

	$180	$200	$220
A	394	328	262
B	0	27	131
C	27	0 0	131
D	0	27	158

Answer:
The correct answer is D.
WORKING

For the low level of variable costs, the best fee strategy would be to charge $180 as this has the highest contribution of $1,733. The regret for $180 is therefore zero. The regret for the other two decisions is the difference between the contribution that they generate at the low level of variable cost and $1,733:

For fee strategy $200, regret is: (1,733 - 1,706) = 27
For fee strategy $220 regret is (1,733 - 1,575) = 158

Question 4. The management of Stow Hotel are risk seekers. Which decision making technique is appropriate for risk seekers?
Answer:
The correct answer is Maximax
Tutorial note: Maximin is used by risk averse decision makers (people who do not like risk). Minimax regret is also used by risk averse decision makers. Expected values are used by risk neutral decision makers.

Question 5. Identify, by selecting the relevant box in the table below, whether each of the following statements regarding the use of expected values in decision making is correct or incorrect.
Statement 1: They accurately reflect the risks associated with each decision
Statement 2: They are more appropriate for actions that will be repeated many times
Statement 3: They may be unreliable as the probabilities used are estimates
Statement 4: They are used by risk neutral decision makers
Answer:

They accurately reflect the risks associated with each decision		INCORRECT
They are more appropriate for decisions that are repeated many times	CORRECT	
They may be unreliable as the probabilities used are estimates	CORRECT	
They are used by risk neutral decision makers	CORRECT	

Case: Budgeting Strategy and Pricing Decisions for Gam Co's New Product Launch
Gam Co sells electronic equipment and is about to launch a new product onto the market. It needs to prepare its budget for the coming year and is trying to decide whether to launch the product at a price of $30 or $35 per unit. The following information has been obtained from market research:

Price per unit $30		Price per unit $35	
Probability	Sales volume	Probability	Sales volume
0.4	120,000	0.3	108,000
0.5	110,000	0.3	100,000
0.1	140,000	0.4	94,000

Notes
1. Variable production costs would be $12 per unit for production volumes up to and including 100,000 units each year. However, if production exceeds 100,000 units each year, the variable production cost per unit would fall to $11 for all units produced.

2. Advertising costs would be $900,000 per year at a selling price of $30 and $970,000 per year at a price of $35.

3. Fixed production costs would be $450,000 per year.

Required: (a) Calculate each of the six possible profit outcomes which could arise for Gam Co in the coming year. (b) Calculate the expected value of profit for each of the two price options and recommend, on this basis, which option Gam Co would choose. (c) Briefly explain the maximin decision rule and identify which price should be chosen by management if they use this rule to decide which price should be charged. (d) Discuss the factors which may give rise to uncertainty when setting budgets.

Answer:

(a) Profit outcomes

Sales price per unit	$30	$35
Unit contribution		
Up to 100,000 units	$18	$23
Above 100,000 units	$19	$24

Sales price $30

Sales volume	Unit contribution $	Total contribution $000	Fixed costs $000	Advertising costs $000	Profit $000
120,000	19	2,280	450	900	930
110,000	19	2,090	450	900	740
140,000	19	2,660	450	900	1,310

Sales price $35

Sales volume	Unit contribution $	Total contribution $000	Fixed costs $000	Advertising costs $000	Profit $000
108,000	24	2,592	450	970	1,172
100,000	23	2,300	450	970	880
94,000	23	2,162	450	970	742

(b) Expected values

Sales price $30

Sales volume	Profit $000	Probability	EV of profit $000
120,000	930	0.4	372
110,000	740	0.5	370
140,000	1,310	0.1	131

Sales price $35

Sales volume	Profit $000	Probability	EV of profit $000

108,000	1,172	0.3	351.6	
100,000	880	0.3	264	
94,000	742	0.4	296.8	
			912.4	

If the criterion of expected value is used to make a decision as to which price to charge, the price charged should be $35 per unit since the expected value of this option is the greatest.

(c) Maximin decision rule

Under this rule, the decision-maker selects the alternative which offers the most attractive worst outcome, i.e. the alternative which maximises the minimum profit. In the case of Gam this would be the price of $35 as the lowest profit here is $742,000 as compared to a lowest profit of $740,000 at a price of $30.

(d) Reasons for uncertainty arising in the budgeting process

Uncertainty arises largely because of changes in the external environment over which a company will sometimes have little control. Reasons include:

· Customers may decide to buy more or less goods or services than originally forecast. For example, if a major customer goes into liquidation, this has a huge effect on a company and could also cause them to go into liquidation.

· Competitors may strengthen or emerge and take some business away from a company. On the other hand, a competitor's position may weaken leading to increased business for a particular company.

· Technological advances may take place which lead a company's products or services to become out-dated and therefore less desirable.

· The workforce may not perform as well as expected, perhaps because of time off due to illness or maybe simply because of lack of motivation.

· Materials may increase in price because of global changes in commodity prices.

· Inflation can cause the price of all inputs to increase or decrease.

· If a company imports or exports goods or services, changes in exchange rates can cause prices to change.

· Machines may fail to meet production schedules because of breakdown.

· Social/political arrest could affect productivity (e.g. the workforce goes on strike).

Tutorial note: This list is not exhaustive, nor would candidates be expected to make all the points raised in order to score full marks.

Case: Budget Preparation and Cost Analysis for Northland Local Government Organisations (LGO)

Northland's major towns and cities are maintained by local government organisations (LGO), which are funded by central government. The LGOs submit a budget each year that forms the basis of the funds received. You are provided with the following information as part of the 20X3 budget preparation:

Administrative overheads

Administrative overhead costs are budgeted by taking the previous year's actual expenditure and adding a set % to allow for inflation. Adjustments are also made for known changes. The details for these are:

Overhead cost category	20X2 cost $	Known changes between 20X2 and 20X3	Inflation adjustment
Property cost	120,000	None	+ 5%
Central wages	150,000	Note 1	+ 3%
Stationery	25,000	Note 2	0%

Note 1: One new staff member will be added to the overhead team; this will cost $12,000 in 20X3.
Note 2: A move towards the paperless office is expected to reduce stationery costs by 40% on the 20X2 spend.

Road repairs
In 20X3, 3,200 metres of road will need to be repaired. The total cost of road repairs for the previous four years, which includes variable and fixed costs, was as follows:

Year	Metres of road repaired	Total cost $000
20X2	3,500	52,500
20X1	2,000	37,500
20X0	2,500	43,000
20W9	3,000	47,000

Local property tax
One of the LGOs deals with the administration of a local property tax. The manager of this department wants to introduce activity based budgeting. One of the activities that his staff are involved in is dealing with enquiries from taxpayers. The driver for this is the number of enquiries, which is expected to be 28,800 per year. There are 15 staff who handle enquiries. Staff costs for dealing with such enquiries is $20,000 per year per member of staff. A team supervisor is also employed at a cost of $35,000 per year. Each member of staff and the supervisor requires a computer terminal, which is leased at a cost of $200 per terminal per year.

Accounting services
Def Co provides accounting services to LGOs in Northland. On average, each staff member works six chargeable hours per day, and spends the rest of their working day on non-chargeable administrative work. One of Def Co's main objectives is to produce value for money to its customers.

Question 1. What is the total budgeted administrative overhead for the year 20X3?
Answer:
The correct answer is $307,500
WORKING

	$
Property cost ($120,000 * 1.05)	126,000
Central wages (($150,000 * 1.03) + $12,000)	166,500
Stationery ($25,000 * 0.6)	15,000

| | 307,500 |

Question 2. What should be the budgeted cost of road repairs for the year 20X3, assuming no inflation? A. $32,000,000 B. $48,000,000 C. $49,500,000 D. $50,500,000
Answer:
The correct answer is C.
WORKING
Using the high low method based on data from 20X2 (high) and 20X1 (low):
Variable cost per unit = (52,500 - 37,500)/(3,500-2,000) = 10 (i.e. $10,000 per metre).
Fixed cost (i.e. total cost - total variable cost) in 20X2 = 52,500 - (3,500 * 10) = 17,500.
Budget for 20X3 = 17,500 + (3,200 * 10) = 49,500 (i.e. $49,500,000).

Question 3. The manager of the LGO that deals with property tax has asked you to help with the budget for enquiries from taxpayers using activity based budgeting. What is the budgeted cost of one enquiry (to the nearest $)?
Answer:
The correct answer is $ 12
WORKING

	$
Staff costs (15 * 20,000)	300,000
Computer terminals (16 * 200)	3,200
Supervisor's salary costs	35,000
Total annual costs	338,200
Total number of enquiries	28,800
Therefore, cost per enquiry (338,200/28,800)	$11.74

Question 4. What is the name given to a budget which has been prepared by building on a previous period's budgeted or actual figures? A. Incremental budget B. Flexible budget C. Zero based budget D. Functional budget 52,500-37,500
Answer:
The correct answer is A.

Question 5. Def Co has developed some targets to improve the value of money of the services it provides to the LGOs. Match each of Def Co's targets to the correct element of value for money.
Target 1: Obtaining a score of 4.7 or above on customer satisfaction surveys
Target 2: Cutting departmental expenditure by 5%
Target 3: Increasing the number of chargeable hours handled by advisers to 6.2 per day
Answer:

Target	Value for money
Obtaining a score of 4.7 or above on customer satisfaction surveys	Effectiveness
Cutting departmental expenditure by 5%	Economy
Increasing the number of chargeable hours handled by advisers to 6.2 per day	Efficiency

Tutorial note: Target 1 is assessing output, so is a measure of effectiveness. Target 2 is a financial target and so assesses economy factors. Target 3 is measuring the rate of work handled by staff which is an efficiency measure.

Case: Performance Analysis of Noble Restaurant's May Budget and Variance Calculations

Noble is a restaurant that is only open in the evenings, on six days of the week. It has eight restaurant and kitchen staff, each paid a wage of $8 per hour for hours actually worked. It also has a restaurant manager and a head chef, who are each paid a monthly salary of $4,300. Noble's budget and actual figures for the month of May was as follows:

		Budget		Actual		
Number of meals		1,200		1,560		
	S	$	$	$		
Revenue: Food		48,000		60,840		
Drinks		12,000		11,700		
		60,000		72,540		
Variable costs						
Staff wages		(9,216)		(13,248)		
Food costs		(6,000)		(7,180)		
Drink costs		(2,400)		(5,280)		
Energy costs		(3,387)		(3,500)		
		(21,003)		(29,208)		
Contribution		38,997		43,332		
Fixed costs						
Manager's and chef's pay		(8,600)		(8,600)		
Rent, rates and depreciation	(4,500)			(4,500)		
		(13,100)		(13,100)		
Operating profit		25,897		30,232		

The budget above is based on the following assumptions:

1. The restaurant is only open six days a week and there are four weeks in a month. The average number of orders each day is 50 and demand is evenly spread across all the days in the month.

2. The restaurant offers two meals: Meal A, which costs $35 per meal and Meal B, which costs $45 per meal. In addition to this, irrespective of which meal the customer orders, the average customer consumes four drinks at $2.50 per drink. Therefore, the average spend per customer is either $45 or $55 including drinks, depending on the type of meal selected. The May budget is based on 50% of customers ordering Meal A and 50% of customers ordering Meal B.

3. Food costs represent 12.5% of revenue from food sales.

4. Drink costs represent 20% of revenue from drinks sales.

5. When the number of orders per day does not exceed 50, each member of hourly paid staff is required to work exactly six hours per day. For every incremental increase of five in the average number of orders per day, each member of staff has to work 0.5 hours of overtime for which they are paid at the increased rate of $12 per hour. Assume that all costs for hourly paid staff are treated wholly as variable costs.

6. Energy costs are deemed to be variable and are related to the total number of hours worked by each of the hourly paid staff.

Required: (a) Calculate the flexed budget for the month of May, assuming that the standard mix of customers remains the same as budgeted. (b) After preparation of the flexed budget, you are informed that the following variances have arisen in relation to total food and drink sales: Sales mix contribution variance $1,014 Adverse, Sales quantity contribution variance $11,700 Favourable. Briefly describe the sales mix contribution variance and the sales quantity contribution variance. Identify why each of them has arisen in Noble's case. (c) Noble's owner told the restaurant manager to run a half-price drinks promotion at Noble for the month of May on all drinks. Actual results showed that customers ordered an average of six drinks each instead of the usual four but, because of the promotion, they only paid half of the usual price for each drink. You have calculated the sales price variance for drink sales alone and found it to be a worrying $11,700 adverse. The restaurant manager is worried and concerned that this makes his performance for drink sales look very bad. Briefly discuss TWO other variances that could be calculated for drinks sales or food sales in order to ensure that the assessment of the restaurant manager's performance is fair. These should be variances that COULD be calculated from the information provided above although no further calculations are required here.

Answer:
(a) Flexed budget
Number of meals 1,560

	$	$
Food sales (1,560 * $40)	62,400	
Drink sales (1,560 * ($2.50 * 4))	15,600	
Total revenue		78,000
Variable costs:		
Staff wages (WORKING 1)	(12,672)	
Food costs (12.5% * $62,400)	(7,800)	
Drink costs ($15,600 * 20%)	(3,120)	
Energy costs (WORKING2)	(4,234)	
	(27,826)	
	50,174	
Contribution		
Fixed costs:		
Manager's and chef's pay	(8,600)	
Rent, rates and depreciation	(4,500)	
	(13,100)	
Operating profit		37,074

WORKINGS
(1) Staff wages
Average number of orders per day = 1,560/(6 days * 4 weeks) = 65 per day.
Therefore extra orders = 15 per day.
8 staff * 1.5 hours * 6 days * 4 weeks = 288 extra hours.

At $12 per hour = $3,456 extra wages.
Total flexed wages = $9,216 + $3,456 = $12,672.

(2) Energy costs
Standard total hours worked = (8 * 6) * 6 days * 4 weeks = 1,152 hours
Extra hours worked = 288
Total hours = 1,152 + 288 = 1,440
At $2.94 ($3,387/1,440) per hour = $4,234
Tutorial note: The average revenue per meal for food is $40 since 50% of customers order a meal that costs $35 and 50% of customers order a meal that costs $45.

(b) Sales mix and quantity variances
The sales mix contribution variance measures the effect on profit of changing the mix of actual sales from the standard mix. The sales quantity contribution variance measures the effect on profit of selling a different total quantity from the budgeted total quantity. The mix variance is adverse here. Since meal B generates a higher contribution than meal A, the adverse variance shows that more of meal A must have been sold, relative to B, than budgeted. Since the quantity variance is favourable, this means that the total quantity of meals sold (in the standard mix) was higher than expected, as evidenced by the number of meals sold being 1,560 rather than the budgeted 1,200. Tutorial note: The sales mix contribution variance and sales quantity contribution variance simply mean the sales mix and sales quantity variances in a marginal costing situation (where the variances are expressed in terms of contribution).

(c) Two other variances
Drink sales
As well as the price variance for drinks sales, the sales volume variance could be calculated. This will examine the difference between the standard volume of sales that would ordinarily be expected for this number of customers (1,560 * 4 drinks) and the actual volume of drinks sold because of the drinks promotion (1,560 * 6 drinks). Since the variance is calculated by applying the increase in volume to the standard margin, this variance will be favourable. In addition, the total sales price variance for drinks sales could be split into an operational and a planning variance. The manager is only responsible for any operational variance and any part of the sales margin variance that relates to a planning error (i.e. the last minute decision by the owner to run the drinks promotion) should be separated out. This way, the manager will not be held accountable for matters outside of his control.
Food sales
By running the half price drinks offer promotion, more customers have been attracted to the restaurant. Drinks have been treated as a "loss leader" (i.e. sold at a low price to entice customers). It would therefore be relevant to calculate some variances in relation to food sales to show how the drinks promotion has increased food sales. The most obvious one to calculate would be the sales margin volume variance for food sales.
Tutorial note: Candidates only needed to mention two variances.

Case: Budgeting Approaches at Newtown School: Evaluating Incremental and Zero-Based Budgeting

Newtown School's head teacher has prepared the budget for the year ending 31 May 20X5. The government pays the school $1,050 for each child registered at the beginning of the school year, which is 1 June, and $900 for any child joining the school part-way through the year. The school does not have to refund the money to the government if a child leaves the school part-way through the year. The number of pupils registered on 1 June 20X4 is 690, which is 10% lower than the previous year. Based on past experience, the probabilities for the number of pupils starting the school part-way through the year are as follows:

Probability	No. of pupils joining late
0.2	50
0.3	20
0.5	26

The head teacher admits to being "poor with numbers" and does not understand probabilities so, when calculating budgeted revenue, he just calculates a simple average for the number of pupils expected to join late. His budgeted revenue for the year ending 31 May 20X5 is therefore as follows:

	Pupils	Rate per pupil	Total income
		$	$
Pupils registered at beginning of school year	690	1,050	724,500
Average expected number of new joiners	32	900	28,800
			753,300

The head teacher uses incremental budgeting to budget for his expenditure, taking actual expenditure for the previous year as a starting point and simply adjusting it for inflation, as shown below.

	Note	Actual cost for year ended 31 May 20X4	Inflationary adjustment	Budgeted cost for year ended 31 May 20X5
		$		$
Repairs and maintenance	1	44,000	+ 3%	45,320
Salaries	2	620,000	+ 2%	632,400
Capital expenditure	3	65,000	+ 6%	68,900
Total budgeted expenditure				746,620
Budget surplus				6,680

Notes

1. $30,000 of the costs for the year ended 31 May 20X4 related to standard maintenance checks and repairs that have to be carried out by the school every year in order to comply with government health and safety standards. These are expected to increase by 3% in the coming year. In the year ended 31 May 20X4, $14,000 was also spent on redecorating some of the classrooms. No redecorating is planned for the coming year.

2. One teacher earning a salary of $26,000 left the school on 31 May 20X4 and there are no plans to replace her. However, a 2% pay rise will be given to all staff with effect from 1 December 20X4.

3. The full $65,000 actual costs for the year ended 31 May 20X4 related to improvements made to the school gym. This year, the canteen is going to be substantially improved, although the extent of the improvements and level of service to be offered to pupils is still under discussion. There is a 0.7 probability that the cost will be $145,000 and a 0.3 probability that it will be $80,000. These costs must be paid in full before the end of the year ending 31 May 20X5.

The school's board of governors, who review the budget, are concerned that the budget surplus has been calculated incorrectly. They believe that it should have been calculated using expected income, based on the probabilities provided, and using expected expenditure, based on the information provided in notes 1 to 3. For the last three years, there have been shortfalls of cash despite a budget surplus being predicted. Since the school has no other source of funding available to it, these shortfalls have had serious consequences, such as the closure of the school kitchen for a considerable period in the last school year, meaning that no hot meals were available to pupils. This is thought to have been the cause of the 10% fall in the number of pupils registered at the school on 1 June 20X4.

The school's board of governors have heard about zero-based budgeting and has requested advice on whether its application would be useful in improving Newtown's budgeting process. Required: (a) Considering the views of the board of governors, recalculate the budget surplus/deficit for the year ending 31 May 20X5. (b) Discuss the advantages and disadvantages of using incremental budgeting. (c) Briefly outline the three main steps involved in preparing a zero-based budget. (d) Discuss the extent to which zero-based budgeting could be used by Newtown School to improve the budgeting process.

Answer:
(a) Budget deficit/surplus
Budgeted income:
Income from pupils registered on 1 June 20X4: $724,500 (given in question)
Expected number of new joiners: (0.2 * 50) + (0.3 * 20)+(0.5 * 26) = 29
Expected income from new joiners at $900 each = $26,100
Total expected income = $750,600
Budgeted expenditure:
Repairs and maintenance: $30,000 * 1.03 = $30,900
Salaries: 1/2 ($620,000 - $26,000) + 1/2 (($620,000 - $26,000) * 1.02 = $297,000 + $302,940 = $599,940
Expected capital expenditure = (0.7 * $145,000) + (0.3 * $80,000) = $125,500
Total expected expenditure = $756,340
Budget deficit = $5,740

(b) Using incremental budgeting
Advantages
· Incremental budgeting is very easy to perform. This makes it possible for a person without any accounting training to build a budget.

· Incremental budgeting is also very quick compared to other budgeting methods.

· The information required to complete it is also usually readily available.

Disadvantages

· On the other hand, incremental budgeting encourages inefficiency because it does not question the preceding year's figures on which it is based. No-one asks how those figures could be reduced.

· Similarly, in some organisations, it encourages slack because departmental managers may attempt to use their entire budget up for one year, even if they do not need to, just to ensure that that cash is available again the next year

· Errors from one year are carried to the next, since the previous year's figures are not questioned.

(c) Zero-based budgeting (ZBB)

The three main steps involved in preparing a zero-based budget are as follows: 1. Activities are identified by managers. Managers are then forced to consider different ways of performing the activities. These activities are then described in what is called a "decision package", which: - analyses the cost of the activity; - states its purpose; - identifies alternative methods of achieving the same purpose; - establishes performance measures for the activity; - assesses the consequence of not performing the activity at all or of performing it at different levels. As regards this last point, the decision package may be prepared at the base level, representing the minimum level of service or support needed to achieve the organisation's objectives. Further incremental packages may then be prepared to reflect a higher level of service or support. 2. Management will then rank all the packages in the order of decreasing benefits to the organisation. This will help management decide what to spend and where to spend it. This ranking of the decision packages happens at numerous levels of the organisation. 3. The resources are then allocated, based on order of priority up to the spending level.

(d) Use of ZBB at Newtown School

There is definitely a place for ZBB at Newtown School. At the moment, incremental budgeting is responsible for recurring unexpected cash shortages, which is deterring new pupils from joining the school. Had a deficit been predicted for the year ended 31 May 20X3, perhaps $65,000 would not have been spent on improving the school gym, and then it would not have been necessary to close the school kitchen. ZBB would be good to establish the way cash is spent on those activities that are, to a certain extent, discretionary. For example, although there is a need for pupils to have somewhere to eat lunch, it is not essential for children to have a cooked meal every day. It is essential that children do have somewhere to eat though and, as a bare minimum, they would need an area where they could eat their sandwiches and have access to fresh water. ZBB could be used to put together decision packages which reflect the different levels of service available to the children. For example, the most basic level of service could be the provision of an area for the children to eat a lunch brought from home. The next level would be the provision of some cold and maybe hot food for the children, but on a self- service basis. Finally, the highest level of service would be a restaurant for the children where they get served hot meals at tables. At Newtown School the catering manager could prepare the decision

packages and they would then be decided upon by the head teacher, who would rank them accordingly. Similarly, although some level of sports education is needed, the extent of the different activities offered is discretionary. ZBB could be used to create decision packages for each of these services in order to prioritise them better than they are currently being prioritised. ZBB takes a long time to implement and would not be appropriate to all categories of expenditure at the school. Much of the budgeting is very straight forward. Incremental budgeting could still be used as a starting point for essential expenditure such as salary costs, provided that changes in staff numbers are also taken into account. There is an element of essential, recurring expenditure in relation to repairs and maintenance too, since the costs of the checks and repairs needed to comply with health and safety standards seem to largely stay the same each year, with an inflationary increase.

Case: Performance Management and Budgeting Approaches for Yumi Co's Restaurants

The following scenario relates to three requirements.

Yumi Co owns a number of restaurants. It is a well-established company and its restaurants have gained a favourable reputation for the quality of their meals. Yumi Co's restaurants are all set in rural locations where there is limited competition and this enabled them to develop a loyal customer base Restaurants design their own menus and decor to fit with their requirements of their local market. Yumi Co has been consistently profitable however as is the case across the restaurant industry profit margins are quite low and there is still a constant need for Yumi Co to monitor costs. One of Yumi Co's restaurants is located in the small town of Cowly. Cowly has recently been the location for the filming of a popular television series and visitor numbers to the town have increased significantly as a result Yumi Co's restaurant in Cowly has noticed a similar increase in customer numbers. At the start of the current month a new restaurant opened in Cowly. The manager of Yumi Co's restaurant in Cowly has expressed concerns about the impact this new competitor will have on their ability to achieve profit targets for the rest of the year. Budgets for all of Yumi Co's restaurants are prepared by the head office. At the start of each year restaurant managers are given an annual budget, which is split into months. At the end of each month the manager receives a statement comparing actual monthly performance against budget. The statement for the Cowly restaurant for the most recent completed month is as follows

	Actual	Budget	Variance
Number of customers	1,800	1,500	
	$	$	$
Revenue	87,300	75,000	12,300 F
Costs			
Food and drink	26,100	22,500	3,600 A
Staff wages	38,250	31,500	6,750 A
Heat light and power	8,100	7,500	600 A
Rent rates and other overheads	12,600	12,000	600 A
Profit	2,250	1,500	750 F

Notes

(1) Rent. rates and other overheads are apportioned to its restaurants by Yumi Co's head office based on a fixed annual charge
(2) All other budgeted costs are treated as variable costs based on the expected number of customers Yumi Co currently adopts an incremental approach to budgeting with the annual budget figures for each year being based on the previous year's figures. However, a new finance director has recently joined the company, and he has questioned whether this is suitable for all Yumi Co's restaurants. The new finance director has also suggested that the company should adopt a more participative approach to budgeting.

Required: (a) (i) Prepare a flexed budget for the Cowly restaurant. (ii) With reference to your answer from part (i), explain the main weaknesses in the current monthly budget statements issued to the restaurants as a basis for managing performance. (b) Discuss whether an incremental approach to budgeting is appropriate for Yumi Co. (c) Define a participative approach to budgeting and explain the potential advantages and disadvantages of introducing this approach at Yumi Co.

Answer:

(a) Cowly restaurant

(i) Flexed budget

	Original Budget	Flexed budget	Actual	Variance
Number of customers	1,500	1,800	1,800	
	$	$	$	$
Revenue (WORKING 1)	75,000	90,000	87,300	2,700 A
Food and drink costs (WORKING 2)	(22,500)	(27,000)	(26,100)	900 F
Staff costs (WORKING 3)	(31,500)	(37,800)	(38,250)	450 A
Heat, light and power (WORKING 4)	(7,500)	(9,000)	(8,100)	900 F
Rent, rates and other overheads	(12,000)	(12,000)	(12,600)	600 A
Profit	1,500	4,200	2,250	1,950 A

WORKINGS

(1) Revenue: $75,000/1,500 = $50 per customer: $50 * 1,800 = $90,000
(2) Food and drink: $22,500/1,500 = $15 per customer: $15 * 1,800 = $27,000
(3) Staff costs: $31,500/1,500 = $21 per customer: $21 * 1,800 = $37,800
(4) Heat, light and power: $7,500/1,500 = $5 per customer: $5 * 1,800 = $9,000

(ii) Main weaknesses in current statements for managing performance

The most significant weakness in the current performance report is that the original budget is not flexed to adjust for the actual numbers of customers served. The existing report shows that the restaurant has overspent on all its costs which could be a concern given the importance of cost control in Yumi Co. However, the main reason for the revenue and cost variances is that the number of customers the restaurant served was 20% higher than budgeted (1,800 v 1,500). If the budget is flexed for the actual number of customers, this allows a more meaningful assessment of the restaurant's performance to be made. Once the flexed budget is prepared, it can be seen that revenues were actually lower than would have been expected, given the number of customers served with average spend per head being $48.50 instead of $50. Food and drink costs were also less than budget. Taken together with the reduction in average

customer spending, this might suggest that some of the items on the menu had been changed since the budget was originally set. Another weakness in Yumi Co's budgetary control report is that staff costs and heat, light and power costs are assumed to be purely variable costs - dependent on the number of customers. However, although the restaurant may recruit some temporary staff in busy periods, it is likely that at least some of the staff will be permanent, meaning that it would be more appropriate to treat staff costs as semi-variable rather than variable. Similarly, it seems likely that there will be a significant fixed element within heat, light and power costs, so treating these as wholly variable costs does not seem appropriate.

(b) Whether an incremental approach to budgeting is appropriate
Under an incremental budgeting approach, the current year's budget and results are taken as the starting point for preparing the next year's budget. The budget is then adjusted for any expected changes, such as the impact of inflation on costs and prices, and sales growth or decline. The main advantage of the incremental approach is that it is a relatively straightforward way of preparing a budget, appropriate for organisations which are operating in relatively stable environments. The locations of Yumi Co's restaurants, away from significant competition, suggest that the operating environment is relatively stable, meaning incremental budgeting is appropriate. Similarly, the fact that Yumi Co appears to have a relatively well-established brand and customer base suggests that an incremental approach to budgeting future revenues appears reasonable, even if it is difficult to identify some changes which need to be adjusted for in the next year's budget. However, one of the major disadvantages of incremental budgeting is that it does not provide any incentive to make operations more efficient or economical. If the current year figures include slack or inefficiencies, using them as the start-point for the next year's figures means that inefficiency is automatically perpetuated into the next year. Such an approach seems somewhat inconsistent with the focus on cost control within Yumi Co. If the company is worried about its relatively low margins, an approach to budgeting which challenges costs more critically (such as zero-based budgeting or activity-based budgeting) might be more suitable for helping to drive down costs. For example, the highest cost is staff wages which could be analysed and Yumi Co could investigate making changes to its staffing model to reduce costs and/or improve efficiency. As mentioned in part (a), whether labour costs and heat, light and power vary proportionately with the number of customers appears debatable. If Yumi Co's incremental budgets ignore the relationship between activities and costs, ultimately the budgets will provide management with little relevant information for managing costs. This could become an increasingly important issue if competition in Yumi Co's markets intensifies.

(c) Participative approach and potential advantages and disadvantages The current budget process is a centralised, top-down process, meaning that the managers from Yumi Co's restaurants do not have any opportunity to influence the budgets for their restaurants. By contrast, in a participative approach, each manager would be able to influence the figures for their restaurant, rather than having budget targets imposed on them. Involving the managers in the budgeting process should help to make the budgets more effective and realistic. Local managers should have a greater understanding of the environmental factors and operational constraints which will influence the performance of their restaurants. For example, the manager of the Cowly restaurant will have a better understanding of its customers and market conditions

and so provide greater insight into the potential impact of the new restaurant than a member of the finance team at Yumi Co's head office. Similarly, managers are more likely to be committed to achieving a budget if they have been involved in creating it - not least because their involvement in its preparation should help to ensure that they consider the budget figures to be realistic. However, involving the restaurant managers in the budgeting process is likely to make it more time-consuming. For example, instead of running their restaurants, managers will have to spend time in meetings with head office staff planning and preparing their budgets. In this respect, it may be more appropriate for Yumi Co to maintain the current, top-down process for restaurants which are operating in a stable environment (and where the insights from local managers will add little value), but introduce a more participative approach for restaurants like Cowly which are facing a period of change.

Case: Analyzing Sales Trends and Seasonal Variations for Pondtail Co
Pondtail Co's sales revenue for the last three years is as follows:

Year	Quarter	$m
1	Spring	84
	Summer	72
	Autumn	90
	Winter	104
2	Spring	88
	Summer	72
	Autumn	96
	Winter	114
3	Spring	94
	Summer	76
	Autumn	104
	Winter	126

Question 1. What is the increase in the four-quarter moving average for sales revenue for the period, to the nearest 0.1%?
Answer:
The correct answer is 14.3
WORKING

Year	Quarter	Revenue $m	4-Q moving Total $m	4-Q moving average $m
1	1	84		
	2	72		
	3	90	350	87.5
	4	104		
2	1	88		

		2	72					
		3	96					
		4	114					
3	1		94					
		2	76					
		3	104		400		100	
			126					

Increase = ($100m - $87.5m)/$87.5m * 100% =14.3%

Question 2. What is the sales revenue trend for year 2 winter (to the nearest $0.1m)?
Answer:
The correct answer is $ 94.5m.
WORKING

Year		Quarter	Revenue	4-Q moving	4-Q moving	Average
				Total	average	= Trend
			$m	$m	$m	$m
2	1		88			
		2	72			
		3	96			
				376	94	
		4		114		94.5
				380	95	
3	1		94			
		2	76			

Question 3. The seasonal variation for summer has been calculated as -$20.22m using the additive model. The trend figure for year 3 Summer has been calculated as $98.5m. What is the deseasonalised sales revenue for Year 3 Summer? A. $120.22m B. $96.22m C. $79.78m D. $55.78m
Answer:
The correct answer is B.
WORKING
Deseasonalised figure = Actual - Seasonal variation = $76m - (-$20.22m) = $96.22m

Question 4. Assume the trend can be described by the equation: Revenue, y = 77.33 + 2.46x, where x is the number of quarters and Year 1 Spring is represented by x = 1. The seasonal variation for Winter has been calculated as + 18.16. What would be the expected sales revenue in Year 4 Winter? A. $98.53m B. $116.69m C. £132.39m D. $134.85m
Answer:
The correct answer is D.
WORKING
If x = 1 is year 1 Spring is 1, x = 16 (4 * 4) for year 4 Winter.
Expected sales revenue = $77.33m + ($2.46m * 16) + $18.16m = $134.878m

Question 5. Identify, by selecting the relevant box in the table below, whether each of the following statements about time series analysis is correct or incorrect.
Statement 1: Time series analysis assumes that all movements in actual figures can be completely explained by changes in trend, seasonal variations and cyclical variations
Statement 2: The further into the future forecasts are made, the more reliable they are
Statement 3: The seasonal variations using the additive model should sum to 0.
Statement 4: The seasonal variations using the multiplicative model should sum to 1.
Answer:
| It assumes that all movements in actual figures can be completely explained by changes in trend, seasonal variations and cyclical variations | | INCORRECT |
| The further into the future forecasts are made, the more reliable they are
| | INCORRECT |
| The seasonal variations using the additive model should sum to 0
| CORRECT | |
| The seasonal variations using the multiplicative model should sum to 1
| | INCORRECT |
Tutorial note: The first statement is not correct, as it ignores the possibility of random variations. The second statement not true as the opposite applies, the further into the future the forecast is made, the less reliable it is likely to be. For the multiplicative model, seasonal variations should sum to the number of elements in the time series (here 4, the four seasons).

Case: Analyzing Correlation and Regression for Wetmay Clothes Co's Sales Data
The management accountant of Wetmay Clothes Co is analysing the extent to which sales of different products vary according to the amount of rainfall. His assistant was preparing the analysis, but has had to take time off urgently, leaving the analysis for various products incomplete. The analysis for the sales of overcoats is as follows, where x is the amount of monthly rainfall and y the sales of overcoats.
$\Sigma x = 300$
$\Sigma y = 2,000$
$\Sigma xy = 103,292$
$\Sigma x^2 = 15,472$
$\Sigma y^2 = 690,972$
n = 6

Question 1. What is the correlation coefficient between the amount of rainfall and the sale of raincoats, to two decimal places?
Answer:
The correct answer is 0.97
WORKING
$(\Sigma x)^2 = 300^2 = 90,000$
$(\Sigma y)^2 = 2,000^2 = 4,000,000$

=Correlation coefficient, r = (nΣxy - ΣxΣy)/ √ (nΣx²-(Σx)²)(nΣy²-(Σy)²) = [6 * 103,292 - (300 * 2,000)/(6 * 15,472 - 90,000)(6 * 690,972 - 4,000,000) = 0.97

Question 2. Assuming a linear relationship between the amount of rainfall and the sale of raincoats, which of the following equations is correct? A. y = - 15.17 + 6.97x B. y = 15.17 + 6.97x C. y = - 6.97 + 15.17x D. y = 6.97 + 15.17x
Answer:
The correct answer is A. y = a + bx
WORKING
Where: a = Σy/n - bΣx/n and b = (nΣxy - ΣxΣy)/ √ (nΣx²-(Σx)²)
b = (6 * 103,292)/(300 * 2,000)/(6 * 15,472 - 90,000) = 6.97
a = 2,000/6 - (6.97 × 300/6) = -15.17

Question 3. The correlation coefficient between the amount of rainfall and the sales of shorts is -0.49. What is the coefficient of determination? A. +0.24 B. - 0.24 C. +0.7 D. - 0.7
Answer:
The correct answer is A.
Coefficient of determination r² = - 0.49² = +0.24

Question 4. The management accountant is looking to forecast sales of parkas in November. The assistant calculated a trend line of y = 50 + 8.5x, but also believed that there would be a seasonal variation of + 80. Expected rainfall in November is 62 mm. What would be the expected sales of parkas in November?
Answer:
The correct answer is 657
WORKING
[50 + (8.5 ×62)] + 80 = 657

Question 5. Identify, by selecting the relevant box in the table below, whether each of the following statements about correlation and regression is true or false.
Statement 1: Regression analysis assumes the x variable is dependent on the y variable
Statement 2: A correlation coefficient of -1 implies that the two variables are perfectly negatively correlated
Statement 3: The coefficient of determination measures how much of the total change in one variable is caused by the change in the other variable
Statement 4: The more data that is used for regression analysis, the more reliable the forecasts based on the analysis are likely to be
Answer:
| Regression analysis assumes the x variable is dependent on the y variable.
| | FALSE |
| A correlation coefficient of -1 implies that the two variables are perfectly negatively correlated
| TRUE | |
| The coefficient of determination measures how much of the total change in one variable is caused by the change in the other variable. | | FALSE |

| The more data is used for regression analysis, the more reliable the forecasts based on the analysis are likely to be. | TRUE | |

Tutorial note: The first statement is not true: the y variable is dependent on the x variable. The third statement is not true: the coefficient of determination measures explanation of change, not causation of change.

Case: Analyzing Learning Curve and Overhead Costs for Bear Co's New Television

Bear Co has developed a new model of television. The estimated labour time for the first unit is 12 hours but a learning rate of 75% is expected to apply for the first eight units produced

Note: The learning index for a 75% learning rate is -0.415. Overhead production costs are expected to be the same as the previous model, for which the following data is available:

Month	Output (units)	Total overhead cost $
September	1,800	278,200
October	2,000	310,000
November	1,700	252,900
December	1,000	200,000

Question 1. What is the expected time for the production of the eighth television? A. 5 hours B. 3 hours C. 9 hours D. 40.5 hours

Answer:

The correct answer is B.

WORKING

Learning curve formula = $y = ax^2$

Cumulative average time per unit for 8 units: Y = 12 * 8 raised to the power of -0.415 = 5.063 hours

Therefore cumulative total time for 8 units = 40.50 hours

Cumulative average time per unit for 7 units:

Y = 12 * 7 raised to the power of -0.415 = 5.351 hours

Therefore cumulative total time for 7 units = 37.46 hours

Therefore, incremental time for 8th unit = 40.50 - 37.46 = 3.04 hours

Question 2. The first phase of production has now been completed for the new television. The first unit actually took 12.5 hours to make and the total time for the first eight units was 34.3 hours, at which point the learning effect came to an end. What is the actual learning rate, and did the labour force learn more quickly or less quickly than expected?

Answer:

The correct answer is The learning rate was 70%

WORKING

Cumulative number of televisions produced	Cumulative total hours	Cumulative average hours per unit
1	12.5	12.5

2	?	12.5 * r
4	?	12.5 * r²
8	34.3	12.5 × r^3

Using algebra: 34.3 = 8 * (12.5 * r^3)

4.2875 = (12.5 * r^3)

0.343 = r^3

r = 0.70

The learning rate was 70% as compared to the forecast rate of 75%, meaning that the labour force learned more quickly than anticipated.

Question 3. Calculate the variable overhead cost per unit using the high-low method (to two decimal places).

Answer:

The correct answer is $ 110 per unit.

WORKING

Variable cost per unit = ($310,000 - $200,000)/(2,000-1,000) = $110

Question 4. Identify, by selecting the relevant box in the table below, whether each of the following statements regarding the learning curve model is true or false.

Statement 1: The learning rate shows the incremental time taken for each unit as a percentage of the time taken for the previous units of production, every time units produce doubles

Statement 2: The learning effect is most pronounced where the task is repetitive

Statement 3: The higher the learning rate in percentage is, the more the time per unit falls as subsequent units of output are produced

Statement 4: High labour turnover and breaks in production may reduce the learning effect

Answer:

| The learning rate shows the incremental time taken for each unit as a percentage of the time taken for the previous unit of production | | FALSE |

| The learning effect is most pronounced where the task is repetitive

| TRUE | |

| The higher the learning rate in percentage is, the more the time per unit falls as subsequent units of output are produced | | FALSE |

| High labour turnover and breaks in production may reduce the learning effect

| TRUE | |

Tutorial note: The first statement is incorrect; the learning rate shows how the cumulative average time per unit falls as cumulative output doubles, not how the incremental time per unit falls. The third statement is also incorrect; a higher learning rate percentage means that cumulative output per unit falls at a lower rate, so time per unit will also fall more slowly.

Question 5. Which TWO of the following circumstances favour a penetration pricing policy in relation to the launch of the new television? A. Demand is relatively inelastic B. There are significant economies of scale C. The company wishes to discourage new entrants to the market D. The product life cycle is particularly short E. The television has some new features that consumers value that do not exist in any competitors' products

Answer:
The correct answer is B and C.
Tutorial note: If demand is inelastic or the product life cycle is short, a price skimming approach would be more appropriate. Similarly if the television has features that do not exist in competitors' products, a skimming approach would be more appropriate as consumers would be prepared to pay a higher price than the competitors.

Case: Cost Analysis and Learning Curve Implications for Big Chairs Co's New Massaging Chair
Big Chairs Co (BCC) manufactures and sells executive leather chairs. It is considering a new design of massaging chair to launch into the competitive market in which it operates. It has carried out an investigation in the market and, using a target costing system, has targeted a competitive selling price of $120 for the chair. BCC wants a margin on selling price of 20% (ignoring any overheads). The frame and massage mechanism will be bought in for $51 per chair and BCC will upholster it in leather and assemble it ready for despatch. Leather costs $10 per metre and two metres are needed for a complete chair although 20% of all leather is wasted in the upholstery process. The upholstery and assembly process will be subject to a learning effect as the workers get used to the new design. BCC estimates that the first chair will take two hours to prepare but this will be subject to a learning rate of 95%. The learning improvement will stop once 128 chairs have been made and the time for the 128th chair will be the time for all subsequent chairs. The cost of labour is $15 per hour. The learning formula is shown on the formula sheet and at the 95% learning rate the value of b is -0.074.
Required: (a) Calculate the average cost for the first 128 chairs made and identify any cost gap that may be present at that stage. (b) Assuming that a cost gap for the chair exists suggest four ways in which it could be closed. (c) The production manager denies any claims that a cost gap exists and has stated that the cost of the 128th chair will be low enough to yield the required margin. Calculate the cost of the 128th chair made and state whether the target cost is being achieved on the 128th chair.
Answer:
a) Average cost
First 128 chairs

	$
Frame and massage mechanism	51.00
Leather 2 metres * $10 * 100/80	25.00
Labour (WORKING)	20.95
Total	96.95
Target selling price is $120.	
Target cost of the chair is therefore $120 * 80%	$96
Cost gap	$0.95 per chair

WORKING
Labour cost
Tutorial note: This is calculated using learning curve principles. Either the formula or a tabular approach would give the average cost of 128 chairs. Both methods are acceptable.

Cumulative output (units)	Average time per unit (hours)	Total time (hours)	Average cost per chair at $15 per hour
1	2		
2	1.9		
4	1.805		
8	1.7145		
16	1.6290		
32	1.5476		
64	1.4702		
128	1.3967	178.77	20.95

Formula Y = a * x^b

$Y = 2 * 128^{-0.074}$

Y = 1.3967

The average cost per chair is 1.3967 * $15 = $20.95

(b) Methods for closing the cost gap

· Re-design the chair to remove unnecessary features and hence cost.

· Negotiate with the frame supplier for a better cost. This may be easier as the volume of sales improve as suppliers often are willing to give discounts for bulk buying. Alternatively, a different frame supplier could be found that offers a better price. Care would be needed here to maintain the required quality.

· Leather can be bought from different suppliers or at a better price also. Reducing the level of waste would save on cost. Even a small reduction in waste rates would remove much of the cost gap that exists.

· Improve the rate of learning by better training and supervision.

· Employ cheaper labour by reducing the skill level expected. Care would also be needed here not to sacrifice quality or push up waste rates.

Tutorial note: Only four were asked for.

(c) Calculation of cost The cost of the 128th chair will be:

	$
Frame and massage mechanism	51.00
Leather 2 metres * $10 * 100/80	25.00
Labour 1.29 hours * $15 per hour (WORKING)	19.35
Total	95.35

Against a target cost of $96 the production manager is correct in his assertion that the required return is now being achieved.

WORKING

Using the formula to calculate the cost of the first 127 chairs and then deducting that cost from the cost of the first 128 chairs gives:

Y= a * x^b

$Y = 2 * 127^{-0.074}$

Y = 1.3975

Total time is 127 * 1.3975 = 177.48 hours
Time for the 128th chair is 178.77 - 177.48 = 1.29 hours.

Case: Cost Analysis, Learning Curve Impact, and Budgeting Implications for Mic Co's Microphone Production

Mic Co produces microphones for mobile phones and operates a standard costing system. Before production commenced, the standard labour time per batch for its latest microphone was estimated to be 200 hours. The standard labour cost per hour is $12 and resource allocation and cost data were therefore initially prepared on this basis.

Production of the microphone started in July and the number of batches assembled and sold each month was as follows:

Month	No of batches assembled and sold
July	1
August	1
September	2
October	4
November	8

The first batch took 200 hours to make, as anticipated, but, during the first four months of production, a learning effect of 88% was observed, although this finished at the end of October. The learning formula is shown on the formula sheet and at the 88% learning rate the value of b is -0.1844.

 Mic Co uses cost plus pricing to establish selling prices for all its products. Sales of its new microphone in the first five months have been disappointing. The sales manager has blamed the production department for getting the labour cost so wrong, as this, in turn, caused the price to be too high. The production manager has disclaimed all responsibility, saying that, "as usual, the managing director prepared the budgets alone and didn't consult me and, had he bothered to do so, I would have told him that a learning curve effect was expected".

Required: (a) Calculate the actual total monthly labour costs for producing the microphones for each of the five months from July to November. (b) Discuss the implications of the learning effect coming to an end for Mic Co, with regard to costing, budgeting and production. (c) Discuss the potential advantages and disadvantages of involving senior staff at Mic Co in the budget setting process, rather than the managing director simply imposing the budgets on them.

Answer:

(a) Monthly costs

Month	Cumulative number of batches	Cumulative average hours batch	Cumulative total per hours	Incremental number of batches	Incremental total hours	Actual labour cost per month $
July	1	200	200	1	200	2,400
August (W1)	2	176	352	1	152	1,824

September	4	154.88	619.52	2	267.52	3,210.24
October	8	136.294	1,090.352	4	470.832	5,649.98
November (W2)	16	124.4	1,990.36	8	900.008	10,800.10

WORKINGS

(1) Calculations for August

Cumulative average hours per batch: 200 * 0.88 = 176 hours.

Cumulative total hours = 2 * 176 = 352 hours.

Incremental number of batches = cumulative no. of 2 batches for August less cumulative number of 1 batch for July = 1 batch.

Incremental total hours = cumulative total of 352 for August - 200 for July = 152 hours.

Actual labour cost = incremental total hours of 152 * $12 per hour = $1,824.

(2) Time for 7th batch $Y = ax^b = 200 * 7^{-0.1844} = 139.693$ hours.

Total time for 7 batches = 139.693 * 7 = 977.851 hours.

Total time for 8 batches = 1,090.352 hours.

Therefore 8th batch took 112.501 hours (1,090.352 - 977.851)

Time for batches 9 - 16 = 112.501 * 8 = 900.008 hours.

Therefore cumulative average time for batches 1 - 16 = 1,090.352 + 900.008 = 1,990.36 hours.

Cumulative average time for 16 batches = 1,990.36/16 = 124.4 hours per batch.

Tutorial note: The labour costs for November could be arrived at quickly simply by taking the 112.501 hours for the 8th batch, multiplying it by 8 batches and applying this number to the $12 per hour labour cost. This quick calculation is totally sufficient to earn full marks.

(b) Implications of end of learning period

The learning period ended at the end of October. This means that from November onwards the time taken to produce each batch of microphones is constant. Therefore, in future, when Mic Co makes decisions about allocating its resources and costing the microphones, it should base these decisions on the time taken to produce the 8th batch. The resource allocations and cost data prepared for the last six months will have been inaccurate since they were based on a standard time per batch of 200 hours. Mic Co could try to improve its production process so that the learning period could be extended. It may be able to do this by increasing the level of staff training provided. Alternatively, it could try and motivate staff to work harder through payment of bonuses, although the quality of production needs to be maintained.

(c) Involving senior staff the budget setting process

Advantages

· Since they are based on information from staff who are most familiar with the department, they are more likely to improve the accuracy of the budget. In Mic Co's case, the selling price could have been set more accurately and sales may have been higher if the production manager had been consulted.

· Staff are more likely to be motivated to achieve any targets as it is "their" budget and they therefore have a sense of ownership and commitment. The production manager seems resigned to the fact that he is not consulted on budgetary matters.

· Morale amongst staff is likely to improve as they feel that their experience and opinions are valued.

· Knowledge from a range of levels of management is pooled.

· Co-ordination is improved due to the number of departments involved in the budget setting process.

Disadvantages

· The whole budgeting process is more time consuming and therefore costly.

· The budgeting process may have to be started earlier than a non-participative budget would need to start because of the length of time it takes to complete the process.

· Managers may try to introduce budgetary slack (i.e. make the budget easy to achieve so that they receive any budget-based incentives).

· Disagreements may occur between the staff involved, which may cause delays and dissatisfaction. In Mic Co's case, however, the fact that the production manager was not consulted has led to disagreement after the event.

· Can support hoarding of resources and power by subordinates.

Case: Revising Labour Standards and Analyzing Variances for Bokco's New Product

Bokco is a manufacturing company. It has a small permanent workforce but it is also reliant on temporary workers, whom it hires on three-month contracts whenever production requirements increase. All buying of materials is the responsibility of the company's purchasing department and the company's policy is to hold low levels of raw materials in order to minimise inventory holding costs. Bokco uses cost plus pricing to set the selling prices for its products once an initial cost card has been drawn up. Prices are then reviewed on a quarterly basis. Detailed variance reports are produced each month for sales, material costs and labour costs. Departmental managers are then paid a monthly bonus depending on the performance of their department. One month ago, Bokco began production of a new product. The standard cost card for one unit was drawn up to include a cost of $84 for labour, based on seven hours of labour at $12 per hour. Actual output of the product during the first month of production was 460 units and the actual time taken to manufacture the product totalled 1,860 hours at a total cost of $26,040. After being presented with some initial variance calculations, the production manager has realised that the standard time per unit of seven hours was the time taken to produce the first unit and that a learning rate of 90% should have been anticipated for the first 1,000 units of production. The production manager has been asked to recalculate the standard time for the first 460 units, based on a learning rate of 90%.

Note: The learning index b for a 90% learning curve is -0.1520.

Question 1. What is the revised standard time for the first 460 units based on a learning rate of 90%? A. 2,757 hours B. 1,268 hours C. 2,898 hours D. 3,220 hours

Answer:
The correct answer is B.
WORKING
Revised hours for actual production: Cumulative time per hour for 460 units is calculated by using the learning curve formula:
$Y = ax^b$
a = 7
x = 460
b= - 0.1520
Therefore y = 7 * 460^-0.1520 = 2.7565054
 Therefore revised time for 460 units = 1,268 hours (460 * 2.7565054).

Question 2. An engineer has now informed the production manager that the learning rate should have been 85%. Based on this, he has correctly calculated that the revised standard time for the first 460 units is 765 hours. What are the labour efficiency planning and labour efficiency operational variances? Planning Operational A $29,460 favourable $16,320 adverse B $29,460 adverse $13,140 adverse C $206,220 favourable $91,980 adverse D

	Planning	Operational
A	$29,460 favourable	$16,320 adverse
B	$29,460 adverse	$13,140 adverse
C	$206,220 favourable	$91,980 adverse
D	$29,460 favourable	$13,140 adverse

Answer:
The correct answer is D.
WORKINGS
(1) Labour efficiency planning variance
(Standard hours for actual production - revised hours for actual production) * standard rate =
([460 * 7] -765) * $12 = $29,460 F
(2) Labour efficiency operational variance
(Revised hours for actual production - actual hours for actual production) * standard rate (765 - 1,860) * $12 = $13,140 A

Question 3. The following reasons were given by the engineer for changing the expected learning rate from 90% to 85%: 1. Staff turnover was lower than expected 2. Unexpected problems were encountered with production 3. Unexpected changes to Health and Safety laws meant that the company had to increase the number of breaks for employees during production Which reasons could have caused the difference between the original and revised rate of learning? A. 1, 2 and 3 B. 2 and 3 only C. 1 only D. None of the statements
Answer:
The correct answer is C.
Tutorial note: The revised learning rate of 85% was actually better than the original expected rate of 90% and only (1) could cause it to improve.

Question 4. The production manager has been criticised by other departmental managers for failing to take into account the learning rate in the original standard. They claim "He has no idea of all the problems this has caused". Which of the following might have been caused by the failure of the production manager to take into account the learning rate in the original standard? 1. Insufficient numbers of temporary staff would have been employed, leading to an inability to satisfy demand 2. Since the company uses cost plus pricing, the price for the product will have been set too high leading to a fall in demand for the product 3. The sales manager will be held responsible for the poorer sales of the product, which will probably be reflected in an adverse sales volume variance. He will become demotivated 4. Since production is actually happening more quickly than anticipated, the company may well have run out of raw materials, leading to a stop in production A. 1, 2 and 4 B. 1 and 4 only C. 2, 3 and 4 D. 2 and 3 only
Answer:
The correct answer is C.
Tutorial note: (1) is incorrect. Bokco will have hired too many temporary staff because of the fact that the new product can actually be produced more quickly than originally thought. (2) is correct. The budgeted cost, on which the price is based would be too high since it does not take account of the abour efficiencies as a result of the learning. 3) Since the price charged is too high (statement 2), demand for the product will fall. 4) Production will occur more quickly since the time per unit is less than anticipated.

Question 5. Which of the following statements concerning planning and operational variances are true? 1. If the variance calculated using the original standard is adverse, the operational variance will always be adverse 2. Operational variances are generally a better reflection of the underlying performance of managers than traditional variances 3. Planning variances reflect factors outside of the control of operational managers. A. 1, 2 and 3 B. 2 and 3 only C. 1 only D. None of the statements
Answer:
The correct answer is B.
Tutorial note: The operational variance shows the difference between the revised standard and the actual performance. This could be adverse or favourable, even if the variance calculated using the original standard is adverse, so (1) is incorrect. The other two statements are correct.

Case: Evaluating Manager Performance and Calculating Variances for Chaff Co
Chaff Co processes and sells brown rice. It buys unprocessed rice seeds and, using a relatively simple process, removes the outer husk of the rice to produce the brown rice. There is substantial loss of weight in the process. The market for the purchase of seeds and the sales of brown rice has been, and is expected to be, stable. Chaff Co uses a standard costing system to monitor its performance. There has been some concern about the interpretation of the variances that have been calculated in month 1.
1. The purchasing manager is adamant, despite criticism from the production director, that he has purchased wisely and saved the company thousands of dollars in purchase costs by buying the required quantity of seeds from a new supplier at a cheaper price.

2. The production director is upset at being criticised for increasing the wage rates for month 1; he feels the decision was the right one, as morale was poor and he had to do something about it.

3. The maintenance manager feels that saving $8,000 on fixed overhead has helped the profitability of the business. He argues that the machines' annual maintenance can wait for another month without a problem, as the machines have been running well.

The variances for month 1 are as follows:

Material price	48,000	Favourable
Material usage	52,000	Adverse
Labour rate	15,000	Adverse
Labour efficiency	20,000	Favourable
Variable overhead expenditure	18,000	Adverse
Variable overhead efficiency	30,000	Favourable
Fixed overhead expenditure	8,000	Favourable
Sales price	85,000	Adverse
Sales volume	21,000	Adverse

Chaff Co uses labour hours to absorb the variable overhead. This part of the scenario relates to requirement (b).

In month 2 the following data applies:

Standard costs for 1 tonne of brown rice:

· 1.4 tonnes of rice seeds are needed at a cost of $60 per tonne;

· It takes 2 labour hours of work to produce 1 tonne of brown rice and labour is normally paid $20 per hour;

· 2 hours of variable overhead at a cost of $30 per hour;

Standard selling price is $240 per tonne.

Standard contribution per tonne is $56 per tonne.

Budget information for month 2 is:

· Fixed costs were budgeted at $210,000 for the month

· Budgeted production and sales were 8,400 tonnes

Actual results for month 2 were as follows:

· Production and sales, 8,000 tonnes;

· 12,000 tonnes of rice seeds were bought and used, costing $660,000;

· 15,000 labour hours were paid for and worked, costing $318,960;

· Variable production overhead cost $480,000;

· Fixed costs were $200,000;

· Revenue achieved was $1,800,000.

Required: (a) Comment on the performance of the purchasing manager, the production director and the maintenance manager using the variances and other information above and reach a conclusion as to whether or not they have each performed well. (b) Calculate the variances for month 2 in as much detail as the information allows.

Answer:

(a) Performance evaluation of managers

When assessing variances, it is important to consider the whole picture and the interrelationships that exist. In Chaff there appears to be doubt about the wisdom of some of the decisions that have been made.

Purchasing manager

The purchasing manager has clearly bought a cheaper product, saving $48,000. The cause of this is not specified and it could be due to good buying or negotiation, reductions in quality or changes in overall market conditions. The market for buying seeds is stable so there is more likely to be an internal reason for the problem. The material usage variance is significantly adverse, indicating much more waste than is normal has occurred in month 1. This suggests that the quality of the seed bought was poor and as a result a $52,000 excess loss has occurred. It is possible that the labour force working poorly or too quickly caused the waste and this has to be considered. The sales price achieved is also well down on standard with the sales price variance showing an $85,000 loss of revenue and (therefore) profit. The market for sales of brown rice is stable so it is reasonable to presume that the fall in sales price achieved is as a result of internal quality issues rather than general price falls. The purchasing manager of the only ingredient may well be responsible for this fall in quality. This may have also led to a fall in the volume of sales, another $21,000 of adverse variance. In conclusion the purchasing manager appears mainly responsible for a loss of $110,000 taking the four variances above together ($85,000 + $52,000 + $21,000 - $48,000).

Production director

The production director has increased wage rates and this has cost an extra $15,000 in month 1. However one could argue that this wage increase has had a motivational effect on the labour force. The labour efficiency variance is $20,000 favourable and so it is possible that a wage rise has encouraged the labour force to work harder. Academic evidence suggests that this effect might only be temporary as workers get used to the new level of wages. In conclusion the increase in the wage rate did cost more money but it may have improved morale and enhanced productivity. The total of the two variances above is $5,000 favourable ($20, 000 - $15,000).

Maintenance manager

The maintenance manager has decided to delay the annual maintenance of the machines and this has saved $8,000. This will increase profits in the short term but could have disastrous consequences later. In this case only time will tell. Any machine break down before the next maintenance could result in lost production and sales. The maintenance manager has only delayed the spending and has not prevented it altogether. A saving of $8,000 as suggested by the variance has not been made. It is also possible that the adverse variable overhead expenditure variance has been at least partly caused by poor machine maintenance. The variance calculated is not the saving made as it represents a timing difference only. The calculation also ignores the risks involved.

(b) Variances for Month 2

Sales price variance

		$	
Actual sales at actual price (actual revenue)		1,800,000	
Actual sales at standard price (8,000 tonnes * $240)		1,920,000	
Sales price variance		120,000	Adv

Sales volume contribution variance

	Tonnes	$	
Budgeted sales	8,400		
Actual sales	8,000		
Deficit	400		
* standard contribution per unit		56	
Sales volume variance		22,400	Adv

Materials price variance

		$	
Actual materials at actual price		660,000	
Actual materials at standard price (12,000 tonnes * $60)		720,000	
Materials price variance		60,000	Fav

Material usage variance

	Tonnes	$	
Materials used	12,000		
Standard quantity for actual output (8,000 * 1.4)	11,200		
Difference	800		
* standard cost per kg		60	
Materials usage variance		48,000	Adv

Labour rate variance

	$		
Actual hours paid × actual rate	318,960		
Actual hours paid × standard rate (15,000 * $20)	300,000		
Labour rate variance	18,960	Adv	

Labour efficiency variance

	Hours	$	
Hours worked	15,000		
Standard hours for actual output (8,000 * 2 hours)	16,000		
Difference	1,000		
* standard rate per hour		20	
Labour efficiency variance		20,000	Fav

Variable overhead rate (expenditure) variance

	Hours	$	
Hours worked	15,000		
Standard hours for actual output (8,000 * 2 hours)	16,000		
Difference	1,000		
* standard variable overhead rate per hour		30	
Variable overhead efficiency variance		30,000	Fav

Fixed overhead expenditure variance

	$		
Actual cost	200,000		
Budgeted	210,000		
Fixed overhead expenditure variance	10,000	Fav	

Tutorial note: Since the company uses marginal costing there are no fixed overhead volume, capacity or efficiency variances. Also, the standard contribution is given (and therefore not required), but could be calculated as follows:

	$	$
Sales price		240
Less:		
Rice seed (1.4 Tonnes * $60)	84	
Labour (2 hours * $20)	40	
Variable overhead (2 hours * $30)	60	
Marginal costs of production		184
Standard contribution		56

Case: Evaluating the Impact of Organic Ingredient Usage on Production and Sales Performance
Crumbly Cakes makes cakes, which are sold directly to the public. The new production manager (a celebrity chef) has argued that the business should use only organic ingredients in its cake production. Organic ingredients are more expensive but should produce a product with an improved flavour and give health benefits for the customers. It was hoped that this would stimulate demand and enable an immediate price increase for the cakes. Crumbly Cakes operates a responsibility-based standard costing system that allocates variances to specific individuals. The individual managers are paid a bonus only when net favourable variances are allocated to them. The new organic cake production approach was adopted at the start of March, following a decision by the new production manager. No change was made at that time to the standard costs card. The variance reports for February and March are shown below (Fav = Favourable and Adv = Adverse):

Manager responsible	Allocated variances	February	March
Production manager		$	$
	Material price (total for all ingredients)	25 Fav	2,100 Adv
	Material mix	0	600 Adv
	Material yield	20 Fav	400 Fav
Sales manager			
	Sales price	40 Adv	7,000 Fav
	Sales contribution volume	35 Adv	3,000 Fav

The production manager is upset that he seems to have lost all hope of a bonus under the new system. The sales manager thinks the new organic cakes are excellent and is very pleased with the progress made. Crumbly Cakes operates a JIT inventory system and holds virtually no

inventory. This part of the scenario relates to requirement (b). In April the following data applied:

Ingredients	Kg	S
Flour	0.10	0.12 per kg
Eggs	0.10	0.70 per kg
Butter	0.10	1.70 per kg
Sugar	0.10	0.50 per kg
Total input	0.40	
Normal loss (10%)	(0.04)	
Standard weight of a cake	0.36	
Standard sales price of a cake		0.85
Standard contribution per cake after all variable costs		0.35

The budget for production and sales in April was 50,000 cakes. Actual production and sales was 60,000 cakes in the month, during which the following occurred:

Ingredients used	Kg	$
Flour	5,700	741
Eggs	6,600	5,610
Butter	6,600	11,880
Sugar	4,578	2,747
Total input	23,478	20,978
Actual loss	(1,878)	
Actual output of cake mixture	21,600	
Actual sales price of a cake		0.99

All cakes produced must weigh 0.36 kg, as this is what is advertised.

Required: (a) Assess the performance of the production manager and the sales manager and indicate whether the current bonus scheme is fair to those concerned. (b) Calculate the material price variances for each ingredient, the material mix and yield variances, and the sales price and sales contribution variations for April. (You are not required to make any comment on the performance of the managers.)

Answer:
(a) Performance evaluation
Production manager Assessing the performance of the two managers is difficult in this situation. In a traditional sense the production manager has seriously over spent in March following the move to organic ingredients. He has a net adverse variance against his department of $2,300 in one month. No adjustment to the standards has been made to allow for the change to organic. The manager has not only bought organically he has also changed the mix, increasing the input proportion of the more expensive ingredients. This may have contributed to the increased sales of cakes. However, the decision to go organic has seen the sales of the business improve; the taste of the cakes should be better and customers could perceive a health benefit. However, the production manager is allocated none of the favourable sales variances that result. Assuming that the improved sales are entirely as a result of the production manager's decision to change the ingredients, the overall net favourable variance is $7,700. The production manager did

appear to be operating in the original standard in February, indicating a well performing department. Indeed he will have earned a small bonus in that month.

Sales manager

A change to organic idea would need to be "sold" to customers. It would presumably require a change of marketing and proper communication to customers. The sales manager would probably feel he has done a good job in March. It is debatable, however, whether he is entirely responsible for all of the favourable variances. The move to organic certainly helped the sales manager as in February he seems to have failed to meet his targets.

Bonus scheme

The problem here is that the variances have to be allocated to one individual. The good sales variances have been allocated to the sales manager when in truth the production manager's decision to go organic appears to have been a good one and the driver of the business success. Responsibility accounting systems struggle to cope with "joint" success stories, refuting in general a collective responsibility. Under the current standards the production manager has seemingly no chance to make a bonus. The main problems appear to be the out-of-date standards and the fact that all sales variances are allocated to the sales manager, despite the root cause of the improved performance being at least in part the production manager's decision to go organic. The system does not appear fair.

General comments

It would appear that some sharing of the total variances is appropriate. This would be an inexact science and some negotiation would be needed. One problem seems to be that the original standards were not changed following the decision to go organic. In this sense the variances reported are not really "fair". Standards should reflect achievable current targets and this is not the case here.

(b) Variances

(i) Material price variances

Ingredient	Actual price/kg	Standard price/kg	Actual quantity kg	(AP - SP) * AQ Price variance	Adv or Fav
Flour	0.13	0.12	5,700	57	Adv
Eggs	0.85	0.70	6,600	990	Adv
Butter	1.80	1.70	6,600	660	Adv
Sugar	0.60	0.50	4,578	458	Adv
Total				2,165	Adv

(ii) Material mix variance

Ingredient	Actual mix	Standard mix	Standard price	Variance	Adv or Fav
Flour	5,700	5,870	0.12	-20	
Eggs	6,600	5,870	0.70	511	
Butter	6,600	5,870	1.70	1,241	
Sugar	4,578	5,870	0.50	-646	
Totals	23,478	23,478		1.086	Adv

(iii) Material yield variance

Actual yield	60,000 cakes

Standard yield (23,478/0.4)	58,695 cakes
Difference	1,305 cakes
Standard cost of a cake (WORKING)	$0.302
Yield variance (1,305 * 0.302)	394 Fav

(iv) Sales price variance

Actual	Standard	Actual	(AP - SP)	Adv or Fav
price (AP)	price (SP)	volume (AV)	* AV	
0.99	0.85	60,000	8,400	Fav

(v) Sales volume contribution variance

Actual volume	60,000 cakes
Budget volume	50,000 cakes
Standard contribution	$0.35
Variance (60,000 - 50,000) * 0.35	$3,500 Fav

WORKING

Ingredients	Kg		$
Flour	0.10	$0.12 per kg	0.012
Eggs	0.10	$0.70 per kg	0.070
Butter	0.10	$1.70 per kg	0.170
Sugar	0.10	$0.50 per kg	0.050
Total input	0.40	Standard cost of a cake	0.302
Normal loss (10%)	(0.04)		
Standard weight of a cake	0.36		

Case: Sales Performance Variance Analysis for Valet Co Amid Economic Challenges

Valet Co is a car valeting (cleaning) company. It operates in the country of Strappia, which has been badly affected by a recent global financial crisis. Petrol and food prices have increased substantially in the last year and the average disposable household income has decreased by 30%. Recent studies have shown that the average car owner keeps their car for five years before replacing it, rather than three years as was previously the case. Figures over recent years also show that car sales in Strappia are declining while business for car repairs is on the increase. Valet Co offers two types of valet - a full valet and a mini valet. A full valet is an extensive clean of the vehicle, inside and out; a mini valet is a more basic clean of the vehicle. Until recently, four similar businesses operated in Valet Co's local area, but one of these closed down three months ago after a serious fire on its premises. Valet Co charges customers $50 for each full valet and $30 for each mini valet and this price never changes. Its budget and actual figures for the last year were as follows:

Number of valets:			Budget		Actual
Full valets		3,600		4,000	
Mini valets		2,000		3,980	
	$	$	$	$	
Revenue		240,000		319,400	
Variable costs:					

Staff wages	(114,000)		(122,000)	
Cleaning materials	(6,200)		(12,400)	
Energy costs	(6.520)		(9,200)	
		(126,720)		(143,600)	
Contribution		113,280		175,800	
Fixed costs: Rent, rates and depreciation		(36,800)		(36,800)	
Operating profit		76,480		139,000	

The budgeted contribution to sales ratios for the two types of valet are 44.6% for full valets and 55% for mini valets.

Required: (a) Using the data provided for full valets and mini valets, calculate: (i) The total sales mix contribution variance; (ii) The total sales quantity contribution variance. (b) Briefly describe the sales mix contribution variance and the sales quantity contribution variance. (c) Discuss the SALES performance of the business for the period, taking into account your calculations in part (a) AND the information provided in the scenario.

Answer:

(a) Variances

(i) The sales mix contribution variance

Calculated as (actual sales quantity - actual sales quantity in budgeted proportions) * standard contribution per unit.

Standard contributions per valet: Full = $50 * 44.6% = $22.30 per valet

Mini = $30 * 55% = $16.50 per valet

Actual sales quantity in budgeted proportions (ASQBP):

Full: 7,980 * (3,600/5,600) = 5,130

Mini: 7,980 * (2,000/5,600) = 2,850

Valet type	ASQ	ASQBP	Difference	Standard contribution	Variance
				$	$
Full	4,000	5,130	(1,130)	22.30	25,199 A
Mini	3,980	2,850	1,130	16.50	18,645 F
					6,554 A

(ii) The sales quantity contribution variance

Calculated as (actual sales quantity in budgeted proportions - budgeted sales quantity) * standard contribution per unit.

Valet type	ASQBP	BQ	Difference	Standard contribution	Variance
				$	$
Full	5,130	3,600	1,530	22.30	34,119 F
Mini	2,850	2,000	850	16.50	14,025 F
					48,144 F

(b) Description

The sales mix contribution variance

This variance measures the effect on profit of changing the mix of actual sales from the standard mix.

The sales quantity contribution variance

This variance measures the effect on profit of selling a different total quantity from the budgeted total quantity.

(c) Sales performance of the business
The sales performance of the business has been very good over the last year, as shown by the favourable sales quantity variance of $48,144. Overall, total revenue is 33% higher than budgeted (($319,400 - $240,000)/$240,000). This is because of an increase in the total number of valets which have been performed. Considering where the increase in sales quantity has actually taken place, it can be seen from the data provided that it is the number of mini valets that has increased dramatically. This number has increased by 99% ((3,980 - 2,000)/2,000) whereas the number of full valets has only increased by 11% ((4,000 - 3,600)/3,600). Even 11% is still positive, however. The fact that the mini valets increased so dramatically in number combined with the fact that they generate a lower contribution per unit than the full valet led to an adverse sales mix variance of $6,554 in the year. This cannot be looked at in isolation as a sign of poor performance; it is simply reflective of the changes which have occurred in Strappia. We are told that disposable incomes in Strappia have decreased by 30% over the last year. This means that people have less money to spend on non-essential expenditure such as car valeting. Consequently, they are opting for the cheaper mini valet rather than the more expensive full valet. At the same time, we are also told that people are keeping their cars for an average of five years now as opposed to three years. This may be leading them to take more care of them and get them valeted regularly because they know that the car has to be kept for a longer period. The total quantity of valets has therefore increased, particularly the mini valets. Also, there is now one less competitor for Valet than there was a year ago, so Valet may have gained some of the old competitor's business. Together, all of these factors would explain the increase in the total number of valets performed and in particular, an increase in the less expensive valet.
Tutorial note: Other valid points will be given full credit.

Case: Analysis of Production Variance and Market Share in Standard Costing
The Safe Soap Co makes environmentally-friendly soap using three basic ingredients. The standard cost of one batch of soap was $6.4, as follows:

Material	Kg	$ per kg
Lye	0-25	10	
Coconut oil	0-6	4	
Shea butter	0-5	3	

The budget for production and sales in September was 120,000 batches. Actual production and sales were 136,000 batches. The actual ingredients used were as follows:

Material	Kg
Lye	34,080
Coconut oil	83,232
Shea butter	64,200

In October the production manager made some changes to the production process in order to improve the quality of the soap and reduce the amount of material waste that occurs during the production process:

1. Use of an alternative supplier for all three materials. The quality was higher, but the new supplier charged a higher price.

2. A higher proportion of Lye and a correspondingly lower proportion of coconut oil were used in the product mix compared to the standard.

3. Use of new machinery designed to reduce the amount of work in progress wasted due to spillage and leakage.

The sales manager has reported that many customers have commented favourably on the improved quality of the soap and have ordered larger quantities than previously.

Question 1. Which of the following is true about the actual quantities of Lye and Shea Butter used compared with the standard mix?

	Lye	Shea Butter	
A. More than the standard mix	More than the standard mix		
B.	More than the standard mix	Less than the standard mix	
C.	Less than the standard mix	More than the standard mix	
D.	Less than the standard mix	Less than the standard mix	

Answer:

The correct answer is B.

WORKING

The calculation of actual materials in standard mix is shown below for all three materials, and this is compared with the actual materials actual mix:

Material	Actual quantity in standard mix	Actual quantity in actual mix	Actual - standard
	kg	kg	kg
Lye	181,512 * 0.25/1.35 = 33,613.33	34,080	(466.67)
Coconut oil	181,512 * 0.6/1.35 = 80,672	83,232	(2,560)
Shea butter	181,512 * 0.5/1.35 = 67,226.67	64,200	3,026.67
	181,512	181,512	

Question 2. What was the yield variance for September (to the nearest $)? A. $291,277 adverse B. $102,400 favourable C. $9,899 favourable D. $45,512 adverse

Answer:

The correct answer is C.

WORKINGS

(1) Recommended approach (quicker): T

otal kg of materials per standard batch (0.25 + 0.6 + 0.5) = 1.35 kg

Total kg used: 181, 512 should yield (181,512/1.35) 134,453.33 batches

Actual output	136,000.00	
Surplus	1546.67	batches
Standard cost per batch	6.4	
Yield variance	9,898.67	F

(2) Alternative approach
Standard quantity to produce 136,000 batches = 136,000 * 1.35 kg = 183,600 kg
Actual total kg of materials used to produce 136,000 batches = 34,080 + 83,232 + 64,200 = 181,512 kg

Material	Standard quantity in standard mix	Actual quantity in standard mix	Variance	Standard cost per kg	Variance
	kg	kg	$		$
Lye	0.25 * 136,000 = 34,000	33,613.33	386.67	10	3,866.70
Coconut	0.6 * 136,000 = 81,600	80,672	928	4	3,712
Shea	0.5 * 136,000 = 68,000	67,226.67	773.33	3	2,319.99
	183,600	181,512			9,898.69 F

Question 3. The budgeted sales of 120,000 batches had been based on achieving a market share of 10%. The actual sales of the total market in September were 1.4 million units. The Safe Soap Co makes contribution of $3.6 on each batch of soap sold. What was the market share variance (sales volume operational variance) for the month of September? A. $14,400 adverse B. $57,600 favourable C. $72,000 favourable D. $72,000 adverse
Answer:
The correct answer is A.
WORKING
Revised budget sales quantity, based on actual market in September is 140,000 (1.4 million * 10%). Market share variance is calculated in the same way as a traditional sales variance, except the revised budgeted sales are used instead of the original budgeted sales.

	Units
Actual sales	136,000
Revised budgeted sales	140,000
Shortfall	4,000
Standard contribution per unit	$3.6
Market share variance	14,400 A

Question 4. Identify, by selecting the relevant box in the table below, the likely effect that the changes in the production process in October will have on each variance calculated for that month,
FAVOURABLE or ADVERSE: Materials mix variance
FAVOURABLE or ADVERSE: Materials price variance
FAVOURABLE or ADVERSE: Yield variance

FAVOURABLE or ADVERSE: Sales volume variance

Answer:

Materials mix variance		ADVERSE
Materials price variance		ADVERSE
Yield variance	FAVOURABLE	
Sales volume variance	FAVOURABLE	

Tutorial note: The material mix variance would be adverse as a higher portion of Lye was used than standard and Lye is the most expensive material with a cost of $10 per kg.

Question 5. The following statements have been made about both standard costing and total quality management (TQM): 1. They focus on assigning responsibility solely to senior managers 2. They work well in rapidly changing environments Which of the above statements is/are true?
A. 1 only B. 2 only C. Neither 1 nor 2 D. Both 1 and 2

Answer:

The correct answer is C.

Tutorial note: Neither statement is correct. Responsibility is not assigned solely to senior managers as, for example, in a TQM environment quality is everybody's responsibility. In addition, standard costing can be difficult to apply in dynamic situations.

Case: Variance Analysis and Impact of Production Mix on Organic Bread Company's Costing
The Organic Bread Company (OBC) makes a range of breads for sale direct to the public. The production process begins with workers weighing out ingredients on electronic scales and then placing them in a machine for mixing. A worker then manually removes the mix from the machine and shapes it into loaves by hand, after which the bread is then placed into the oven for baking. All baked loaves are then inspected by OBC's quality inspector before they are packaged up and made ready for sale. Any loaves which fail the inspection are donated to charity. The standard cost card for OBC's Mixed Bloomer, one of its most popular loaves is as follows:

White flour	450	grams at $1.8 per kg	0.81
Wholegrain flour	150	grams at $2.20 per kg	0.33
Yeast	10	grams at $20 per kg	0.20
	610	grams	1.34

Budgeted production of Mixed Bloomers was 1,000 units for the quarter, although actual production was only 950 units. The total actual quantities used and their actual costs were:

	Kg	$ per Kg
White flour	408.5	1.90
Wholegrain flour	152.0	2.10
Yeast	10.0	20.00
Total	570.5	

Question 1. What was the material mix variance for the period? A. A favourable variance of $6.02 B. An adverse variance of $6.02 C. A favourable variance of $16.51 D. An adverse variance of $16.51

Answer:

The correct answer is D.

WORKING

	Actual quantity used	Actual quantity in Standard	Difference	price	Variance
kg	(W) kg	kg	$	$	
A	B	(B - A)			
White flour	408.5	420.86	12.36	1.8	22.25
Wholegrain flour	152.0	140.29	(11.71)	2.2	(25.76)
Yeast	10.0	9.35	(0.65)	20.0	(13.00)
	570.5	570.5	0		(16.51)

Tutorial note: The variance is adverse - less white flour was used than the standard, and more Wholegrain flour and yeast than standard. Wholegrain flour and yeast are more expensive than white flour, leading to a more expensive mix.

Question 2. What output would be expected, given that 570.5 kg of mix was used? A. 425 loaves B. 935 loaves C. 950 loaves D. 1,000 loaves

Answer:

The correct answer is B.

WORKING

Standard input for 1 loaf = 610 grams (or 0.61 kg)

Therefore, expected output given 570.5 kg of input = 935.25 (570.5/0.61)

Question 3. Which of the following might cause an adverse yield variance? 1. The mix may not be removed completely out of the machine, leaving some mix behind 2. Since the loaves are made by hand, they may be made slightly too large, meaning that fewer loaves are baked 3. Errors or changes in the mix may cause some loaves to be sub-standard and therefore rejected by the quality inspector 4. The loaves might be baked at the wrong temperature and therefore be rejected by the quality inspector A. 1, 2 and 4 only B. 1 and 4 only C. 2 and 3 only D. 1. 2. 3 and 4

Answer:

The correct answer is D.

Question 4. The production manager's annual appraisal is linked to the material mix, yield and usage variances. In order to get a better assessment, the manager is planning to vary the product mix by using a higher portion of white flour, and a lower portion of wholemeal flour, as this would lead to a favourable material mix variance. Which variances other than the material mix variance may be affected by the production manager's action? 1. Yield variance 2. Sales price variance 3. Material price variance 4. Sale volume variance A. 1 and 4 only B. 2 and 3 only C. 1, 2 and 4 D. 1, 3 and 4

Answer:

The correct answer is C.

Tutorial note: Varying the mix might reduce the yield (e.g. if the quality inspector rejects loaves because he believes that the quality is inferior). The poorer quality loaves may lead to a fall in sales, leading to an adverse sales volume variance, and OBC may need to reduce the price to try to make up for the shortfall in demand, leading to an adverse sales price variance. The material price variance depends on the prices paid to suppliers, and this is not likely to change as a result of the decision to vary the mix.

Question 5. OBC budgeted to sell 1,000 loaves at a budgeted selling price of $2 per unit. Actual sales volume in the quarter was 950 units and the actual sales price achieved was $1.80 per loaf. This was because a competitor launched a similar loaf at the same time. OBC had been unaware that this was going to happen when it prepared its budget and, had it known this, it would have revised its expected selling price to $1.70 per unit, which was the price of the competitor's product. What is the sales price planning variance? A. $285 Adverse B. $285 Favourable C. $95 Favourable D. $95 Adverse
Answer:
The correct answer is A.
WORKING
Planning variance = ($1.70 - $2) * 950 = $285 Adverse

Case: Material Variance Analysis and Performance Assessment Challenges at Kappa Co
Kappa Co produces Omega, an animal feed made by mixing and heating three ingredients: Alpha, Beta and Gamma. The company uses a standard costing system to monitor its costs. The standard material cost for 100 kg of Omega is as follows:

Input	Kg	Cost per kg ($)	Cost per 100 kg of Omega ($)
Alpha	40	2.00	80.00
Beta	60	5.00	300.00
Gamma	20	1.00	20.00
Total	120		400.00

Notes
1. The mixing and heating process is subject to a standard evaporation loss.
2. Alpha, Beta and Gamma are agricultural products and their quality and price varies significantly from year to year. Standard prices are set at the average market price over the last five years. Kappa Co has a purchasing manager who is responsible for pricing and supplier contracts.
3. The standard mix is set by the finance department. The last time this was done was at the product launch which was five years ago. It has not changed since.
Last month 4,600 kg of Omega was produced, using the following inputs:

Input	Kg	Cost per kg ($)	Total cost ($)
Alpha	2,200	1.80	3,960
Beta	2,500	6.00	15,000
Gamma	920	1.00	920

| Total | 5,620 | | 19,880 |

At the end of each month, the production manager receives a standard cost operating statement from Kappa Co's performance manager. The statement contains material price and usage variances, labour rate and efficiency variances, and overhead expenditure and efficiency variances for the previous month. No commentary on the variances is given and the production manager receives no other feedback on the efficiency of the Omega process. Required: (a) Calculate the following variances for the last month: (i) the material usage variance for each ingredient and in total; (ii) the total material mix variance; (iii) the total material yield variance. (b) Discuss the problems with the current system of calculating and reporting variances for assessing the performance of the production manager.

Answer:

(a) Materials variances

(i) Usage variance

	Should use	Did use	Difference	Std cost/kg	Variance
kg	kg	kg	$	$	
Alpha	1,840	2,200	360 A	2.00	720 A
Beta	2,760	2,500	260 F	5.00	1,300 F
Gamma	920	920		1.00	1
	5,520	5,620			580 F

(ii) Mix variance

	AQSM	AQAM	Difference	Std cost/kg	Variance
kg	kg	kg	$	$	
Alpha	1,873.33	2,200	326.67 A	2.00	653.34 A
Beta	2,810.00	2,500	310.00 F	5.00	1,550.00 F
Gamma	936.67	920	16.67 F	1.00	16.67 F
	5,620	5,620			913.33 F

(iii) Yield variance

	SQSM	AQSM	Difference	Std cost/kg	Variance
kg	kg	kg	$	$	
Alpha	1,840	1,873.33	33.33 A	2.00	66.66 A
Beta	2,760	2,810.00	50.00 A	5.00	250.00 A
Gamma	920	936.67	16.67 A	1.00	16.67 A
	5,520	5,620			333.33 A

Tutorial note: Alternative calculation of yield variance:
5,620 kg input should produce 4,683.33 kg of Omega
5,620 kg input did produce 4,600 kg of Omega
Difference = 83.33kg * $4 per kg ($400/100 kg) = $333.32 A

(b) Problems with the current system for assessing the production manager's performance
The raw material price variances included in the report are probably outside the production manager's control, and are more the responsibility of the purchasing manager. Furthermore, the

production manager has no participation in setting the standard mix. Holding managers accountable for variances they cannot control is demotivating. There appears to be no use of planning variances. Prices and quality of the three materials are volatile and using ex ante prices and usage standards can give a distorted view of mix and yield variances. Failing to isolate non-controllable planning variances can be demotivating. The standard mix for the product has not changed in five years despite changes in the quality and price of ingredients. It can also lead the production manager to attempt control action based on variances which are calculated based on standards which are out of date. As Kappa Co does not currently give feedback or commentary, a true picture is lacking as to the production manager's performance. There is also no follow up on the variances calculated. As Kappa Co does not appear to place much importance on the variances, the production manager will not be motivated to control costs and could become complacent which could adversely affect Kappa Co overall. This can be illustrated by looking at the overall usage variance reported which shows a $580 favourable variance, so the production manager could assume good performance. However, if the usage variance is considered in more detail, through the mix and yield calculations, it can be seen that it was driven by a change in the mix. There is a direct relationship between the materials mix variance and the materials yield variance and by using a mix of materials which was different from standard, it has resulted in a saving of $913.33; however, it has led to a significantly lower yield than Kappa Co would have got had the standard mix of materials been adhered to. Also changing the mix could affect quality and as a result sales and there is no information about this.

Case: Analysis of Clear Co's Sales Performance Amidst Market Competition and Technological Shifts

Clear Co is an eye treatment specialist, founded in 20X4, which runs five clinics nationwide. It is based in Zeeland, a country in which 20% of the population is over 65 years old, compared to only 15% ten years ago. Clear Co offers two eye treatment procedures: laser treatment and lens treatment. Laser treatment is the less complex of the two procedures. Technology changes rapidly in this industry and as a result 90% of patients now qualify for laser treatment, compared to only 80% five years ago. The remaining 10% of patients are only able to have lens treatment, of which there are two types: refractive lens exchange (RLE) and implantable contact lenses (ICL). Clear Co started providing RLE, a treatment most effective for patients aged 40 or older, in 20X4 when it was founded. Two years ago, it also began providing ICL, a treatment recommended for patients under the age of 40. The market for eye treatment procedures in Zeeland is dominated by a few main suppliers, of which Clear Co is one. Until two years ago, Clear Co was the largest supplier but, following the merger of two other companies, it is now the second largest. The merged company, Eos Co, has recently released its financial statements for the year, showing profits which were 10% higher than forecast. Eos Co's press release stated that it has achieved this despite offering reduced prices for the ICL treatment. It has been able to offer reduced prices because of the economies of scale achieved by the merger. The following information relates to the two types of lens treatments offered by Clear Co for the year just ended:

Lens treatment	RLE		ICL	
Budget		Actual	Budget	Actual
Number of treatments	3,750	4,130	1,320	960
Selling price per treatment ($)	3,000	2,900	3,650	3,400
Variable cost treatment ($)	600	590	1,150	1,200

Required: (a) Calculate the following TOTAL variances for Clear Co's lens treatments: (i) the sales mix contribution variance (ii) the sales quantity contribution variance. (b) Explain what each of the sales mix contribution variance and sales quantity contribution variance measures. (c) Using your answer from part (a) and any other relevant calculations, discuss Clear Co's SALES performance for the year just ended.
Note: There are up to four marks available for additional calculations relevant to SALES performance and six marks available for discussion.

Answer:
(a) Total variances

	RLE	ICL	Total
Actual Quantity in Actual Mix	4,130	960	5,090
Actual Quantity in Budgeted Mix	3,764.8	1,325.2	5,090
Budgeted Quantity in Budgeted Mix	3,750	1,320	5,070
	$	$	$
Standard contribution (W)	2,400	2,500	
Sales mix contribution variance	876,497F	913,018A	36,521A
Sales quantity contribution variance	35,5023F	13,018F	48,521F

Tutorial note: Alternative quantity variance calculation using the weighted average standard contribution:

Total contribution (3,750 * $2,400 + 1,320 * $2,500)	$12,300,000
Budgeted total sales quantity	5,070
Weighted average contribution per procedure	$2,426
Quantity variance ((5,090 - 5,070) * $2,426)	48,520F

WORKING

	RLE	ICL
	S	$
Selling price	3,000	3,650
Variable costs	600	1,150
Standard contribution	2,400	2,500

(b) What the variances measure
The sales mix contribution variance measures the effect on contribution of changing the mix of actual sales from the budgeted sales mix. The sales quantity contribution variance measures the effect on contribution of selling a different total quantity from the budgeted total quantity.

(c) SALES performance for the year
Possible additional calculations

Actual compared to budgeted revenue	RLE	ICL	Total
	$	$	$
Actual sales revenue	11,977,000	3,264,000	15,241,000
Budgeted sales revenue	11,250,000	4,818,000	16,068,000
Difference in revenue	727,000	-1,554,000	-827,000
Percentage terms	6.46%	-32.25%	-5.15%
Sales volume variance	$	$	$
(AQ-BQ) * standard contribution	9,12,000F	900,000A	12,000F
Selling price variance			
(AP-SP) * AQ	413,000A	240,000A	653,000A
Total sales variance			
(AP - standard variable costs) * AQ	9,499,000	2,160,000	11,659,000	Actually received
Budgeted units * standard contribution	9,000,000	3,300,000	12,300,000	Expect to receive
	499,000F	1,140,000A	641,000A	

Sales performance

When comparing budgeted revenues to actual revenues, it can be seen that ICL has under-performed this year, with revenues being 32.25% lower than budgeted. This is a result of both lower sales volumes and a lower selling price for ICL, which has resulted in an adverse sales volume variance of $900,000 and an adverse sales price variance of $240,000. The main reason for this is probably the merger that took place during the year, which resulted in Clear Co's now biggest competitor subsequently reducing prices for ICL and presumably capturing a bigger slice of the market as a result. Even though Clear Co's actual price for ICL was $250 less than budgeted, its sales volumes still fell by 27% so it was apparently unable to match the competition. Looking at the mix of sales between RLE and ICL at Clear Co, there is an adverse mix variance of $36,521. This is because, whilst the sales of ICL were lower than budgeted, the sales of RLE were higher than budgeted. Since RLE has a lower standard contribution than ICL, this produced an adverse mix variance. This shift in sales mix could be partly attributable to the fact that the RLE procedure is for people aged over 40 and there is an increasingly ageing population in Zeeland. Clear Co has had to lower its price to make these sales of RLE but again, this is probably due to increased pressure to reduce prices resulting from the merger. Another factor which it is not possible to quantify from the information provided, but which will invariably affect sales of lens treatments overall, is the increased availability of laser treatments to customers. Given that 90% of customers are now eligible for the less complex laser treatment, this side of the business may well have grown at Clear Co. Overall, the sales volume variance is favourable for Clear Co because of the increased sales of RLE. However, to achieve this, prices have been reduced, resulting in a significant adverse sales price variance of $653,000. These results are disappointing and Clear Co may have to rethink its strategy moving forwards.

Case: Analysis of Lock Co's Operational Efficiency and Variance Management in May

Lock Co makes a single product, a lock, and uses marginal costing. A junior member of the accounts team produced the following variance statement for the month of May.

	Budget	Actual	Variances
	(1,000 units)	(960 units)	
	$	$	$
Revenue	80,000	76,800	3,200 Adv
Less: Marginal cost			
Direct materials	(12,000)	(11,126)	874 Fav
Direct labour	(20,000)	(18,240)	1,760 Fav
Variable overheads	(4.000)	(3,283)	717 Fav
Contribution	44,000	44,151	151 Fav

The standard cost of materials was set at the start of the year as 4 kg per unit at $3 per kg. Lock Co used 3,648 kg of material in the period. There were no opening or closing inventories of materials or finished goods. The standard labour cost was 2 hours at $10 per hour. Actual labour used was 1,824 hours.

Question 1. What is the adverse sales volume contribution variance for the month of May?
Answer:
The correct answer is $1760
WORKING

Budgeted sales (units)	1,000
Actual sales (units)	960
Shortfall (units)	40
Standard contribution per unit ($44,000/1,000)	$44
Variance (40 * $44)	$1,760 A

Question 2. After performing the analysis, a decision was made to revise the standard cost of materials to $3.30 per kg due to an increase in commodity prices on world markets. What was the planning price variance for materials for May?
Answer:
The correct answer is $1,094 adverse
WORKING

Actual materials at original standard price (3,648 * 3)	10,944
Actual materials at revised standard price (3,648 * 3.3)	12,038
Planning price variance	1,094 A

Question 3. The production manager recently visited the factory of another lock company, and discovered that the standard time used for a similar product was lower. The production manager has therefore decided that the standard time for producing one unit should be revised to 1.75 hours. The standard hourly rate remains unchanged. What was the labour operational efficiency variance for May? A. $912 favourable B. $144 adverse C. $740 adverse D. $1440 adverse
Answer:
The correct answer is D.

WORKING
Actual labour hours	1,824
Revised standard quantity for actual output (1.75 * 960)	1,680
Surplus hours used	144
* standard rate per hour	10
Labour operational efficiency variance	1,440 A

Question 4. Which THREE of the following events would most likely contribute towards an adverse labour operational efficiency variance in May? A. The union introduced a "go slow" agreement in the factory. B. A number of factory workers retired and were replaced by new recruits. C. The standard time per unit was revised downwards at the end of the month D. Higher quality material was used E. The original standard time per unit was too difficult F. Workers received a pay rise that was not reflected in the standard rate per hour
Answer:
The correct answers are A, B, C.
Tutorial note: A "go slow" agreement means workers produce less per hour. If workers are replaced, the new workers may initially be less productive as there will be a learning process. The operational efficiency variance shows the difference between actual time and revised standard time for actual output. If revised standard time is reduced, the operational efficiency variance will decline. Higher quality material may lead to more efficient work, so any impact on labour efficiency is likely to be favourable. The original standard is not relevant when calculating operational variances. The revised standard is used. A pay rise may lead to an adverse rate variance, but if anything would lead to a favourable efficiency variance as workers may be more motivated.

Question 5. Which of the following describes a "basic standard" in the context of budgeting? A. A standard which is kept unchanged over a period of time B. A standard which is based on current price levels C. A standard set at an ideal level, which makes no allowance for normal losses, waste and machine downtime D. A standard which assumes an efficient level of operation, but which includes allowances for factors such as normal loss, waste and machine downtime
Answer:
The correct answer is A.

Case: Performance Analysis of Labour Rate and Efficiency Variances at Truffle Co in November
Truffle Co makes high quality, hand-made chocolate truffles which it sells to a local retailer. All chocolates are made in batches of 16, to fit the standard boxes supplied by the retailer. The standard cost of labour for each batch is $6.00 and the standard labour time for each batch is 30 minutes. In November, Truffle Co had budgeted production of 24,000 batches; actual production was only 20,500 batches. 12,000 labour hours were used to complete the work and there was no idle time. All workers were paid for their actual hours worked. The actual total labour cost for November was $136,800. The production manager at Truffle Co has no input into the

budgeting process. At the end of October, the managing director held a meeting and offered staff the choice of either accepting a 5% pay cut or facing a certain number of redundancies. All staff subsequently agreed to accept the 5% pay cut with immediate effect. At the same time, the retailer requested that the truffles be made slightly softer. This change was implemented immediately and made the chocolates more difficult to shape. When recipe changes such as these are made, it takes time before the workers become used to working with the new ingredient mix, making the process 20% slower for at least the first month of the new operation. The standard costing system is only updated once a year in June and no changes are ever made to the system outside of this.

Required: (a) Calculate the total labour rate and total labour efficiency variances for November, based on the standard cost provided above. (b) Analyse the total labour rate and total labour efficiency variances into component parts for planning and operational variances in as much detail as the information allows. (c) Assess the performance of the production manager for the month of November.

Answer:
(a) Basic variances
Standard cost of labour per hour = $6/0.5 = $12 per hour
Labour rate variance
(Actual hours paid * actual rate) - (actual hours paid * standard rate)
Actual hours paid * standard rate = $136,800/0.95 = $144,000
Therefore rate variance = $144,000 - $136,800 = $7,200 F
Labour efficiency variance
(Actual production in standard hours - actual hours worked) * standard rate = [(20,500 * 0.5) - 12,000] * $12 = $21,000 A

(b) Planning and operational variances
Labour rate planning variance
(Revised rate - standard rate) * actual hours paid = [$12- ($12 * 0.95)] * 12,000= $7,200 F
Labour rate operational variance
There is no labour rate operational variance. (Revised rate - actual rate) * actual hours paid = $11.40 - $11.40 * 12,000 = 0
Labour efficiency planning variance
(Standard hours for actual production - revised hours for actual production) * standard rate [10,250 - (20,500 * 0.5 * 1.2)] x $12 = $24,600 A
Labour efficiency operational variance
(Revised hours for actual production - actual hours for actual production) * standard rate (12,300 - 12,000) * $12 = $3,600 F

(c) Discussion
Considering the total variances, it looks like the production manager has been extremely poor at controlling his staff's efficiency, since the labour efficiency variance is $21,000 adverse. It also appears that he has managed to secure labour at a lower rate. In order to assess the production manager's performance fairly, however, only the operational variances should be taken into

account, as planning variances reflect differences that arise because of factors that are outside the control of the production manager. The operational variance for the labour rate was $0, which means that the labour force was paid exactly what was agreed: their reduced rate of $11.40 per hour. The manager did not have to pay anyone for overtime, for example, which would have pushed this rate up. The rate reduction was secured by the company and was not within the control of the production manager, so he cannot take credit for the favourable rate planning variance of $7,200. The company is the source of this improvement. As regards labour efficiency, the planning and operational variances give us more information about the total efficiency variance of $21,000A. When this is broken down into its two parts, it becomes clear that the operational variance, for which the manager does have control, is actually $3,600 favourable. This is because, when the recipe is changed as in November, the chocolates usually take 20% longer to make in the first month while the workers are getting used to handling the new ingredient mix. When this is taken into account, it can therefore be seen that workers took less than the 20% extra time that they were expected to take, hence the positive operational variance. The planning variance, on the other hand, is $24,600 adverse. This is because the standard labour time per batch was not updated in November to reflect the fact that it would take longer to produce the truffles. The manager cannot be held responsible for this. Overall, the manager has performed well, given the change in the recipe.

Case: Variance Analysis of Material Costs and Production Performance at Bedco in November
Bedco manufactures children's bed sheets and pillowcases which it supplies to a major furnishings retailer. It uses a just-in- time system and holds no inventories. The standard cost for the cotton which is used to make the bed sheets and pillowcases is $5 per m². Each bed sheet uses 2 m² of cotton and each pillowcase uses 0.5m². Production levels for bed sheets and pillowcases for November were as follows:

	Budgeted (units)	Actual (units)
Bed sheets	120,000	120,000
Pillowcases	190,000	180,000

The actual cost of the cotton in November was $5.80 per m². 248,000m² of cotton was used to make the bed sheets and 95,000 m² was used to make the pillowcases. The world commodity prices for cotton increased by 20% in the month of November. At the beginning of the month, the furnishings retailer made an unexpected request for an immediate design change to the pillowcases. The new design required 10% more cotton than previously. It also resulted in production delays and therefore a shortfall in production of 10,000 pillowcases in total that month. The production manager at Bedco is responsible for all buying and any production issues which occur, although he is not responsible for the setting of standard costs.
Required: (a) Calculate the following variances for the month of November, for both bed sheets and pillow cases, and in total: (i) Material price planning variance; (ii) Material price operational variance; (iii) Material usage planning variance; (iv) Material usage operational variance. (b) Assess the performance of the production manager for the month of November in respect of the variances calculated.
Answer:

(a) Planning and operational variances
(i) Material price planning variance

		(Standard price - revised price) * actual quantity
Sheets		($5 - $6) * 248,000 = $248,000 adverse	
Pillow cases		($5 - $6) * 95,000 = $95,000 adverse	
Total		$343,000 adverse	

(ii) Material price operational variance

		(Revised price - actual price) * actual quantity	
Sheets		($6 - $5.80) * 248,000 = $49,600 favourable	
Pillow cases		($6 - $5.80) * 95.000 = $19,000 favourable	
Total		$68.600 favourable	

(iii) Material usage planning variance

(Standard quantity for actual production - revised quantity for actual production) * standard price
Revised quantity for each pillow case 0.5m² * 1.1 = 0.55m
Sheets (240,000 - 240,000) * $5 = 0
Pillow cases (90,000 - 99,000) * $5 = $45,000 adverse
Total $45,000 adverse

(iv) Material usage operational variance
(Actual quantity - revised quantity for actual production) * standard price
Sheets (248,000 - 240,000) * $5 = $40,000 adverse
Pillow (95,000 - 99,000) * $5 = $20,000 favourable
Total $20,000 adverse
Tutorial note: Although (i) could be calculated using the revised quantity rather than the actual quantity and (iii) could be calculated using the revised price rather than the standard price, the above method is the one preferred by the examiner.

(b) Performance of the production manager
In total, there has been an overspend of $339,400, which looks poor. However, when the reasons for this are examined, together with the variances calculated in (a), it is apparent that the production manager cannot be held solely responsible for the overspend. In fact, he has had little control over the situation.
Increase in cotton price
Since cotton is used to make bed sheets and the price of this rose in the world market by 20% from $5 to $6, the production manager's performance has to be looked at in light of this. Because of the increased market price, the adverse material price planning variance is very high, since the budgeted cost of $5 per m² was far below the actual market price of $6 per m² The production manager cannot be held responsible for this since he does not set the standard costs. He can only be held responsible for any difference in price between the $6 market price and the $5.80 actual price paid. Since the $5.80 paid per m² is less than the market price of $6

per m², the manager performed well, as shown by the favourable material price operating variance of $68,600.

Increase in amount of cotton used

Since more cotton was used for actual production than budgeted, a total adverse material usage variance of $65,000 ($45,000 + $20,000) arose. However, of this, $45,000 (material usage planning variance) arose because of the request for a change in the design of the pillowcases by Bedco's customer. This was not within the control of the production manager and his performance should not therefore be assessed on it. However, an adverse material usage operational variance of $20,000 also arose; the performance of the production manager is weak here. Most of the adverse operational variance actually related to the production of bed sheets rather than pillowcases. It is not clear why this arose but it is definitely poor.

Bedco was also unable to produce all the pillowcases ordered by its customer in November as the order fell short by 10,000 units. If this was genuinely because of the late design change, however, it seems unfair to judge the production manager on this.

Case: Variance Analysis of Material and Labour Costs for SU Co in February

The School Uniform Company (SU Co) manufactures school uniforms. One of its largest contracts is with the Girls' Private School Trust (GPST), which has 35 schools across the country, all with the same school uniform. After a recent review of the uniform at the GPST schools, the school's spring/summer dress has been re-designed to incorporate a dropped waistband. Each new dress now requires 2.2 metres of material, which is 10% more material than the previous style of dress required. However, a new material has also been chosen by the GPST which costs only $2.85 per metre which is 5% cheaper than the material used on the previous dresses. In February, the total amount of material used and purchased at this price was 54,560 metres. The design of the new dresses has meant that a complicated new sewing technique needed to be used. Consequently, all staff required training before they could begin production. The manager of the sewing department expected each of the new dresses to take 10 minutes to make as compared to 8 minutes per dress for the old style. SU Co has 24 staff, each of whom works 160 hours per month and is paid a wage of $12 per hour. All staff worked all of their contracted hours in February on production of the GPST dresses and there was no idle time. No labour rate variance arose in February. Activity levels for February were as follows:

Budgeted production and sales (units) 30,000

Actual production and sales (units) 24,000

The production manager at SU Co is responsible for all purchasing and production issues which occur. SU Co uses standard costing and usually, every time a design change takes place, the standard cost card is updated prior to production commencing. However, the company accountant responsible for updating the standards has been off sick for the last two months. Consequently, the standard cost card for the new dress has not yet been updated.

Required: (a) Calculate the material variances in as much detail as the information allows for the month of February. (b) Calculate the labour efficiency variances in as much detail as the information allows for the month of February. (c) Assess the performance of the production manager for the month of February.

Answer:
(a) Material variances
| SP (standard price per metre: $2.85/0.95) | $3.00 |
| SQ (standard quantity per dress: 2.2 metres/1.1) | 2 metres |
From the scenario, the revised price per metre (RP) is $2.85, the actual price per metre (AP) is $2.85 and the revised quantity per dress (RQ) is 2.2 metres.
| SQAP (standard quantity for actual production: 2 metres * 24,000) | 48,000 metres |
| RQAP (revised quantity for actual production: 2.2 metres * 24,000) | 52,800 metres |
From the scenario, the actual production level (AP) is 24,000 dresses and actual quantity of material bought and used (AQ) is 54,560 metres.
Material price variances
Planning variance	
(SP - RP) * AQ: ($3.00 - $2.85) * 54,560	8,184 F
Operational variance	
(RP - AP) * AQ: ($2.85 - $2.85) * 54,560	0
Total price variance	8,184 F
Material usage variances
Planning variance	
(SQAP - RQAP) * SP: (48,000 - 52,800) * $3.00	14,400 A
Operational variance	
(RQAP - AQ) * SP: (52,800 - 54,560) * $3.00	5,280 A
Total usage variance	19,680 A
Total material variance	11,496 A
Tutorial note: These variances could have been calculated using the alternative approach as below:
Material usage variances
Planning variance	
(AP × RQ) * (SP - RP): 24,000 * 2.2 metres * ($3.00 - $2.85)	7,920 F
Operational variance	
(RP - AP) * AQ: 54,560 metres * ($2.85 - $2.85)	0
Material usage variances

Planning variance	
(SQ - RQ) * AP * SP: 24,000 * (2 metres - 2.2 metres) * $3.00	14,400 A
Operational variance	
((AP * RQ) - AQ) * RP: 24,000 * 2.2 metres - 54,560 * $2.85	5,016 A
Total material variance	11,496 A

(b) Labour efficiency variances
AH (actual hours worked and paid): 24 * 160 hours	3,840 hours
SHAP (standard hours for actual production): (24,000 * 8)/60	3,200 hours
RHAP (revised hours for actual production): (24,000 * 10)/60	4,000 hours

From the scenario, the standard rate per hour (SR) is $12, the standard time per dress is eight minutes and the revised time per dress is 10 minutes.

Labour efficiency variances

Planning variance	
(SHAP - RHAP) * SR: (3,200 - 4,000) * $12	9,600 A
Operational variance	
(RHAP - AH) * SR: (4,000 - 3,840) * $12	1,920 F
Total labour efficiency variance	7,680 A

(c)Performance of the production manager

The production manager did not have any control over the change in the design of the dress as this change wasrequested by the client. Similartly, it was not his fault that the company accountant responsible for updating standardcosts was off sick and therefore unable to update the standards., Therefore, the production manager should be judgeonly by those variances over which he has control, which are the operational variances.

Materials

No operational variance arose in relation to materials price, since the actual price paid was the same as the revisedprice. A planning variance of $8,184F does arise but the production manager cannot take the credit for this, as thematerial chosen by GPST for the new dresses just happens to be cheaper. As regards usage, an adverse variance of $5.280 arose. This suggests that, even with the revised quantity ofmaterial being taken into account, staff still used more than 2.2 melres on average to produce each dress. This isprobably because they had to learn a new sewing technique and they probably made some mistakes, resuilting insome wastage. The manager is responsible for this as it may have been caused by insufficient training. However, thelabour efficiency variances below shed some more light on this.

The labour efficiency operational variance was favourable, which suggests good performance by the productionmanager. Staff took less than the expected revised 10 minutes per dress. However, when looked at in combinationwith the material usage operational variance above, it could be inferred that staff may have rushed a litle andconsequently used more material than necessary.

When both of the operational variances are looked at together, the adverse materials usage $5,280 far outweighs thefavourable labour efficiency variance of $1,920. Consequently, it could be concluded that, overall, the manager'sperformance was somewhat disappointing.

Labour

The labour efficiency operational variance was favourable, which suggests good performance by the production manager. Staff took less than the expected revised 10 minutes per dress. However, when looked at in combination with the material usage operational variance above, it could be inferred that staff may have rushed a little and consequently used more material than necessary. When both of the operational variances are looked at together, the adverse materials usage $5,280 far outweighs the favourable labour efficiency variance of $1,920. Consequently, it could be concluded that, overall, the manager's performance was somewhat disappointing.

Case: Variance Analysis for Product MN at Grayshott Co

Marcus manages the production and sales departments for product MN at Grayshott Co. Marcus has been asked to attend a meeting with Grayshott Co's finance director to explain the results for product MN in the last quarter. Budgeted and actual results for product MN were as follows:

	Budget	Actual
Sales volume (units)	40,000	38,000
	$000	$000
Revenue ($65 per unit)	2,600	2,394
Material (5.2 kg at $4 per kg)	(832)	(836)
Labour (2 hours at $8 per hour)	(640)	(798)
Variable overheads (2 hours at $4 per hour)	(320)	(399)
Fixed overheads	(220)	(220)
Profit	588	141

There was no opening and closing inventory in the last quarter. Grayshott Co operates a marginal costing system. Marcus is angry about having to attend the meeting as he has no involvement in setting the original budget and he believes that the adverse results are due to the following circumstances which were beyond his control:

1. A decision by Grayshott Co's board to increase wages meant that the actual labour rate per hour was 25% higher than budgeted. This decision was made in response to a request by the production department to enable it to meet a large, one-off customer order in the last quarter.

2. Due to the closure of a key supplier, Grayshott Co agreed to a contract with an alternative supplier to pay 6% more per kg than the budgeted price for material. The actual cost per kg of material was $4.40.

3. Difficult economic conditions meant that market demand for product MN was lower by 10%. At present Grayshott Co does not operate a system of planning and operational variances and Marcus believes it should do so.

Question 1. What was the market share variance for product MN for the last quarter?
Answer:
The correct answer is $40,400 Favourable
WORKING

Revised sales budget (40,000 units * 90%)	36,000	units	
Actual sales	38,000	units	
Difference (units)	2,000	favourable	
At standard contribution per unit			
($65 - (5.2 * $4)-(2 * $8)-(2 * $4))	$20.20		
Variance	$40,400	favourable	

Question 2. What was the adverse materials price planning variance for product MN for the last quarter?
Answer:
The correct answer is $45600

Tutorial note: The materials price planning variance compares the original standard price to the revised standard price

WORKING

Original standard price per kg ($)	4.00	
Revised standard price per kg ($)	4.24	
Difference ($ per kg)	0.24	adverse
Actual quantity of material used ($836,000/$4.40 per kg)	190,000	kg	
Variance	$45,600	adverse

Question 3. What was the labour rate operational variance for product MN for the last quarter?
A. $159,600 Favourable B. $159,600 Adverse C. $160,000 Favourable D. $160,000 Adverse
Answer:
The correct answer is B.
Tutorial note: The labour rate operational variance compares the revised standard rate per hour to the actual rate per hour. There is no revision to the standard rate of $8, as the increase was requested by the production department to meet a large, one-off customer order.
WORKING
Actual rate per hour (1.25 * $8) $10.00
Difference ($10 - $8) $2.00 adverse
Number of hours worked ($798,000/$10 per hour) 79,800
Variance $159,600 adverse

Question 4. Which of the following would explain a labour efficiency planning variance? 1. A change in employment legislation requiring staff to take longer rest periods 2. Customers demanding higher quality products leading to a change in product design 3. The learning effect for labour being estimated incorrectly in the production budget A. 1 and 2 only B. 2 and 3 only C. 3 only D. 1, 2 and 3
Answer:
The correct answer is D.
Tutorial note: A labour efficiency planning variance arises when the standard hours have to be revised due to factors which are beyond the control of the operational managers. All the factors would require the original standard hours to be revised and would therefore cause a labour efficiency planning variance.

Question 5. Which of the following statements regarding the problems of introducing a system of planning and operational variances is/are true? 1. Operational managers may argue that variances are due to the original budget being unrealistic 2. Operational managers may seek to blame uncontrollable external factors for the variances A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2
Answer:
The correct answer is C.
Tutorial note: Both statements are true and are known issues with the introduction of a system of planning and operating variances.

Case: Performance Assessment for Accountancy Teaching Co (AT Co) in 20X9

The Accountancy Teaching Co (AT Co) specialises in the provision of accountancy tuition courses in the private sector. It makes up its accounts to 30 November each year. In the year ending 30 November 20X8, it held 60% of market share. However, over the last twelve months, the accountancy tuition market in general has faced a 20% decline in demand for accountancy training leading to smaller class sizes on courses. In 20X8 and before, AT Co suffered from an on-going problem with staff retention, which had a knock-on effect on the quality of service provided to students. Following the completion of developments that have been on-going for some time, in 20X9 the company was able to offer a far-improved service to students. The developments included:

· A new dedicated 24-hour student helpline

· An interactive website providing instant support to students

· A new training programme for staff

· An electronic student enrolment system

· An electronic marking system for the marking of students' progress tests. The costs of marking electronically were expected to be $4m less in 20X9 than marking on paper. Marking expenditure is always included in cost of sales

Extracts from the management accounts for 20X8 and 20X9 are shown below:

	20X8		20X9	
	$000	$000	$000	$000
Revenue		72,025		66,028
Cost of sales		(52,078)		(42,056)
Gross profit		19,947		23,972
Indirect expenses:				
Marketing	3,291		4,678	
Property	6,702		6,690	
Staff training	1,287		3,396	
Interactive website running costs			3,270	
Student helpline running costs	-		2,872	
Enrolment costs	5,032		960	
Total indirect expenses		(16,312)		(21,866)
Net operating profit		3,635		2,106

On 1 December 20X8, management asked all "freelance lecturers" to reduce their fees by at least 10% with immediate effect ("freelance lecturers" are not employees of the company but are used to teach students when there are not enough of AT Co's own lecturers to meet tuition needs). All employees were also told that they would not receive a pay rise for at least one year. Total lecture staff costs (including freelance lecturers) were $41.663m in 20X8 and were included in cost of sales, as is always the case. Freelance lecturer costs represented 35% of these total lecture staff costs. In 20X9 freelance lecture costs were $12.394m. No reduction was made to course prices in the year and the mix of trainees studying for the different qualifications remained the same. The same type and number of courses were run in both 20X8 and 20X9 and the percentage of these courses that was run by freelance lecturers as opposed to

employed staff also remained the same. Due to the nature of the business, non-financial performance indicators are also used to assess performance, as detailed below:

	20X8	20X9
Percentage of students transferring to AT Co from another training provider	8%	20%
Number of late enrolments due to staff error	297	106
Percentage of students passing exams first time	48%	66%
Labour turnover	32%	10%
Number of student complaints	315	84
Average number of employee	1,080	1,081

Required: Assess the performance of the business in 20X9, using the following headings:

· Revenue

· Cost of sales

· Gross profit

· Indirect expenses

· Net operating profit

Note: Up to 7 marks are available for calculations.

Answer:

Revenue (WORKING 1)

Revenue has decreased from $72.025m in 20X8 to $66.028m in 20X9, a fall of 8.3%. However, this must be assessed by taking into account the change in market conditions, since there has been a 20% decline in demand for accountancy training. Given this 20% decline in the market place, AT Co's revenue would have been expected to fall to $57.62m if it had kept in line with market conditions. Comparing AT Co's actual revenue to this, its actual revenue is 14.6% higher than expected. As such, AT Co has performed fairly well, given market conditions. It can also be seen from the non-financial performance indicators that 20% of students in 20X9 had transferred over from alternative training providers. This may be because they have heard about the improved service that AT Co is providing. Hence, they are most likely the reason for the increased market share that AT Co has managed to secure in 20X9.

Cost of sales (WORKING 2)

Cost of sales has decreased by 19.2% in 20X9. This must be considered in relation to the decrease in revenue as well. In 20X8, cost of sales represented 72.3% of revenue and in 20X9 this figure was 63.7%. This is quite a substantial decrease. The reasons for it can be ascertained by, firstly, looking at the freelance staff costs. In 20X8, the freelance costs were $14.582m. Given that a minimum 10% reduction in fees had been requested to freelance lecturers and the number of courses run by them was the same year on year, the expected cost for freelance lecturers in 20X9 was $13.124m. The actual costs were $12.394m. These show that a fee reduction of 15% was actually achieved. This can be seen as a successful reduction in costs. The expected cost of sales for 20X9 before any cost cuts, was $47.738m assuming a consistent ratio of cost of sales to revenue. The actual cost of sales was only $42.056m, $5.682m lower. Since freelance lecturer costs fell by $2.188m, this means that other costs of sale fell by the remaining

$3.494m. Staff costs are a substantial amount of this balance but since there was a pay freeze and the average number of employees hardly changed from year to year, the decreased costs are unlikely to be related to staff costs. The decrease is therefore most probably attributable to the introduction of online marking. AT Co expected the online marking system to cut costs by $4m, but it is probable that the online marking did not save as much as possible, hence the $3.494m fall. Alternatively, the saved marking costs may have been partially counteracted by an increase in some other cost included in cost of sales.

Gross profit (WORKING 3)
As a result of the above, the gross profit margin has increased in 20X9 from 27.7% to 36.3%. This is a big increase and reflects very well on management.

Indirect expenses (WORKING 4)
· Marketing costs: These have increased by 42.1% in 20X9. Although this is quite significant, given all the improvements that AT Co has made to the service it is providing, it is very important that potential students are made aware of exactly what the company now offers. The increase in marketing costs has been rewarded with higher student numbers relative to the competition in 20X9 and these will hopefully continue increasing next year, since many of the benefits of marketing won't be felt until the next year anyway. The increase should therefore be viewed as essential expenditure rather than a cost that needs to be reduced.
· Property costs: These have largely stayed the same in both years.
· Staff training: These costs have increased dramatically by over $2m, a 163.9% increase. However, AT Co had identified that it had a problem with staff retention, which was leading to a lower quality service being provided to students. Also, due to the introduction of the interactive website, the electronic enrolment system and the online marking system, staff would have needed training on these areas. If AT Co had not spent this money on essential training, the quality of service would have deteriorated further and more staff would have left as they became increasingly dissatisfied with their jobs. Again, therefore, this should be seen as essential expenditure.
· Given that the number of student complaints has fallen dramatically in 20X9 to 84 from 315, the staff training appears to have improved the quality of service being provided to students.
· Interactive website and the student helpline: These costs are all new this year and result from an attempt to improve the quality of service being provided and, presumably, improve pass rates. Therefore, given the increase in the pass rate for first time passes from 48% to 66% it can be said that these developments have probably contributed to this. Also, they have probably played a part in attracting new students, hence improving revenue.
· Enrolment costs have fallen dramatically by 80.9%. This huge reduction is a result of the new electronic system being introduced. This system can certainly be seen as a success, as not only has it dramatically reduced costs but it has also reduced the number of late enrolments from 297 to 106.

Net operating profit (WORKING 5)

This has fallen from $3.635m to $2.106m. On the face of it, this looks disappointing but it has to be remembered that AT Co has been operating in a difficult market in 20X9. It could easily have been looking at a large loss. Going forward, staff training costs will hopefully decrease. Also, market share may increase further as word of mouth spreads about improved results and service at AT Co. This may, in turn, lead to a need for less advertising and therefore lower marketing costs. It is also apparent that AT Co has provided the student website free of charge when it should have been charging a fee for this. The costs of running it are too high for the service to be provided free of charge and this has had a negative impact on net operating profit. Tutorial note: Candidates are not expected to write such a detailed answer in the time available.

WORKINGS (All amounts are in $000)
WORKING 1. Revenue
Decrease in revenue = ($72,025 - $66,028)/$72,025 = 8.3%
Expected 20X9 revenue given 20% decline in market = $72,025 * 80% = $57,620
Actual 20X9 revenue CF expected = ($66,028 - $57,620)/$57,620 = 14.6% higher.

WORKING 2. Cost of sales
Decrease in cost of sales = ($42,056 - $52,078)/$52,078 = 19.2%
Cost of sales as percentage of revenue: 20X8 = $52,078/$72,025 = 72.3%
20X9 = $42,056/$66,028 = 63.7%
Freelance staff costs: in 20X8 = $41,663 * 35% = $14,582
Expected cost for 20X9 = $14,582 * 90% = $13,124
Actual 20X9 cost = $12,394
$12,394 - $14,582 = $2,188 decrease
$2,188/$14,582 = 15% decrease in freelancer costs.
Expected cost of sales for 20X9, before costs cuts, = $66,028 * 72.3% = $47,738.
Actual cost of sales = $42,056.
Difference = $5,682, of which $2,188 relates to freelancer savings and $3,494 to other savings.

WORKING 3. Gross profit margin
20X8: $19,947/$72,025 = 27.7%
20X9: $23,972/$66,028 = 36.3%

WORKING 4. Indirect costs
Increase in marketing costs = ($4,678 - $3,291)/$3,291 = 42.1%
Increase in staff training costs = ($3,396 - $1,287)
Decrease in enrolment costs = ($960 - $5,032)/$5,032 = 80.9%

WORKING 5. Net operating profit Decreased from $3,635 to $2,106. This is fall of 1,529/3,632 = 42.1%

Case: Evaluating the Impact of Advertising and Incentives on Web Co's Performance

Web Co is an online retailer of fashion goods and uses a range of performance indicators to measure the performance of the business. The company's management have been increasingly concerned about the lack of sales growth over the last year and, in an attempt to resolve this, made the following changes right at the start of quarter 2:

Advertising: Web Co placed an advert on the webpage of a well-known online fashion magazine at a cost of $200,000. This had a direct link from the magazine's website to Web Co's online store.

Search engine: Web Co also engaged the services of a website consultant to ensure that, when certain key words are input by potential customers onto key search engines, Web Co's website is listed on the first page of results. This makes it more likely that a customer will visit a company's website. The consultant's fee was $20,000.

The following incentives were also offered to customers:

Incentive 1: A free "Fast Track" delivery service, guaranteeing delivery within two working days, for all continuing customers who subscribe to Web Co's online subscription newsletter. Subscribers are thought by Web Co to become customers who place further orders.

Incentive 2: A $10 discount to all customers spending $100 or more at any one time.

The results for the last two quarters are shown below, quarter 2 being the most recent one. The results for quarter 1 reflect the period before the changes and incentives detailed above took place and are similar to the results of other quarters in the preceding year.

	Quarter 1	Quarter 2
Total revenue	$2,200,000	$2,750,000
Net profit margin	25%	16.7%
Total number of orders from customers	40,636	49,600
Total number of visits to website	101,589	141,714
Conversion rate - visitor to purchaser	40%	35%
The percentage of total visitors accessing website through magazine link	0	19.9%
Number of customers spending more than $100 per visit	4,650	6,390
Number of subscribers to online newsletter	4,600	11,900

Required: Assess the performance of the business in Quarter 2 in relation to the changes and incentives that the company introduced at the beginning of this quarter. State clearly where any further information might be necessary, concluding as to whether the changes and incentives have been effective.

Answer:

Web has made two changes and introduced two incentives in an attempt to increase sales. Using the performance indicators provided, it is possible to assess whether these attempts have been successful.

Total revenue

This has increased from $2.2m to $2.75m, an increase of 25% (WORKING 1). This is a substantial increase, especially considering the fact that a $10 discount has been given to all customers spending $100 or more at any one time. However, because a number of changes and incentives have been introduced, it is not possible to assess how effective each of the individual

changes/incentives has been in increasing revenue without considering the other performance indicators.

Net profit margin (NPM) This has decreased from 25% to 16.7%. In $ terms this means that net profit was $550,000 in quarter 1 and $459,250 in quarter 2 (WORKING 2). If the 25% NPM had been maintained in quarter 2, the net profit would have been $687,500 for quarter 2. It is therefore $228,250 lower than it would have been. This is mainly because of the $200,000 paid out for advertising and the $20,000 paid to the consultant for the search engine work. The remaining $8,250 difference could be a result of the cost of the $10 discounts given to customers who spent more than $100, depending on how these are accounted for. Alternatively, it could be due to the costs of providing the Fast Track service. More information would be required on how the discounts are accounted for (whether they are netted off against revenue or included in cost of sales) and also on the cost of providing the Fast Track service. Although it is not clear how long the advert is going to run for in the fashion magazine, $200,000 does seem to be a very large cost. This expense is largely responsible for the fall in NPM. This is discussed further under "number of visits to website".

Number of visits to website

These have increased dramatically from 101,589 to 141,714, an increase of 40,125 visits (39.5% WORKING 3). The reason for this is a combination of visitors coming through the fashion magazine's website (28,201 visitors W5), with the remainder of the increase most probably being due to the search engine consultants' work. Both of these changes can therefore be said to have been effective in improving the number of people who at least visit Web's online store. However, given that the search engine consultant only charged a fee of $20,000 compared to the $200,000 paid for magazine advertising, in relative terms, the consultant's work provided value for money. Web's sales are not really high enough to withstand a hit of $200,000 against profit, hence the fall in NPM.

Number of orders/customers spending more than $100

The number of orders received from customers has increased from 40,636 to 49,600, an increase of 22% (WORKING 4). This shows that, although most of the 25% revenue increase is due to a higher number of orders, 3% of it is due to orders of a higher purchase value. This is also reflected in the fact that the number of customers spending more than $100 per visit has increased from 4,650 to 6,390, an increase of 1,740 orders. So, for example, if each of these 1,740 customers spent exactly $100 rather than the $50 they might normally spend, it would easily explain the 3% increase in sales that is not due to increased order numbers. It depends partly on how the sales discounts of $10 each are accounted for. As stated above, further information is required on these. An increase in the number of orders would also be expected, given that the number of visitors to the site has increased substantially. This leads on to the next point.

Conversion rate - visitor to purchaser

The conversion rate of visitors to purchasers has gone down from 40% to 35%. This is not surprising, given the advertising on the fashion magazine's website. Readers of the magazine may well have clicked on the link out of curiosity and may come back and purchase something at a later date. It may be useful to have a breakdown of the visitor to purchaser rate, showing one statistic for visitors who have come from the online magazine and one for those who have not. This would help clarify the position.

Subscribers to online newsletter

These have increased by a massive 159%. It is not clear what impact this has had on the business as we do not know whether the level of repeat customers has increased. This information is needed. Surprisingly, it seems that there has not been an increased cost associated with providing Fast Track delivery, as the whole fall in net profit has been accounted for, so one can only assume that Web managed to offer this service without incurring any additional cost itself.

Conclusion

All of the measures seem to have increased sales or, in the case of Incentive 1, increased subscribers. More information is needed in relation to a couple of areas, as noted above. The business has therefore been responsive to changes made and incentives implemented but the cost of the advertising was so high that, overall, profits have declined substantially. This expenditure seems too high in relation to the corresponding increase in sales volumes.

WORKINGS

WORKING 1. Increase in revenue ($2.75m - $2.2m)/$2.2m = 25% increase.

WORKING 2. NPM: 25% * $2.2m = $550,000 profit in quarter 1. 16.7% * $2.75m = $459,250 profit in quarter 2.

WORKING 3. No. of visits to website: increase = (141,714 - 101,589)/101,589 = 39.5%.

WORKING 4. Increase in orders = (49,600 - 40,636)/40,636 = 22%.

WORKING 5. Customers accessing website through magazine line = 141,714 * 19.9% = 28,201.

WORKING 6. Increase in subscribers to newsletter = (11,900 - 4,600)/4,600 = 159%.

Case: Analysis of Best Night Co's Financial and Non-Financial Performance for Year Ended 30 June 20X7

Best Night Co operates a chain of 30 hotels across the country of Essland. It prides itself on the comfort of the rooms in its hotels and the quality of service it offers to guests. The majority of Best Night Co's hotels are located in major cities and have previously been successful in attracting business customers. In recent years, however, the number of business customers has started to decline as a result of tough economic conditions in Essland. Best Night Co's policy is to set standard prices for the rooms in each of its hotels, with that price reflecting the hotel's location and taking account of competitors' prices. However, hotel managers have the authority to offer discounts to regular customers, and to reduce prices when occupancy rates in their hotel are expected to be low. The average standard price per night, across all the hotels, was $140 in 20X7, compared to $135 in 20X6. In addition to room bookings, the hotels also generate revenue from the additional services available to customers, such as restaurants and bars.

Summary from Best Night Co's management accounts

	Year ended 30 June 20X7	Year ended 30 June 20X6
$000	$000	
Revenue - rooms at standard price per night	111,890	104,976
Room discounts or rate reductions given	(16,783)	(11,540)
Other revenue: food, drink	24,270	23,185

Total revenue	119,377	116,621	
Operating costs	(95,462)	(92,379)	
Operating profit	23,915	24,242	

Other performance information

	Year ended	Year ended
30 June 20X7	30 June 20X6
Capital employed (Note 1)	$39.5m	$39.1m
Average occupancy rates (Note 2)	74%	72%
Average customer satisfaction score (Note 3)	4.2	4.5

Note 1: Capital employed is calculated using the depreciated cost of non-current assets at all Best Night Co's hotels.
Note 2: Occupancy rates for the year ended 30 June 20X7 were budgeted to be 72%.
Note 3: Customer satisfaction scores are graded on a scale of 1-5 where 5 represents Excellent. On average, in any given town in Essland, the top 10% of hotels earn a score of 4.5 or above

Two themes are becoming increasingly frequent in the comments Best Night Co's customers make alongside the scores:
1. Repeat customers have said that the standard of service in recent visits has not been as good as in previous visits.
2. The rooms need redecorating, and the fixtures and fittings need replacing. For example, the beds need new mattresses to improve the level of comfort they provide.
Best Night Co had planned a two-year refurbishment programme beginning in 20X7 of all the rooms in each hotel. However, this programme has been put on hold, due to the current economic conditions, and in order to reduce expenditure.
Required: Using the information provided, discuss Best Night Co's financial and non-financial performance for the year ended 30 June 20X7.
Note: There are 5 marks available for calculations and 15 marks available for discussion.

Answer:
Performance for year ended 30 June 20X7
Gross room revenue - Best Night Co's gross room revenue based on standard room rates has increased by 6.6% in 20X7, which reflects the higher occupancy rates (74% v 72%) and the increase in standard room rates ($140 v $135 per night).
However, this gives a rather misleading impression of how well the hotels have performed in the year to 20X7.
Revenue after discounts: Revenue from room sales, adjusted for discounts or rate reductions offered, has actually only increased 1.8%, and that reflects the significant 45% increase in discounts or reductions offered:

	20X7	20X6	% change
	$000	$000	
Standard revenue	111,890	104,976	6.6%
Discounts/reductions	16,783	11,540	45.4%
Room revenue net of discounts	95,107	93,436	1.8%

Faced with the declining number of business customers, and consequently the prospect of lower occupancy rates, managers may have decided to offer lower room rates to try to retain as many of their existing business customers as possible, or to try to attract additional leisure customers. Although occupancy rates increased by 2.8% (from 72% to 74% which now exceeds the budgeted level), revenue, net of discounts, only increased by 1.8%. This means that revenue per room per night after discounts in 20X7 was lower than in 20X6, despite the standard rate being higher ($140 v $135).

In the context of tough market conditions, the decision to increase the standard room rate for 20X7 appears rather optimistic. Although the hotel managers have managed to achieve occupancy rates higher than budget, they have only managed to do so by reducing room rates. Additional revenue: One of the potential benefits of increased occupancy rates, even if guests are paying less per room per night, is that they will generate additional revenue from food and drink sales. This appears to be the case because additional revenues have increased by approximately 5%.

Total revenue: In total, revenue (net of discounts) has increased 2.4% in 20X7 v 20X6. Given the tough competitive environment, Best Night Co could view any increase in revenues as positive. Moreover, provided the revenue achieved from selling the room is greater than the variable cost of providing it, increasing occupancy levels should increase the hotels' contribution to profit.

Operating profit: However, despite the increase in revenue, operating profits have fallen by $0.3m (1.3%) between 20X7 and 20X6, due to a sizeable increase in operating costs.

There is no detail about Best Night Co's operating costs, for example, the split between fixed and variable costs. However, in an increasingly competitive market, cost control is likely to be very important. As such, the $3m (3.3%) increase in operating costs between 20X6 and 20X7 is potentially a cause for concern, and the reasons for the increase should be investigated further. However, when looking to reduce costs, it will be very important to do so in a way which does not compromise customer satisfaction. More generally, Best Night Co needs to avoid cutting expenditure in areas which will have a detrimental effect on customer satisfaction ratings, for example, not replacing mattresses even though they are becoming uncomfortable to sleep on.

Operating profit margin: The increase in costs has also led to a fall in operating profit margin from 20.8% to 20.0%. It is perhaps more instructive to look at the margin based on standard room rates per night, reflecting the effect of the discounts offered as well as the increase in costs. On this basis, the margin falls slightly more, from 18.9% to 17.6%.

| | 20X7 | 20×6 |
$000	$000	
Total revenue	119,377	116,621
Discounts offered	16,783	11,430
Gross revenue	136,160	128,051
Operating profit	23,915	4,242
Operating profit margin	17.6%	18.9%

ROCE: This reduced profitability is also reflected in the company's return on capital employed which has fallen slightly from 62% ($24.2m/$39.1m) to 60.5% ($23.9m/$39.5m). This suggests that the value which Best Night Co is generating from its assets is falling. The decline in ROCE could be a particular concern given the relative lack of capital investment in the hotels recently.

Capital investment will increase the cost of Best Night Co's non-current assets, thereby reducing ROCE for any given level of profit.

Non-financial performance: customer satisfaction scores

Although the reduction in profitability should be a concern for Best Night Co, the reduction in customer satisfaction scores should potentially be seen as a greater cause for concern. The scores suggest that, in the space of one year, Best Night Co hotels have gone from being in the top 10% of hotels to only just being in the top 25%. This is a significant decline in one year, and one which Best Night Co cannot afford to continue. Best Night Co prides itself on the comfort of its rooms and the level of service it offers its guests. Both of these factors are likely to be important considerations for people when considering whether or not to stay in a Best Night Co hotel. Therefore, falling customer satisfactions levels could indicate that fewer existing customers will stay at a Best Night Co hotel in future - thereby threatening occupancy rates, and prices, in future. Moreover, the scores suggest that the decision to defer the refurbishment programme is likely to have a detrimental effect on future performance.

Case: Financial Analysis and Balanced Scorecard Evaluation for Easyair Co

Easyair Co was founded seven years ago, and is one of a growing number of low-cost airlines in the country of Shania. Summarised financial information for the most recent financial year is provided below:

	$m
Operating profit	700
Interest payable	(100)
Profit before tax	600
Tax	(200)
Profit after tax	400
Statement of financial position extracts	
Non-current liabilities	300
Share capital	100
Retained earnings	2,000

Question 1. What was Easyair's return on capital employed for the year (to the nearest %)?
Answer:
The correct answer is 29%.
WORKING
ROCE = Operating profit/(Equity + long term liabilities) * 100 = 700/2,400 * 100 = 29%

Question 2. Easyair's asset turnover ratio has been calculated as 1.9 times.
What was Easyair's operating profit margin (to the nearest %)
Answer:
The correct answer is 15%
Asset turnover = Revenue/(Equity +long term liabilities) = 1.9 times
Therefore, revenue = 1.9 * 2,400 = 4,560

Operating profit margin = Operating profit/Revenue * 100 = 700/4,560 * 100 = 15.35%

Question 3. Easyair Co had a cash balance of $100m at the end of the year. The finance director believes that this should have been used to repay some of the non-current liabilities on the last day of the year. However, this was not done, and the financial statements above reflect the fact that the liability was not repaid. What effect would repaying the non-current liabilities on the last day of the financial year have had on the following financial ratios?
INCREASE DECREASE NO EFFECT: Return on capital employed Return on equity
INCREASE DECREASE NO EFFECT: Return on equity

Answer:
| Return on capital employed | INCREASE | |
| Return on equity | | NO EFFECT |
Tutorial notes:
1. Return on equity = Profit before (or after) tax/Equity
If the liabilities were repaid on the last day of the year, there would be no effect on profit before or after tax as the interest expense would still be due in respect of the year.
Repaying the liability would reduce cash (an asset) and reduce a liability by the same amount, but would have no impact on equity Therefore, no impact on return on equity.
2. ROCE = Operating profit /(Equity + long-term liabilities)
Repaying the non-current (i.e. long-term) liabilities would reduce capital employed but would not affect profit. The ratio would therefore increase.

Question 4.
Easyair Co is considering introducing the "balanced scorecard" to allow the airline to monitor performance effectively. Which THREE of the following are advantages of using the balanced scorecard for monitoring performance? A. It aims to measure a wider range of aspects of performance rather than just focusing on financial aspects B. Performance measures are linked to objectives which are based on the organisation's strategy C. If focuses management's attention on value for money objectives D. It measures the organisation's performance from the perspective of a wide range of stakeholders E. It contains a small number of key performance indicators, ensuring than senior management focus on the important areas of the business F. It prevents the manipulation of data by managers
Answer:
The correct answer is A, B and E.
Tutorial note: One of the criticisms on the balances scorecard is that it only considers the interests of two stakeholder groups - shareholders and customers. The interests of other stakeholders such as employees and suppliers are largely ignored.

Question 5. Which FOUR of the following are perspectives of the balanced scorecard? A. Financial B. Competitiveness C. Customer D. Resource utilisation E. Internal business processes F. Flexibility G. Quality H. Innovation and learning
Answer:
The correct answer is A, C, E and H.

Case: Performance Evaluation of The People's Bank Using the Balanced Scorecard Approach

The People's Bank is a bank based in the country of Nawkrei. It has a total of 65 branches across the country and also offers online banking (access to services via computer) and telephone banking (access to customer service agents over the telephone) to its customers. Recently, The People's Bank also began offering its customers a range of mobile banking services, which can be accessed from customers' smartphones and tablet computers. Its customer-base is made up of both private individuals and business customers. The range of services it offers includes:

Current accounts
Savings accounts
Credit cards
Business and personal loans
Mortgages (loans for property purchases)

The People's Bank's vision is to be "the bank that gives back to its customers" and their purpose is "to help the people and businesses of Nawkrei to live better lives and achieve their ambitions". In order to achieve this, the bank's values are stated as:

1. Putting customers' needs first, which involves anticipating and understanding customers' needs and making products and services accessible to as many customers as possible. The People' Bank has recently invested heavily in IT security to prevent fraud and also invested to make more services accessible to disabled and visually impaired customers

2. Making business simple, which involves identifying opportunities to simplify activities and communicating clearly and openly

3. Making a difference to the communities they serve, which involves primarily helping the disadvantaged and new homeowners but also supporting small and medium-sized businesses (SMEs) and acting fairly and responsibly at all times

Performance measure

Performance measure	20X6 Actual	20X6 Target
Financial perspective		
Return on capital employed (ROCE)	11%	12%
Interest income	$7.5m	$7m
Net interest margin (margin achieved on interest income)	2.4%	2.5%
Amount of new lending to SMEs	$135m	$150m
Customer perspective		
Number of first-time homebuyers given a mortgage by The People's Bank	86,000	80,000
Number of complaints (per 1,000 customers)	1.5	2
Number of talking cashpoints installed for the visually impaired	120	100
Number of wheelchair ramps installed in branches	55	50
Internal processes		
Number of business processes within The People's Bank		

re-engineered and simplified	110	100
Number of new services made available through mobile banking	2	5
Incidences of fraud on customers' accounts or credit cards		
(per 1,000 customers)	3	10
Total carbon dioxide emissions (tonnes)	430.000	400.000
Learning and growth		
Number of colleagues trained to provide advice to SMEs	1,300	1,500
Number of hours (paid for by The People's Bank) used		
to support community projects	1,020,000	1,000,000
Number of trainee positions taken up by candidates		
from Nawkrei's most disadvantaged areas	1,990	2,000
Number of community organisations supported (either		
through funding or by volunteers from The People's Bank)	7,250	7,000

Required: (a) Explain why the balanced scorecard approach to performance measurement is more useful to measure performance for The People's Bank than a traditional approach using solely financial performance measures. (b) Using all of the information provided, including The People's Bank's vision and values, discuss the performance of The People's Bank in 20X6. Note: Use each of the four headings of the balanced scorecard to structure your discussion.

Answer:

(a) Balanced scorecard approach

The balanced scorecard approach looks not only at the financial performance but also non-financial performance. In order to maintain a competitive edge, organisations have to be very aware of the changing needs of their customers. In the case of The People's Bank, this has involved identifying specific categories of customers which have particular needs, like SMEs in a commercial context, or like the disabled or visually impaired in a non-commercial context. This permits these needs to be addressed. The People's Bank has a vision and strategy which goes far beyond just making money. They want to help the community and disadvantaged people and give something back to customers also. Hence, by using the balanced scorecard, performance measures which address whether the Bank is being successful in pursuing their vision can be incorporated. In addition, from a purely business perspective, if employees and customers are valued and internal processes are efficient, an organisation should have more chance of achieving long-term success anyway. So, even putting aside the social objectives The People's Bank has, the balanced scorecard can be useful to The People's Bank to measure these other aspects of future success too.

(b) Performance of the bank using the balanced scorecard headings

Financial perspective

The People's Bank has had a year of mixed success when looking at the extent to which it has met its financial targets. Its return on capital employed (ROCE) shows how efficiently it has used its assets to generate profit for the business. The target for the year was 12% but it has only achieved an 11% return. The People's Bank's interest income, however, was in fact $0.5m higher than its target, which is good. This may have been achieved by offering slightly better interest rates to customers than competing banks, as the interest margin The People's Bank achieved is slightly lower than target. The most likely reason for the under target ROCE is therefore

probably the investment which The People's Bank has made in IT security and facilities for the disabled and visually impaired. Whilst this ma have reduced ROCE, this investment is essentially a good idea as it helps The People's Bank pursue its vision and will keep customers happy. It will also, in the case of the IT security investment, prevent the bank and its customers from losing money from fraud in the future. The other performance measure, the amount of new lending to SMEs, is a little disappointing, given The People's Bank's stated value of making a difference to communities. The failure to meet this target may well be linked to having an insufficient number of staff trained to provide advice to SMEs and, consequently, fewer of them may have been successful in securing additional finance.

Customer perspective

With regard to its customers, The People's Bank has performed well in the year. It has exceeded its target to provide mortgages to new homeowners by 6,000. This is helping The People's Bank pursue its vision of helping new homeowners. It has also managed to beat the target for customer complaints such that there are only 1.5 complaints for every 1,000 customers, well below the target of 2. This may be as a result of improved processes at the bank or improved security. It is not clear what the precise reason is but it is definitely good for The People's Bank's reputation. The bank has also exceeded both of its targets to help the disabled and visually impaired, which is good for its reputation and its stated value of making services more accessible.

Internal processes

The number of processes simplified within the bank has exceeded the target, which is good, and the success of which may well be reflected in the lower customer complaints levels. Similarly, the investment to improve IT systems has been a success, with only three incidences of fraud per 1,000 customers compared to the target of 10. However, perhaps because of the focus on this part of the business, only two new services have been made available via mobile banking, instead of the target of five, which is disappointing. Similarly, it is possible that some of the new systems have prevented the business from keeping its CO_2 emissions to their target level.

Learning and growth

The People's Bank has succeeded in helping the community, exceeding both of its targets relating to hours of paid volunteer work and number of community organisations supported by volunteers or funding. These additional costs could have contributed to the bank not quite meeting its target for ROCE. However, the bank has not quite met its targets for helping small businesses and helping the disadvantaged. As mentioned earlier, the shortfall in training of employees to give advice to SMEs may have contributed to The People's Bank's failure to meet its target lending to SMEs. As regards the percentage of trainee positions, the target was only just missed and this may well have been because the number of candidates applying from these areas was not as high as planned and the bank has no control over this. Overall, the bank has had a fairly successful year, meeting many of its targets. However, it still has some work to do in order to meet its stated values and continue to pursue its vision.

Case: Performance Analysis of The One Stop Car Co Using Fitzgerald and Moon's Building Block Model

The One Stop Car Co (OSC Co) offers a range of services for car owners at its 55 service centres across the country. The car maintenance business is extremely competitive in all regions across the country. Each service centre operates autonomously and managers are able to choose how to package up the services they offer. OSC Co's aim is to "make the task of car maintenance a pleasure and not a chore". Its national website states the following:

· Range of service packs available, including express service and full valet

· 'We work whilst you wait' service, with average wait times of only two hours

· Watch our friendly, experienced mechanics producing high quality work

· Freshly made tea and coffee and free internet in our comfortable lounges

· Monthly free prize draw for all customers completing an online feedback form

Customers initially access the national website, but depending on their location, they are automatically redirected to the website of their nearest service centre so that they can view the offers available at that centre. All bookings are made through the OSC website. Results for one of the service centres, the Midlands Service Centre (MSC), for the year which has just ended are given below. The column headed OSC shows the average figures for all of OSC Co's 55 service centres:

	Notes	MSC	OSC Average
Sales revenue ($)		760,500	890,365
Gross profit ($)		304,200	328,146
Number of mechanics: senior	1	7	7.8
Number of mechanics: junior	2	5	5.2
Number of new service packs developed	3	3	2
Number of website hits		14,000	18,260
Total number of jobs booked and completed		9,506	11,870
Number of jobs from repeat customers only		1,500	1,660
Total time spent completing jobs (hours)		23,100	24,800
Percentage of customer feedback forms showing score of 9 or 10	4	80%	70%

Notes:

1. Mechanics are classified as senior if they have been qualified for more than five years.

2. Junior mechanics includes both trainee mechanics who are unqualified and mechanics who have been qualified for less than five years.

3. The MSC introduced three new service packs during the year:

· free valets for orders over $100;

· a safety check costing only $20, instead of the usual $40, for all customers booking a full service;

· a $10 air conditioning efficiency check, which usually costs $20, for all customers booking an oil change.

These three new service packs produced revenues of $66,000, $58,000 and $54,000 respectively. Two comparable new service packs developed by other centres produced revenues of $44,000 and $42,000.

4. The online feedback form asks customers to rate the centre from 1 to 10, with 10 being the best. The CEO of OSC Co has recently attended a business seminar and heard about Fitzgerald

and Moon's building block model of performance management. The CEO is interested in how the dimensions block could be applied at OSC Co. The dimensions of performance identified in the model are: competitiveness, financial performance, quality of service, flexibility, resource utilisation and innovation.

Required: (a) For each of the dimensions of the building block model, calculate one performance indicator for MSC and one for the OSC average using the data available. Briefly justify your choice of performance indicator and discuss MSC's performance relative to the other OSC service centres. (b) Explain how the standards and rewards blocks support the dimensions block in Fitzgerald and Moon's building block model.

Answer:

(a) Dimensions of the building block model

Competitiveness

	MSC	OSC Average
Percentage of website hits converted into orders		
(9,506/14,000) * 100	67.9%	
(11,870/18,260) * 100		65%

This ratio indicates whether MSC's services are attractive compared to its competitors, which is important if it is going to survive in such a competitive market. It has performed substantially better than other OSC service centres on average, having converted 67.9% of website hits into jobs, compared to the 65% converted by other service centres. This is a good result.

Financial performance

	MSC	OSC Average
Gross profit margin		
($304,200/$760,500) * 100	40%	
($328,146/$890,365) * 100		36.9%

Gross profit margin is the preferred measure for financial performance from the data presented. It shows the percentage of revenue which exceeds the cost of goods sold. MSC's gross profit margin is almost 3 percentage points higher than the average, which is a good result. This could be partly because they did relatively well on their new service pack sales (note 4) but it is also likely to be because their ratio of senior mechanics to junior mechanics is lower than the average, and junior mechanics will invariably be paid less than senior ones.

Quality of service

	MSC	OSC Average
Gross profit margin		
(1,500/9,506) * 100	15.78%	
(1,660/11,870) * 100		13.98%

Quality is a key element of MSC's service to customers and if it is poor, customers will not return. Again, MSC has outperformed the other service centres on average by 1.8 percentage points. This could be because it has a higher ratio of senior mechanics to junior mechanics than other service centres, so the quality of work is probably better. hence the higher level of repeat customers.

Flexibility

| | MSC | OSC Average |
| Time taken per job | | |

| (23,100/9,506) | 2.43 hours | |
| (24,800/11,870) | | 2.09 hours |

The time taken to complete each job is important as many customers will use MSC because they can sit and wait for the work to be done, rather than having to hire a rental car for the day, for example. The comparison shows that MSC takes longer to complete a job than the OSC average. This is not really a good thing and is probably because they have slightly less experienced staff on the whole; but it could also be that they do a more thorough job than other service centres. Given the higher level of return customers than the average and the grading of 9 or 10 by customers (10 percentage points higher than the average), this is presumably not viewed negatively by customers.

Resource utilisation

	MSC	OSC Average
Sales per mechanic		
$760,600/12	$63,375	
$890,365/13		$68,490

The key resource in a service company is its staff and so these indicators measure how this resource is being utilised. MSC's utilisation of its staff is lower than that of the other service centres by $5,115 per mechanic. This clearly ties in with the average time to complete a job, which is longer at MSC than other service centres. However, given that they use slightly less experienced staff on average than other centres and their gross margin is higher than average, this should not be viewed too negatively.

Innovation

	MSC	OSC Average
Percentage revenue generated from new service packs		
[($66,000 + $58,000 + $54,000)/$760,500]	40%	23.4%
[($44,000 + $42,000)/$890,365]		9.66%

MSC wants to offer a wide variety of service packs to its customers and needs to be innovative in packaging services up. The 23.4% indicates that MSC is indeed innovative in their approach to their customers' needs, offering an innovative mix of services. MSC has really outperformed other service centres on this front, generating a far larger part of its revenue by the introduction of new service packs, which must have attracted customers. This is a really strong performance.

(b) How the standards and rewards blocks support the dimensions block

The standards block sets the target for the performance indicators chosen for each of the dimensions. The targets must meet three criteria - they must be achievable, fair and encourage employees to take ownership. If the targets set do not meet these criteria, the performance of the organisation could suffer. The rewards block ensures that employees are motivated to achieve the standards. It also considers the properties o good reward schemes which are that they should be clear, motivating and based on controllable factors. If standards and rewards are set appropriately, the staff will be engaged and motivated and it is then more likely that the goals, i.e. dimensions, of the organisation will be achieved.

Case: Assessing Robinholt University's 20X6 Performance Against Strategic Aims

Robinholt University is one of the largest and most popular universities in the country of Richpori. It had 27,000 registered students in 20X6, whereas in 20X5, the number of registered students was only 24,000. Robinholt University managed to increase its student numbers in 20X6 by making the entry requirements for students slightly lower than in previous years. All courses at the university last for three years Robinholt University has five strategic aims:

1. To provide education which promotes intellectual initiative and produces confident and ambitious graduates who have reached the highest academic standards to prepare them for success in life and the workplace

2. To provide an organised, efficient learning environment with access to cutting edge technology and facilities

3. To be a leader in sustainable business practices which protect the environment and support local people

4. To provide attractive, innovative conference and event facilities, attracting clients both nationally and internationally

5. To be recognised both nationally and internationally for the scope and relevance of their research

Extracts from the university's income statement for the last two years are as follows:

	20X6	20X5
	$m	$m
Income		
Tuition fees	148.0	135.6
Research grants	3.5	4.5
Conferences and other events	18.0	16.0
Total income	169.5	156.1
Expenditure		
Academic staff costs	80.8	76.2
Administration staff costs	50.4	48.0
Premises, facilities and technology costs	7.6	8.4
Event and conference costs	8.3	8.0
Research grants	3.1	4.0
Sustainability and community assistance	1.2	2.4
Total expenditure	151.4	147.0
Surplus	18.1	9.1

Every year final year students complete an external survey run by the National Organisation for Students. In this, they have to agree or disagree with statements made. Extracts from this for the last two years are shown below (the percentage rates show the number of students who agreed with the statements made):

Teaching	20X6	20X5
The course is intellectually stimulating and quality of teaching high	83%	86%
Academic support		
2) I have received good advice and support with my studies		
from academic staff	82%	86%
Organisation and management

3) The course is well organised and its administration is good	81%	90%
Learning resources			
4) The standard of rooms, facilities and equipment is good	83%	92%
Personal development			
5) The course has helped me develop as a person	82%	80%
Overall satisfaction			
6) Overall, I am satisfied with the quality of the course	81%	83%

The overall satisfaction percentage is used by the Education Authority to set the maximum level of tuition fees that a university can charge each year and is seen as the main measure of success both internally and externally.

Other key information

	20X6	20X5
Students graduating with a First Class Honours degree		
(highest class attainable)	20%	28%
Employers happy with the graduates from Robinholt University	72%	75%
Ratio of students to staff members	40.1	35.1
Staff retention rate	75%	90%

The staff retention rate in 20X5 was consistent with previous years. Data gathered from students who graduated in 20X5 showed that 65% of students found a graduate job within one year of leaving compared to 68% of 20X4's graduates In 20X5, Robinholt University won the Green Environmental award for their campuses, which all have extensive recycling facilities. Students were also involved in a local "Grow-to-Give" food sharing project that year, which provided thousands of pounds worth of fresh produce to food banks offering food to poorer residents. Due to staff shortages, the university was not involved in this project in 20X6. The recycling bins have also been abandoned because of the cost of using them. Every year, the University Research Council issues a range of prestigious awards for contributions to research. One of Robinholt University's main competitors in the area won an award in 20X5 for their contribution to some pioneering research on genetics. Robinholt University has yet to win an award for research. However, in 20X5 it did win an Innovation award for its new innovative conference facilities which have attracted a number of new clients in the last year.

Required: Using Robinholt University's five strategic aims, assess its performance for 20X6. Note There are 4 marks available for calculations and 16 marks for discussion.

Answer:
Performance for 20X6
1. To provide education which promotes intellectual initiative and produces confident and ambitious graduates who have reached the highest academic standards to prepare them for success in life and the workplace
There are various performance indicators which can be looked at to ascertain whether RU is meeting this strategic aim. First, question 1 of the survey shows that 83% of students think that the course is intellectually stimulating and the quality of teaching is high. This has gone down by three percentage points since 20X5, which is not good. In the NOS survey, the percentage of graduates agreeing that the course has developed them as a person has increased from 80% in 20X5 to 82% in 20X6. This would indicate that RU is indeed developing confident and ambitious

graduates. However, the number of graduates achieving first class degrees in 20X6 has fallen vastly from 28% to 20%. Given that the entry requirements were only relaxed in 20X6, this should not have had any effect on results. This infers that the quality of teaching may have declined and the ratio of students to academic staff has increased from 35:1 to 40:1. It appears that, although many new students were recruited in 20X6, there were not enough new academic staff recruited to deal with the influx of students. This is shown by the 13% increase in student numbers but academic staff costs only increased by 6%. As there was presumably a pay rise in the year too, it is clear that a proportionate amount of new staff were not recruited. This failing is also reflected by the fall in the answer to question 2 from 86% to 82%, with students being less satisfied in 20X6 with the advice and support they have received. Also, the staff retention rate has gone down in 20X6, meaning that staff are less familiar with RU and therefore more likely to provide a fragmented service. However, in 20X5 74% of employers were happy with the graduates they recruited, in 20X6 this dropped to 72%. In addition, in 20X5 only 65% of students have managed to obtain graduate jobs within a year compared to previous years. Given that RU has relaxed the entry requirements for students in 20X6, this may mean that its 20X6 recruits are not as well qualified as its 20X5. This could mean that in the future the number of graduates obtaining graduate jobs within a year and the satisfaction percentages of employers could fall further. This decision has meant that there has been a 23% increase in fee income, but it compromises RU's ability to meet its first strategic aim.

2. To provide an organised, efficient learning environment with access to cutting edge technology and facilities As regards premises, the money spent on maintaining these has decreased by 10% in 20X6, despite the increased student numbers. In the NOS survey, the percentage of students satisfied with these facilities has gone down nine percentage points from 92% to 83%. This suggests that this particular strategic aim has been neglected. Students seem far less satisfied with the way that the courses are run and administered now, with a fall of nine percentage points in answers to question 4. Administration staff costs have only increased by 5% despite a 13% increase in student numbers and, presumably, a pay rise during the year. It can be inferred that staff are under increasing pressure and unable to cope with the increased numbers. This is again reflected by the fall in the staff retention rate from 90% in 20X5 to 75% in 20X6.

3. To be a leader in sustainable business practices which protect the environment and support local people As with the above strategic aim, this one also seems to have been a little forgotten in 20X6. In 20X5, RU won an environmental award for its campuses. It also took part in a food sharing initiative which helped the local community. It has now got rid of its recycling bins and ceased to be involved in the food share project. RU's spending on sustainability and community assistance has actually halved in 20X6. This decline in activity is partly attributable to staff shortages. All in all, this is not very good as RU is now failing to meet one of its main strategic aims.

4. To provide attractive, innovative conference and event facilities, attracting clients both nationally and internationally Conference and event income has gone up by 13% in 20X6, which is a good increase for RU. It has managed to control its costs relating to these events well too,

since these have only increased by 4%. RU has also won an award for its conference facility and attracted a number of new clients. RU therefore appears to be focusing well on this strategic aim.

5. To be recognised both nationally and internationally for the scope and relevance of their research Income from research at RU has actually gone down by 13% this year, as have the associated costs. Whilst a local university has won an award for their contribution to research, RU has not been successful in this regard. The suggestion is that this aim has not been focused on in 20X6.

Overall satisfaction
In addition to the above, it should be considered that the overall satisfaction percentage for students has decreased from 83% to 81%. This could have serious implications for RU as it is the main performance indicator used both internally and externally to assess how RU is performing. As well as meaning that RU may well now attract fewer students, it will also affect the fees which can be charged to students in future years. The university needs to consider how it can improve the service it is providing in order to improve overall satisfaction.

WORKINGS

	20×6	20X5	%age
	$m	$m	increase/(decrease)
Income			
Tuition fees	148	135.6	9%
Research grants	3.5	4.5	(22%)
Conferences and other events	18	16	13%
Total income	169.5	156.1	9%
Expenditure			
Academic staff costs	80.8	76.2	6%
Administration staff costs	50.4	48	5%
Premises, facilities and technology costs	7.6	8.4	(10%)
Event and conference costs	8.3	8	4%
Research grants	3.1	4	(23%)
Sustainability and community assistance	1.2	2.4	(50%)
Total expenditure	151.4	147	3%
Surplus	18.1	9.1	99%
Student numbers	27,000	24,000	13%

Case: Assessing Performance and Balanced Scorecard Implementation for Hammocks Co
Hammocks Co own and operate a small chain of four luxury vacation resorts. All four resorts are located on islands that enjoy a hot, sunny climate for nine months of the year. Each resort has gourmet restaurants, water sports and spa facilities, as well as sun terraces and pools.

Hammocks Co's management currently focus on two distinct stakeholder groups: shareholders and customers, and has two objectives:

1. to make a profit long term; and
2. to create customer loyalty.

All operational (non-management) staff at the resorts receive comprehensive training and are employed in secure, long-term contracts, which is unusual in this industry. Guests who visit the resorts pay one upfront fee and then enjoy unlimited food, drink and use of the resort facilities. When a guest arrives at a resort they are personally greeted by a concierge, offered a drink and cold towel while their luggage is transferred to their luxury room. All rooms are scrupulously clean and contain complimentary drinks, snacks, toiletries, bathrobes and slippers. The rooms are all equipped with appliances, which Hammocks Co's management believe that guests need during their stay, including satellite television, coffee-maker, refrigerator and hairdryer. If a guest requests something that is not available in the room, a call to the reception ensures that it arrives within ten minutes. An extract from Hammocks Co's management accounting data is as follows:

	Budget 20X7	Actual 20X7	Actual 20X6	Actual 20X6 Competitor 'Loungers'
Average number of guests per week	2,000	1,960	1,940	1,700
Average revenue per week ($)	4,000,000	3,920,000	3,880,000	3,060,000
Average staff costs per week:				
Maintenance ($)	480,000	480,000	470,588	455,000
Service ($)	960,000	960,000	941,176	800,000
Average weekly spend on repairs ($)	200,000	160,000	196,078	180,000
Ratio of operational staff to guests	1.50	1.53	1.50	1.30
Average rooms available per week	1,200	1,200	1,200	1,100
Market share %	29	28	29	23

The actual 20X7 figures are based on the year to date figures (ten weeks).

Rooms are designed for double occupancy.

Note: General inflation is 2% higher in 20X7 compared to 20X6.

Extracts from TripEvent, an influential online customer forum

"I love Hammocks Co; the service and attention to detail is exemplary and the resorts are always pristine. However, their competitor "Loungers" has full body dryers, ionised water taps and a range of professional haircare equipment in all their rooms."

"Our third time back to Hammocks Co this year and we continue to be amazed by the wonderful level of service. One thing though is the menus don't seem to have changed much from one visit to the next."

"We booked Hammocks Co on the spur of the moment but then found that we couldn't get a flight. We called Hammocks Co's administrative centre to change our booking to another resort where we could get a flight to and were told that it would not be a problem. However, it took two more calls and three emails to gel confirmation and then our credit card was charged twice in error. Of course it was eventually all resolved, the incorrect charge refunded, a complimentary limousine provided to and from the airport and we received the most amazing customer service at the resort, but it was frustrating at the time."

"When I made my booking I was assured that my bed would be made with the special antiallergenic bedding which I need for a good night's sleep and that my favourite blend of tea would be available. When I arrived, neither of these requirements were met. To be fair to Hammocks Co though, everything was in order two hours later when I went to bed."

Required: (a) Based on the limited information available, discuss the performance of Hammocks Co in light of its two existing objectives. (b) (i) Explain TWO advantages of Hammocks Co using the balanced scorecard approach to performance management. (ii) Suggest and justify ONE goal and TWO performance measures for each of the TWO perspectives of the balanced scorecard which are not currently addressed by Hammock Co's objectives.

Answer:

(a) Performance in light of two existing objectives

To make a profit long-term

In order to make a profit the long term revenues need to be higher than the long term costs. The weekly revenue per guest is $2,000 in the 20X7 budget, the 20X7 actual results and the 20X6 actual results which is not in line with inflation. This means that revenues per guest are falling in real terms. However all staff costs have increased by 2% which is caused by inflation. Overall this means that the profit per guest, based on the limited figures available is falling. The repair costs, allowing for inflation have been set at the same level as 20X6. The actual for 20X7 appears to be better than budget, but as repairs are likely to be incurred on an ad hoc basis, this does not necessarily indicate an improvement. The 20X6 repair costs are higher than the competitor's but this is not a like-with-like comparison because Hammocks Co has more rooms. On a repair per room basis, Hammocks Co has slightly lower cost at $163 per room compared to the competition's $164 per room. Due to the secure long-term contracts which Hammocks Co offers its staff, staff costs are fixed costs in the management accounts. This means that in order to be profitable, these costs need to be covered by the contribution per guest. Although there is not the data to calculate the contribution per guest per week, the higher level of guest occupancy level in 20X7 (both budgeted and actual) is a positive indication. Hammocks' occupancy level per room was 81% compared to the competitor's 77% (all based on double occupancy) indicating that performance is good.

To create customer loyalty

There are several indicators that Hammocks Co has created a loyal customer base:

· Compared to its main competitor, Hammocks Co receives more revenue, charges a higher price per guest per week and has better occupancy rates. This indicates good customer satisfaction.

· The ratio of staff to guest is higher than the competition; 1.5 compared to 1.3 in 20X6 (actual in 20X7 is slightly higher due to a lower occupancy rate than budgeted and the fact that staff numbers are fixed). However, this may simply be due the seasonal nature of the business.

· The comments on TripEvent are very positive about the level of service and standard of cleanliness and maintenance. However, the entire customer experience is not positive. Complaints like the administrative errors and unchanging menus could be a warning sign of possible erosion of customer loyalty.

(b) Balanced scorecard

(i) Advantages (only TWO were required)

A balanced scorecard approach to performance management is important to Hammocks Co because it will provide management with a set of information which covers all relevant areas of business performance. At present, Hammocks Co considers performance from a financial and customer perspective. These perspectives are important but they do not allow a wide enough consideration of all of the factors that should be considered in this business. Introducing the balanced scorecard will:

· Ensure that all internal systems and processes support the customer and financial objectives. For example, in decision-making there is little point in buying a new IT system that does not either improve customer experience or reduce processing costs.

· Encourage full integration between all departments. Errors in invoicing or sending specific requirements are system or internal process errors. While a customer might not choose a holiday resort for its excellent administration, they may refuse to use a company again if they receive poor service. Neglecting one aspect of the scorecard can therefore affect customer satisfaction and longer term financial performance.

· Make sure important elements are assessed and expected performance levels quantified and/or qualified. This this means that performance can be measured, explained, compared and where necessary, control action can be taken. The errors that occur at Hammocks Co are spoiling the company's reputation, but there is no evidence that any action is being taken.

(ii) Goals and measures for the two perspectives not currently addressed

Internal business process

Goal: To have an effective and efficient administration. The feedback on TripEvent indicates that the only guest complaints relate to administrative issues prior to the guest arrival and not operational issues at the resort. In fact the actions of the resort staff with the speedy resolution of bedding issues and the organising of a complimentary transfer seems to have diverted trouble. Therefore measures need to be focused on the weaker area which is the administration.

Measures:

1. Number of times that a guest request is not received at resort prior to their arrival/number of requests made. This will measure the number of times the guest experience is not seamless from booking to arrival.

2. Average number of corrections to booking due to an administrative error. This measures inefficient use of staff time and potentially increased customer frustration.

Innovation and learning

Goal: To match leading competitor's facilities The comment on TripEvent shows that even loyal customers are noticing that rivals are including more innovative facilities at their resorts. Although the true strength of Hammocks Co lies in the quality of the service it is important that the facilities' appliances and service offerings are updated to compare favourably with that of its rivals.

Measures:

1. Number of in-room appliances offered by rivals but not by Hammocks Co.

The measure will ensure that Hammocks Co consider what is included within the guest rooms by comparing to external factors.

2. Number of new items offered on the menu each month.
This should ensure that the chefs consider the latest trends in fine dining and do not ever appear stagnant from the point of view of the customer.

Case: Challenges in Evaluating School Performance in Ducland
All schools in the country of Ducland are funded by the state and are accountable to the Department of Education (DoE) which oversees educational standards and monitors performance of the schools.
The DoE's objectives, which are also the objectives for all the schools in Ducland, are to:
1. Strive for continuous improvement in performance standards
2. Provide a supportive learning environment, which encourages a high standard of pupil achievement
3. Ensure pupils are prepared for adult life and have the skills and character necessary to contribute to society and the economy
4. Provide all children with access to high quality education, regardless of their location or background
Summary performance data for each school is accessible via the DoE's website. Parents in Ducland have the right to choose which school their child should attend and many parents use the performance data to help with their selection. Inspectors from the DoE visit each school in Ducland at the end of every five years. The DoE believes that to gain a better insight into the quality of the teaching and learning environment, inspectors should attend a selection of lessons and speak to some of the pupils. Tonford School has recently had its inspection visit, and the school's data entry on the DoE's website has been updated following that visit. The revised entry is shown below:

Performance factor	Notes	Tonford School Actual (20X7)	National target (20X7)	Tonford School Actual (20X2)
Exam results	1	62%	65%	64%
Pupil progress	2	0.4	0.25	0.3
Inspection grade	3, 4	Very good	Good	Good
Pupil numbers		662	n/a	627
Number of teaching staff	5	35	n/a	33

Notes:
1. The exam results indicator shows the percentage of pupils leaving school with at least five final exams including compulsory subjects of mathematics, science and languages at Grade A-C (the top three grades).
2. Pupil progress is an indicator of how well pupils have performed in compulsory subjects in their final exams at age 16 compared to their performance in intermediate exams at age 11. Academic grades are given numerical values, and the pupil progress score is the movement in the average of pupils' grades. Scores typically range between -0.5 and +0.5.
3. There are six inspection grades: excellent; very good; good; average; poor and very poor.

4. The inspector's summary report for Tonford School concluded: "There is a very strong sense of community values and citizenship. Pupils appear to have a genuine respect for their teachers, and for one another, despite their diverse backgrounds."

5. The DoE recommends that the pupil/teacher ratio should be less than 22:1.

Required: (a) Explain the problems which not-for-profit organisations face as a result of having multiple objectives. (b) Assess Tonford School's performance against the objectives set by the DoE, using the performance data published on the DoE's website. Note: Use the DOE's four objectives provided to structure your answer. (c) Explain the difficulties in assessing performance of schools in Ducland due to the qualitative nature of their objectives.

Answer:

(a) Problem of multiple objectives

The primary objective of commercial organisations is to maximise the wealth they generate for their owners (shareholders). In contrast, the objectives of NFPOs are often non-financial and reflect the interests which the various stakeholders have in an organisation. These stakeholders often have varying interests in the organisation, meaning that the organisation will also have a number of different objectives. These conflicts may make it difficult to set clear objectives on which all stakeholders agree. Consequently, the organisation's management will face a dilemma when trying to decide which objectives are most important and therefore prioritised in the course of strategic planning and decision-making. This can be a particular problem when different objectives make different demands on resources or require different courses of action. Another problem is that these organisations often do not generate revenue but simply have a fixed budget for spending which they have to keep to and are often subject to strong external influences which will influence the setting of objectives e.g. political factors.

(b) Tonford School's performance against the objectives set by the DoE

Tutorial note: This solution is longer than one which candidates would need to produce to score the marks available. However, it is intended to illustrate the range of relevant points candidates could have identified from the scenario, and therefore the number of marks potentially available in this question.

Objective 1: Strive for continuous improvement in performance standards

The percentage of pupils achieving the target grades is not only below the national target, it is also lower than Tonford School achieved five years ago. As such, the school does not appear to be achieving continuous improvement. However, exam results alone are not necessarily an accurate indicator of a school's performance. For example, exam results will reflect the underlying ability of the pupils, as well as the quality of the teaching they receive. There is a danger that if Tonford School focuses only on exam results it will become selective and only accept the most academically gifted pupils. However, such an approach would contradict the objective to provide all children with access to high quality education, regardless of their background. Pupil progress may be a more valuable measure than exam results, because the extent to which pupils' performance improves provides an indication of the value added by the school, rather than pupils' inherent ability. Given the typical range of scores, Tonford School's performance in this respect (+0.4) is significantly above the national target (+0.25) and is at the upper end of the range. The increase in pupil numbers seems likely to suggest that the school is

becoming more popular with parents. Given that parents can choose which school their children can attend, the increase in pupil numbers is likely to reflect a perception among parents that the school is performing well. The results of the recent inspection visit would seem likely to reinforce this perception. Tutorial note: An alternative interpretation could be that all the other schools in the area are already full, and Tonford has spare capacity, which is why its pupil numbers increased. However, such an explanation seems less likely given the context of the other performance indicators.

Objective 2: Provide a supportive learning environment, which encourages a high standard of pupil achievement

The pupil progress score suggests the school is providing children with a high quality education and a learning environment which encourages a high standard of pupil achievement. That Tonford School's 20X7 score is higher than its 20X2 score also suggests an improvement in the learning environment (but again, to some extent, the scores may reflect pupils' aptitude for learning as well as the efforts of the school). The school's inspection grade is higher than five years ago, and is above the national target, which suggests the school is improving, and is performing relatively well. Although there is no indication that the DoE gives any more weighting to any single aspect of the performance data compared to other areas, the inspection grades could potentially be the most important indicator of how well as school is performing. However, although Tonford School's grading is "Very good" this suggests there is still room for further improvement, because the school did not achieve the top arade: "Excellent".

Tonford School's teacher/pupil ratio has remained essentially the same over the last five years - at 19 pupils per teacher, which is favourable compared to the national target of 22 pupils per teacher.

20X7: 662 pupils/35 members of teaching staff = 18.9 pupils per member of staff

20X2: 627 pupils/33 members of teaching staff = 19 pupils per member of staff

Having a low teacher pupil ratio is likely to be beneficial because it will allow teachers to give more time to each pupil, thereby providing a supportive learning environment. As the school is funded by the DoE, it seems likely that the DoE would have had to authorise the budget needed to recruit the additional teachers. On this basis, Tonford School's ability to increase the number of teachers it employ! suggests that the DoE is pleased with the way it is performing, and therefore authorised the additional budget.

Objective 3: Ensure pupils are prepared for adult life and have the skills and character necessary to contribute to society and the economy

The inspector has highlighted Tonford School's "strong sense of community values and citizenship". This suggests the school is performing well in relation to the objective of preparing students for adult life, and developing their social skills. Exam results and the pupil progress scores in compulsory subjects indicate that the school is making a significant contribution in providing pupils with core knowledge and skills necessary for adulthood.

Objective 4: Provide all children with access to high quality education, regardless of their location or background

The inspector's report has highlighted that pupils at Tonford School come from diverse backgrounds' and awarded the school an improved grading over the last five years. Coupled with pupil progress scores, this indicates that the school is fulfilling the objective to provide children which access to high quality education, regardless of their background.

(c) Difficulties in assessing performance due to the qualitative nature of objectives

In order to assess any organisation's performance against its objectives, performance information needs to be available, and, in many cases, this information is obtained by measuring aspects of performance relevant to the objectives.

Difficulties of measurement

However, one of the inherent difficulties with qualitative objectives compared to quantifiable objectives is how to measure them. For example, exam success rate (% of pupils achieving 5 grades A-C) is quantifiable, and relatively easy to measure, using exam results data. However, trying to measure the overall quality of education in a school or whether a school provides a "supportive learning environment" is potentially much more difficult, because there aren't any specific outputs (e.g. results) which can be measured. So, while exam results and pupil progress metrics are indicators of pupil achievement in schools - which can be measured - assessing them only provides a partial assessment of whether schools are providing children with "access to high quality education" or whether they are providing "supportive learning environment which encourages a high standard of pupil achievement". A related problem is that the aspects of performance which are monitored end up being the ones where performance can most easily be measured, rather than those which are most important in ensuring that the objectives are achieved. The DoE has recognised these issues though and acknowledged the need for inspectors to visit schools on a regular basis, to gain an insight into the aspects of performance which cannot be reflected in statistical measures.

Subjectivity

Another major problem with assessing qualitative aspects of performance is that they tend to be subjective. For example, people are likely to have different expectations of what constitutes a high quality of education, a supportive learning environment, or the extent to which students are prepared for adult life. In this respect, one of the key things the DoE has to ensure is that its inspectors are consistent in their grading of schools. For example, if one inspector rates a school as "Good", but another inspector would have rated the same school as "Excellent", this inconsistency would significantly reduce the validity of the performance data which is produced.

Case: Evaluating Performance and Investment Decisions at Welco

Welco is a trading company with two divisions: the Design division, which designs wind turbines and supplies the designs to customers under licenses and the Gearbox division, which manufactures gearboxes for the car industries. The results for the two divisions for the most recent financial year are as follows:

	Design division $000	Gearbox division $000
Sales	14,300	25,535
Cost of sales	(4,900)	(16,200)
Gross profit	9,400	9,335
Administrative costs	(3,400)	(4,200)
Distribution costs	:	(1,260)

| Operating profit | 6,000 | 3,875 |
| Asset turnover ratio | 0.61 | 0.79 |

Welco's sales and cost of sales figures have remained unchanged for the last two years. The following information has been noted:

Year ended	Year 2	Year
Inventory holding period	45 days	38 days
Payables payment period	40 days	35 days
Receivables collection period	60 days	68 days
Current ratio	1.1	1.3
Quick ratio	1.3	1.4

Question 1. What was the return on capital employed of the Gearbox division? A. 28.9% B. 12.0% C. 25.5% D. 40.1%
Answer:
The correct answer is B.
WORKING
Return on capital employed (ROCE) = asset turnover * operating profit margin
Asset turnover = Revenue/Capital employed = 0.79 (given)
Operating profit margin = Operating profit/Revenue * 100 = 15.18%
Therefore, ROCE = 0.79 * 15.18% = 0.12 or 12.0%.

Question 2. The return on capital employed of the Design division was more than twice that of the Gearbox division. The following explanations have been provided for this:
1. The operating profit margin of the Design division is much higher than that of the Gearbox division
2. Design division has managed to achieve higher sales per $ of capital employed
3. The capital requirements of a design business are much lower than the capital requirement of a manufacturing division such as the Gearbox division
4. The managers of the Design division have performed better than the managers of the Gearbox division Which of the above statements is/are correct? A. 1 and 3 B. 3 only C. 1 and 4 D. 2
Answer:
The correct answer is A.
Tutorial note: (1) is true - the operating margin of the Design division is 42% (6,000/14,300) compared to 15.2% (3,875/25,535) for the Gearbox division. Since the return on capital employed is the product of the operating profit margin and the asset turnover ratio, a higher operating profit margin will indeed explain the higher return on capital employed. (2) is not true. The asset turnover of the design division is lower than that of the Gearbox division. (3) is true. A design division is unlikely to require many assets, while a production division will need to invest in machinery. (4) - since the two divisions are not comparable, given their different capital requirements, it is not possible to conclude that the managers of the Design division have performed better, based solely on ROCE.

Question 3. The following statements have been made about the company's performance for Year 2, which is the most recent year: 1. Customers are taking longer to pay and this may have contributed to the decline in the company's current ratio 2. Inventory levels have increased and this may have contributed to the decline in the company's quick ratio Which of the above statements is/are true? A. 1 only B. 2 only C. Both 1 and 2 D. Neither 1 nor 2
Answer:
The correct answer is D. Tutorial note: (1) is incorrect because customers are actually paying more quickly. (2) is incorrect because the quick ratio excludes inventory

Question 4. Welco is considering introducing non-financial performance indicators. A junior accounting assistant has suggested the following advantages of non-financial performance indicators:
1. They focus the attention of management on the areas such as quality which will lead to better long-term performance
2. They cannot be manipulated
3. Non-financial reports can generally be compiled more quickly than financial reports
4. Using only financial performance measures may lead to excessive cost cutting that may harm the business in the long term Which of the above statements are correct? A. 1, 2 and 3 B. 2, 3 and 4 C. 1 and 4 only D. 1, 3 and 4
Answer:
The correct answer is D.
Tutorial note: (2) is not true - non financial performance measures may be manipulated.

Question 5. The Gearbox division is considering investing in capital equipment costing $2.7m. The useful economic life of the equipment is expected to be 50 years, with no resale value at the end of the period. The forecast return on the initial investment is 15% per year before depreciation. The division's cost of capital is 7%. What is the expected annual residual income of the initial investment? A. $0 B. ($270,000) C. $162,000 D. $216,000
Answer:
The correct answer is C.
WORKING
Divisional profit before depreciation = $2.7m * 15% = $405,000 per year.
Less depreciation = $2.7m * 1/50 = $54,000 per year.
Divisional profit after depreciation = $351,000
Imputed interest = $2.7m * 7% = $189,000
Residual income = $162,000.

Case: Assessing Divisional Performance and Investment Decisions at a Manufacturing Company
The Biscuits division (Division B) and the Cakes division (Division C) are two divisions of a large, manufacturing company. Although both divisions operate in almost identical markets, each division operates separately as an investment centre. Each month, operating statements must be prepared by each division and these are used as a basis for performance measurement for

the divisions. Last month, senior management decided to recharge head office costs to the divisions. Consequently, each division is now going to be required to deduct a share of head office costs in its operating statement before arriving at "net profit", which is then used to calculate return on investment (ROI). Prior to this, ROI has been calculated using controllable profit only. The company's target ROI, however, remains unchanged at 20% per year. For each of the last three months, Divisions B and C have maintained ROIs of 22% per year and 23% per year respectively, resulting in healthy bonuses being awarded to staff. The company has a cost of capital of 10%. The budgeted operating statement for the month of July is shown below:

	B	C
	$000	$000
Revenue	1,300	1,500
Less variable costs	(700)	(800)
Contribution	600	700
Less controllable fixed costs	(134)	(228)
Controllable profit	466	472
Less apportionment of head office costs	(155)	(180)
Net profit	311	292
Divisional net assets	$23.2m	$22.6m

Required: (a) Calculate the expected annualised Return on Investment (ROI) using the new method as preferred by senior management, based on the above budgeted operating statements, for each of the divisions. (b) Calculate the annualised residual income (RI) for each of the divisions, based on the net profit figures for the month of July. (c) Discuss the expected performance of each of the two divisions, using both ROI and RI, and making any additional calculations deemed necessary. Conclude as to whether, in your opinion, the two divisions have performed well. (d) Division B has now been offered an immediate opportunity to invest in new machinery at a cost of $1.68m. The machinery is expected to have a useful economic life of four years, after which it would have no residual value. Division B's policy is to depreciate all of its machinery on a straight line basis over the life of the asset. The machinery would be expected to expand Division B's production capacity, resulting in an 8.5% increase in contribution per month. Recalculate Division B's expected annualised ROI and annualised RI, based on July's budgeted operating statement after adjusting for the investment. State whether the managing director will be making a decision that is in the best interests of the company as a whole if ROI is used as the basis of the decision. (e) Explain any behavioural problems that will result if the company's senior management insist on using solely ROI, based on net profit rather than controllable profit, to assess divisional performance and reward staff.

Answer:
(a) ROI and RI
Return on investment = Net profit/Net assets
Division B
$311,000 * 12/$23,200,000 = 16.1%
Division C
$292,000 * 12/$22,600,000 = 15.5%

(b) Residual income

	B	C
	$000	$000
Net profit	3,732	3,504
Less: Imputed interest charge		
$22.6 * 10%		(2,260)
$23.2m * 10%	(2.320)	
Residual income	1,412	1,244

(c) Performance of the two divisions
ROI
Divisions B and C have ROIs of 16.1% and 15.5% respectively, compared to the target of 20%. This suggests that the divisions have not performed well, but the reason for this is that now, uncontrollable head office costs are being taken into effect before calculating the ROI. The target ROI has not been reduced to reflect the change in the method being used to calculate it. Using the old method, ROI would have been as follows:
B: ($311,000 + $155,000) * 12/$23.2m = 24.1%
C: ($292,000 + $180,000) * 12/$22.6m = 25.1%
From this it can be seen that both divisions have actually improved their performance, rather than it having become worse.
RI
From the residual income figures, it can clearly be seen that both Division B and C have performed well, with healthy RI figures of $1.4m and $1.2m respectively, even when using net profit rather than controllable profit as bases for the calculations. The cost of capital of the company is significantly lower than the target return on investment that the company seeks, making the residual income figure show a more positive position.

(d) Division B
ROI with investment
Depreciation = $1,680,000/48 months = $35,000 per month.
Net profit for July = $311,000 + ($600,000 * 8.5%) - $35,000 = $327,000
Annualised net profit: $327,000 * 12 = $3,924,000
Operating net assets after investment = $23,200,000 + $1,680,000 = $24,880,000.
ROI = $3,924,000/$24,880,000 = 15.8%.
RI with investment

	$000
Net profit with investment	3,924
Less imputed interest ($24,880,000 * 10%)	(2.488)
Residual income	1,436

If the managing director makes a decision based on ROI, he will reject the investment, as the ROI with the investment is 15.8% which is less than the ROI without the investment, which was 16.1% (see (a)). If he makes the decision based on RI, the investment will be accepted since RI is $1,436,000 with the investment, which is higher than the RI of $1,412,000 without the investment (see (b)). RI is consistent with the objective of maximising the wealth of

shareholders, so any investment that increases RI should be accepted. But, if the managing director uses ROI he will reject the investment. This will be inconsistent with the goal of maximising the wealth of shareholders, so is an example of goal incongruence.

(e) Behavioural problems
The staff in both divisions have been used to meeting targets and getting rewarded appropriately. Suddenly, they will find that even though in reality divisional performance has improved, neither division is meeting its ROI target. This will purely be as a result of the inclusion of the head office costs. The whole basis of being assessed on uncontrollable apportioned costs is questionable in the first place. However, if it is going to be done this way, at the least the target ROI must be revised. Staff are likely to become frustrated with a new system which is inherently unfair. This could give rise to staff collectively opposing the system. At the least, they are likely to become quickly demotivated, working slower than possible and perhaps withdrawing things like voluntary overtime. The cost to the company as a whole is likely to be high and the situation needs to be resolved as quickly as possible.

Case: Evaluating Divisional Performance and Investment Decisions at Cardale Industrial Metal Co
Cardale Industrial Metal Co (CIM Co) is a large supplier of industrial metals. The company is split into divisions: Division F and Division N. Each division operates separately as an investment centre, with each having full control over its non-curren assets. In addition, both divisions are responsible for their own current assets, controlling their own levels of inventory and having full responsibility for the credit terms granted to customers and the collection of receivables. Similarly, each division has full responsibility for its current liabilities and deals directly with its own suppliers. All cash balances are automatically transferred to a company bank account at the end of each day and are not therefore included in the definition of divisional capital. The following figures relate to two of the divisions, Division F and Division N for the most recent financial year:

	Division F $000	Division N $000
Sales	14,500	8,700
Controllable profit	2,645	1,970
Less apportionment of head office costs	(1.265)	(684)
Net profit	1,380	1,286
Non-current assets	9,760	14,980
Inventory and trade receivables	2,480	3,260
Trade payables	2,960	1,400

Question 1. Select the appropriate figures from the list below to identify the return on investment of each division if the controllability principle is observed.
F: 7.6% 28.5%
N: 7.6% 11.7%
Answer:

Division	
F	28.5%
N	11.7%

Tutorial note: The controllability principle means that managers should only be judged based on things within their control. Controllable profit should be used to calculate ROI since it ignores head office recharges, which are outside of the control of the management. Since the divisions are responsible for investment in non-current assets, current assets and current liabilities, all such items should be included in net assets.

WORKING

	Division F $000	Division N $000
Controllable profit	2,645	1,970
Non-current assets	9,760	14,980
Inventory and trade receivables	2,480	3,260
Trade payables	2,960	1,400
Total net assets	9,280	16,840
Therefor, ROI	2,645/9,280*100	1,970/16,840*100
	= 28.5%	= 11.7%

Question 2 The management of CIM Co is considering introducing residual income as a divisional performance measure, charging divisions interest of 10% of capital employed. It has been agreed that controllable profit will be used as the basis the calculation of residual income. What is the residual income for each division for the most recent financial year? A $1,125,000 $6,000 B $1,380,000 $1,286,000 C $1,669,000 $480,000 D $1,717,000 $286,000

Answer:

The correct answer is D.

WORKING

		Division F	Division N
		$000	$000
Controllable profit		2,645	1,970
Imputed interest	(10% * 9,280)	(928)	
	(10% * 16,840)		(1,684)
Residual income		1,717	286

Question 3. Each divisional manager is paid a salary plus an annual performance-related bonus, based on the return on investment (ROI) achieved by their division for the year. For each whole percentage point above 10% which the division achieves for the year, a bonus equivalent to 2% of annual salary is paid. Identify, by clicking on the relevant box in the table below, whether each of the following actions would increase or decrease the bonus for the manager of Division F.

Action	Effect on bonus
Delay payments to suppliers because of limited cash	
Delay an investment in a new computer system	

Answer:

Action	Impact on bonus

| Delay payments to suppliers because of limited cash | INCREASE | |
| Delay an investment in a new computer system | INCREASE | |

Tutorial note: Delaying payments to suppliers reduces the division's capital, since payables reduces the net assets of the division, while cash balances are transferred to the central bank account of the company and not therefore included in capital. The first action would therefore increase the ROI and therefore the bonus of the manager. An investment in a computer system would increase the capital of the division thereby reducing the ROI. Delaying the investment will therefore increase the ROI and the bonus received by the manager, even though it may not be in the long term interests of the company to continue to use an out of date system.

Question 4. Cim Co has two other divisions, A and B. Each division is currently considering the following separate projects:

	Division A	Division B
Capital required for the project	$32.6m	$22.2m
Sales generated by project	$14.4m	$8.8m
Operating profit margin	30%	24%
Cost of capital	10%	10%
Current return on investment of division	15%	9%

If residual income is used as the basis for the investment decision, which Division(s) would choose to invest in the respective projects?

Answer:

The correct answer is Division A only

WORKING

Division	A	B		
Profit	$14.4m * 30%=$4.32m	$8.8m * 24% =	$2.112m	
Imputed interest	charge $32.6m * 10%=$3.26m	$22.2m * 10% =	$2.22m	
Residual income	$1.06m		$(0.108)m	

Question 5. Which of the following measures would be appropriate for assessing the performance of the managers of a profit centre?

1. % of products returned for warranty repairs each year 2. Sales price and volume variances 3. Operating profit after deducting depreciation 4. Residual income A. 1 and 2 only B. 1, 2 and 3 C. 2, 3 and 4 D. 1. 3 and 4

Answer:

The correct answer is A.

Tutorial note: (1) and (2) would be appropriate measures of the performance, as they are within the control of the managers of the divisions and reflect quality of output, and ability to sell the products. (3) is not appropriate, as profit centre managers cannot make investment decisions, so it would be unfair to deduct deprecation from their profit. Similarly residual income would not be appropriate - as managers of a profit centre cannot make investment decisions, it is not fair to evaluate their performance by a measure that deducts the cost of capital from their profit.

Case: Performance Measurement and Investment Decisions at Sports Co

Sports Co is a large manufacturing company specialising in the manufacture of a wide range of sports clothing and equipment. The company has two divisions: Clothing (Division C) and Equipment (Division E). Each division operates with little intervention from Head Office and divisional managers have autonomy to make decisions about long-term investments. Sports Co measures the performance of its divisions using return on investment (ROI), calculated using controllable profit and average divisional net assets. The target ROI for each of the divisions is 18%. If the divisions meet or exceed this target the divisional managers receive a bonus. Last year, an investment which was expected to meet the target ROI was rejected by one of the divisional managers because it would have reduced the division's overall ROI. Consequently, Sports Co is considering the introduction of a new performance measure, residual income (RI), in order to discourage this dysfunctional behaviour in the future. Like ROI, this would be calculated using controllable profit and average divisional net assets. The draft operating statement for the year, prepared by the company's trainee accountant, is shown below.

	Division C $000	Division E $000
Sales revenue	3,800	8,400
Less variable costs	(1.400	(3,030)
Contribution	2,400	5,370
Less fixed costs	(945)	(1,420)
Net profit	1,455	3,950
Opening divisional controllable net assets	13,000	24,000
Closing divisional controllable net assets	9,000	30,000

Notes:

(1) Included in the fixed costs are depreciation costs of $165,000 and $460,000 for Divisions C and E respectively. 30% of the depreciation costs in each division relates to assets controlled but not owned by Head Office. Division E invested $2m in plant and machinery at the beginning of the year, which is included in the net assets figures above, and uses the reducing balance method to depreciate assets. Division C, which uses the straight-line method, made no significant additions to non- current assets. It is the policy of both divisions to charge a full year's depreciation in the year of acquisition.

(2) Head Office recharges all of its costs to the two divisions. These have been included in the fixed costs and amount to $620,000 for Division C and $700,000 for Division E.

(3) Sports Co has a cost of capital of 12%.

Required: (a) (i) Calculate the return on investment (ROI) for each of the two divisions of Sports Co. (ii) Discuss the performance of the two divisions for the year, including the main reasons why their ROI results differ from each other. Explain the impact the difference in ROI could have on the behaviour of the manager of the worst performing division. (b) (i) Calculate the residual income (RI) for each of the two divisions of Sports Co and briefly comment on the results of this performance measure. Explain the advantages and disadvantages of using residual income (RI) to measure divisional performance.

Answer

(a) Two divisions

(i) Return on investment (ROI)

ROI = Controllable profit/average divisional net assets

Controllable profit	C	E
$000	$000	
Net profit	1,455	3,950
Add back depreciation on non-controllable assets	49.5	138
Add back Head Office costs	620	700
Controllable profit	2,124.5	4,788
Average divisional net assets		
	$000	$000
Opening assets	13,000	24,000
Closing assets	9,000	30,000
Average assets	11,000	27,000
ROI	19.3%	17.7%

(ii) Divisional performance

Whilst Division C has exceeded the target ROI, Division E has not. If controllable profit in relation to revenue is considered, Division C's margin is 56% compared to Division E's margin of 57%, so Division E is actually performing slightly better. However, Division E has a larger asset base than Division C too; hence, Division C has a higher ROI. Since Division E appears to be a much larger division and is involved in sports equipment manufacturing, it could be expected to have more assets. Division E's assets have gone up partly because it made substantial additions to plant and machinery. This means that as well as increasing the average assets figure, the additions will have been depreciated during the year, and so result in lower profits. This may potentially have had a large impact on profits since Division E uses the reducing balance method of depreciation, meaning that more depreciation is charged in the early years. Based on the ROI results, the manager of Division C will get a bonus and the manager of Division E will not. This will demotivate the manager of Division E and may discourage him from making future investments, unless the performance measure used is changed.

(b) Residual income
(i) Two divisions

	C	E
	$000	$000
Controllable profit	2,124.5	4,788
Less: imputed charge on assets at 12%	(1,320)	(3,240)
Residual income	804.5	1,548

Comment From the residual income results, it can clearly be seen that both divisions have performed well, with healthy RI figures of between $0.8m and $1.55m. The cost of capital of Sports Co is significantly lower than the target return on investment which the company seeks, making the residual income figure show a more positive position.

(ii) Advantages

The use of RI should encourage managers to make new investments, if the investment adds to the RI figure. A new investment can add to RI but reduce ROI and in such a situation measuring

performance with RI would not result in the dysfunctional behaviour which has already been seen at Sports Co. Instead, RI will lead to decisions which are in the best interests of the company as a whole being made. Since an imputed interest charge is deducted from profits when measuring the performance of the division, managers are made more aware of the cost of assets under their control. This is a benefit as it can discourage wasteful spending. Alternative costs of capital can be applied to divisions and investments to account for different levels of risk. This can allow more informed decision-making.

Disadvantages

RI does not facilitate comparisons between divisions since the RI is driven by the size of divisions and their investments. This can clearly be seen in Sports Co where the RI of Division E is almost twice that of Division C, which will be related to Division E being a much larger division. RI is also based on accounting measures of profit and capital employed which may be subject to manipulation so as, for example, to obtain a bonus payment. In this way it suffers from the same problems as ROI.

Case: Optimizing Transfer Pricing for Maximum Profit at Bath Co

Bath Co specialises in the manufacture and sale of baths. Each bath consists of a main unit plus a set of bath fittings. The company is split into two divisions, A and B. Division A manufactures the bath and Division B manufactures sets of bath fittings. Currently, all of Division A's sales are made externally. Division B, however, sells to Division A as well as to external customers. Both of the divisions are profit centres. The following data is available for both divisions:

Division A		
Current selling price for each bath	$450	
Costs per bath:		
Fittings from Division B	$75	
Other materials from external suppliers	$200	
Labour costs	$45	
Annual fixed overheads	$7,440,000	
Annual production and sales of baths	80,000	units
Maximum annual market demand for baths	80,000	units
Division B		
Current external selling price per set of fittings	$80	
Current price for sales to Division A	$75	
Costs per set of fittings:		
Materials	$5	
Labour costs	$15	
Annual fixed overheads	$4,400,000	
Maximum annual production and sales of sets of fittings (including internal and external sales)	200,000	units
Maximum annual external demand for sets of fittings	180,000	units
Maximum annual internal demand for sets of fittings	80,000	units

The transfer price charged by Division B to Division A was negotiated some years ago between the previous divisional managers, who have now both been replaced by new managers. Head Office only allows Division A to purchase its fittings from Division B, although the new manager of Division A believes that he could obtain fittings of the same quality and appearance for $65 per set, if he was given the autonomy to purchase from outside the company. Division B makes no cost savings from supplying internally to Division A rather than selling externally.

Required: (a) Under the current transfer pricing system, prepare a profit statement showing the profit for each of the divisions and for Bath Co as a whole. Your sales and costs figures should be split into external sales and inter-divisional transfers, where appropriate. (b) Head Office is considering changing the transfer pricing policy to ensure maximisation of company profits without demotivating either of the divisional managers. Division A will be given autonomy to buy from external suppliers and Division B to supply external customers in priority to supplying to Division A. Calculate the maximum profit that could be earned by Bath Co if transfer pricing is optimised. (c) Discuss the issues of encouraging divisional managers to take decisions in the interests of the company as a whole, where transfer pricing is used. Provide a reasoned recommendation of a policy Bath Co should adopt.

Answer:

(a) Profit statement

	Division A	Division B	Company
Revenue:	$000	$000	$000
External (W1)	36,000	9,600	45,600
Inter-divisional transfers (80,000 * $75)	0	6,000	
Total	36,000	15,600	45,600
Variable costs:			
External material costs (WORKING 2)	(16,000)	(1,000)	(17,000)
Inter-divisional transfers (80,000 * $75)	(6,000)	0	
Labour costs (W3)	(3,600)	(3,000)	(6,600)
Total	(25,600)	(4,000)	(23,600)
Fixed costs	(7.440)	(4,400)	(11,840)
Profit	2,960	7,200	10,160

WORKINGS ($000)

WORKING 1. External sales

A: 80,000 * $450 = $36,000

B: 120,000 * $80 = $9,600

B: 80,000 * $75 = $6,000

WORKING 2. External material costs

A: 80,000 * $200 = $16,000

B: 200,000 * $5 = $1,000

WORKING 3. Labour costs

A: 80,000 * $45 = $3,600

B: 200,000 * $15 = $3,000

(b) Profit if transfer pricing is optimised

	Division A	Division B	Company
Revenue:	$000	$000	$000
External (WORKING 1)	36,000	14,400	50,400
Internal sales (20,000 * $65)		1,300	
Total	36,000	15,700	50,400
Variable costs:			
External material costs (WORKING 2)	(19,900)	(1,000)	(20,900)
Inter-divisional transfers (= internal sales)	(1,300)		
Labour costs	(3,600)	(3,000)	(6,600)
Total	(24,800)	(4,000)	(27,500)
Fixed costs	(7,440)	(4,400)	(11,840)
Profit	3,760	7,300	11,060

Tutorial note: A transfer price of $65 has been used on the assumption that Bath will introduce the policy discussed in (b). Provided that the transfer price is set between the minimum of $20 (Division B's marginal cost) and $65 (the cost to Division A of buying from outside the group), the actual transfer price is irrelevant in this calculation. The overall profit of the company will be the same.

WORKINGS ($000)

WORKING 1. external sales
A: 80,000 * $450 = $36,000
B: 180,000 * $80 = $14,400

WORKING 2. Material costs
A: 60,000 * $265 + (20,000 * $200) = $19,900
B: 200.000 * $5 = $1,000

c) Issues and suitable transfer price

Divisional managers' performance is assessed using a metric as decided by the company. This may simply be the profit for the period, or, depending on the type of responsibility centre being used, a metric such as residual income or return on capital employed. Whatever the metric being used, the division's profit figure is going to affect it and divisional managers are therefore going to be keen to maximise their individual profits. By focusing on individual decisions, divisional managers are often not aware of the impact of their decisions on the company as a whole. This would particularly be the case where a decision which is in the best interests of the company actually makes an individual division's performance look worse. The transfer pricing system in place needs to take into account the behavioural impact of the prices being charged. It can be seen from (b) that the best decision for Bath is that:

· Division A buys 60,000 sets of fittings from an outside supplier and buys the remaining 20,000 sets of fittings from Division B in order to ensure that Division B is working to full capacity.

· Division B sells as many fittings as possible externally, at $80 per set. Since the maximum external demand is 180,000 units, Division B sells the remaining 20,000 sets to Division A. The minimum transfer price that would be acceptable to Division B is its marginal cost of $20 per unit, since it has spare capacity. However, using this transfer price, Division B becomes worse off than before the autonomy was given and Division B's manager will not like this. Division A will not want to pay more than the $65 that it can buy from outside the group.

Bath's policy therefore needs to ensure that, firstly, Division A's manager is prepared to buy 20,000 sets of fittings from Division B and secondly, Division B is prepared to sell them at $65 per set. Since it is in Division B's best interest to work to full capacity and the manager of Division B knows that Division A can obtain fittings for $65 per set, it should not be difficult for B to agree to sell to A at this price. A policy of negotiated transfer prices would achieve this fairly quickly. However, Bath also needs to have a policy that divisions buy internally first, where this would be in the best interests of the overall profitability of the company. This would ensure that Division A buys the 20,000 sets of fittings from Division B. In this way, Bath's overall profit is maximised while also ensuring that divisional managers do not become demotivated.

Case: Optimizing Transfer Pricing for Mobe Co's Electronic Motors

Mobe Co manufactures electronic mobility scooters. The company is split into two divisions: the scooter division (Division S) and the motor division (Division M). Division M supplies electronic motors to both Division S and to external customers. The two divisions run as autonomous profit centres; Division M has the freedom to decide how many motors to sell to Division S and how many to sell to external customers, and Division S may buy motors externally or from Division M. Details of the two divisions are given below:

Division S

Division S's budget for the coming year shows that 35,000 electronic motors will be needed. An external supplier could supply these to Division S for $800 each.

Division M

Division M has the capacity to produce a total of 60,000 electronic motors per year. Details of Division M's budget, which has just been prepared for the forthcoming year, are as follows:

Budgeted sales volume (units)	60,000
Selling price per unit for external sales of motors	$850
Variable costs per unit for external sales of motors	$770

The variable cost per unit for motors sold to Division S is $30 per unit lower due to cost savings on distribution and packaging. Maximum external demand for the motors is 35,000 units per year.

Question 1. If the transfer price for the motors is set at $760 per motor, how many motors per year will Division M be willing to sell to Division S?

Answer:

The correct answer is 25000 units.

WORKING

Division M will only be willing to sell to Division S if the transfer price exceeds marginal cost, plus the opportunity cost. Division M has capacity to produce 60,000 motors. External demand is 35,000 per year, so division M has spare capacity of 25,000 units. Therefore, up to 25,000 units division M would be prepared to sell for anything above marginal cost of $740 ($770 less cost savings of $30). For additional units, there will be an opportunity cost equal to the lost contribution on external sales of $80 (850 - 770). Division M would only be prepared to sell for a price above $820 (740 + 80). (Another way of looking at this is to consider that the supplying

division could sell externally for $850, so would accept an adjusted price of $820 for units sold to Division S.) This is above the transfer price of $760 so Division M would not be prepared to sell any additional units. Therefore, Division M would be prepared to sell 25,000 units to division S at a price of $760.

Question 2. How many motors should Division M supply to Division S in order to maximise group profits?
Answer:
For every motor sold externally, Division M generates contribution of $80 ($850 - $770) for the group as a whole. For every motor which Division S has to buy from outside of the group, there is an incremental cost of $60 per unit ($800 - [$770 - $30]). Therefore, from a group perspective, as many external sales should be made as possible before any internal sales are made. Division M's total capacity is 60,000 units. Given that it can make external sales of 35,000, 35,000 units should be sold externally. The remaining 25.000 units of Division M's capacity can be used to supply Division S.

Question 3. Assume Division M has spare capacity to produce 28,000 motors. Head office has now introduced a new policy stating that Division M must sell 35,000 motors per year to Division S. It wants Division M to set a total price for all 35,000 motors. What is the minimum total transfer price at which Division M would be willing to sell 35,000 motors to Division S?
Answer:
The correct answer is $ 26,460,000
First 28,000 units can be produced from Division M's spare capacity, therefore the minimum transfer price that division M will accept will be the marginal cost of producing these, which is $740 per unit. The minimum transfer price of the next 7,000 units equals the marginal cost plus the contribution on lost external sales, which is $820 per unit (740 + 80). In total therefore, the minimum transfer price for 35,000 units would be $ (740 * 28,000) + (820 * 7,000)

Question 4. Which THREE of the following are objectives of a good and ethical transfer pricing system? A. To ensure that decisions taken by divisional managers are in the interests of the organisation as a whole B. To assist managers in budget preparation C. To give divisional managers autonomy in making decisions about trading with other divisions D. To encourage divisions within an organisation to trade with each other rather than buying or selling externally E. To allow a fair measure of divisional performance F. To transfer profits into low tax jurisdictions
Answer:
The correct answer is A, C and E.

Question 5. Which TWO of the following statements about the use of the "full cost plus" method of setting transfer prices are correct? A. It always ensures that the supplying division is compensated for the opportunity cost of lost contribution on external sales B. It motivates the supplying division to keep costs under control C. The transfer price covers the costs of production of the supplying division if actual output exceeds budgeted output D. It may lead to dysfunctional decisions if the supplying division has spare capacity

Answer:
The correct answer is C and D.

Case: Optimizing Adaptor Supply for Portable Garage Co (PGC)
The Portable Garage Co (PGC) is a company specialising in the manufacture and sale of a range of products for motorists. It is split into two divisions: the battery division (Division B) and the adaptor division (Division A). Division B sells one product - portable battery chargers for motorists which can be attached to a car's own battery and used to start up the engine when the car's own battery fails. Division A sells adaptors which are used by customers to charge mobile devices and laptops by attaching them to the car's internal power source. Recently, Division B has upgraded its portable battery so it can also be used to rapidly charge mobile devices and laptops. The mobile device or laptop must be attached to the battery using a special adaptor which is supplied to the customer with the battery. Division B currently buys the adaptors from Division A, which also sells them externally to other companies. The following data is available for both divisions:

Division B

Selling price for each portable battery, including adaptor	$180	
Costs per battery:		
Adaptor from Division A	$13	
Other materials from external suppliers	$45	
Labour costs	$35	
Annual fixed overheads	$5,460,000	
Annual production and sales of portable batteries (units)	150,000	
Maximum annual market demand for portable batteries (units)	180,000	

Division A

Selling price per adaptor to Division B	$13	
Selling price per adaptor to external customers	$15	
Costs per adaptor:		
Materials	$3	
Labour costs	$4	
Annual fixed overheads	$2,200,000	
Current annual production capacity and sales of adaptors		
both internal and external sales (units)	350,000	
Maximum annual external demand for adaptors (units)	200,000	

In addition to the materials and labour costs above, Division A incurs a variable cost of $1 per adaptor for all adaptors it sells externally. Currently, Head Office's purchasing policy only allows Division B to purchase the adaptors from Division A but Division A has refused to sell Division B any more than the current level of adaptors it supplies to it. The manager of Division B is unhappy. He has a special industry contact who he could buy the adaptors from at exactly the same price charged by Division A if he were given the autonomy to purchase from outside the group. After discussions with both of the divisional managers and to ensure that the managers

are not demotivated, Head Office has now agreed to change the purchasing policy to allow Division B to buy externally, provided that it optimises the profits of the group as a whole. Required: (a) Under the current transfer pricing system, prepare a profit statement showing the profit for each of the divisions and for The Portable Garage Co (PGC) as a whole. Your sales and costs figures should be split into external sales and inter-divisional transfers, where appropriate. (b) Assuming that the new group purchasing policy will ensure the optimisation of group profits, calculate and discuss the number of adaptors which Division B should buy from Division A and the number of adaptors which Division A should sell to external customers. Assume now that no external supplier exists for the adaptors which Division B uses. (c) Calculate and discuss what the minimum transfer price per unit would be for any additional adaptors supplied above the current level by Division A to Division B so that Division B can meet its maximum annual demand for the new portable batteries.

Answer:
(a) Profit statement for current position:

	Division B	Division A	PGC Co
	$000	$000	
Sales revenue:			
External sales			
(150,000 * $180/200,000 * $15)	27,000	3,000	30,000
Internal transferred sales (150,000 * $13)		1,950	
Total revenue	27,000	4,950	30,000
Variable costs:			
External material costs	6,750	1,050	7,800
Internal transferred costs	1,950		
Labour costs	5,250	1,400	6,650
Other costs of external sales		200	200
Total variable costs	13,950	2,650	14,650
Contribution	13,050	2,300	15,350
Less fixed costs	5,460	2,200	7,660
Profit	7,590	100	7,690

(b) New group purchasing policy
If Division B can buy adaptors from outside the group at $13 per unit, the optimum position is for Division A to sell as many adaptors as possible to external customers at $15 each and then sell the remainder to Division B at a price to be agreed between them. This would mean that Division A continues to sell Division B 150,000 adaptors but Division B then buys the remaining 30,000 adaptors from an external supplier. This is because the contribution per unit for Division A's external sales is $7 ($15 - $3 - $4 - $1). This means that for every external sale it loses, it forfeits $7 for the group. However, the incremental cost for the group of Division B buying adaptors from outside the group is only $6 ($13 external cost less the $7 cost of making them in-house). So, it makes sense for Division A to satisfy its external sales first before selling internally.

(c) No external supplier exists

In order for Division A to supply Division B with 180,000 adaptors, it would have to reduce its external sales from 200,000 units to 170,000. This is because it only has enough spare capacity to supply Division B with 150,000 units at present after it has supplied adaptors to its external customers. The minimum transfer price in situations where there is no spare capacity is marginal cost plus opportunity cost. In this case, contribution is lost by not selling 30,000 units to the external customers. As the marginal cost for Division A's internal sales is $7 ($4 + $3) and the contribution per unit for external sales is $7 per unit ($15 - $3-$4-$1), the transfer price for the additional 30,000 units would need to be $14.

Case: Improving Security and Internal Distribution Procedures at St Peregrine's Hospital

St Peregrine's is a state owned and run hospital in Homeland. The hospital keeps a database containing details of all its patients. The database is maintained on a central server, and doctors and nurses have access to the database from persona computers in the ward offices. The hospital also maintains an accounting system that includes the financial and managemen accounts, along with details of suppliers and payroll costs. John has just been appointed as the new finance director of the hospital and he has come to you for some advice. He is concerned about security of all types of information in the system. He is also thinking of producing some more interesting reports for the meetings of the board of governors, which would include more qualitative information, such as patient satisfaction statistics. John has already had discussions with some of the senior doctors and managers of the hospital about the adequacy of the management information they are receiving. Some of the comments made are as follows:

"I receive the daily management report, but frankly I have very little time to read it. Most of the information included in it is irrelevant to my job!"

"I get frustrated by the amount of e-mails I receive, or am copied in on. I spend two hours a day dealing with e-mails, when I should be spending that time visiting patients."

"We have a report about the number of available beds. Often when I try to book one of these for patient, it turns out that the bed is not ready yet, as it has not been cleaned and made up."

"E-mail is used too much for communication that should be spoken. We had an embarrassing case recently where a nurse accidentally copied in the relatives of a patient onto an e-mail she was writing, complaining about the patient being a "miserable old woman."

John wishes to introduce procedures for the internal distribution of data within the organisation to try to overcome some of these problems. Required: (a) Suggest and describe four controls or procedures to ensure that the information held in the hospital is secure and remains confidential. (b) Suggest controls that should be in place regarding the generation and distribution of internal information within the hospital, and explain how these may help overcome some of the issues that managers are complaining about.

Answer:

(a) Controls and procedures over security

Physical controls Physical controls should exist to stop unauthorised access to the personal computers that are linked into the servers. Offices should be locked, using keypads or swipe

cards, so personnel can only enter the offices where they actually work. This would mean that nurses would not be able to enter the accounts office, for example, unless accompanied by a member of the accounts staff.

Logical access controls

These are controls within the system itself. They ensure that personnel with access to the system can only access the applications and data that are relevant to their job. So nurses would not have access to the payroll records, for example. Such systems rely on passwords. Staff should be given passwords that only allow them access to the areas that are relevant to their jobs. The system should require regular changes to passwords, so that if they are discovered, the damage is limited. Personnel controls

Personnel controls aim to stop employees deliberately or accidentally compromising security. Personnel controls may include:

· Recruitment of honest individuals;

· Training, emphasising the importance of security;

· Regulations relating to security (such as not allowing staff to share passwords) that are enforced strictly;

· Supervision;

· System logs that automatically monitor what employees do while on line. These may produce exception reports to alert management to unusual activities or repeated attempts to log on with different passwords.

Firewalls

Where the system is connected to the Internet, or to an intranet, there is a risk that personnel outside the organisation can access the system. Firewalls are designed to prevent this.

Anti-virus software

Viruses (or malware) are malicious programs that aim to harm the system, or to gain access to confidential information. Viruses can be imported into the system by e-mail, or by connecting an infected flash drive or other storage device to the system. A particular risk to security is spyware, which watches what users of the system do, and then sends the information to a third party (e.g. key logging programs which can be used to discover passwords).

(b) Procedures relating to internal distribution

Reports

The first issue is the management report, and the comment by one manager that he does not read most of it. This is a danger where managers are provided with too much data, often referred to as information overload. Procedures should be put in place to ensure that reports are only sent to personnel to whom they are relevant.

· All reports should contain distribution lists;

· The people on the distribution list should be asked on a regular basis whether the report is still relevant, and if not, they should be removed from the distribution list. This exercise may also highlight obsolete reports that are still being prepared but not used.

Standards should exist for all reports, to ensure consistency, as this will ensure that reports are easier to understand and use. Examples of standards are:

· Standard fonts;

· Reports should include the name of the person who prepared them;

· Page numbers so it will be clear if any pages are missing;

· Standard report headers;

· The date of preparation of the report;

· The date of the information on the report.

There should also be clear standard definitions of measures used in reports. The number of empty hospital beds is a good example. A bed should not be considered to be empty until it is actually available for another patient. If reports have to be specially programmed, a cost benefit analysis should be carried out before the report is commissioned. The cost of preparing the report should be ascertained. Ascertaining the benefits may be more difficult in financial terms, but at least if management is aware of the cost of a proposed report, it can make a judgement whether or not it is worth it.

E-mail

E-mail can be a very useful tool for communication, but can also lead to problems, some of which have been highlighted by managers. The major problem is that people may communicate too much using e-mail, sending messages that are too trivial to merit the attention of the receiver. This is compounded by the fact that often other people are copied in on e-mails that do not really concern them. Finally, e-mails may lead to situations where communication that should just have been expressed informally in a "chat" is recorded in writing, and this can often end up being seen by others for whom it was not intended. In order to overcome these problems, the organisation should have procedures designed to encourage the sensible use of e-mail. Staff should be encouraged to think about whether the e-mail is really necessary in the first place, and if so, whether they need to copy the whole department onto the e-mail.

Security

There should be security procedures in place relating specifically to the distribution of reports:

· Reports containing confidential information should be marked "private and confidential".

· Users of such reports should not leave them out on their desks where unauthorised staff can read them.

· Disciplinary procedures should be in place for staff that divulge confidential information to others, whether intentionally or simply due to careless handling of confidential information.

Case: Moffat Co's Decision to Invest in an Enterprise Resource Planning System

Moffat Co, which commenced trading on 1 December 20X1, supplies and fits tyres and exhaust pipes and services motor vehicles at 30 locations. The directors and middle management are based at the Head Office of Moffat. Each location has a manager who is responsible for day-to-day operations and is supported by an administrative assistant. All other staff at each location are involved in fitting and servicing operations. Each location has its own systems, including a basic accounting system and inventory recording system. Monthly management accounts are prepared and sent to head office. Budgets are also prepared by each branch and sent to head office. The directors of Moffat are currently considering investing in an enterprise resource

planning system (ERPS) as they are concerned that sub optimal decisions are being made because the system does not provide appropriate information throughout the organisation. Required: (a) Explain the characteristics of THREE types of information required to assist in decision making at different levels of management and on differing timescales in Moffat Co, providing TWO examples of information that would be appropriate to each level. (b) Explain the features of an ERPS and discuss the advantages of Moffat investing in an ERPS.

Answer:

(a) Types of information

The management of an organisation need to exercise control at different levels in an organisation. These levels are often categorised as being strategic, tactical and operational. The information required by management at these levels varies in nature and content.

Strategic information

Strategic information is required by the management of an organisation in order to enable management to take a longer-term view of the business and assess how the business may perform during that period. The length of this longer-term view will vary from one organisation to another, being very much dependent on the nature of the business and the ability of those responsible for strategic direction to be able to scan the planning horizon. Strategic information tends to be holistic and summary in nature and would be used by management when, for example, undertaking SWOT analysis. In Moffat strategic information might relate to the development of new services such as the provision of a home-based vehicle recovery service or the provision of twenty-four hour servicing. Other examples would relate to the threats posed by Moffat's competitors or assessing the potential acquisition of a tyre manufacturer in order to enhance customer value via improved efficiency and lower costs.

Tactical information

Tactical information is required in order to facilitate management planning and control for shorter time periods than strategic information. Such information relates to the tactics that management adopt in order to achieve a specific course of action. In Moffat this might involve the consideration of whether to open an additional outlet in another part of the country or whether to employ additional supervisors at each outlet in order to improve the quality of service provision to its customers.

Operational information

Operational information relates to a very short time scale and is often used to determine immediate actions by those responsible for day-to-day management. In Moffat, the manager at each location in Moffat would require information relating to the level of customer sales, the number of vehicles serviced and the number of complaints received during a week. Operational information might be used in Moffat in order to determine whether staff are required to work overtime due to an unanticipated increase in demand, or whether operatives require further training due to excessive time being spent on servicing certain types of vehicle.

(b) ERPS

An ERPS is a software system that provides a seamless flow of information across the entire organisation. This is achieved by using one database for all the information in the organisation which is accessed by the various programmes used by the different departments within the organisation. These different programmes are often presented as modules, and typically include

an accounting module, a manufacturing resource planning module, purchase ordering, payroll, inventory control, project management and customer relationship management. Moffat employees are based at multiple locations - head office and 30 trading locations, each with their own separate IT systems. An ERPS would mean that all employees at all locations are using the same system and promote greater sharing of data. The first advantage of having one unified set of data is that management at head office will have up to date information in real time. Currently management relies on each location sending their monthly management accounts. These have to be consolidated at head office before management can see how well the business is performing. With an ERPS, transactions entered at the locations would be processed in real time by the one system, and management at head office could access this information as often as they wish. The ERPS would be able to produce accounting reports automatically based on the transactions in the database. The budgeting process could become more streamlined - as branches prepare their budgets online, these can be consolidated automatically by the ERPS to form the master budget, replacing a manual process. Having a single database might help the business identify customers that are common to many different branches, and therefore enable the company to give such customers rewards for their loyalty. This would hopefully lead to increased revenue from such customers. Sharing of data would be useful for branches too. If a branch managers experience stock outs of a particular part, for example, he would be able to check the inventory records of other branches to see if they have the part he needs. Overall the ERPS would enable a unified view of the organisation for senior management and greater sharing of data by the branch managers.

Case: Decision Analysis for Gym Bunnies' Expansion

Gym Bunnies (GB) is a health club. It currently has 6,000 members, with each member paying a subscription fee of $720 per year. The club is comprised of a gym, a swimming pool and a small exercise studio. A competitor company is opening a new gym in GB's local area, and this is expected to cause a fall in GB's membership numbers, unless GB can improve its own facilities. Consequently, GB is considering whether or not to expand its exercise studio in a hope to improve membership numbers. Any improvements are expected to last for three years.

Option 1

No expansion. In this case, membership numbers would be expected to fall to 5,250 per year for the next three years. Operational costs would stay at their current level of $80 per member per year.

Option 2

Expand the exercise studio. The capital cost of this would be $360,000. The expected effect on membership numbers for the next three years is as follows:

Probability	Effect on membership numbers
0.4	Remain at their current level of 6,000 members per year
0.6	Increase to 6,500 members per year

The effect on operational costs for the next three years is expected to be:

Probability	Effect on operational costs
0.5	Increases to $120 per member per year

| 0.5 | Increases to $180 per member per year |
(Ignore time value of money)
Required: (a) Using the criterion of expected value, prepare and fully label a decision tree that shows the two options available to GB. Recommend the decision that GB should make. (b) Calculate the maximum price that GB should pay for perfect information about the expansion's exact effect on membership numbers. (c) Briefly discuss the problems of using expected values for decisions of this nature.

Answer:
(a) Decision tree
Tutorial note: Candidates will not be required to draw graphs in the exam. This question is provided to help understand how a decision tree is constructed.
WORKINGS
Option 1: Net income = $720 - $80 = $640 per year.

Option2:
If costs $120 per year, net income = $720 - $120 = $600 per year.
 =If costs $180 per year, net income = $720 - $180 = $540 per year.
Expected value and decision
EV at A=(0.5 * $3.6m) +(0.5 * $3.24m) = $3.42m
EV at B = (0.5 * $3.9m) + (0.5 * $3.51m) = $3.705m
EV at C =(0.4 * $3.42m)+(0.6 * $3.705m) = $3.591m per year
At D, compare EV of:
Option 1: (3 * $3.36m) = $10.08m
Option 2: ($3 * $3.591m) - $0.36m = $10.413m
Therefore choose option 2 expand exercise studio.
Estimating accurate probabilities is difficult because this exact situation has not arisen before. The EV criterion is useful where the attitude of the investor is risk neutral. The management of Gym Bunnies' attitude to risk is not known, which makes it difficult to say whether this criterion is suitable. In a decision such as this one, it would be useful to see what the worst case scenario and best case scenario results would be too, in order to assist decision making.

(b) Value of perfect information
With perfect information
If membership numbers were 6,000:
EV = $3.42m * 3 = $10.26m
Less costs of $0.36 = $9.9m
Therefore with these membership numbers, GB would choose option 1 instead.
If membership numbers were 6,500:
EV= $3.705 * 3 = $11.115m
Less costs of $360 = $10.755m
In this instance GB would choose option 2.

So if membership numbers are 6,000, of which there is a 0.4 probability, EV will be $10.08m (option 1). If membership numbers are 6,500, of which there is a 0.6 probability, EV will be $10.755m (option 2).
Therefore EV with perfect information = (0.4 * $10.08m) +(0.6 * $10.755) = $10.485m.
Without perfect information
EV is $10.413m
Therefore the value of the information is $72,000 ($10.485m - $10.413m). This represents the maximum price that GB should be prepared to pay for the information.

(c) Problems of using expected values
The expansion decision is a one off decision, rather than a decision that will be repeated many times. Expected values, on the other hand, give us a long run average of the outcome that would be expected if a decision was to be repeated many times. The actual outcome may not be very close to the expected value calculated and the technique is therefore not really very useful here. Also, estimating accurate probabilities is difficult because this exact situation has not arisen before. The expected value criterion for decision making is useful where the attitude of the investor is risk neutral. We do not know what the management of Gym Bunnies' attitude to risk is, which makes it difficult to say whether this criterion is a good one to use. In a decision such as this one, it would be useful to see what the worst case scenario and best- case scenario results would be too, in order to assist decision making.

Case: Evaluating the Impact of Expanding Services on Oliver's Salon Performance
Oliver is the owner and manager of Oliver's Salon, which is a quality hairdresser that experiences high levels of competition. The salon traditionally provided a range of hair services to female clients only, including cuts, colouring and straightening A year ago, at the start of his 20X1 financial year, Oliver decided to expand his operations to include the hairdressing needs of male clients. Male hairdressing prices are lower, the work simpler (mainly haircuts only) and so the time taken per male client is much less. The prices for the female clients were not increased during the whole of 20X0 and 20X1 and the mix of services provided for female clients in the two years was the same. The latest financial results are as follows:

	20X0		20X1	
	$	$	$	$
Sales		200,000		238,500
Less: Cost of sales:				
Hairdressing staff costs	65,000		91,000	
Hair products - female	29,000		27,000	
Hair products - male			8,000	
		94,000		126,000
Gross profit		106,000		112,500
Less: Expenses:				
Rent	10,000		10,000	
Administration salaries	9,000		9,500	

Electricity		7,000		8,000		
Advertising		2,000		5,000		
			28,000		32,500	
Profit			78,000		80,000	

Oliver is disappointed with his financial results. He thinks the salon is much busier than a year ago and was expecting more profit. He has noted the following extra information: 1. Some female clients complained about the change in atmosphere following the introduction of male services, which created tension in the salon. 2. Two new staff were recruited at the start of 20X1. The first was a junior hairdresser to support the specialist hairdressers for the female clients. She was appointed on a salary of $9,000 per year. The second new staff member was a specialist hairdresser for the male clients. There were no increases in pay for existing staff at the start of 20X1 after a big rise at the start of 20X0 that was designed to cover two years' worth of increases.

Oliver introduced some non-financial measures of success two years ago:

	20×0	20X1
Number of complaints	12	46
Number of male client visits	0	3,425
Number of female client visits	8,000	6,800
Number of specialist hairdressers for female clients	4	5
Number of specialist hairdressers for male clients	0	1

Required: (a) Calculate the average price for hair services per male and female client for each of the years 20X0 and 20X1. (b) Assess the performance of Oliver's Salon using the headings provided: (i) Financial (ii) Quality (iii) Resource utilisation.

Answer:
(a) Average price per client
20X0: Female clients paid $200,000 for 8,000 visits. This is an average price per visit of $200,000/8,000 = $25.
In 20X1 the female hairdressing prices did not increase and the mix of sales did not change so of the total revenue $170,000 (6,800 * $25) was from female clients. This means that the balance of $68,500 ($238,500 - $170,000) was from male clients at an average price of $20 per visit ($68,500/3,425).

(b) Financial performance assessment
Hairdressing sales growth: Oliver's Salon has grown significantly during the two years, with an increase of 19.25% (WORKING 1). This is impressive in a mature industry like hairdressing. The increase has come from the launch of the new male hairdressing with a significant contraction in the core female business - down 15% (W1).
Hairdressing gross margin: Oliver's hairdressing overall gross margin has reduced significantly, down from 53% to 47.2% in 20X1 (WORKING 2).
There has been an increase in staff numbers for the female part of the business and this, combined with the fall in the volume of sales from female clients, has significantly damaged margins from that customer type, with a fall from 53% to 40.5% (WORKING 2). The margin from male clients in 20X1 is 63.5%, which is better than that achieved in 20X0 from the female

clients. This is probably mainly due to faster throughput, so that despite the lower average prices charged the overall margin was still quite good.

Staff costs: The staffing levels have had to increase to accommodate the new male market and the extra levels of business. The new hairdresser for the male clients is being paid slightly more than the previously employed staff (W3). This might encourage dissatisfaction. The addition of a junior will clearly reduce the overall average wage bill but increases costs overall while the volume of female clients is shrinking.

Advertising spend: This has increased by 150% in the year ($5,000/$2,000). This is probably nothing to worry about, as it is likely that the launching of the new product range (males!) will have required advertising. Indeed, given the increase in sales of male hair services it is fair to say that the money was well spent.

Rent is clearly a fixed cost and administrative expenses have gone up a mere 5.5%; these costs appear under control given the overall volume of clients is well up on 20X0.

Electricity costs have jumped 14.3%, which seems a lot but is probably a cost that Oliver would find hard to control. Energy companies are often very large organisations where competition is rarely significant. Small businesses have little choice but to pay the going rate for energy.

Net profit: Overall net profit has worsened to 33.5% from 39% (WORKING 4). This is primarily due to the weakening gross margin and extra costs incurred for advertising. The advertising cost may not recur and so the net margin might improve next year. Overall it is understandable that Oliver is disappointed with the financial results. With a 19.25% increase in overall sales he might have expected more net profit.

(c) Non-financial performance

Quality: The number of complaints is up by 283% (W4) and is proportionately more frequent. This seems to be due to two main reasons: 1. the switch away from a single gender salon has upset the existing customer base. It is possible that by trying to appeal to more customer types Oliver is failing to meet the needs of at least one group. It may be that the quality of hair services has not worsened but that the complaints are regarding the change towards a multi-gender business; 2. the wage rates paid to the new junior staff seem to be well below the wage rates of the existing staff (W3). This implies that they are in training and could be of poorer quality. It is stated that they are in a supporting role but if not properly supervised then mistakes could easily occur. This can easily lead to complaints from dissatisfied customers.

Resource utilisation: The main resources that Oliver has are the staff and the rented property. As far as the property is concerned the asset is being used to a much higher degree with 27.8% more clients being serviced in the year (10,225/8,000).

However, as the overall margins are lower one might argue that just focusing solely on volume misses the point on asset utilisation. As far as the staff usage is concerned it is a mixed scene. The female specialists are producing less per member of staff than in 20X0 after the recruitment of one more staff member and a fall in volume of female clients. Each specialist served 2,000 female clients in 20X0 and only 1,360 in 20X1 (W7). Oliver may have been concerned with the complaints coming in and decided to do something about service levels by increasing resources for the female clients. The specialist dealing with male clients has produced far more treatments than those serving the females. This is probably not unusual; the male customer requires only a simple service. Without comparative data it is not possible conclude whether or

not 3,425 customers per year is good. This specialist cannot be said to be doing "better" than the others. Cutting men's hair is quicker to do, so more output is inevitable.

WORKINGS

WORKING 1. Sales growth Sales growth overall is $238,500/$200,000 or +19.25%. The female hairdressing sales has though fallen by 15% ($200,000 - $170,000)/$200,000. This is entirely reflected in volume, as there was no price increase in 20X1 for female clients.

WORKING 2. Gross margin Gross margin overall is $106,000/$200,000 or 53% in 20X0 and $112,500/238,500 or 47.2% in 20X1. This can be analysed between the female and male clients:

		20X0	20X1	
		Female	Female	Male
		$	$	$
Sales		200,000	170,000	68,500
Less cost of sales:				
Hairdressing staff costs (W3)	(65,000)	(74,000)	(17,000)
Hair products - female		(29,000)	(27,000)	
Hair products - male				(8,000)
Gross profit		106,000	69,000	43,500
GP%		53%	40.5%	63.5%

WORKING 3. Staff costs

Staff cost growth is $91,000/$65,000 or +40%. In absolute terms average staff costs were $65,000/4 = $16,250 in 20X0. Additional staff cost $26,000 ($91,000 - $65,000) in total for two people. The junior was paid $9,000 and so the new specialist for the male customers must have been paid $17,000

WORKING 4. Complaints Number of complaints up by 46/12 or 283%. Complaints per customer visit up from 12/8,000 or 0.15% to 46/10,225 or 0.45%

WORKING 5. Clients per specialist Number of female clients per specialist is 8,000/4 or 2,000 in 20X0 and 6,800/5 or 1,360 in 20X1. Number of male clients per specialist is 3,425 in 20X1.

WORKING 6. Net profit Net profit is $78,000/200,000 or 39% in 20X0 and $80,000/238,500 or 33.5% in 20X1.

Case: Performance Comparison Between Public and Private Schools in Bigton
The Education ministry of Homeland wishes to introduce performance measurement into schools as a way of improving efficiency and quality of education. As a pilot exercise, staff from the ministry of education have selected two schools in Bigton, and obtained comparative financial data for the most recent school year: 1. Northtown is a state owned school whose performance in terms of the exam league tables is slightly above the national average. 2. St Trinian's, a private day school located close to Northtown, has excellent academic standards. Both schools provide education to children from the age of 11 to 18 and have similar facilities, although St Trinian's is slightly smaller than Northtown. Data collected by the ministry of education staff is as follows:

| | Northtown | St Trinian's |

Number of pupils	1,200	700	
Average class size (number of pupils)	30	15	
Costs:	$000	$000	
Teaching	3,600	2,800	
Back office costs	720	210	
Buildings maintenance	648	210	
Internet and computers for students	180	70	
Energy	180	53	
Total costs	5,328	3,343	

Required: (a) Explain the characteristics that differentiate public sector organisations from commercial organisations, using the two schools in Bigton to illustrate your answer. (b) Evaluate the performance of Northtown against St Trinian's using the benchmark data provided.

Answer:

(a) Characteristics that differentiate public sector organisations from commercial ones

Broader group of stakeholders

Public sector bodies often have a wider group of stakeholders than commercial organisations. In the case of the schools in Homeland, for example, stakeholders will include teachers and staff, pupils, parents of pupils and the taxpayer (represented in this case by the ministry of education). The interests of these groups may conflict - parents want good quality education, teachers and staff want good working conditions, while taxpayers would like to reduce the amount spent on education. Commercial organisations may also have a diverse group of stakeholders, but not so many of these will have sucl a strong interest in the organisation.

Customers do not pay for the services they receive

In the case of the state financed schools, the pupils attending the schools do not have to pay for the education the receive, unlike the customers of commercial organisations. This may lead to difficulties in allocating resources to where they can best be used. Pupils may be happy to sign up for extra-curricular activities, for example, if they do not have to pay for these, but would not sign up for them if they had to pay. Demand for free services is therefore not a good indicator of how much users value them.

Monopoly providers

Many public sector bodies are monopoly providers of their service. This means that customers cannot switch to other providers if they receive poor service. In the case of the schools in Homeland, for example, children must attend the school that serves the area in which they live. The system of league tables attempts to reduce the impact of this monopoly by closing down schools where less than 20% of pupils attain satisfactory exam results.

Difficulty of measuring output

It may often be difficult to measure output in public sector bodies. In schools, the output can be measured to some extent by the number of students obtaining good exam results. However, even this measure is not ideal - it does not take into account the provision of extra-curricular activities in the schools and does not take account of differences in the abilities of the pupils.

(b) Evaluation of the performance of Northtown against St Trinian's

The raw data provided can be made more comparable by calculating the cost per pupil, rather than simply looking at total costs, as the number of pupils is likely to be the main cost driver. The costs per pupil for each category are shown below:

	Northtown	St Trinian's
	$	$
Teaching	3,000	4,000
Back office costs	600	300
Buildings maintenance	540	300
Internet and computers for students	100	150
Energy	125	76
Total costs	4,415	4,776

It can be seen that the total cost per student at St Trinian's is 8% higher than the cost per pupil in the state system. This higher cost can be entirely explained by the higher teaching cost per pupil at St Trinian's. The higher teaching cost is likely due to two factors: 1. St Trinian's enjoys smaller class sizes; 2. As a private school, it may pay higher salaries to attract better teachers. Far from reflecting any inefficiency, the higher teacher costs reflect the aim of the private school, which is to provide a better standard of education than the state schools. The school is succeeding in this area, as it is stated that the school has an excellent academic record. It may not be desirable or feasible for state financed schools to match the level of spending per pupil that is enjoyed in the private sector, due to political constraints. In terms of all the other items of expenditure, it can be seen that St Trinian's spends less per pupil than Northtown. Most of these are "support" activities where savings could be made without impacting on the quality of the education that the pupils receive. Back office costs, in particular are twice the cost per student in Northtown compared to St Trinian's. There does not appear to be a valid reason for this. It would be expected that a school with a larger number of pupils would be able to enjoy economies of scale in this area. The high back office costs suggest inefficiency on the part of Northtown. Higher spending on Buildings maintenance may be justified if the buildings are older. It may also be that St Trinian's is spending too little in this area, as cutting back on maintenance may be a short-term fix that could lead to bigger problems in the long term. Higher energy costs may reflect a lack of awareness of energy efficiency (e.g. it may be that the heating is too high in Northtown or there may be poor insulation in the school). High energy costs will also add to the school's "carbon footprint", which may show poor compliance with government policies in this area. The higher spending on IT could relate to poor procurement by Northtown. Spending on such items is an area where all state schools could benefit from centralised procurement. If the ministry of education were to take over the procurement of computers for schools, it would become a very large buyer, and could command large bulk discounts that would not be available to schools such as St Trinian's. Overall, Northtown's expenditure appears to be too high in all these areas, and the school could benefit by trying to reduce spending per pupil to the levels achieved by St Trinian's. If the school were able to achieve reductions in spending in these areas, it would be able to spend the savings on increasing the quality of teaching.

Case: Key Reports for Monitoring Hotel Performance at Hotelco

Hotelco owns and runs 35 hotels in the UK, some catering mainly for tourists and holidaymakers, other servicing business ravellers. In addition to providing accommodation, each hotel has a bar and restaurant which are open to both residents and non-residents. Until now the company's accounts department, based at its head office, has produced an annual statement of financial position and statement of profit or loss, but has not been required to produce any periodic management accounts. The directors of Hotelco are concerned that the company's profitability is declining. They have therefore decided to introduce a management information system that will enable them to monitor the performance of individual hotels. They propose to install computers networked to head office in every hotel. Relevant data will be input by the accountant at each hotel, enabling reports to be generated for each hotel individually and for the company as a whole.

Required: Describe the reports that should be generated by Hotelco's management information system. Your answer should include the information to be contained in each report and why this would be relevant to management in monitoring performance.

Answer:

A well-designed management information system should provide relevant, accurate and timely information to all levels of management. Hence the introduction of a new system should not only allow the directors to monitor performance, but may actively help to address the issue of declining profits by providing greater feedback to tactical and operational managers.

(a) Periodic reports

The computerisation of hotel records and the on-line link to head office allow the latter to acquire and assimilate large volumes of data rapidly. This would permit monthly financial statements to be produced for each hotel in time for directors to review them and action their findings whilst the implications are still relevant. The statements should comprise the statements of financial position, cash flow and profit or loss, and would enable directors to gain an overview of the effects of local management decisions and the effectiveness of corporate policy on a regional basis. These periodic reports should include comparative data in addition to actual data. Figures could be included for budget/previous periods/industry data. Variances could be reported.

(b) Demand reports

The new system should also be capable of producing a range of reports on demand such that senior management can assess high risk aspects of the business as required (i.e. monthly or more frequently if desired).

(i) Room occupancy report

This report would detail what percentage of a hotel's available rooms was occupied and by utilising information from registration cards should split this figure between business and non-business users. Incorporating room charge-out rates into the same report would enable management to:

· assess the accuracy of revenues from room letting;

· identify if variations in regional rates have a significant impact on occupancy rates and overall profitability;

· identify any trends in business/non-business usage and the opportunity for differential pricing and attracting more guests.

Room rates should also be compared to a centralised master file of approved rates and discounts to ensure hotel managers are not offering rooms at below cost in an attempt to attract business. To ensure all income from rooms let is recorded, the room occupancy report should compare rooms for which income has been recorded to a housekeeper's report of rooms cleaned.

(ii) Bad debts report

This report should highlight all debts more than (say) 60 days overdue. Bad debts could be a major contributor to declining profits, particularly if the hotels catering for business travellers are taking block corporate bookings. As an additional control to ensure that all reported bookings are genuine, this report should also include a comparison of revenues with a direct room cost such as laundry bills.

(iii) Restaurant sales report

This should compare total revenues from the restaurant to the number of bills raised and occupancy rate, thereby allowing the directors to ascertain if unduly preferential arrangements are being allowed by some of their hotels. Differentiation should also be made between billings to non-residents, as this will enable attention to be focused on this separate revenue source. This is important if the restaurant is not being operated at capacity such that non- residents could be a useful source of income.

(iv) Bar sales report

Total billing should be compared as for restaurant sales, but without the division between residents and non- residents, as the latter would be difficult to obtain in view of the large number of cash transactions.

(v) Restaurant and bar inventory report

Physical control over bar and restaurant inventory is difficult to maintain and losses represent a potentially significant restriction on profits. A head office official should attend a physical count at each hotel. The quantities should then be the benchmark for subsequent movements and be "enforced" by random spot checks. The inventory report should compare the verified figure as adjusted for subsequent purchases and sales to occupancy rate and highlight significant percentage variation from preceding months (i.e. indicating pilferage and misappropriation). The overall inventory holding of each hotel should be compared to inventory turnover to ensure the former does not represent an excessive usage of working capital. (vi) Cash availability report

Many of the bar and restaurant takings of each hotel will be in cash; like inventory, this is easily susceptible to misappropriation. The head office directors will require a report that summarises the cash takings and receipts, and makes a comparison between hotels making allowances for differences in the number and type of resident (e.g. business users may utilise corporate client cards rather than their own cash).

(vii) Wages report

Given that wages, often casual wages, represent a significant item of cash expenditure for hotels and one which can be directly related to revenue, a report should be produced detailing the number of waged staff per week and their wages. This could then be compared to revenue reports to identify any significant departures from the expected relationship. This may indicate general inefficiency capable of improvement or fraud.

(c) Error/exception reports

A unique feature of computerised systems is their ability to sift through large volumes of data and extract only those figures of significance to users. These exception reports should be produced automatically to highlight matters such as:

· hotel revenue falling below budget (e.g. by more than 10%);

· group cash reserves/funding requirements exceeding available limits;

· hotels giving rooms below the approved room rates.

Case: Cost Analysis of Products A, B, and C: Traditional vs. Activity-Based Costing

Gadget Co produces three products, A, B and C, all made from the same material. Until now, it has used traditional absorption costing using labour hours to allocate overheads to its products. The company is now considering an activity based costing system in the hope that it will improve profitability. Information for the three products for the last year is as follows:

	A	B	C
Production and sales volumes (units)	15,000	12,000	18,000
Selling price per unit	$7.50	$12	$13
Raw material usage (kg) per unit	2 N	3	4
Direct labour hours per unit	0.1	0.15	0.2
Machine hours per unit	0.5	0.7	0.9
Number of production runs per annum	16	12	8
Number of purchase orders per annum	24	28	42
Number of deliveries to retailers per annum	48	30	62

The price for raw materials remained constant throughout the year at $1.20 per kg. Similarly, the direct labour cost for the whole workforce was $14.80 per hour. The annual overhead costs have been analysed by activity as follows:

	$
Machine set up costs	26,550
Machine running costs	66,400
Procurement costs	48,000
Delivery costs	54,320

Required: (a) Calculate the full cost per unit for products A, B and C under traditional absorption costing, using direct labour hours as the basis for apportionment. (b) Calculate the full cost per unit of each product using activity based costing. (c) Using the information given and your calculation from (a) and (b) above, explain how activity based costing may help Gadget Co improve the profitability of each product.

Answer:

(a) Traditional absorption costing

Total annual overhead costs:	$
Machine set up costs	26,550

Machine running costs		66,400
Procurement costs		48,000
Delivery costs		54,320
		195,270

Overhead absorption rate:

	A	B	C	Total
Production volumes	15,000	12,000	18,000	
Labour hours per unit	0.1	0.15	0.2	
Total labour hours	1,500	1,800	3,600	6,900

Therefore, overhead absorption rate = $195,270/6,900 = $28.30 per hour.

Cost per unit	A	B	C
	$	$	$
Raw materials ($1.20 * 2:3:4 kg)	2.4	3.6	4.8
Direct labour ($14.80 * 0.1:0.15:0.2 hours)	1.48	2.22	2.96
Overhead ($28.30 * 0.1:0.15:0.2 hours)	2.83	4.25	5.66
Full cost per unit	6.71	10.07	13.42

(b) Activity based costing

Cost drivers			
Cost pools	$	Cost driver	
Machine set up costs	26,550	36 production runs (16 + 12+ 8)	
Machine running costs	66,400	32,100 machine hours (7,500 + 8,400 + 16,200)	
Procurement costs	48,000	94 purchase orders (24 + 28 + 42)	
Delivery costs	54,320	140 deliveries (48 + 30 + 62)	
	195,270		

Cost per machine set up		$26,550 + 36 = $737.50	
Cost per machine hour		$66,400 + 32,100 = $2.0685	
Cost per order		$48,000 + 94= $510.6383	
Cost per delivery		$54.320 + 140= $388	

Allocation of overheads to each product:

	A	B	C	Total
$		$	$	$
Machine set up costs	11,800	8,850	5,900	26,550
Machine running costs	15,514	17,376	33,510	66,400
Procurement costs	12,255	14,298	21,447	48,000
Delivery costs	18,624	11,640	24,056	54,320
	58,193	52,164	84,913	195,270
Number of units produced	15,000	12,000	18,000	
	$	$	$	
Overhead cost per unit	3.88	4.35	4.72	

Total cost per unit	A	B	C
	$	$	$
Materials	2.4	3.6	4.8
Labour	1.48	2.22	2.96
Overheads	3.88	4.35	4.72
	7.76	10.17	12.48

(c) How ABC may improve profitability

When comparing the full unit costs for each of the products under absorption costing as compared to ABC, the following observations can be made:

Product A

The unit cost for product A is 16% higher under ABC as opposed to traditional absorption costing. Under ABC, it is $7.76 per unit compared to $6.71 under traditional costing. This is particularly significant given that the selling price for product A is $7.50 per unit. This means that when the activities that give rise to the overhead costs for product A are taken into account, product A is actually making a loss. If the company wants to improve profitability it should look to either increase the selling price of product A or somehow reduce the costs. Delivery costs are also high, with 48 deliveries a year being made for product A. Maybe the company could seek further efficiencies here. Also, machine set up costs are higher for product A than for any of the other products, due to the larger number of production runs. The reason for this needs to be identified and, if possible, the number of production runs needs to be reduced.

Product B

The difference between the activity based cost for B as opposed to the traditional cost is quite small, being only $0.10. Since the selling price for B is $12, product B is clearly profitable whichever method of overhead allocation is used. ABC does not really identify any areas for concern here.

Case: Maximizing Net Profit and Throughput Accounting Analysis for Products A and B

(a) Flopro makes and sells two products A and B, each of which passes through the same automated production operations. The following estimated information is available for period 1:

i. Product unit data:	A	B
Selling price per unit ($)	60	70
Direct material cost ($)	2	40
Variable production overhead cost ($)	28	4
Overall hours per product unit (hours)	0.25	0.15

ii. Budgeted production/sales of products A and B are 120,000 units and 45,000 units respectively. The selling prices per unit for A and B are $60 and $70 respectively.

iii. Maximum demand for each product is 20% above the budgeted sales levels.

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

One of the production operations has a maximum capacity of 3,075 hours that has been identified as a bottleneck that limits the overall production/sales of products A and B. The bottleneck hours required per product unit for products A and B are 0.02 and 0.015 respectively. Required: Calculate the mix (units) of products A and B that will maximise net profit and the value ($) of the maximum net profit. (b) The bottleneck situation detailed in (a) still applies. Flopro has decided to determine the profit maximising mix of products A and B based on the throughput accounting principle of maximising the throughput return per production hour of the bottleneck resource. This may be measured as: Throughput return per production hour = (selling price - material cost)/bottleneck hours per unit. All other information detailed in (a) still applies, except that the variable overhead cost as per (a) is now considered to be fixed for the short/intermediate term, based on the value ($) which applied to budgeted production/sales. (i) Calculate the mix (units) of products A and B that will maximise net profit and the value of that net profit. (ii) Calculate the throughput accounting ratio for product B which is calculated as: throughput return per hour of bottleneck resource for product B/overall total overhead cost per hour of bottleneck resource. (3 marks) (iii) Comment on the interpretation of throughput accounting ratios and their use as a control device. Your answer should refer to the ratio for product B.

Answer:
(a) Optimum product mix
The contribution per product unit (selling price - variable cost) may be calculated as:
A = $60 - (2 + 28) = $30
B = $70- (40+ 4) = $26

Contribution per unit	$30	$26
Bottleneck hours per unit	0.02	0.015
Contribution per bottleneck hour	$1,500	$1,733
Ranking	2	1

Therefore produce and sell product B up to its maximum demand and then product A with the remaining capacity:

Maximum demand of product B (45,000 * 120%)		54,000 units	
Bottleneck hours required for B (54,000 * 0.015)		810 hours	
Bottleneck hours available for A (3,075 - 810)		2,265 hours	
Output of product A which is possible (2,265/0.02)		113,250 units
Maximum net profit:			
			$
Contribution product A	113,250 * $30	3,397,500
Contribution product B	54,000 * $26	1,404,000
Total contribution		4,801,500
Less: Fixed overhead cost:		1,470,000
Net profit		3,331,500

(b) Throughput accounting

(i) Product mix to maximise net profit
Throughput per unit is calculated as selling price - direct material cost:
A = $60 - 2 = $58
B = $70 - 40 = $30

	A	B
Throughput per unit	$58	$30
Bottleneck hours per unit	0.02	0.015
Throughput return per bottleneck hour	$2,900	$2,000

Flopro should sell product A up to its maximum demand and then product B using the remaining capacity.

Maximum demand of product A (120,000 * 120%)	144,000 units	
Bottleneck hours required for A (144,000 * 0.02)	2,880 hours	
Bottleneck hours available for B (3,075 - 2,880)	195 hours	
Output of product B which is possible (195/0.015)	13,000 units	

Maximum net profit:

Throughput return product A 144,000 * ($60 - 2)	8,352
Throughput return product B 13,000 * ($70 - 40)	390
Total throughput return	8,742
Less: Overhead cost:	
Variable based on budget (120,000 * $28 + 45,000 * $4)	(3,540)
Fixed	(1,470)
Net profit	3,732

(ii) Throughput accounting ratio for product B
Throughput accounting ratio = Throughput return per hour of bottleneck/Total overhead cost per hour of bottleneck
Throughput return per hour of bottleneck for product B was calculated in part (i) as $2,000.
Total overhead cost per hour of bottleneck:
Total overhead costs: (3,540,000 + 1,470,000) = $5,010,000
Total hours of bottleneck: 3,075
Total overhead cost per hour of bottleneck (5,010,000/3075) = $1629.27
Throughput accounting ratio = 2,000/1,629.27 = 1.2275

(iii) Interpretation
Where throughput accounting principles are applied, a product is worth producing and selling if its throughput return per bottleneck hour is greater than the production cost per throughput hour. This may be measured by the throughput accounting ratio. Where the ratio is less than 1.00, cost exceeds return and the focus should be on improving the size of the ratio. Efforts may be made to improve the position for each product and in total by focusing on areas such as
· Improved throughput ($) per unit by increasing selling price or reducing material cost per unit. Product B has a very high material element ($40 per unit)
· Improving the throughput ($) per unit by reducing the time required on the bottleneck resource. Reducing the time for product B from 0.015 hours to 0.01 hours through methods change would improve its ratio.

· Improving the overall position by reducing the cost of spare capacity. This may be achieved by operational re- design aimed at reducing or eliminating the impact of any bottlenecks. The throughput ratio for product B is 1.2275 which is greater than 1.00 and therefore acceptable. Its ratio is considerably less than that of product A, which is 1.780 ($2,900/$1,629.27). The product ratio may be used as a basis for the monitoring of trend, by product and in total.

Case: Importance and Implementation of Environmental Management Accounting at Little Chemical Co
The Little Chemical Co (LCC) manufactures a small range of speciality chemicals for use in the agriculture industry. Recently the company received a large fine because some of the chemical discharges produce emissions of sulphur dioxide into the atmosphere in excess of permitted standards. As a result of the fine, the company has received bad publicity and lost many of its customers. The managing director of LCC has told the other directors that the company needs to manage the impact of its operations on the environment more carefully. He has also heard that environmental management accounting is becoming more common and wishes to know what this is. He states "Our existing management accounts tell us nothing about our environmental costs or about the amount of emissions and other pollution that we produce. We need this information so we can manage them."
Required: (a) Explain why the management of environmental costs is becoming increasingly important to organisations such as LCC. (b) Explain the meaning of the term environmental management accounting, and illustrate how it can help LCC to improve the management of its environmental activities.

Answer:
(a) Why the management of environmental costs is becoming increasingly important
There are three main reasons why the management of environmental costs is becoming increasingly important: 1. Increasing awareness of environmental issues means that organisations are expected to behave in an environmentally friendly way. LCC has recently experienced a loss of customers due to its own poor reputation. 2. Environmental costs account for a huge portion of costs for many industrial companies such as LCC. In addition to fines, there are image costs, such as the loss of customers that LCC experienced due to excessive pollution. There may also be costs of compliance - such as measuring emissions to ensure they are within legal limits. Management needs to be aware of such costs in order to manage them. 3. There may be benefits associated with better environmental behaviour - such as cost savings if action is taken to reduce waste.

(b) Environmental management accounting
The managing director of LCC has complained that the existing management accounts do not provide management with an accurate view of environmental costs. As a result of this, management make decisions that are bad for the environment and bad for the organisation's profits. In the case of LCC, for example, more information is needed about the current level of emissions and the costs and benefits of reducing these. Environmental management accounting

(EMA) means providing information to management to help them to manage the environmental costs and activities. EMA does not provide only financial information. The United Nations Division for Sustainable Development distinguishes between:

· Physical information such as the use, flows and destinies of energy, water and materials, including waste.

· Monetary information on environment related costs, earning and savings.

EMA makes use of management accounting techniques such as activity-based costing (ABC) and life cycle costing, which can be used to manage environmental costs more effectively. In ABC, for example, the drivers that cause environmental costs to be incurred can be identified. Managers can then take steps to reduce the use of the drivers, so that the environmental costs are reduced without reducing output. EMA would help the managers at LCC to better understand the impact of their activities on the environment. Physical information about the amount of emissions generated could be provided so managers can monitor these and find ways to reduce them. In addition, financial information about the costs and benefits of environmental programs could assist in decision making about investments in new equipment that would help to reduce the pollution. Tutorial note: This topic will not be examined numerically.

Case: Profit Analysis and Cost Calculation for Product D

Scovet Co has identified a market for a new product D for which the following estimated information is available: 1. Sales revenue for the years 20X2, 20X3 and 20X4 of $6m, $7m and $6m respectively. No sales are expected after 20X4. The unit selling price will be $10 throughout the period. 2. Contribution to sales percentage of 60% for each year. 3. Product specific fixed costs in the years 20X2, 20X3 and 20X4 of $2.5m, $2.2m and $1.8m respectively. 4. Capital investment of $4.5m on 1 January 20X2 with nil residual value at 31 December 20X4. Note: Ignore taxation and the time value of money.

Required: (a) Calculate the total profit of product D over its life. (b) Calculate the cost per unit of product D, which includes absorption of all product specific costs over the life of the product.

Answer:

(a) Profit over the life of the product

	1 Jan. 20X2	31 Dec. 20X2	31 Dec. 20X3	31 Dec. 20X4
	$m	$m	$m	$m
Initial investment	-4.5			
Contribution (at 60%)		3.6	4.2	3.6
Fixed costs		-2.5	-2.2	-1.8
Net cash flow	-4.5	1.1	2.0	1.8

Net cash flow and therefore profit 0.4 million.

Hence product D is viable on financial grounds since it generates positive profit over its life.

(b) Cost per unit

| | $ |
| Variable cost per unit ($10 × 0.4) | 4.00 |

| Fixed cost per unit (W) | 5.79 |
| Total cost per unit | 9.79 |

WORKING

	$m	
Initial investment	4.5	
Fixed costs:		
20X2	2.5	
20X3	2.2	
20X4	1.8	
Total product specific fixed costs	11.0	
Budgeted sales units (millions)	1.9	
Budgeted fixed cost per unit ($)	5.79	
	$m	
Budgeted sales units: Total revenue over the life of the product	19	
Budgeted units (at $10 per unit)	1.9	

Case: Analysis of Lifecycle Costs and Strategic Decisions for a New Fitness Monitor

Fit Co specialises in the manufacture of a small range of hi-tech products for the fitness market. It is currently considering the development of a new type of fitness monitor, which would be the first of its kind in the market. It would take one year to develop, with sales then commencing at the beginning of the second year. The product is expected to have a commercial life of two years, before it is replaced with a technologically superior product. The following cost estimates have been made.

Units manufactured and sold	Year 1	Year 2	Year 3	Total
	100,000	200,000	300,000	
	$000	$000	$000	$000
Research and development costs	160			160
Product design costs	800			800
Marketing costs	1,200	1,000	1,750	3,950
Manufacturing costs:				
Variable labour production costs		1,250	2,500	3,750
Other variable production costs		2,750	5,900	8,650
Fixed production costs		650	1,290	1,940
Distribution costs		520	1,020	1,540
Selling costs		480	820	1,300
Administration costs		200	900	1,500	2,600
Total costs	2,360	7,550	14,780	24,690

All costs are specific to the new product.

Note: You should ignore the time value of money.

Question 1. Based on the cost estimates made, what is the life cycle cost per unit? A. $64.17 B. $73.63 C. $74.43 D. $82.30

Answer:

The correct answer is D.

WORKING

All costs relating to the product are included in the lifecycle cost per unit. Therefore cost per unit = $24,690,000/300,000 = $82.30

Question 2. The cost estimates made have not taken account of the learning effect on the production process; it assumed a labour production time per unit of 0.5 hours. It has now been estimated that, although the first unit is expected to take 0.5 hours, a learning curve of 95% is expected to occur until the 1001h unit has been completed. Labour cost per hour is $25 in both years. The value of the learning co-efficient, b, is -0.0740005. What is the revised variable labour production cost for the new product's lifecycle? A. $2,475,075 B. $2,474,175 C. $2,475,000 D. $4,950,150

Answer:

The correct answer is A.

99,003 hours(WORKING) * $25 =$2,475,075

WORKING

If x= 100,y=0.5 x100^-0.0740005 = 0.3556 hours per unit

Therefore, total hours for 100 units IS 35.56 hours

Time for 99th unit, y= 0.5 * 99^-0.0740005 = 0.3559 hours per unit

Therefore, total hours for 99 units is 35.23 hours

Time for 100th (and all subsequent units) is 0.33 hours

Year 2

100 units at 0.3556 hours per unit is 36 hours

99,900 units at 0.33 hours per unit is 32,976 hours

Year 3

200,000 units at 0.33 hours per unit is 66,000 hours

Revised total labour hours is 99,003

Question 3. Which TWO of the following statements regarding life cycle costing are true? A. It includes forecast costs that may turn out to be incorrect B. It ignores post-abandonment costs relating to a product C. It is not generally used in service industries D. It allows managers to make better decisions about launching and discontinuing products, as it shows the costs and revenues associated with a product over its life

Answer:

The correct answers are A and D.

Tutorial note: Lifecycle costs usually include post-abandonment costs relating to a product, they are not ignored. Life cycle costing is used in services industries (e.g. banks calculate the life cycle costs of their customers).

Question 4. One of the directors has commented that the cost estimates are incomplete as they do not included costs that would be incurred during the service and abandonment phase of the new fitness monitor. Which of the following costs are typically incurred during the service and abandonment phase? 1) Decommissioning of factories 2) Design updating 3) Servicing and warranty costs 4) Disposing of products as required by local environmental laws A. 1 and 3 only B. 2 and 3 C. 1 and 4 D. 1, 3 and 4

Answer:

The correct answer is D.

Tutorial note: Design updating is a process that occurs during the manufacturing phase. All other costs are incurred during the design and abandonment phase.

Question 5. It is now the start of year 2. Unexpectedly, a competitor has launched a product similar to Fit Co's fitness monitor. Fit Co will now have to launch the fitness monitor at a lower price than expected. The marketing department believes that at a price of $75, it will be able to sell 100,000 units in year 2 and 200,000 units in year 3, as planned. Costs for years 2 and 3 would remain unchanged. There would be no costs during the abandonment phase. Which of the following statements is correct? A. The product should be abandoned since the lifecycle revenue of $22.5m is less than the lifecycle costs of $24.69m B. The product should be continued since the lifecycle revenue of $22.5m is more than the remaining lifecycle costs of $22.33m C. The product should be abandoned since $75m revenue in year 2 is less than the year 2 costs of $75.5m D. The product should not be sold in year 2 as a loss would be made, but launched in year 3 when expected revenue of $15m would exceed the costs of $14.78m

Answer:

The correct answer is B.

Tutorial note: Although the product will now make a loss over its whole lifecycle, many of the lifecycle costs have already been incurred in year 1. At the start of year 2, Fit Co should only consider costs and revenues over the remaining product life, and since revenues are expected to exceed remaining costs, the product should not be abandoned. Abandoning the product because Year 2 costs exceed revenue is typical of decisions that might be made when lifecycle costing is not used, when managers simply consider costs and revenues on a period-by-period basis. Waiting till Year 3 to launch is implausible; if the product is only launched in Year 3, it is unlikely that sales of 200,000 units would be achieved since there would be less awareness of the product.

Case: Relevant Cost Analysis for Special Order at Parser Co

The managing director of Parser Co, 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 company uses a cost of capital of 20% to appraise projects. 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.

Required: (a) Briefly explain what is meant by opportunity cost. (b) Adjust the schedule prepared by the accountant to a relevant cost basis, incorporating appropriate opportunity costs.

Answer:
(a) Opportunity cost
Opportunity costs represent the value of the loss or sacrifice when choosing between scarce alternatives. Lack of scarcity implies zero opportunity cost.

(b) 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 * 6,000 hours) that will be incurred, plus the displacement costs of $2 x 2,000 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.

Case: Evaluating Further Processing for Sniff Co's Perfume Products

Sniff Co manufactures and sells its standard perfume by blending a secret formula of aromatic oils with diluted alcohol. The oils are produced by another company following a lengthy process and are very expensive. The standard perfume is highly branded and successfully sold at a price of $39.98 per 100 millilitres (ml). Sniff Co is considering processing some of the perfume further by adding a hormone to appeal to members of the opposite sex. The hormone to be added will be different for the male and female perfumes. Adding hormones to perfumes is not universally accepted as a good idea as some people have health concerns. On the other hand, market research carried out suggests that a premium could be charged for perfume that can "promise" the attraction of a suitor. The market research has cost $3,000. Data has been prepared for the costs and revenues expected for the following month (a test month) assuming that a part of the company's output will be further processed by adding the hormones. The output selected for

further processing is 1,000 litres, about a tenth of the company's normal monthly output. Of this, 99% is made up of diluted alcohol, which costs $20 per litre. The rest is a blend of aromatic oils costing $18,000 per litre. The labour required to produce 1,000 litres of the basic perfume before any further processing is 2,000 hours at a cost of $15 per hour. Of the output selected for further processing, 200 litres (20%) will be for male customers and 2 litres of hormone costing $7,750 per litre will then be added. The remaining 800 litres (80%) will be for female customers and 8 litres of hormone will be added, costing $12,000 per litre. In both cases the adding of the hormone adds to the overall volume of the product as there is no resulting processing loss. Sniff Co has sufficient existing machinery to carry out the test processing. The new processes will be supervised by one of the more experienced supervisors currently employed by Sniff Co. His current annual salary is $35,000 and it is expected that he will spend 10% of his time working on the hormone adding process during the test month. This will be split evenly between the male and female versions of the product. Extra labour will be required to further process the perfume, with an extra 500 hours for the male version and 700 extra hours for the female version of the hormone-added product. Labour is currently fully employed, making the standard product. New labour with the required skills will not be available at short notice. Sniff Co allocates fixed overhead at the rate of $25 per labour hour to all products for the purposes of reporting profits. The sales prices that could be achieved as a one-off monthly promotion are:
Male version: $75.00 per 100 ml;
Female version: $59.50 per 100 ml.
Required: (a) Outline the financial and other factors that Sniff Co should consider when making a further processing decision. Note: No calculations are required. (b) Assess whether or not Sniff Co should further process the perfume. Your answer should provide separate calculations for the male and the female versions of the perfume. (c) Calculate the selling price per 100 ml for the female version of the product that would ensure further processing would break even in the test month.

Answer:
(a) Financial and other factors to consider in further processing decision
· Incremental revenue. The new perfume, once further processed, should generate a higher price and the extra revenue is clearly relevant to the decision.
· Incremental costs. A decision to further process can involve more materials and labour. Care must be taken to only include those costs that change as a result of the decision and therefore sunk costs should be ignored.
· Sunk costs would include, for example, fixed overheads already incurred before the further process decision was taken. The shortage of labour means that its "true" cost will be higher and need to be included.
· Impact on sales volumes. Sniff is selling a "highly branded" product. Existing customers may well be happy with the existing product. If the further processing changes the existing product too much, sales and loyalty could be affected.
· Impact on reputation. As is mentioned in the question, adding hormones to a product is not universally popular. Many groups exist around the world that protest against the use of hormones in products. This association could damage Sniff.

· Potential legal cases being brought regarding allergic reactions to hormones.

(b) Further processing decision
Production costs for 1,000 litres of the standard perfume

		$
Aromatic oils	10 litres * $18,000	180,000
Diluted alcohol	990 litres * $20	19,800
Material cost		199,800
Labour	2,000 hours * $15	30,000
Total		229,800
Cost per litre		229.80
Sales price per litre		399.80

Lost contribution per hour of labour used on new products ($399,800 - $199,800)/2,000 hours = $100 per hour.

Incremental costs

	Male	Female
	$	$
Hormone	2 litre * $7,750 = 15,500	8 litre * $12,000 = 96,000
Supervisor	Sunk cost = 0	Sunk cost = 0
Labour	500 hours * $100 = 50,000	700 hours * $100 = 70,000
Fixed cost	Sunk cost = 0	Sunk cost = 0
Market research	Sunk cost = 0	Sunk cost = 0
Total	65,500	166,000

Incremental revenues

	Male	Female
	$	$
Standard	200 litre * $399.80 = 79,960	800 litre * $399.80 = 319,840
Hormone added	202 litre * $750 = 151,500	808 litre * $595 = 480,760
Incremental revenue	71,540	160,920
Net benefit/(cost)	6,040	(5.080)

The Male version of the product is worth further processing in that the extra revenue exceeds the extra cost by $6,040. The Female version of the product is not worth further processing in that the extra cost exceeds the extra revenue by $5,080. In both cases the numbers appear small. Indeed, the benefit of $6,040 may not be enough to persuade management to take the risk of damaging the brand and the reputation of the business. To put this figure into context: the normal output generates a contribution of $170 per litre and on normal output of about 10,000 litres this represents a monthly contribution of around $1.7m (after allowing for labour costs). Future production decisions are a different matter. If the product proves popular, however, Sniff might expect a significant increase in overall volumes. If Sniff could exploit this and resolve its current shortage of labour then more contribution could be created. It is worth noting that resolving its labour shortage would substantially reduce the labour cost allocated to the hormone added project. Equally, the prices charged for a one off experimental promotion might be different to the prices that can be secured in the long run.

(c) Selling price per 100 ml for female version of product
The selling price charged would have to cover the incremental costs of $166,000. For 808 litres
that would mean the price would have to be:
($166,000+8319,840)/808 litres = $601.29 per litre or $60.13 per 100 ml.
This represents an increase of only 1.05% on the price given and so clearly there may be scope
for further consideration of this proposal.

Case: Profit Volume Analysis for Multi-Product Manufacturing: Break-Even and Sales Strategy
Evaluation
A to C Co manufactures three products, A, B, and C. The contribution per unit of each of these
products is as follows:

Product	A	B	C
	$	$	$
Selling price	10	20	30
Less			
Materials cost	(6.2)	(7.6)	(20.4)
Direct labour	(2.0)	(8.0)	(3.0)
Variable overhead	(1)	(3)	(3)
Contribution per unit	0.8	1.4	3.6

Total fixed costs are $9,000 per month Budgeted production and estimated maximum demand
for each product for the following month are as follows:

Product	A	B	C
	Units	Units	Units
Budgeted sales	4,000	2,000	4,000
Maximum demand	4,100	4,600	4,100

Required: (a) Calculate monthly break-even revenue assuming that sales of the three products
are made in the budgeted mix. (b) Draw a profit volume chart, showing two lines: (i) On the
assumption that sales of all products are made using the budgeted mix of products. (ii) On the
assumption that sales of the product with the highest contribution to sales ratio are made first,
followed by the product with the second highest, and so on, with sales of each product being
made up until maximum demand.

Answer:
(a) Calculation of monthly break even revenue
Using the formula: Break even revenue = Fixed cost/Weighted average C/S ratio = $9,000/0.102
= $88,236
WORKING
Weighted average C/S ratio = Budgeted total contribution/Budgeted total revenue

Product	A	B	C	Total
Budgeted sales (units)	4,000	2,000	4,000	
Selling price per unit	10	20	30	

Budgeted revenue	40,000	40,000	120,000	200,000
Contribution per unit	0.8	1.4	3.6	
Budgeted contribution	3,200	2,800	14,400	20,400
C/S ratio	0.08	0.07	0.12	0.102

Weighted average C/S ratio is therefore 0.102.

Tutorial note: The C/S ratios of the individual products are not required to calculate the weighted average C/S ratio. However, they are needed for the next part of the question.

(b) Profit volume charts
(description of the chart: Create a line graph that depicts the relationship between profit ($) and revenue. The x-axis should represent revenue, ranging from $0 to $256,000, with key points labeled at $75,000, $88,236, $123,000, $164,000, $200,000, and $256,000. The y-axis should represent profit, ranging from -$9,000 to $15,480, with key points at -$9,000, $5,760, $9,040, $11,400, and $15,480. Two lines should be included: A line representing "standard sales mix," which is a straight, diagonal line that starts from the point (0, -$9,000) and go through point ($88,236, 0). A second line should start from the origin and go through the points (0, -$9,000), ($123,000, $5,760), ($164,000, $9,040), ($200,000, $11,400), and ($256,000, $15,480). Label both lines clearly, and ensure that the graph includes gridlines for both axes to enhance clarity.)

i. Sales in standard product mix
In order to draw this line it is sufficient to know only two points, and to draw a straight line between them: When revenue = 0, loss = total fixed cost, = $9,000. When revenue is as per budget, it is $200,000 (see part (c) above). Profit at this point is total contribution less fixed costs, being $20,400 - $9,000 = $11,400.

ii. Products sold in order of C/S ratio In this situation it is assumed that product C would be sold first, as it has the highest C/S ratio. Sales of product C would be made up until maximum demand for product C is reached, after which sales of product A would start, up to maximum demand for product A, and finally sales of product C. The Profit volume chart will be multi gradient, as the gradient depends on the C/S ratio of the product. In order to draw the chart, it is necessary to calculate revenue and profit at each of the following points:

· Zero revenue;

· Maximum sales of Product C only;

· Maximum sales of Product C and Product A;

· Maximum sales of all three products.

	Sales revenue	Contribution	Fixed cost	Profit
Zero revenue	0	0	(9,000)	(9,000)
Sell 4,100 units of C	123,000	14,760	(9,000)	5,760
Sell 4,100 units of A and C	164,000	18,040	(9,000)	9,040
Sell 4,100 units of A and C and 4,600 units of B	256,000	24,480	9,000)	15,480

Case: Multi-Product Profit-Volume Analysis for Hair Co's Electrical Goods

Hair Co manufactures three types of electrical goods for hair: curlers (C), straightening irons (S) and dryers (D). The budgeted sales prices and volumes for the next year are as follows:

	C	S	D
Selling price	$110	$160	$120
Units	20,000	22,000	26,000

Each product is made using a different mix of the same materials and labour. Product S also uses new revolutionary technology for which the company obtained a ten-year patent two years ago. The budgeted sales volumes for all the products have been calculated by adding 10% to last year's sales. The standard cost card for each product is shown below:

	C	S	D
	$	$	$
Material 1	12	28	16
Material 2	8	22	26
Skilled labour	16	34	22
Unskilled labour	14	20	28

Both skilled and unskilled labour costs are variable.
The general fixed overheads are expected to be $640,000 for the next year.
Required: (a) Calculate the weighted average contribution to sales ratio for Hair Co. Note: round all workings to two decimal places. (b) Calculate the total break-even revenue for the next year for Hair Co. (c) Draw a multi-product profit-volume (PV) chart showing clearly the profit/loss lines assuming that: (i) products can be sold in order of the ones with the highest ranking contribution to sales ratios first; and (ii) products are sold in a constant mix. Note: only one graph is required. (d) Briefly comment on your findings in (c).

Answer:
(a) Weighted average contribution to sales ratio
Weighted average contribution to sales ratio (WA C/S ratio) = Total contribution/Total revenue.

Per unit:	C	S	D
	$	$	$
Selling price	110	160	120
Material 1	(12)	(28)	(16)
Material 2	(8)	(22)	(26)
Skilled labour	(16)	(34)	(22)
Unskilled labour	(14)	(20)	(28)
Contribution	60	56	28
Sales units	20,000	22,000	26,000
Total revenue	$2,200,000	$3,520,000	$3,120,000
Total contribution	$1,200,000	$1,232,000	$728,000

WA C/S ratio = ($1,200,000 + $1,232,000 + $728,000)/($2,200,000 + $3,520,000 + $3,120,000) = $3,160,000/$8,840,000 = 35.75%

(b) Calculation of monthly break even revenue
Using the formula
Break even revenue = Fixed cost/Weighted average C/S ratio = $640,000/35.75% = $1,790,210

(c) PV chart

Tutorial note: Candidates will not be required to draw graphs in the exam. This question is provided to help understand how the multi-product chart is derived. Calculate the individual C/S ratio for each product then rank them according to the highest one first.

Per unit:	C	S	D
	$	$	$
Contribution	60	56	28
Selling price	110	160	120
C/S ratio	0.55	0.35	0.23
Ranking	1	2	3

Product	Revenue	Revenue (x axis co-ordinate)	Profit	Cumulative Profit (y axis co-ordinate)
$	$	$	$	$
0	0	0	(640,000)	(640,000)
Make C	2,200,000	2,200,000	1,200,000	560,000
Make S	3,520,000	5,720,000	1,232,000	1,792,000
Make D	3,120,000	8,840,000	728,000	2,520,000

(description of the multi-product PV chart: Create a line graph that compares profit ($000) against sales revenue ($000). The x-axis should represent sales revenue, ranging from $0 to $10,000, with key points labeled at $2,000, $4,300, $6,300, $8,000, and $10,000. The y-axis should represent profit, ranging from -$1,000 to $3,000, with key points labeled at -$500, $0, $500, $1,000, $1,500, $2,000, $2,500, and $3,000. A solid line labeled "Most profitable first" that starts slightly below the origin, rises steeply, and passes through the points ($0, -$500), ($2,000, $500), ($4,300, $1,200), ($6,300, $1,800), ($8,000, $2,300), and ($8,400, $2,500). A dashed line labeled "Constant mix" that follows a smoother, less steep path, starting from the same point as the solid line and passing through the points ($0, -$500), ($2,000, $0), ($4,000, $800), ($6,000, $1,500), ($8,000, $2,200), and ($8,400, $2,500).)

(d) Comment on findings in (c)

From the chart above it can be seen that if the products are sold in order of the highest ranking first, break-even will take place at a point just under $1,200,000 of revenue. The exact figure can be worked out by taking the fixed costs of $640,000 and dividing them by Product C's C/S ratio of 0.55 (i.e. the exact BEP is $1,163,636). This is substantially lower than the break-even point which occurs if the products are sold in a constant mix, which is $1,790,210 as calculated in (b) above. The reason for this is obviously because the more profitable product, C, contributes more per unit to fixed costs when being sold on its own that when a mix of products, C, S and D are sold. The weighted average C/S ratio of all three products is only 35.75%, compared to C's C/S ratio of 55%. Obviously, break-even will occur earlier if C is sold in priority. In reality, however, the mix of sales will vary throughout the year and Hair can neither assume that the products are sold in a constant mix, nor that the most profitable can be sold first.

Case: Optimizing Resource Allocation and Profit Maximization for BVX's Garden Furniture Production

BVX manufactures three garden furniture products - chairs, benches and tables. The budgeted unit cost and resource requirements of each of these items are detailed below:

	Chair	Bench	Table
	$	$	$
Timber cost	5.00	15.00	10.00
Direct labour cost	4.00	10.00	8.00
Variable overhead cost	3.00	7.50	6.00
Fixed overhead cost	4.50	11.25	9.00
	16.50	43.75	33.00
Budgeted volumes per annum	4,000	2,000	1,500

Notes:

· These volumes are believed to equal the market demand for these products.

· Fixed overhead costs are attributed to the three products on the basis of direct labour hours.

· The labour rate is $4.00 per hour.

· The cost of the timber is $2.00 per square metre.

The products are made from a specialist timber. A memo from the purchasing manager advises you that because of a problem with the supplier, it is to be assumed that this specialist timber is limited in supply to 20,000 square metres per annum. The sales director has already accepted an order for 500 chairs, 100 benches and 150 tables which if not supplied would incur a financial penalty of $2,000. These quantities are included in the market demand estimates above. The selling prices of the three products are:

Chair $20

Bench $50

Table $40

Required: (a) Determine the optimum production plan and state the net profit that this should yield per annum. (b) Calculate and explain the maximum price which should be paid per square metre in order to obtain extra supplies of the timber.

Answer:
(a) Optimum production plan

	Chair	Bench	Table	Total
Contribution/unit	$8.00	$17.50	$16.00	
Timber/unit (m²)	2.5	7.5	5	
Contribution/m²	$3.20	$2.33	$3.20	
Ranking	1st	3rd	1st	
Minimum units to avoid penalty	500	100	150	
Timber required for minimum units (m²)	1,250	750	750	2,750
Number of units to maximum demand/production resources	3,500	233	1,350	

Timber used for production above minimum units	8,750	1,747.5	6,750	17,247.5
Timber used				19,997.5
Timber available				20,000
Total number of units				
to be produced	4,000	333	1,500	
Contribution from:			$	
Chairs	4,000 * $8.00	32,000.00	
Benches	333 * $17.50	5,827.50	
Tables	1,500 * $16.00	24,000.00	
		61,827.50	
Fixed costs		54,000.00	
Profit		7,827.50	

Since the optimum plan includes production of sufficient quantities of each item to meet the order comprising the minimum demand, and production of the most profitable items already meets the maximum demand, there is no need to consider the financial penalty.

(b) Maximum price

The maximum price which should be paid for the timber, a scarce resource, is also known as its shadow price. The shadow price is the price at which the purchaser makes a nil contribution from its use. Therefore it is necessary to consider the use of any additional timber acquired. The present situation is that demand for chairs and tables is fully satisfied from the existing resources, but there is some unsatisfied demand for benches. Any additional timber would therefore be used to manufacture more benches. Based on the current input cost of $2.00 per m² each m² of timber earns a contribution of $2.33. The maximum price to be paid is therefore the sum of these amounts; $4.33 per m². However, there is no benefit in obtaining more timber than can be used to satisfy the total demand for benches, so this shadow price of $4.33 per m2 only applies for up to 12,500m² of timber. Thereafter there is no use for the timber, so its shadow price is nil.

Case: Linear Programming for Optimal Production Plan with Resource Constraints

A company uses linear programming to establish an optimal production plan in order to maximise profit. The company finds that for the next year materials and labour are likely to be in short supply. Details of the company's products are as follows:

	A	B
	$	$
Materials (at $2 per kg)	6	8
Labour (at $6 per hour)	30	18
Variable overheads (at $1 per hour)	5	3
Variable cost	41	29
Selling price	50	52

| Contribution | 9 | 23 |

There are only 30,000 kg of materials and 36,000 labour hours available. The company also has an agreement to supply 1,000 units of product A which must be met.

Required: (a) Formulate the objective function and constraint equations for this problem. (b) Plot the constraints on a suitable graph and determine the optimal production plan.

Answer:

(a) Objective function and constraints

Objective is to maximise profit:

Let a = the number of units of A to be produced

Let b = the number of units of B to be produced

Objective function: 9a + 23b

Constraints:

Non-negativity b $\geqslant$ 0

Restriction on A a $\geqslant$ 1,000

Materials 3a + 4b $\leqslant$ 30,000

Labour 5a + 3b $\leqslant$ 36,000

(b) Graphical solution

(description of the chart: Create a 2D line chart representing two linear constraints and an iso-contribution line, with the following details: 1. Axes: The x-axis (horizontal) is labeled "a units (000)" and ranges from 0 to 12. The y-axis (vertical) is labeled "b units (000)" and ranges from 0 to 14. Lines: A vertical line at a=1,000 (labeled as "a = 1,000"). A diagonal line representing the constraint $5a+3b$=36,000 The line starts approximately at (0, 12) on the y-axis and intersects the x-axis near (7.2, 0). Another diagonal line representing the constraint $3a+4b$=30,000. This line starts approximately at (0, 8.3) on the y-axis and intersects the x-axis (10, 0). A third line labeled "Iso-contribution line" that runs diagonally across the graph, starting near (0, 4.5) and intersects the x-axis near (11.5, 0)

Optimal point is the intersection of the lines: a = 1,000; and materials constraint 3a + 4b = 30,000.

(3 * 1,000) + 4b = 30,000

3,000 + 4b = 30,000

therefore 4b = 30,000 - 3,000 giving 4b = 27,000

so b = 27,000 + 4,000 therefore b= 6,750 units

The optimal production plan is to make 1,000 units of A and 6,750 units of B.

Case: Optimal Production Strategy for Tablet Co Using Linear Programming

Tablet Co makes two types of tablet computer, the Xeno (X) and the Yong (Y). X currently generates a contribution of $30 per unit and Y generates a contribution of $40 per unit. There are three main stages of production: the build stage, the program stage and the test stage. Each

of these stages requires skilled labour which, due to a huge increase in demand for tablet computers, is now in short supply. The following information is available for the two products:

	Stage Xeno (X) Minutes per unit	Yong (Y) Minutes per unit
Build ($10 per hour)	24	20
Program ($16 per hour)	16	14
Test ($12 per hour)	10	4

Tablet Co is now preparing its detailed production plans for the next quarter. During this period, it expects that the skilled labour available will be 30,000 hours (1,800,000 minutes) for the build stage, 28,000 hours (1,680,000 minutes) for the program stage and 12,000 hours (720,000 minutes) for the test stage. The maximum demand for X and Y over the three- month period is expected to be 85,000 units and 66,000 units respectively. Fixed costs are $650,000 per month. Due to rapid technological change, the company holds no inventory of finished goods.

Required: (a) Use linear programming to calculate the optimum number of each product which Tablet Co should make in the next quarter assuming it wishes to maximise contribution. Calculate the total profit for the quarter. (b) Calculate the amount of any slack resources arising as a result of the optimum production plan and explain the implications of these amounts for decision making within Tablet Co.

Answer:

(a) Optimum production plan

Tutorial note: Candidates will not be required to draw graphs in the exam. This question is provided is to help understand how a linear program is constructed.

Define the variables

Let x = number of units of Xeno to be produced.

Let y = number of units of Yong to be produced.

Let C = contribution.

State the objective function: $C = 30x + 40y$

Subject to the constraints: Build time: $24x + 20y \leqslant 1,800,000$

Program time: $16x + 14y \leqslant 1,680,000$

Test time: $10x + 4y \leqslant 720,000$

Non-negativity constraints : $x, y \geqslant 0$

Sales constraints: $x \leqslant 85,000$ and $y \leqslant 66,000$

Workings for drawing the graph

Build time:

If x = 0, y = 1,800,000/20 = 90,000

If y = 0, x = 1,800,000/24 = 75,000

Program time:

If x = 0, y = 1,680,000/14 = 120,000

If y = 0, x = 1,680,000/16 = 105,000

Test time:

If x = 0, y = 720,000/4 = 180,000

If x = 0, y = 720,000/10 = 72,000

Plot an iso-contribution line

If y = 40,000, C = 40,000 * $40 = $1,600,000
If C = $1,600,000 and y = 0, x = $1,600,000/$30 =53,333.33
(description for the chart: Create a chart with the following specifications: Axes: X-axis: Labeled "Units of x" ranging from 0 to 200,000. Y-axis: Labeled "Units of y" ranging from 0 to 180,000. Lines: A Vertical Line: Labeled "Maximum sales of x" intersecting the x-axis at approximately 85,000 units. A Horizontal Line: Labeled "Maximum sales of y" intersecting the y-axis at approximately 66,000 units at point a. Downward Sloping Line 1: Labeled "Test time," intersecting the y axis at 180,000 and intersecting x axis at point d at 72,000. Downward Sloping Line 2: Labeled "Build time," intersecting the y axis at 90,000 and intersecting x axis at 75,000, intersecting with the "Test time" at point c, intersecting with "Maximum sales of y" at point b. Downward Sloping Line 3: Labeled "Program time," intersecting the y axis at 120,000 and intersecting x axis at 105,000. Dashed Downward Sloping Line: Labeled "Iso-contribution line," intersecting with the "Build time" at point b on the y-axis around 40,000 units and intersecting with 'Program time' on the x-axis around 53,333 units. Shaded Region: Mark a shaded region enclosed by points 0, a, b, c, d to indicate a feasible region.)
Moving the iso-contribution line out to the furthest point on the feasible region, the optimum production point is b. This is the intersection of the build time constraint and the sales constraint for y. Solving the simultaneous equations for these two constraints:
y = 66,000
24x + 20y = 1,800,000
24x + (20 * 66,000) = 1,800,000
24x + 1,320,000 = 1,800,000
24x = 480,000
x = 20,000
C = (20,000 8 $30) + (66,000 * $40) = $600,000 + $2,640,000 = $3,240,000
Fixed costs = 3 * $650,000 = $1,950,000
Therefore profit = $1,290,000

(b) Slack resources
Test time used = (20,000 * 10)/60 + (66,000 * 4)/60 = 7,733 hours
Therefore slack hours = 12,000 - 7,733 = 4,267 hours
Program time used = (20,000 * 16)/60 + (66,000 * 14)/60 = 20,733 hours
Therefore slack hours = 28,000 - 20,733 = 7,267 hours
The slack values for test time and program time mean that there are 4,267 and 7,267 hours of each respective department's time unutilised under the optimum production plan. If possible, this time could be used by the organisation elsewhere or subcontracted out to another company.

Case: Marginal Revenue and Cost Analysis for Product Y
A company manufactures a single product, product Y. It has documented levels of demand at certain selling prices for this product as follows:
| Demand | Selling price | Cost |

Units	$ per unit	$ per unit
1.100	48	22
1,200	46	21
1,300	45	20
1,400	42	19

Required: Using a tabular approach calculate the marginal revenues and marginal costs for product Y at the different levels of demand, and so determine the selling price at which the company profits are maximised.

Answer:

Demand	Selling price per unit	Total revenue	Marginal revenue	Cost per unit	Total cost	Marginal cost
Units	$	$ = units * unit selling price	$	$	$ = units * cost per unit	$
1,100	48	52,800	52,800	22	24,200	24,200
1,200	46	55,200	2,400	21	25,200	1,000
1,300	45	58,500	3,300	20	26,000	800
1,400	42	58,800	300	19	26,600	600

MR ⩾ MC up to 1,300 units, therefore profits will be maximised at this point which is a selling price of $45.

Case: Cost Plus Pricing and Alternative Pricing Strategies for Albany's New Product
Albany has recently spent some time on researching and developing a new product for which it is trying to establish a suitable price. Previously it has used cost plus 20% to set the selling price. The standard cost per unit has been estimated as follows:

Direct materials		$	
	Material 1	10	(4 kg at $2.50/kg)
	Material 2	7	(1 kg at $7/kg)
Direct labour		13	(2 hours at $6.50/hour)
Fixed overheads		7	(2 hours at $3.50/hour)
		37	

Required: (a) Using the standard costs calculate two different cost plus prices using two different bases and explain an advantage and disadvantage of each method. (b) Give two other possible pricing strategies that could be adopted and describe the impact of each one on the price of the product.

Answer:

(a) Cost plus prices
Marginal cost plus = $30 * 120% = $36
Advantage
· Simple and easy to calculate.

· Focuses on contribution.

· Can easily adjust the mark-up.

Disadvantage
· May not cover fixed costs.

· Ignores price/demand relationship.

Total cost plus = $37 * 120% = $44.40
Advantage
· More likely to ensure a profit is made.

· Product is not sold below full cost.

· Can easily adjust the mark-up.

Disadvantage
· Fixed costs need to be allocated to the cost unit which may be ambiguous.

· Ignores price/demand relationship.

(b) Possible pricing strategies
Any two of the following:
· Price skimming - tends to lead to a high price initially, useful if the product is completely new.

· Penetration pricing - go to market with a low price initially to gain market share.

· Price discrimination - use two different prices in two different markets if there are barriers
between the markets (e.g. age, time and location).

· Premium pricing - charging a higher price than the competitors as the product can be
differentiated.

· Cost plus pricing - leads to a price that will cover costs although care needs to be taken with
regard to marginal cost plus to ensure that the plus is large enough to cover fixed costs.

· Market price - leads to an acceptable price but one which may vary.

· Price to maximise profits although a demand function will need to be established - leads to an
optimal price but may not affect the market price.

Case: Profitability Analysis and Van Selection for Shifters Haulage
Shifters Haulage (SH) is considering changing some of the vans it uses to transport crates for
customers. New vans come in three sizes; small, medium and large. SH is unsure about which
type to buy. The capacity is 100 crates for the small van, 150 for the medium van and 200 for
the large van. Demand for crates varies and can be either 120 or 190 crates per period, with the
probability of the higher demand figure being 0.6. The sale price per crate is $10 and the
variable cost $4 per crate for all van sizes. This is subject to the condition that if the capacity of
the van is greater than the demand for crates in a period, the variable cost will be lower by 10%

to allow for the fact that the vans will be partly empty when transporting crates. SH is concerned that if the demand for crates exceeds the capacity of the vans then customers will have to be turned away. SH estimates that in this case goodwill of $100 would be charged against profits per period to allow for lost future sales, regardless of the number of customers that are turned away. Depreciation charged would be $200 per period for the small, $300 for the medium and $400 for the large van. SH has in the past been very aggressive in decision making, pursuing rapid growth strategies. However, managers have recently grown more cautious as the business has become more competitive.

Required: (a) Prepare a profits table showing the SIX possible profit figures per period. (b) Using your profit table from (a) above discuss which type of van SH should buy taking into consideration the possible risk attitudes of the managers. (c) Suggest three methods that businesses can use to reduce the uncertainty that exists in their decision making.

Answer:

(a) Profit calculations

	Small van	Medium van	Large van
Capacity	100	150	200
Low Demand (120)	300 WORKING 1	468 WORKING 3	368 WORKING 5
High Demand (190)	300 WORKING 2	500 WORKING 4	816 WORKING 6

WORKINGS	WORKING 1	WORKING 2	WORKING 3	WORKING 4	WORKING 5	WORKING 6
Sales	1,000	1,000	1,200	1,500	1,200	1,900
Variable cost	(400)	(400)	(480)	(600)	(480)	(760)
Goodwill	(100)	(100)		(100)		
VC adjustment			48		48	76
Depreciation	(200)	(200)	(300)	(300)	(400)	(400)
Profit	300	300	468	500	368	816

(b) Van purchase decision

The type of van to buy depends on the risk attitude of the investor. If they were optimistic about the future then the maximax criteria would suggest that they choose the large van as this has the potentially greatest profit. If they are more pessimistic, they would focus on the minimum expected returns and choose the medium van, as the worst possible result is $468, which is better than the other options. As the business managers are becoming more cautious they may prefer a maximin criterion. Expected values can be calculated as:

Small van = $300

Medium van ($468 * 0.4) + ($500 * 0.6) = $487

Large van ($368 * 0.4) + ($816 * 0.6) = $637

Given that SH is considering replacing a number of vans, it could be argued that an EV approach has merit as it is not a one-off decision (assuming individual booking sizes are independent of each other). The final decision lies with the managers, but given their cautiousness, a medium-sized van would seem the logical choice. The small van could never be the correct choice.

(c) Methods of uncertainty reduction

Market research This can be desk-based (secondary) or field-based (primary). Desk-based is cheap but can lack focus. Field-based research is better in that it can target customers and product area; but it can be time consuming and expensive. The Internet is bringing down the cost and speeding up this type of research, email is being used to gather information quickly on the promise of free gifts, etc.

Simulation

Computer models can be built to simulate real life scenarios. The model will predict what range of returns an investor could expect from a given decision without having risked any actual cash. The models use random number tables to generate possible values for the uncertainty the business is subject to. Again, computer technology is assisting in bringing down the cost of such risk analysis.

Sensitivity analysis

This can be used to assess the range of values that would still give the investor a positive return. The uncertainty may still be there, but the affect that it has on the investor's returns will be better understood. Sensitivity calculates the % change required in individual values before a change of decision results. If only a (say) 2% change is required in selling price before losses result an investor may think twice before proceeding. Risk is therefore better understood.

Calculation of worst and best case figures

An investor will often be interested in range. It enables a better understanding of risk. An accountant could calculate the worst-case scenario, including poor demand and high costs whilst being sensible about it. He could also calculate best-case scenarios including good sales and minimum running costs. This analysis can often reassure an investor. The production of a probability distribution to show an investor the range of possible results is also useful to explain risks involved. A calculation of standard deviation is also possible.

Case: Decision Tree Analysis for Oil Exploration and Development

An oil company has recently acquired rights in a certain area to conduct surveys and geological test drillings that may lead to lifting oil where it is found in commercially exploitable quantities. The area is already considered to have good potential for finding oil in commercial quantities. At the outset the company has the choice to conduct further geological tests or to carry out a drilling programme immediately. On the known conditions, the company estimates that there is a 70% chance of further tests indicating that a significant amount of oil is present. Whether the tests show the possibility of oil or not, or even if no tests are undertaken at all, the company could still pursue its drilling programme or alternatively consider selling its rights to drill in the area. Thereafter, however, if it carries out the drilling programme, the likelihood of final success or failure in the search for oil is considered dependent on the foregoing stages:

i. If the tests indicated that oil was present, the expectation of success in drilling is given as 80%.
ii. If the tests indicated that there was insufficient oil present, the expectation of success in drilling is given as 20%.
iii. If no tests have been carried out at all, the expectation of finding commercially viable quantities of oil is given as 55%.

Costs and revenues have been estimated for all possible outcomes and the net present value of each is given below:

Outcome	Net present value
	$m
Geological testing	(10)
Drilling cost	(50)
Success in finding oil	150
Sale of exploitation rights:	
Tests indicate oil is present	65
Tests indicate "no oil"	15
Without geological tests	40

Required: (a) Prepare a decision tree diagram to represent the above information. (b) For the management of the company, calculate its best course of action. (c) Explain the value and limitations of decision trees in decision making.

Answer:
(a) Diagram
draw the decision tree diagram based on below:
start from 43.5 -> Tests(10) -> 53.5 -> Indicate oil with 0.7 probability -> 70 -> Drill (50) -> 120 -> 0.8 probability to find oil NPV 150
start from 43.5 -> Tests(10) -> 53.5 -> Indicate oil with 0.7 probability -> 70 -> Drill (50) -> 120 -> 0.2 probability No oil NPV 0
start from 43.5 -> Tests(10) -> 53.5 -> Indicate oil with 0.7 probability -> 70 -> Sell rights NPV 65
start from 43.5 -> Tests(10) -> 53.5 -> Indicate no oil with 0.3 probability -> 15 -> Drill (50) -> 30 -> 0.2 probability to find oil NPV 150
start from 43.5 -> Tests(10) -> 53.5 -> Indicate no oil with 0.3 probability -> 15 -> Drill (50) -> 30 -> 0.8 probability No oil NPV 0
start from 43.5 -> Tests(10) -> 53.5 -> Indicate no oil with 0.3 probability -> 15 -> Sell rights NPV 15
start from 43.5 -> Sell rights NPV 40
start from 43.5 -> Drill now(50) -> 82.5 -> 0.55 probability to find oil NPV 150
start from 43.5 -> Drill now(50) -> 82.5 -> 0.45 probability No oil NPV 0

(b) Best course of action
The company should undertake geological tests. If the tests indicate that oil is present then a drilling programme should be carried out. However, if the tests indicate that there is no oil then the company should sell the drilling rights. This strategy will maximise expected returns at $43.5m.

(c) Value and limitations of decision trees in decision making The main value of a decision tree is that it clearly shows all the decisions and uncertain events and exactly how they are interrelated. They are especially beneficial where the outcome of one decision affects another decision. For example in the above, the probability of eventual success changes depending on the test outcomes. The analysis is made clearer by annotating the tree with probabilities, cash

flows, and expected values so that the optimum decisions (based on expected values) can be clearly seen. However, drawing a tree diagram is only one way of undertaking a decision. It is based on the concept of expected value and as such suffers from the limitations of this technique. For example, in this example, if the test drilling proves positive, the tree indicated the company should drill, as opposed to selling the rights. But if it does, there is a 20% chance of it losing $50 million. A risk-averse company may well decide to accept the safer option and sell the rights and settle for $65 million.

Case: Budget Preparation for Glassware Production

BRT Co makes a range of glassware ornaments. The marketing plan for 20X1 is based on the three products that have proved most popular in the past: Dog, Bunny and Cat. The expected sales for each product and selling price are as follows:

	Dog	Bunny	Cat
Sales	10,000	20,000	5,000
Price	$10	$5	$20

The following are direct costs of manufacturing each ornament:

	Dog	Bunny	Cat
Materials			
Silicates @ $2/kg	5.0 kgs	6.0 kgs	7.0 kgs
Recycled glass @ $0.10/kg	1.2 kgs	1.3 kgs	1.4 kgs
Labour			
Blowers @ $2/hour	30 mins	45 mins	60 mins
Finishing and packing @ $3/hour	30 mins	30 mins	60 mins

Opening inventory levels are as follows:

Dog 2,000 units
Bunny 1,000 units
Cat 1,000 units
Recycled glass 1,000 kgs
Silicates 23,500 kgs

The required closing inventory levels for finished products are

Dog 1,000
Bunny 2,000
Cat 500

There must also be sufficient closing raw materials inventory to cope with a level of production equivalent to 20% of the 20X1 demand.

Required: Prepare the following budgets: (a) Sales budget; (b) Production budget (in numbers of Dog, Bunny and Cat); (c) Materials usage budget (for recycled glass and silicates in kgs); (d) Materials purchases budget (in quantities and $s); (e) Labour budget (in hours and $s).

Answer:

Tutorial note: Preparation of functional budgets is assumed knowledge of Management Accounting.

(a) Sales budget

	Dog	Bunny	Cat	Total
Units (000)	10	20	5	35
Unit selling price	$10	$5	$20	
Sales revenue ($000)	$100	$100	$100	$300

(b) Production budget

	Dog	Bunny	Cat	Total
Sales	10,000	20,000	5,000	35,000
Closing inventory	1,000	2,000	500	3,500
	11,000	22,000	5,500	38,500
Opening inventory	(2,000)	(2.000)	(1,000)	(5,000)
Production	9,000	20,000	4,500	33,500

(c) Materials usage (kg)

	Dog	Bunny	Cat	Total
Silicates	45,000	120,000	31,500	196,500
Recycled glass	10,800	26,000	6,300	43,100

(d) Materials purchases

	Silicates kg	Silicates $	Recycled glass kg	Recycled glass $
Usage	196,500	393,000	43,100	4,310
Closing inventory (WORKING)	41,000	82,000	9,000	900
	237,500	475,000	52,100	5,210
Opening inventory	(23,500)	(47,000)	(1,000)	(100)
Purchases	214,000	428,000	51,100	5,110

(e) Labour utilisation budget - hours

Blowers Finishing and packing Total Dog (9,000) 4,500 9,000 Bunny (20,000) 15,000 10,000 25,000 Cat (4,500) 24,000 19,000 43,000 Hourly rate $2 $3 Total cost $48,000 $57,000 $105,000 WORKING kg Silicates 20% × 10,000 × 5 20% × 20,000 × 6 20% × 5,000 × 7 7,000 41,000 Recycled glass 20% × 10,000 × 1.2 2,400 20% × 20,000 × 1.3 5,200 20% × 5,000 × 1.4 1,400

	Blowers	Finishing and packing	Total
Dog (9,000)	4,500	4,500	9,000
Bunny (20,000)	15,000	10,000	25,000
Cat (4,500)	4,500	4,500	9,000
	24,000	19,000	43,000
Hourly rate	$2	$3	
Total cost	$48,000	$57,000	$105,000

WORKING

	kg
Silicates	
20% * 10,000 * 5	10,000
20% * 20,000 * 6	24,000
20% * 5,000 * 7	7,000
	41,000
Recycled glass	
20% * 10,000 * 1.2	2,400
20% * 20,000 * 1.3	5,200
20% * 5,000 * 1.4	1,400
	9,000

Case: Objectives and Participative Style of Budgeting

You have recently been appointed as an assistant management accountant in a large company, PC Co. When you meet the production manager, you overhear him speaking to one of his staff, saying:

"Budgeting is a waste of time. I don't see the point of it. It tells us what we can't afford but it doesn't keep us from buying it. It simply makes us invent new ways of manipulating figures. If all levels of management aren't involved in the setting of the budget, they might as well not bother preparing one."

Required: (a) Identify and explain SIX objectives of a budgetary control system. (b) Discuss the concept of a participative style of budgeting in terms of the six objectives identified in part (a).

Answer:

(a) Objectives of a budgetary control system

To compel planning

Budgeting makes sure that managers plan for the future, producing detailed plans in order to ensure the implementation of the company's long term plan. Budgeting makes managers look at the year ahead and consider the changes in conditions that might take place and how to respond to those changes in conditions.

To co-ordinate activities

Budgeting is a method of bringing together the activities of all the different departments into a common plan. If an advertising campaign is due to take place in a company in three months' time, for example, it is important that the production department knows about the expected increase in sales so that it can scale up production accordingly. Each different department may have its own ideas about what is good for the organisation. For example, the purchasing department may want to order in bulk in order to obtain bulk quantity discounts, but the accounts department may want to order in smaller quantities so as to preserve cash flow.

To communicate activities

Through the budget, top management communicates its expectations to lower level management. Each department has a part to play in achieving the desired results of the

company, and the annual budget is the means of formalising these expectations. The whole process of budget setting, whereby information is shared between departments, facilitates this communication process.

To motivate managers to perform well

The budget provides a basis for assessing how well managers and employees are performing. In this sense, it can be motivational. However, if the budget is imposed from the top, with little or no participation from lower level management and employees, it can have a seriously demotivating effect. (This is discussed further in (b).)

To establish a system of control

Expenditure within any organisation needs to be controlled and the budget facilitates this. Actual results are compared to expected results, and the reasons for any significant, unexpected differences are investigated. Sometimes the reasons are within the control of the departmental manager and he must be held accountable; at other times, they are not.

To evaluate performance

Often, managers and employees will be awarded bonuses based on achieving budgeted results. This makes more sense than evaluating performance by simply comparing the current year to the previous year. The future may be expected to be very different than the past as economic conditions change. Also, events happen that may not be expected to reoccur. For example, if weather conditions are particularly wet one year, a company making and selling umbrellas would be expected to make higher than usual sales. It would not be fair to assess managers against these historical sales levels in future years, where weather conditions are more normal.

Tutorial note: Only six objectives were required. Other objectives that could be explained are: To delegate authority to budget holders: A formal budget permits budget holders to make financial decisions within the specified limits agreed (i.e. to incur expenditure on behalf of the organisation). To ensure achievement of the management's objectives: Objectives are set not only for the organisation as a whole but also for individual targets. The budget helps to work out how these objectives can be achieved.

(b) Participative budgeting

"Participative budgeting" refers to a budgeting process where there is some level of involvement from subordinates within the organisation, rather than budgets simply being set by the top level of management. There are various views about whether participative budgeting is more effective than other styles.

Extent to which participative budgeting helps to achieve objectives

To compel planning

Participative budgeting will compel planning. Although participation can take many forms, often it will take the form of bottom-up budgeting, whereby the participation starts at the lowest level of management and goes all the way up to the top. In this case, planning is taking place at many levels, and should be more accurate than if it simply takes place at a high level, by individuals who are not familiar with the day-to-day needs of the business.

To co-ordinate activities

 Co-ordination of activities may become more time consuming if a participative style of budgeting is used. This is because, not only does there need to be co-ordination between departments but there also has to be co-ordination between the different levels of

management within each department. The process should be cumbersome but also effective, with everyone knowing exactly what the plan is.

To communicate activities

Communication will be particularly effective with participative budgeting, although how effective depends on the extent of the participation. If all levels of management are involved, from the bottom up, they all know what the plan is. However, the plan may change as different departments' budgets are reviewed together and the overall budgeted profit compared to the top level management's expectations. Hence, it may be the case that those people involved in the initial budgets (i.e. lower level management) have to deal with their budgets being changed.

To motivate managers to perform well

If managers play a part in setting the budget, they are more likely to think that the figures included in them are realistic. Therefore, they are more likely to try their best to achieve them. However, it may be that managers have built budgetary slack into their budgets, in an attempt to make themselves look good. Therefore, managers could end up performing less well than they would do had tougher targets been set by their superiors.

To establish a system of control

In terms of establishing a system of control, it is largely irrelevant whether the budget setting process is a participative one or not. What is important is that actual results are compared to expected, and differences are investigated. This should happen irrespective of the budget setting process. Having said that, control is only really effective if the budgeted figures are sound. As stated above, whilst they are more likely to be realistic if a participative style of budgeting is used, the system is open to abuse in the form of budgetary slack.

To evaluate performance

Managers will be appraised by comparing the results that they have achieved to the budgeted results. A participative budget will be an effective tool for this provided that participation is real rather than pseudo and provided that the managers have not built slack into their figures, which has gone uncorrected.

Tutorial note: The main difficulty with discursive questions such as this are that candidates write poorly structured answers that often bear little relevance to the question asked. It is important to spend time thinking and planning before writing an answer. Things to consider when planning are:

· What are the instruction verbs in the question?

· What does the examiner want me to do?

· What theoretical knowledge do I have that might be relevant here?

· What facts (if any) are given in the scenario that might be relevant?

· How should I structure my answer?

The instruction verbs in (a) are "identify and explain". "Identify" simply requires a statement but "explain" calls for reasoning. So for each objectives of budgeting stated it is necessary to explain why it is relevant or important. In (b) the instruction verb was "discuss". This requires an opinion that is supported by facts and logical reasoning. Here, a discussion about how participative (or bottom up) budgeting might help (or hinder) each of the objectives identified in (a) was called for. The examiner often complains about poorly structured answers to discursive questions. Many candidates simply write a "sea of words" with no paragraph breaks and no

apparent logic to the flow of comments. A planned and structured answer will "stand out from the crowd". Here, an obvious structure would be a paragraph for each of the objectives, with a clear sub heading (neatly underlined with a rule in the paper-based exam). Finally, think before you write. Make sure you answer the question the examiner asked; not the question that you wished had been asked.

Case: Rolling Budget Implementation and Challenges at Timana Co

Timana Co manufactures small-panel display screens for smartphones, car navigation and other consumer electronic products. This is a competitive industry characterised by short product life cycles, pricing pressure from online retailers and the need to innovate continually. The company has used annual, incremental budgeting, created on a standalone spreadsheet, as its primary control tool and uses this budget as the basis for performance targets for managers. The finance director recently attended a conference on "Budgeting in the Technology Industry" and realised that the current incremental budgeting system is no longer fit for purpose in a volatile industry like technology. He is aware that the budget has to be updated every quarter to take into account the changes in the market. He has therefore suggested a rolling budget approach. The finance staff have been unhappy about the proposal, claiming that the existing computer system will not support the rolling budget approach and the sales managers were overheard asking: "What is this rolling budget system and how will this affect our bonuses?" The following budget has been prepared for the current year ending 31 December 20X8:

| | Q1 | Q2 | Q3 | Q4 |
	$	$	$	$
Revenue	480,000	494,400	509,232	524,509
Direct labour	(24,000)	(24,720)	(25,462)	(26,225)
Direct material	(48,000)	(49,440)	(50,923)	(52,451)
Contribution	408,000	420,240	432,847	445,833
Fixed production overheads	(120,000)	(120,000)	(130,000)	(130,000)
Administration costs	(210,000)	(210,000)	(216,300)	(216,300)
Profit	78,000	90,240	86,547	99,533

The budget was based on the following assumptions:

1. Sales volume would grow at the same fixed compound rate every quarter
2. Direct material and direct labour are wholly variable costs
3. Fixed production overheads would now be $10,000 higher from Q3 onwards as it was decided the machinery would require extra maintenance
4. Administration costs would increase by 3% in Q3 to account for an increase in the rent for the building The actual results for Q1 were released.

	$
Revenue	470,400
Direct labour	(24,480)
Direct material	(48,000)
Contribution	397,920
Fixed production overheads	(120,000)

| Administration costs | (210,000) |
| Profit | 67,920 |

The sales manager and production manager have both commented on the actual results:

· The sales manager said he had to reduce selling prices to boost demand as the market became more competitive. The decrease in revenue is accounted for solely by changes in selling prices. Sales volume is expected to grow as forecast in the original budget forecast.

· The production manager confirmed that the direct labour cost was higher because of an increase in the minimum wage. It was also agreed that in Q3 the direct labour cost will increase by a one-off amount of $5,000 to account for additional training required under health and safety legislation. The finance director decided to act on the comments he received from the finance team and the sales managers regarding training and the computer system. The first step was to create a position for a new "change manager" who will start at the beginning of Q2 with an annual salary of $150,000 and the administration cost will need to be adjusted to reflect this.

Required: (a) Prepare Timana Co's rolling budget for the next four quarters. (b) Discuss THREE issues related to the implementation of a rolling budget system in Timana Co.

Answer:

(a) Rolling budget for the next four quarters

	Q2 20X8	Q3 20X8	Q4 20X8	Q1 20X9
	$	$	$	$
Revenue (WORKING 1)	484,512	499,047	514,019	529,439
Direct labour (WORKING 2)	(25,214)	(30,971)	(26,750)	(27,552)
Direct material (WORKING 3)	(49.440)	(50,923)	(52,451)	(54.024)
Contribution	409,858	417,153	434,818	447,863
Fixed production overhead (WORKING 4)	(120,000)	(130,000)	(130,000)	(130,000)
Administration costs (WORKING 5)	(247,500)	(253,800)	(253,800)	(253,800)
Profit	42,358	33,353	51,018	64,063

WORKINGS

All figures must be adjusted using the actual result of Q1. The budget will start from Q2 and similarly Q1 of 20X9 will be added.

WORKING 1. Revenue growth

Since the sales volume is growing every quarter, revenue will also grow proportionately.

Growth: $494,400/$480,000 = 1.03 or $509,232/$494,400 = 1.03 i.e. 3% every quarter

WORKING 2. Direct labour

Direct labour is a variable cost, increasing by 3% every quarter to reflect the increase in sales volume. In Q3, there is a one-off increase of $5,000 to reflect the training cost.

WORKING 3. Direct material

Direct material is a variable cost, increasing by 3% every quarter to reflect the increase in sales volume.

WORKING 4. Fixed production overhead

These costs will remain at $120,000 in Q2 and increase to $130,000 in Q3 onwards.

WORKING 5. Administration The change manager will be employed from Q2 with an annual salary of $150,000.

Every quarter, the administration costs will increase by $37,500 ($150,000/4).
The 3% increase in administration costs has been adjusted already in the figures given in the question.

(b) Issues related to implementing a rolling budget approach
Training
Training programmes for both the sales managers and the finance staff would help ensure that the rolling budget implementation goes smoothly. The sales managers have been complaining about the lack of understanding of rolling budgets. A training course for them would improve their knowledge and reduce their resistance to change. Also, members of the finance team may not all have the same budgeting skills. A more technical training programme, including the use of new software, would benefit the finance department.
Information systems
If the rolling budget is introduced and managed with a stand-alone spreadsheet tool, errors and data corruption problems may arise as budget updates will be more frequent, budgeting assumptions will change, and this information will come from different sources. A better solution is to use a software package that integrates with the company's systems. This might mean that Timana Co will need to invest in a new system, like an ERPS. This will ensure budgeting data is unified in one database and allow for multiple users to easily access and update the budget. However, any new system will likely come at a substantial cost and require user support and training. Also, its implementation will probably be time-consuming and expensive.
Performance measures
The sales managers are frustrated as they do not know how their bonuses will be affected and they were not consulted when the decision for the new system was taken. Unhappy and demotivated staff are more likely to seek new employment. This would cause disruption and higher costs as Timana Co would need to hire and train new sales managers. However, moving to a rolling budget could actually be considered a good thing for the sales managers. Their targets will be more realistic, reflecting the current economic environment. For example, if forecasts were to worsen, their targets would reflect this and they would not be assessed on factors out of their control. Also, by moving to quarterly budget cycle, targets can be spread more evenly throughout the year which could improve staff motivation. With annual performance targets, managers may "take it easy" and relax for the rest of the year after their target has been reached, say in month 9.
Conclusion
Overall, rolling budgets have many advantages which are useful in a changing environment such as the technology industry. Timana Co must ensure that the rolling budget is implemented in such a way that staff are consulted, the benefits outweigh the costs, and that this change avoids causing disruption to productivity or morale.

Case: Evaluating Decision Packages and ZBB Transition for Plainfield County Public Authority Library

Plainfield County Public Authority (PCPA) is a local public agency which provides services to the community, including a public library. PCPA is funded primarily from local tax revenues. PCPA has recently moved from an incremental budgeting to a zero-based budgeting (ZBB) system. The central budget office now provides decision unit managers with PCPA's strategic plan and guidelines for budgeting and other support, and gives managers autonomy in how to develop their decision packages. In the past, the library manager adjusted the budget to account for inflation and operational assumptions. Some of the costs the library currently incurs are as follows:

· Annual staff costs: $140,000 for five members of staff

· Annual Information Systems (IS) maintenance costs: $12,500

· Annual website hosting costs: $1,750

The number of library visitors is expected to increase next year, increasing the workload for librarians. This will in turn increase staff costs by 15% due to overtime payments. Despite the increase in the number of library visitors, the library has come under criticism for being old-fashioned and the library manager wishes to respond to this. He is considering two projects for inclusion in his budget:

Decision package 1: Computer upgrade

Under this proposal, only the computers will be replaced. The total cost for this upgrade will be $45,000. Annual IS maintenance costs will fall slightly to $9,000 as the new computing environment will require less support. Annual website costs will remain constant and staff costs are expected to grow as projected above. This upgrade will not substantially change library operations.

Decision package 2: Computer upgrade and integrated library system

Under this proposal, new computers plus additional hardware and software will be purchased which automates the core library processes. The combined cost of the new system will be $98,500. This improvement will allow self-service borrowing of books. Members of the public will scan books when borrowing and returning them, eliminating the need for interaction with a librarian. The new system will allow the library to reduce staff members to four, still earning the same average annual salary while avoiding additional overtime payments. Annual IS maintenance costs will increase to $22,000 and annual website costs will increase to $3,000. The new system will use a dynamic website that lets library members see, in real-time, what books are available at the library and then reserve them online.

Required: (a) Determine the cost of each decision package for the first year and choose between the two options from both financial and non-financial perspectives. (b) Discuss the advantages and disadvantages of moving to ZBB for the library.

Answer:
(a) Choosing between decision packages

Decision package 1: Computer upgrade	$
Computer upgrade	45,000
Annual IS maintenance costs	9,000
Website hosting	1,750
Staff costs ($140,000 * 1.15)	161,000

		216,750
Decision package 2: Upgrade and integrated system	$	
Computer upgrade including integrated library system	98,500	
Annual IS maintenance costs	22,000	
Website hosting	3,000	
Staff costs ($140,00 * 4/5 staff members)	112,000	
		235,500

Financial perspective

Decision package 2 is the more expensive option by $18,750, or 8.7%. However, considering the annual operating costs, decision package 2 will bring annual savings of $34,750 (i.e. the difference between decision package 1 annual costs $171,750 and decision package 2 annual costs $137,000).

Non-financial perspective

Decision package 2 is the more innovative solution and addresses the criticism of the library being old-fashioned. This system will save community members' time as they will be able to search for and reserve books online without visiting the library. Also, the community and staff will have access to accurate and real-time information about what books are available. Automation of library tasks means librarians can be more focused on the needs of library visitors and allows for reducing the number of librarians in the future once the system is operational. Satisfied visitors may also boost the library's reputation with positive comments and feedback on social media. Even though the initial cost for decision package 2 is higher than decision package 1, it seems like the best option as it will reduce longer-term operational costs, improve efficiency and improve the public's ability to access and use library resources.

(b) Move to ZBB

Under ZBB, the library manager is more focused on the objectives and needs of the community when preparing the budget. Decision packages can be evaluated by the value for money provided for the community, not just by cost savings. The library manager is now more involved in the budgeting process and has found operational efficiencies and quality improvements in the process. However, ZBB may be time-consuming for the library manager and can distract him from other important responsibilities. Also it is not known whether he has the appropriate skills to manage the budgeting process. As ZBB is an annual process and focused primarily on next year's budget, short-term objectives might take precedence over long-term benefits. For example, the new library system is more expensive in the short-term but leads to long-term cost savings and benefits - the ZBB approach does not highlight these long-term advantages.

Case: Capacity Analysis and Production Efficiency for Toy Co

Toy Co manufactures toys for toddlers and children. It is a small company and has a good reputation for producing high quality, innovative products. Its profit margins have been consistently higher than competitors in the same industry. However, profitability has been slowly dropping over the past two years due to increasing overhead costs and the loss of several key customers because of shipping errors and missed delivery dates. The management

accountant believes that there are non-value added activities which can be removed to improve efficiency and reduce costs, and he is considering introducing activity-based budgeting. He has decided initially to analyse two popular products, the Tod and the Kid. Much of the production process is automated and occurs in batches. Orders are placed by large retail chains and demand is relatively constant during the year. Operational information for each product is as follows:

	Tod	Kid
Quarterly demand (units)	30,000	36,000
Production batch size (units)	3,000	1,000
Order size (units)	150	120

Information for the quarter:

	Hours required	Total hours available
Quality inspection time	15 per batch	860
Packaging and shipping time	1 hour per order	460

Required: (a) Calculate the hours required for the next quarter and whether there is any spare capacity or shortage in the hours for: (i) Quality inspection; (ii) Packaging and shipping. (b) Discuss the implications of your findings in (a) for Toy Co's production process.

Answer:
(a) Hours required v capacity
If Toy Co would like to use the information given to improve its production process and improve profitability, it has to work out the number of batches and orders required for the quarter.
Step 1 - Calculation of batches and orders

	Tod	Kid	Total
Number of batches (Demand/Batch size)	10	36	46
Number of orders (Demand/Order size)	200	300	500

Step 2 - Calculation of spare capacity/shortage for the quarter

	Required	Available	
Quality inspection department (46 * 15)	690	860	170 Spare capacity
Packaging and shipping (500 * 1)	500	460	40 Shortage

(b) Implications for the production process
Quality inspection time
There are 46 batches in total per quarter for both products. Each batch takes 15 hours to inspect, requiring a total of 690 hours for the quarter. This shows that the quality inspection department is operating at below capacity. The spare capacity is equal to (170/860 x 100) of the hours available. Based on the information provided, management could cut costs in this department by reducing the number of staff or by redeploying them to another area of the business. The information will also be useful for planning and forecasting. For instance, if demand was forecast to increase over the next several quarters, Toy Co would retain the quality control staff and save money by avoiding future employment and training costs. Packaging and shipping time
There is currently a shortage of 40 hours in the packaging and shipping department. Toy Co requires 500 hours to complete the shipment of 500 orders, but only 460 hours are available.

This shortage means that staff are rushing to complete the orders, causing them to make mistakes in the shipping process. This shortage of hours might also be contributing to increased overtime payments, in turn contributing to increasing overheads. Toy Co can solve this problem in several ways. Firstly, it could analyse and improve the shipping and packing process. There may be manual administration tasks, such as completion of forms or labels, which could be automated with new IT systems. Toy Co could increase capacity in the department by hiring a new member of staff. While this would create spare capacity, it would also give Toy Co more flexibility to meet an unexpected increase in demand. This decision is linked to long-term planning. Finally, Toy Co could offer its customers a bulk-purchase discount, enticing them to place larger orders. This would reduce the number of shipments required and the annual shipping costs.

Case: Estimation of Fixed and Variable Electricity Costs Using the High-Low Method
Tomkins Co is engaged in the production of electronic musical instruments. The management accountant wishes to prepare a flexible budget for 20X1. He obtains the following information from a summary of electricity cost as related to direct labour hours for 20X0:

Month	Electricity cost $	Direct labour
May	1,548	297
June	1,667	350
July	1,405	241
August	1.534	280
September	1,600	274
October	1,600	266
November	1,613	285
December	1.635	301

Required: Using the above data, estimate and using the high low method: (i) the annual fixed element of electricity cost; (ii) the variable element per hour of direct labour.

Answer:
Variable and fixed costs using the high-low method
Maximum labour hours = 350, cost $1,667
Minimum labour hours =241, cost $1,405
An increase of 109 hours gives a cost increase of $262.
Variable cost = $262/109 = $2.40 per labour hour
Using the maximum activity level:
Fixed cost per month =$1,667 - (350 * $2.40) = $827
Therefore, annual fixed cost= $827 * 12 = $9,924

Case: Estimating the Learning Rate and Identifying Steady State in Production Efficiency

Alex Co makes specialist computer equipment for the space exploration industry. It recently introduced a new product, the electroscope. This has to be assembled by hand and the process is very labour intensive. A budget was set for the product of 50 hours per unit, based on the time taken to make the first unit. The first unit was produced in November. Actual output and productive labour hours used for the first six months were as follows:

Month	Number of batches made and sold	Labour time taken
November	1	50
December	1	33
January	2	55
February	4	91
March	8	160
April	16	320

The management accountant was surprised that the actual production time was below the flexed budget every month after November. He realised that he had not taken into account the learning curve when he set the budget.

Required: (a) Estimate the learning rate for the period. (b) Determine when the steady state was reached.

Answer: (a) Estimation of learning rate

Month	Cumulative output	Cumulative hours	Cumulative average hours per unit	Comment
November	1	50	50.0	
December	2	(50 + 33) 83	41.5	83% of Nov
January	4	(83 + 55) 138	34.5	83% of Dec
February	8	(138 + 91) 229	28.6	83% of Jan
March	16	(229 + 160) 389	24.3	85% of Feb
April	32	(389 + 320) 709	22.15	91.1% of Mar

Estimated learning rate is 83%. As cumulative output doubles, cumulative average time consistently falls to 83% of the previous cumulative average time. However, the reduction appears to become less starting in March, suggesting that a steady state is reached after that.

(b) Estimate of when steady state starts
The steady state is reached when no further improvement in time is taken (i.e. the incremental time per unit no longer falls). This seems to occur at the beginning of March, since the incremental time of all units in March is 20 and this does not fall further in April.

Month	Output	Incremental hours	Incremental hours per unit
November	1	50	50
December	1	33	33
January	2	55	27.5
February	4	91	22.8
March	8	160	20
April	16	320	20

Case: Forecasting Sales Using Regression Analysis and Evaluating Seasonal Trends for Fruitee Co

Fruitee Co sells soft drinks. Its management accountant is reviewing the performance of a product that was introduced three years ago. She wants to use regression analysis to predict its sales in two years' time. The sales revenue trend for the product has been calculated as follows:

Year	Season	Season number (x)	Sales revenue (y) $m	Trend (4-season moving average) $m
1	Spring	1	86	
	Summer	2	120	
	Autumn	3	90	92.75
	Winter	4	70	95.75
2	Spring	5	96	98.25
	Summer	6	134	100.00
	Autumn	7	96	102.50
	Winter	8	78	106.25
3	Spring	9	108	109.50
	Summer	10	152	111.50
	Autumn	11	104	
	Winter	12	86	

The following further calculations are provided:

$\Sigma x = 52$

$\Sigma y = 816.5$

$\Sigma xy = 5,420.50$

$\Sigma X^2 = 380$

Fruitee Drinks Co's chief executive accepts that this approach may give a broad indication of the figure for future sales, but wants a more accurate indication of what future performance is likely to be. He believes that the company should make a significant investment in big data analytics to obtain the insights required.

Required: (a) Using regression analysis, calculate the forecast trend for Year 6 Summer. (b) Calculate the multiplicative seasonal index and determine the sales forecast for the Summer season in Year 6. (c) Discuss the problems that may be encountered if Fruitee Co decides to invest in data analytics in order to be able to predict future sales.

Answer:

(a) Regression analysis

Figures given in question:

$\Sigma x = 52$

$\Sigma y = 816.5$

$\Sigma xy = 5,420.50$

$\Sigma x^2 = 380$

Calculation

$(\Sigma x)^2 = 52^2 = 2,704$

$y = a + bx$

Where: a = Σy/n - bΣx/n and b = (nΣxy - ΣxΣy)/[nΣx² - (Σx)²]
b = [(8 * 5,420.5) - (52 * 816.5)]/(8* * 380 - 2,704) = 2.7
a = (816.5/8) - (2.7 * 52)/8 = 84.5
So the trend equation in $m is y = 84.5 + 2.7x
Year 6 Summer = Month (5 * 4) + 2 = Month 22
Trend sales ($m) = 84.5 + (2.7 * 22) = 143.9
Tutorial note: n = 8 because there are 8 pairs of data.

(b) Seasonal variations

Year	Season (x)	Season	Sales (y) $m	Trend factor $m	Seasonal $m
1	Spring		86		
	Summer	123	120		
	Autumn		90	92.75	0.970
	Winter		70	95.75	0.731
2	Spring	456	96	98.25	0.977
	Summer		134	100.00	1.340
	Autumn		96	102.50	0.937
	Winter		78	106.25	0.734
3	Spring		108	109.50	0.986
	Summer	10	152	111.50	1.363
	Autumn	11	104		
	Winter	12	86		

Tutorial note: The above data from the question did not all need to be copied out but is provided for completeness.

	Spring	Summer	Autumn	Winter	Total
Year 1			0.970	0.731	
Year 2	0.977	1.340	0.937	0.734	
Year 3	0.986	1.363			
Average	0.9815	1.3515	0.9535	0.7325	4.019

Tutorial note: The sum of the seasonal variations is so close to 4 that it is not worth adjusting them.

Forecast sales
Summer Year 6 ($m) = 138.5 (per (a)) * 1.35 = 187

(c) Potential problems
Value
Fruitee Co is planning to make a significant investment in data analytics and needs to have assurance that the benefits from this investment will make it worthwhile. These benefits may be uncertain and their fulfilment may be difficult to measure.
Volume
The potential volume of big data is very large. It could include data about competitors, economic and social trends such as health concerns about fruit drinks, retail sector

developments and customer feedback. Parameters are likely to have to be established to determine what data should be analysed.

Variety

There would be a significantly large number of categories and types of data collected through Fruitee's systems, not to mention data that it plans to capture in the future. Any data analytics capabilities Fruitee Co invests in needs to be able to classify and differentiate the variety of data collected to produce useable insights.

Velocity

Soft drinks are fast moving consumer goods, so for decision-making in response to market needs to be improved, the capabilities Fruitee Co wants to invest in must deliver useful insights in a timely manner. This means accommodating the speed at which new data is produced and collected, and delivering insights in a timely manner to support decisions.

Veracity

The usefulness of insights from Fruitee Co's data analytics capabilities depends on the reliability and accuracy of the underlying data. Fruitee Co would need to examine its existing data collection methods on whether they capture accurate and timely data, as well as its existing databases to verify their reliability. If found to be unreliable Fruitee Co should consider investing in data capture infrastructure that would increase the veracity of its collected data to the required level.

Structure

Much big data is likely to be unstructured, for example customer feedback about products may come in a number of different forms. Unstructured data may require more complex and time-consuming techniques to analyse it effectively.

Reliability

Data will have different degrees of reliability depending on what it is (e.g. predictions in the media may be based on doubtful assumptions) and its source. The greater the amount of data available, the more reliable forecasts based on it may be. However, there are dangers in dismissing data as unreliable. On-line feedback about products may be judged less reliable than recent sales figures, but on-line feedback may give an early indication of long-term changes in customer preferences. Certain data may be judged as unreliable as it differs significantly from other data of the same type (i.e. is an outlier), but understanding why it differs significantly may give certain insights.

Prioritisation

Data analytics may provide many insights, but it is necessary to determine which are the most significant. Different types of data may give contradictory indications of the future. Fruitee Co may need to determine which data gives the best indication of what is likely to be happening in the short-term (e.g. using evidence of recent sales such as in (a) and (b)) and which data is a better indicator of longer-term trends in sales (e.g. changes in diet, competitor activity).

Clarity

Data analytics may not provide the clear indications that Fruitee Co requires to make reliable future forecasts. Qualitative insights may be difficult to translate into effects on sales volume. Even quantitative data may be difficult to interpret (e.g. how much will changes in the number of retail outlets open affect drink sales). There is a potential danger of placing most reliance on the data that gives the clearest picture rather than the data that is most significant.

Data analytics

Even if there is significant investment in analytics, there is a risk that the process will produce misleading results. Analysis may find relationships between sales and other factors which do not in fact exist ("false positives"). Even if relationships have existed previously, changing circumstances may mean that they cannot be relied on for forecasting the future. Even if correlation between sales and other data is reliably indicated, that does not mean that changes in the other data will cause changes in sales.

Case: Flexed Budget Preparation for Cowly Restaurant

Yumi Co owns a number of restaurants. Budgets for all of Yumi Co's restaurants are prepared by the head office. At the start of each year, restaurant managers are given an annual budget, which is split into months. At the end of each month, the manager receives a statement comparing actual monthly performance against budget. The statement for the Cowly restaurant for the most recent completed month is as follows:

	Actual	Budget	Variance	
Number of customers	1,800	1,500		
	$	$	$	
Revenue	87,300	75,000	12,300	F
Costs:				
Food and drink	26,100	22,500	3,600	A
Staff wages	38,250	31,500	6,750	A
Heat, light and power	8,100	7,500	600	A
Rent, rates and other overheads	12,600	12,000	600	A
Profit	2,250	1,500	750	F

Notes:

1. Rent, rates and other overheads are apportioned to its restaurants by Yumi Co's head office, based on a fixed annual charge
2. All other budgeted costs are treated as variable costs, based on the expected number of customers.

Required: Prepare a flexed budget for the Cowly restaurant.

Answer:

Flexed budget for Cowly restaurant

	Original budget	Flexed budget	Actual	Variance	
Number of customers	1,500	1,800	1,800		
	$	$	$	$	
Revenue	75,000	90,000	87,300	2,700	A
Costs:					
Food and drink	22,500	27,000	26,100	900	F
Staff wages	31,500	37,800	38,250	450	A
Heat, light and power	7,500	9,000	8,100	900	F
Rent, rates and other overheads	12,000	12,000	12,600	600	A
Profit	1,500	4,200	2,250	1,950	A

WORKINGS

Revenue: $75,000 * 1,800/1,500 = $90,000

Food and drink: $22,500 * 1,800/1,500 = $27,000

Staff costs: $31,500 * 1,800/1,500 = $37,800

Heat, light and power: $7,500 * 1,800/1,500 = $9,000

Case: Detailed Variance Analysis for Portland Co's Product

Portland Co manufactures one product from a standard grade of material. The standard cost card indicates the following:

Material	6 kgs @$1.60	9.60	
Labour	3 hours @ $4	12.00	
Variable overhead	3 hours @ $1.70	5.10	
Fixed overhead	3 hours @ $3	9.00	
Standard cost per unit		35.70	
Standard selling price		40.00	
Standard profit per unit		4.30	
Budgeted production and sales for week 1		1,100	units

Actual results for the week were as follows:

Production		1,000	units
		$	
Materials	6,500 kgs @$1.50	9,750	
Labour	3,100 hours worked and paid	12,500	
Variable overhead		5,200	
Fixed overhead		9,800	
		37,250	
Sales	1,000 units @ $39	39,000	
Actual profit		1,750	

Required: Calculate relevant variances in as much detail as the information allows.

Answer:

(1) Sales volume variance Units

	Units

Actual sales	1,000
Budgeted sales	1,100
Variance (units)	100
* standard profit per unit	$4.3
Sales volume variance (Adverse/"A")	$430

(2) Sales price variance

	$
Actual sales * actual price	39,000
Actual sales * standard price (1,000 * $40)	40,000
Sales price variance (A)	1,000

(3) Materials price variance

	$
Actual materials purchased at actual price	9,750
Actual materials at standard price (6,500 * $1.6)	10,400
Materials price variance (Favourable/"F")	650

(4) Materials usage variance

	Kgs
Actual materials used	6,500
Standard quantity for actual output (1,000 units * 6)	6,000
Variance (kgs)	500
× standard cost per kg	$1.6
Material usage variance (A)	$800

(5) Labour rate variance

	$
Hours paid at actual rate	12,500
Hours paid at standard rate (3,100 * $4)	12,400
Labour rate variance (A)	100

(6) Labour efficiency variance

	Hours
Hours worked	3,100
Standard hours for actual output (1,000 units * 3)	3,000
Efficiency variance (hours)	100
Standard cost per hour	$4
Labour efficiency variance (A)	$400

(7) Variable overhead rate variance

	$
Actual variable overhead cost	5,200
Labour hours worked * standard variable	

| overhead absorption rate per hour (3,100 * $1.7) | 5,270 |
| Variable overhead rate variance (F) | 70 |

(8) Variable overhead efficiency variance
	Hours
Hours worked	3,100
Standard hours for actual output (1,000 units * 3)	3,000
Efficiency variance hours	100
Standard variable overhead rate per hour	$1.7
Variable overhead efficiency variance (A)	$170

(9) Fixed overhead expenditure variance
	$
Actual fixed cost	9,800
Budgeted fixed cost (1,100 units * $9)	9,900
Fixed overhead expenditure variance (F)	100

(10) Fixed overhead volume variance
	Units
Actual output	1,000
Budgeted output	1,100
Volume variance (units)	100
* standard fixed overhead cost per unit	$9
Fixed overhead volume variance (A)	$900

(11) Fixed overhead capacity variance
Hours worked	3,100
Budgeted labour hours (1,100 units * 3 hours)	3,300
Capacity variance hours	200
Standard fixed overhead absorption rate per hour	$3
Fixed overhead capacity variance (A)	$600

(12) Fixed overhead efficiency variance
	Hours
Hours worked	3,100
Standard hours for actual output (1,000 units * 3 hours)	3,000
Efficiency variance hours	100
Standard fixed overhead absorption rate per hour	$3
Fixed overhead efficiency variance (A)	$300
Tutorial note: The fixed overhead capacity and efficiency variances provide a further analysis of the fixed overhead volume variance.

Case: Variance Analysis and Flexible Budgeting for Mermus Co

Mermus Co is comparing budget and actual data for the last three months.

		Budget		Actual	
	$	$	$	$	
Sales		950,000		922,500	
Cost of sales					
Raw materials		133,000		130,500	
Direct labour		152,000		153,000	
Variable production overheads	100,700		96,300		
Fixed production overheads	125,400		115,300		
		511,100		495,100	
		438,900		427,400	

The budget was prepared on the basis of 95,000 units produced and sold, but actual production and sales for the three- month period were 90,000 units. Mermus uses standard costing and absorbs fixed production overheads on a machine hour basis. A total of 28,500 standard machine hours were budgeted. A total of 27,200 machine hours were actually used in the three-month period.

Required: (a) Prepare a revised budget at the new level of activity using a flexible budgeting approach. (b) Calculate the following: (i) Raw material total cost variance; (ii) Direct labour total cost variance; Fixed overhead efficiency variance; (iv) Fixed overhead capacity variance; (v) Fixed overhead expenditure variance. (c) Suggest possible explanations for the following variances: Raw materials total cost variance; (iii) (d) Explain three key purposes of a budgeting system.

Answer:

(a) Revised budget using flexible budgeting
The flexed budget will be based on the actual activity level of 90,000 units.

	$	$	
Sales $950,000 * 90/95		900,000	
Cost of sales			
Raw materials 133,000 * 90/95	126,000		
Direct labour 152,000 * 90/95	144,000		
Variable production overheads 100,700 * 90/95	95,400		
Fixed production overheads	125,400		
		490,800	
		409,200	

(b) Variance calculations
Raw materials cost total variance = 126,000 - 130,500 = $4,500 (Adverse)
Direct labour cost total variance = 144,000 - 153,000 = $9,000 (Adverse)
Fixed overhead absorption rate = 125,400/28,500 = $4.40 per machine hour.
Standard machine hours for actual production = 28,500 * 90/95 = 27,000 hours.
Standard fixed overhead (actual production) = 27,000 * 4.4 = $118,800
Fixed overhead absorbed on actual hours = 27,200 * 4.4 = $119,680
Fixed overhead efficiency variance = 118,800 - 119,680 = 880 (Adverse)

Fixed overhead absorbed on budgeted hours = 28,500 * 4.4 = $125,400
Fixed overhead capacity variance = 119,680 - 125,400 = $5,720 (Adverse)
Budgeted overhead expenditure = $125,400
Actual overhead expenditure = $115,300
Fixed overhead expenditure variance = 125,400 - 115,300 = $10,100 (Favourable)

(c) Variance explanations
Raw materials cost variance
The budgeted raw material cost for production of 95,000 units was $1.40 per unit (133,000/95,000) but the actual raw material cost for production of 90,000 units was $1.45 per unit (130,500/90,000). The raw material cost per unit may have increased either because more raw materials per unit were used than budgeted, or because the price per unit of raw material was higher than budgeted. Calculation of the raw material price and usage sub-variances would indicate where further explanation should be sought.
Fixed overhead efficiency variance
The fixed overhead efficiency variance measures the extent to which more or less standard hours were used for the actual production than budgeted. In this case, a total of 27,200 machine hours were actually used, when only 27,000 standard machine hours should have been used. The difference may be due to poorer production planning than expected or to machine breakdowns.
Fixed overhead expenditure variance
The fixed overhead expenditure variance measures the extent to which budgeted fixed overhead differs from actual fixed overhead. Here, actual fixed overhead is $10,100 less than budgeted. This could be due to an error in forecasting fixed production overheads such as rent and power costs, or to a decrease in fixed production overheads, such as changing to a cheaper cleaning contractor.

d) Purposes of a budgeting system Key purposes of a budgeting system that could be discussed include planning, co-ordination, communication, control, motivation and performance evaluation. Students were required only to discuss three key purposes.
Planning
One of the key purposes of a budgeting system is to require planning to occur. Strategic planning covers several years but a budget represents a financial plan covering a shorter period (i.e. a budget is an operational plan). Planning helps an organisation to anticipate key changes in the business environment that could potentially impact on business activities and to prepare appropriate responses. Planning also ensures that the budgeted activities of the organisation will support the achievement of the organisation's objectives.
Co-ordination
Many organisations undertake a number of activities, which need to be co-ordinated, if the organisation is to meet its objectives. The budgeting system facilitates this co-ordination since organisational activities and the links between them are thoroughly investigated during budget preparation, and the overall coherence between the budgeted activities is reviewed before senior managers agree the master budget. Without the framework of the budgeting system,

individual managers may be tempted to make decisions that are not optimal in terms of achieving organisational objectives.

Communication

The budgeting system facilitates communication both vertically (e.g. between senior and junior managers) and horizontally (e.g. between different organisational functions). Vertical communication enables senior managers to ensure that employees at all levels understand organisational objectives. Communication also occurs at all stages of the budgetary control process (e.g. during budget preparation and investigation of period-end variances).

Control

One of the most important purposes of a budgeting system is to facilitate cost control through the comparison of budgeted costs and actual costs. Variances between budgeted and actual costs can be investigated in order to determine the reason why actual performance has differed from what was planned. Corrective action can be introduced if necessary in order to ensure that organisational objectives are achieved. A budgeting system also facilitates management by exception, whereby only significant differences between planned and actual activity are investigated.

Motivation

The budgeting system can influence the behaviour of managers and employees, and may motivate them to improve their performance if the target represented by the budget is set at an appropriate level. An inappropriate target has the potential to be de-motivating, however, and a key factor here is the degree of participation in the budget-setting process. It has been shown that an appropriate degree of participation can have a positive motivational effect.

Performance evaluation

Managerial performance is often evaluated by the extent to which budgetary targets for which individual managers are responsible have been achieved. Managerial rewards such as bonuses or performance-related pay can also be linked to achievement of budgetary targets. Managers can also use the budget to evaluate their own performance and clarify how close they are to meeting agreed performance targets.

Case: Sales Volume and Variance Analysis for Milbao Co

Milbao Co makes and sells three types of electronic game for which the following budget/standard information and actual information is available for a four-week period:

Model	Budget sales	Standard unit data Selling price	Variable cost	Actual sales
	(units)	$	$	(units)
Superb	30,000	100	40	36,000
Excellent	50,000	80	25	42,000
Good	20,000	70	22	18,000

Budgeted fixed costs are $2,500,000 for the four-week period. Budgeted fixed costs should be charged to product units at an overall budgeted average cost per unit where it is relevant to do so.

Required: (a) Calculate the sales volume variance for each model and in total for the four-week period where (i) contribution and (ii) net profit is used as the variance valuation base. (b)

Calculate the TOTAL sales quantity and sales mix variances for Milbao Co for the four-week period, using contribution as the valuation base. (Variances for individual models are not required.)

Answer:
(a) Sales volume variances
(i) Contribution basis

	Superb	Excellent	Good
Actual sales (units)	36,000	42,000	18,000
Budget sales (units)	30,000	50,000	20,000
Difference	6,000	(8,000)	(2,000)
Contribution ($)	60	55	48
Variance	360,000 F	(440,000) A	(96,000)A

(ii) Net profit basis

	Superb	Excellent	Good
Actual sales (units)	36,000	42,000	18,000
Budget sales (units)	30,000	50,000	20,000
Difference	6,000	(8,000)	(2,000)
Profit ($)	35	30	23
Variance	210,000 F	(240,000) A	(46,000)A

(b) Total sales quantity and sales mix variances
Sales mix variance

Product	Actual sales	Actual sales in budgeted	Difference	Standard contribution	Sales mix variance
	(units)	mix (units)	(units)	$	$
Superb	36,000	28,800 (30%)	7,200	60	432,000
Excellent	42,000	48,000 (50%)	(6,000)	55	(330,000)
Good	18,000	19,200 (20%)	(1,200)	48	(57,600)
	96,000	96,000	0		44,400 Fav

Sales quantity variance

Product	Actual sales in budgeted	Budgeted sales	Difference	Standard contribution	Sales quantity variance
	mix (units)	(units)	(units)	$	$
Excellent	28,800	30,000	(1,200)	60	(72,000)
Superb	48,000	50,000	(2,000)	55	(110,000)
Good	19,200	20,000	(800)	48	(38.400)
	96,000	100,000	(4,000)		(220,400) Adv

Case: Material and Labour Variance Analysis for Pan-Ocean Chemicals
Pan-Ocean Chemicals has one product that requires inputs from three types of material to produce batches of product Synthon. Standard cost details for a single batch are shown below:

		Materials		Labour	
Material type	Standard Kgs	Standard price per Kg ($)	Standard hours	Standard rate per hour ($)	
S1	8	0.3	1	5.00	
S2	5	0.5			
S3	3	0.4			

A standard loss of 10% of input is expected. Actual production was 15,408 kgs for the previous week. Details of the materials used were: Actual material used (kg) S1 8,284 S2 7,535 S3 3,334 Total labour cost for the week was $6,916 for 1,235 hours worked.

Required: (a) Calculate: (i) Total material mix, yield and usage variances; (ii Labour rate and efficiency variances. (b) Explain why the sum of the mix variances for materials measured in kg should be zero.

Answer:

(a) Variances

(i) Materials Mix variance

S1:	8 * 0.3 =	2.4
S2:	5 * 0.5 =	2.5
S3:	3 * 0.4 =	1.2
		6.1	for 16 kg

Actual usage in standard mix:

S1	9,576.5
S2	5,985.3
S3	3,591.2
Total	19,153.0

Standard cost of input per kg = 6.1 + 16 = $0.38125
Input in standard mix = 19,153 * 0.31825 = $7,302.1
Mix variance: 7,586.3 - 7,302.1 = $284.2 A.

Alternative calculation

		Actual usage in standard mix	Actual Usage	Variance kg $	Standard cost $	Variance
S1	9,576.5		8,284	1,292.5 F	0.30	387.8 F
S2	5,985.3		7,535	1,549.7 A	0.50	774.9 A
S3	3,591.2		3,334	257.2 F	0.40	102.9 F
Total	19,153.0		19,153			284.2 A

Yield variance
Standard output = 90% * 19,153 = 17,237.7 kgs
A standard input per batch of 16kg of materials should yield: 90% * 16 = 14.4kg of output.
Therefore, the standard cost per kg of output is (1/14.4) * 6.1 = $0.42361.
The yield variance = 0.42361(17,237.7 - 15,408.) =$775.1 A.

Usage variance

Usage variance = 775.1 A + 284.2 A = 1,059.3 A

Proof of usage variance: actual production of 15,408kgs required input of (10/9 * 15,408) = 17,120 kgs which, in standard proportions, is:

S1	8,560	0.30	2,568
S2	5,350	0.50	2,675
S3	3,210	0.40	1,284
Total	17,120		6,527	(or 15,408 * 0.42361 = 6,527)

Variance = 6,527 - 7,586.3 = 1,059.3 A

(ii) Labour

Standard labour cost = $5/14.4 = $0.3472 per kg

Rate variance: 6,916 - (1,235 * 5) = $741 A

Efficiency variance = (1,235 * 5) - (15,408 * 0.3472) = $825 A

Total variance = 6,916 - (15,408 * 0.3472) = 825 A + 741 A = $1,566 A.

(b) Mix variances

The total mix variance measured in quantity is zero since the expected mix is based on the total quantity actually used and hence the difference between total expected and total actual is nil.

Case: Labour Cost Variance Analysis and Standard Revision for Denzel

Denzel makes and sells a single product. The company budgeted to make and sell 120,000 units in November. The standard cost of labour for the product was as follows:

Labour 1.25 hours @ $12 per hour

Actual output for November was 122,000 units. Labour cost for the month was as follows:

Labour (158,600 hours @ $12.6) is $1,998,360

Prior to calculation of variances, it has been decided to revise the standard cost retrospectively, to take account of the following, which are considered to be outside of the control of the managers whose performance is evaluated based on variances:

1. A 3% increase in the labour rate to $13 per hour- due to negotiations with unions that were concluded after the initial standard had been set.

2. The standard for labour use had anticipated that the company would buy a new machine which would lead to a 10% decrease in labour hours. Instead of buying a new machine, existing machines had been improved, so a more appropriate standard is considered to be 1.4 hours per unit.

Required: (a) Prepare a statement reconciling the standard labour cost of actual output (based on the original standard) with the actual cost. The reconciliation should show the total planning variance and the total operating variance. (b) Analyse the planning variance into labour usage planning variance and labour price planning variance. (c) Discuss the principles that should be applied in deciding whether or not a standard should be revised. (d) Discuss the factors to be considered in deciding whether a variance should be investigated.

Answer:

(a) Comparison of standard labour cost with actual labour cost

	$	
Standard cost of actual output based on original standard (122,000 units * 1.25 hours * $12 per hour)	1,830,000	
Planning variance (balancing figure)	390,400	(A)
Revised standard cost of actual output		
(122,000 units * 1.4 hours * $13 per hour)	2,220,400	
Operating variance (balancing figure)	222,040	(F)
Actual labour cost	1,998,360	

(b) Planning variances

Usage variance

	$	
Actual output x original standard time per unit		
* original standard rate (122,000 * 1.25 hours * $12)	1,830,000	
Actual output x revised standard time per unit		
* original standard rate (122,000 * 1.4 hours * $12)	2,049,600	
Planning usage variance	219,600	(A)

Price variance

	$	
Actual output × revised standard time per unit × original standard rate	2,049,600	
Actual output x revised standard time per unit		
* revised standard rate (122,000 * 1.4 hour * $13)	2,220,400	
Planning price variance	170,800	(A)

Tutorial note: The sum of the planning price variance and the planning usage variance is $390,400, which is the total planning variance obtained in part (a).

(c) Principles of revising standards

Variance analysis is used to assess the performance of various managers involved in the purchasing and production process. Their performance is compared to a target, the standard cost, and any differences between actual and standard will be considered to be the responsibility of the manager. The controllability principle is that managers should only be judged on things they have control over. Where standards turn out to be unrealistic, due to changes that are outside of the control of the managers, they do not reflect accurately the performance of the managers. Standards should therefore be revised for uncontrollable factors before variance analysis is performed. The risk of revising variances is that managers may be tempted to include inefficiencies in the revised standard to reduce any adverse variances, which may be due to internal factors. Variances should not be revised to include internal, controllable factors or inefficiencies. In practice, there is likely to be some discussion of whether a change should be included in the revision of a variance or not. It is important therefore that all revisions are authorised by a senior, independent body, such as a budget committee before being used for variance analysis. This should ensure that changes made are fair and reasonable.

(d) Variance investigation

Tutorial note: The following factors could be discussed.

Size

Larger cost savings are likely to arise from taking action to correct large variances and a policy could be established of investigating all variances above a given size. Size can be linked to the underlying variable in percentage terms as a test of significance: for example, a policy could be established to investigate all variances of 5% or more.

Adverse or favourable

It is natural to concentrate on adverse variances in order to bring business operations back in line with budget. However, whether a variance is adverse or favourable should not influence the decision to investigate. The reasons for favourable variances should also be sought, since they may indicate the presence of budgetary slack or suggest ways in which the budgeting process could be improved. Favourable variances may also indicate areas where the budget is easy to achieve, suggesting that the motivational effect of a budget could be improved by introducing more demanding targets.

Cost versus benefits

If the expected cost of investigating a variance is likely to exceed any benefits expected to arise from its correction, it may be decided not to investigate.

Historic pattern of variances

A variance that is unusual when compared to historic patterns of variances may be considered worthy of investigation. Statistical tests of significance may be used to highlight such variances.

Reliability and quality of data

If data is aggregated or if the quality of the measuring and recording system is not as high as would be liked, there may be uncertainty about the benefits to arise from investigation of variances.

Case: Budget Revisions and Sales Variance Analysis for Spike Co

Spike Co manufactures and sells good quality leather bound diaries. Each year it budgets for its profits, including detailed budgets for sales, materials and labour. If appropriate, the departmental managers are allowed to revise their budgets for planning errors. In recent months, the managing director has become concerned about the frequency of budget revisions. At a recent board meeting he said, "There seems little point budgeting any more. Every time we have a problem the budgets are revised to leave me looking at a favourable operational variance report and at the same time a lot less profit than promised."

Required:

(a) Describe the circumstances when a budget revision should be allowed and when it should be refused.

(b) Two specific situations have recently arisen, for which budget revisions were sought:

Materials

A local material supplier was forced into liquidation. Spike's buyer managed to find another supplier, 150 miles away at short notice. This second supplier charged more for the material and a supplementary delivery charge on top. The buyer agreed to both the price and the delivery

charge without negotiation. "I had no choice", the buyer said, "The production manager was pushing me very hard to find any solution possible!" Two months later, another, more competitive, local supplier was found. A budget revision is being sought for the two months where higher prices had to be paid.

Labour

During the early part of the year, problems had been experienced with the quality of work being produced by the support staff in the labour force. The departmental manager had complained in his board report that his team were "unreliable, inflexible and just not up to the job". It was therefore decided, after discussion of the board report, that something had to be done. The company changed its policy so as to recruit only top graduates from good quality universities. This has had the effect of pushing up the costs involved but increasing productivity in relation to that element of the labour force. The support staff departmental manager has requested a budget revision to cover the extra costs involved following the change of policy.

Discuss each request for a budget revision and conclude whether it should be allowed.

(c) The market for leather bound diaries has been shrinking as the electronic versions become more widely available and easier to use. Spike has produced the following data relating to leather bound diary sales for the year to date:

Budget

Sales volume	180,000 units
Sales price	$17.00 per unit
Standard contribution	$7.00 per unit

The total market for diaries in this period was estimated in the budget to be 1.8m units. In fact, the actual total market shrank to 1.6 million units for the period under review.

Actual results for the same period: Sales volume 176,000 units and Sales price $16.40 per unit

Required: (i) Calculate the total sales price and total sales volume variance. (ii) Calculate market size and market share variances. (iii) Comment on the sales performance of the business.

Answer:

(a) Budget revisions

A budget forms the basis of many performance management systems. Once set, it can be compared to the actual results of an organisation to assess performance. A change to the budget can be allowed in some circumstances but these must be carefully controlled if abuse is to be prevented. Allow budget revisions when something has happened that is beyond the control of the organisation that renders the original budget inappropriate for use as a performance management tool. Senior management who should attempt to take an objective and independent view should approve these adjustments. Disallow budget revisions for operational issues. Any item that is in the operational control of an organisation should not be adjusted. This type of decision is often complicated and each case should be viewed on its merits. The direction of any variance (adverse or favourable) is not relevant in this decision.

(b) Budget revision requests

Materials Arguments in favour of allowing a revision:

· The nature of the problem is outside the control of the organisation. The supplier went in to liquidation; it is doubtful that Spike could have expected this or prevented it from happening.

· The buyer, knowing that budget revisions are common, is likely to see the liquidation as outside his control and hence expect a revision to be allowed. He may see it as unjust if this is not the case and this can be demoralising.

Arguments against allowing a budget revision:

· There is evidence that the buyer panicked a little in response to the liquidation. He may have accepted the first offer that became available (without negotiation) and therefore incurred more cost than was necessary.

· A cheaper, more local supplier may well have been available, so it could be argued that the extra delivery cost need not have been incurred. This could be said to have been an operational error.

Conclusion: The cause of this problem (liquidation) is outside the control of the organisation and is the prime cause of the overspending. Urgent problems need urgent solutions and a buyer should not be penalised in this case. A budget revision should be allowed.

Labour

Argument in favour of allowing a revision: The board made this decision, not the departmental manager. It could be argued that the extra cost on the department's budget is outside their control.

· This decision is entirely within the control of the organisation as a whole. As such, it would fall under the definition of an operational decision. It is not usual to allow a revision in these circumstances.

· It is stated in the question that the departmental manager complained in his board report that the staff level needed improving. It appears that he got his wish and the board could be said to have merely approved the change.

· The department will have benefited from the productivity increases that may have resulted in the change of policy. If the department takes the benefit then perhaps they should take the increased costs as well.

Conclusion: This is primarily an operational decision that the departmental manager agreed with and indeed suggested in his board report. No budget revision should be allowed.

Tutorial note: An alternative view is that the board made the final decision and as such the policy change was outside the direct control of the departmental manager. In this case a budget revision would be allowed.

(c) Sales variances

(i) Total sales variances

Sales price variance =(Actual SP - Standard SP) * Actual sales volume =(16.40 - 17.00) * 176,000 =$105,600 (Adverse)

Sales volume variance=(Actual sales volume - Budget sales volume) * std. contribution =(176,000 - 180,000) * 7 =$28,000 (Adverse)

ii) Market size and share variances Market size variance = (Revised sales volume - budget sales volume) * std. contribution =(160,000 - 180,000) * 7 = $140,000 (Adverse)

Market share variance=(Actual sales volume - revised sales volume) * std. contribution =(176,000 - 160,000) * 7 = $112,000 (Favourable)

(iii) Comment on sales performance

Sales price: The biggest issue seems to be the decision to reduce the sales price from $17.00 down to $16.40. This "lost" $105,600 of revenue on sales made compared to the standard price. It seems likely that the business is under pressure on sales due to the increased popularity of electronic diaries. As such, they may have felt that they had to reduce prices to sustain sales at even the level they achieved.

Volume: The analysis of sales volume into market size and share shows the usefulness of planning and operational variances. Overall, the sales level of the business is down by 4,000 units, losing the business $28,000 of contribution or profit. This calculation does not in itself explain how the sales department of the business has performed. In the face of a shrinking market they seem to have performed well. The revised level of sales (allowing for the shrinking market) is 160,000 units and the business managed to beat this level comfortably by selling 176,000 units in the period. As mentioned above, the reducing price could have contributed to the maintenance of the sales level. Additionally, the improved quality of support staff may have helped maintain the sales level. Equally the actions of competitors are relevant to how the business has performed. If competitors have been active then merely maintaining sales could be seen as an achievement. Spike should be concerned that its market is shrinking.

Case: Sales Price and Quantity Variances Analysis for Block Co
Block Co uses an absorption costing system and sells three types of product - Commodity 1, Commodity 2 and Commodity 3. Like other competitors operating in the same market, Block Co is struggling to maintain revenues and profits in face of the economic recession which has engulfed the country over the last two years. Sales prices fluctuate in the market in which Block Co operates. Consequently, at the beginning of each quarter, a market specialist, who works on a consultancy basis for Block Co, sets a budgeted sales price for each product for the quarter, based on his expectations of the market. This then becomes the "standard selling price" for the quarter. The sales department itself is run by the company's sales manager, who negotiates the actual sales prices with customers. The following budgeted figures are available for the quarter ended 31 May.

Product	Budgeted production and sales units	Standard selling price per unit	Standard variable production costs per unit
Commodity 1	30,000	$30	$18
Commodity 2	28,000	$35	$28.40
Commodity 3	26,000	$41.60	$26.40

Fixed production overheads are absorbed on the basis of direct machine hours and the budgeted cost of these for the quarter ended 31 May was $174,400. Commodity 1, 2 and 3 use 0.2 hours, 0.6 hours and 0.8 hours of machine time respectively.

The following data shows the actual sales prices and volumes achieved for each product by Block Co for the quarter ended 31 May and the average market prices per unit.

Product	Actual production and sales units	Actual selling price per unit	Average market price per unit
Commodity 1	29,800	$31	$32.20
Commodity 2	30,400	$34	$33.15

| Commodity 3 | 25,600 | $40.40 | $39.10 |

The following variances have already been correctly calculated for Commodities 1 and 2:

Sales price operational variances

Commodity 1: $35,760 Adverse

 Commodity 2: $25,840 Favourable

Sales price planning variances

Commodity 1: $65,560 Favourable

Commodity 2: $56,240 Adverse

Required: (a) Calculate, for Commodity 3 only, the sales price operational variance and the sales price planning variance. (b) Using the data provided for Commodities 1, 2 and 3, calculate: (i) the total sales mix variance; and (ii) the total sales quantity variance. (c) Briefly discuss the performance of the business and, in particular, that of the sales manager for the quarter ended 31 May.

Answer:

(a) Commodity 3 variances

Sales price operational variance: (actual price - market price) * actual quantity

Commodity 3: ($40.40 - $39.10) * 25,600 = $33,280 F

Sales price planning variance: (standard price - market price) * actual quantity

 Commodity 3: ($41.60 - $39.10) * 25,600 = $(64,000) A

An alternative approach to the variance calculations for Commodity 3 would be as follows:

Sales price operational variance	
Revised standard price	$39.10
Actual price	$40.40
Difference	$1.30 F
Actual sales quantity	25,600
Variance	$33,280 F
Sales price planning variance	
Revised standard price	$39.10
Original standard price	$41.60
Difference	$2.50 A
Actual sales quantity	25,600
Variance	$64,000 A

(b) Sales variances

(i) Sales mix variance

Product	Actual Q in actual mix	Actual Q in standard mix (WORKING)	Difference (units)	Standard profit (WORKING) $	$
1	29,800	85,800 * 30/84 = 30,643	(843)	11.20	(9,441.60)
2	30,400	85,800 * 28/84 = 28,600	1,800	4.20	7,560.00

3	25,600	85,000 * 26/84 = 26,557	(957)	12.00	(11,484.00)	
	85,800	5,800			(13,365.60)	Adv

WORKING

Budgeted machine hours = (30,000 * 0.2) + (28,000 * 0.6) + (26,000 * 0.8) = 43,600.
Overhead absorption rate = $174,400/43,600 = $4 per hour.

| Product | Commodity 1 | Commodity 2 | Commodity 3 |
	$	$	$
Standard selling price	30	35	41.60
Variable production costs	(18)	(28.40)	(26.40)
Fixed production overheads	(0.8)	(2.4)	(3.2)
Standard profit margin	11.20	4.20	12

(ii) Sales quantity variance

Product Commodity	Actual Q in standard mix (i)	Budgeted sales	Difference (units)	Standard profit (W) $	$	
1	30,643	30,000	643	11.20	7,201.60	
Commodity						
2	28,600	28,000	600	4.20	2,520.00	
Commodity						
3	26,557	26,000	557	12.00	6,684.00	
	85,800	84,000			16,405.60	Fav

(c) Discussion of performance

The calculations above have shown that, for the sales price, there is a $23,360 favourable operational variance and a $54,680 adverse planning variance. In total, these net off to a sales price variance of $31,320 adverse. The sales manager can only be responsible for a variance to the extent that he controls it. Since the standard selling prices are set by a consultant, rather than the sales manager, the sales manager can only be held responsible for the operational variance. Given that this was a favourable variance of $23,360, it appears that he has performed well, achieving sales prices which, on average, were higher than the market prices at the time. The consultant's predictions, however, were rather inaccurate, and it is these that have caused an adverse variance to occur overall in relation to sales price. As regards sales volumes, the mix variance is $13,366 adverse and the quantity variance is $16,406 favourable, meaning that the total volume variance is $3,040 favourable. This is because total sales volumes were higher than expected; although it is apparent that the increased sales related to the lower margin Commodity 2, with sales of Commodity 1 and Commodity 3 actually being lower than budget. The total variance relating to sales is $28,280 adverse. This looks poor but, as identified above, it is due to the inaccuracy of the sales price forecasts made by the consultant. We know that Block is facing tough market conditions because of the economic recession and therefore it is not that surprising that market prices were actually a bit lower than originally anticipated. This could be due to the recession hitting even harder in this quarter than in previous ones.

Case: Financial and Non-Financial Performance Analysis of Ties Only Co.

Ties Only Co is a new business, selling high quality imported men's ties via the Internet. The managers, who also own the company, are young and inexperienced but they are prepared to take risks. They are confident that importing quality ties and selling via a website will be successful and that the business will grow quickly. This is despite the well-recognised fact that selling clothing is a very competitive business. They were prepared for a loss-making start and decided to pay themselves modest salaries (included in administration expenses in Table 1 below) and pay no dividends for the foreseeable future. The owners are so convinced that growth will quickly follow that they have invested enough money in website server development to ensure that the server can handle the very high levels of predicted growth. All website development costs were written off as incurred in the internal management accounts that are shown below in Table 1. Significant expenditure on marketing was incurred in the first two quarters to launch both the website and new products. It is not expected that marketing expenditure will continue to be as high in the future. Customers can buy a variety of styles, patterns and colours of ties at different prices. The business's trading results for the first two quarters of trade are shown below in table 1.

	Quarter 1	Quarter 2
	$	$
Sales	420,000	680,000
Less: Cost of Sales	(201,600)	(340,680)
Gross Profit	218,400	339,320
Less: Expenses		
Website development	120,000	90,000
Administration	100,500	150,640
Distribution	20,763	33,320
Launch marketing	60,000	40,800
Other variable expenses	50,000	80,000
Total expenses	(351,263)	(394.760)
Loss for quarter	(132,863)	(55,440)

Required: (a) Assess the financial performance of the business during its first two quarters using only the data in Table 1 above. (b) Briefly consider whether the losses made by the business in the first two quarters are a true reflection of the current and likely future performance of the business. (c) The owners are well aware of the importance of non-financial indicators of success and therefore have identified a small number of measures to focus on. These are measured monthly and then combined to produce a quarterly management report. The data for the first two quarters management reports is shown below:

	Quarter 1	Quarter 2
Website hits	690,789	863,492
Number of ties sold	27,631	38,857
On time delivery	95%	89%
Sales returns	12%	18%

| System downtime | 2% | 4% |

Notes: A website hit is automatically counted each time a visitor to the website opens the home page of Ties Only Co. The industry average conversion rate for website hits to number of ties sold is 3.2%. The industry average sales return rate for internet-based clothing sales is 13%.

Required: Comment on each of the non-financial data in Table 2 above taking into account, where appropriate, the industry averages provided, providing your assessment of the performance of the business.

Answer:

(a) Financial performance

Sales growth

Ties Only has had an excellent start to their business. From a standing start they have made $420,000 of sales and then grown that figure by over 61% to $680,000 in the following quarter. This is impressive particularly given that the clothing industry is very competitive. Equally it is often the case that new businesses make slow starts, this does not look to be the case here.

Gross profit

The gross profit for the business is 52% for quarter 1 and 50% for quarter 2. Comparable industry data is not provided so firm conclusions cannot be drawn. However, gross profit has reduced by 2% in just one quarter. This is potentially serious and should not be allowed to continue. The cause of this fall is unclear, price pressure from competitors is possible, who may be responding to the good start made by the business. If Ties Only were reducing its prices, this would reflect on the gross profit margin produced. It could also be that the supply side cost figures are rising disproportionately. As the business has grown so quickly, it may have had to resort to sourcing extra new supplies at short notice incurring higher purchase or shipping costs. These could all reduce gross margins achieved.

Website development

Website costs are being written off as incurred to the management accounting statement of profit or loss. They should be seen as an investment in the future and unlikely to continue in the long term. Website development has been made with the future in mind; future website costs may be expected to be lower than at present. Taking this into consideration the loss made by the business does not look as serious as it first appears.

Administration costs

These are 23.9% of sales in quarter 1 and only 22.1% of sales in quarter 2. This could be good cost control, impressive given the youth and inexperience of the management team. Also any fixed costs included in the cost (directors' salaries are included) will be spread over greater volume. This would also reduce the percentage of cost against sales figure. This is an example of a business gaining critical mass. The bigger it gets the more it is able to absorb costs. Ties Only may have some way to go in this regard, gaining a much greater size than at present.

Distribution costs

This is a relatively minor cost that again appears under control. Distribution costs are likely to be mainly variable (postage) and indeed the proportion of this cost to sales is constant at 4.9%. Launch marketing Launch marketing is another cost that, although included in this statement of profit or loss, it is unlikely to continue at this level. Once the "launch" is complete this cost will be replaced by more general marketing of the website. Launch marketing will be more

expensive than general marketing and so the profits of the business will improve over time. This is another good sign that the results of the first two quarters are not as bad as they seem.
Other costs
Another cost that appears under control in that it seems to have simply varied with volume.

(b) Reflection of future performance
Although the business has lost over $188,000 in the first two quarters of its life, this is not as disastrous as it looks. The reasons for this view are:
· New businesses rarely breakeven within six months of launch;
· The profits are after charging the whole of the website development costs, these costs will not be incurred in the future;
· Launch marketing is also deducted from the profits. This cost will not continue at such a high level in the future.
The major threat concerns the fall in gross profit percentage that should be investigated. The owners should be relatively pleased with the start that they have made. They are moving in the right direction and without website development and launch marketing they made a profit of $47,137 in quarter 1 and $75,360 in quarter 2. If sales continue to grow at the rate seen so far, the business (given its ability to control costs) is well placed to return significant profits in the future. The current profit (or loss) of a business does not always indicate a business's future performance.

(c) Non-financial indicators of success
Website hits
This is a very impressive start. A new business can often find it difficult to make an impression in the market. Growth in hits is 25% between the two quarters. If this continued over a year the final quarter hits would be over 1.3m hits. The Internet enables new businesses to impact the market quickly.
Number of ties sold
The conversion rates are 4% for quarter 1 and 4.5% for quarter 2. Both these figures may seem low but are ahead of the industry average data. (Industry acquired data must be carefully applied, although in this case the data seems consistent.) It appears that the business has a product that the market is interested in. Ties Only is indeed looking competitive.
Average price achieved for the ties:
Quarter 1: $420,000/27,631 = $15.20 per tie
Quarter 2: $680,000/38,857 = $17.50 per tie
This suggests that the fall in gross profit has little to do with the sales price for the ties. The problem of the falling gross profit must lie elsewhere.
On time delivery
Clearly the business is beginning to struggle with delivery. As it expands, its systems and resources will become stretched. Customers' expectations will be governed by the terms on the website, but if expectations are not met then customers may not return. More attention will have to be placed on the delivery problem.
Sales returns

Returns are clearly common in this industry. Presumably, ties have to be seen and indeed worn before customers accept them as suitable. The concern here is that the business's return rate has jumped up in quarter 2 and is now well above the average for the industry. In other words, performance is worsening and below that of the competitors. If the business is under pressure on delivery (as shown by the lateness of delivery) it could be that errors are being made. If wrong goods are sent out then disappointed customers will return them. The alternative view is that the quality of the product is not what is suggested by the website. If the quality is poor then unhappy customers could well return the products. This is clearly concerning and an investigation is needed.

System down time

System down time is to be avoided by Internet based sellers as much as possible. If the system is down then customers cannot access the site. This could easily lead to lost sales at that time and cause customers not to try again at later dates. Downtime could be caused by insufficient investment at the development stage or the site being is under pressure due to peaking volumes. This second explanation is more likely in this case (as money was invested to build the server to a high specification). The down time percentage has risen alarmingly and this is concerning. Figures for the average percentage down time achieved by comparable systems are needed to be able to comment further. The owners are likely to be disappointed given the level of initial investment they have already made. A discussion with the website developers may well be warranted.

Summary

This new business is doing well. It is growing rapidly and ignoring non-recurring costs is profitable. It needs to focus on delivery accuracy, speed and quality of product. It also needs to focus on a remedy for the falling gross profit margin. WORKINGS

(1) Gross profit

Quarter 1: 218,400/420,000 = 52%

Quarter 2: 339,320/680,000 = 50%

(2) Website conversion rates

Quarter 1: 27,631/690,789 = 4%

Quarter 2: 38,857/863,492 = 4.5%

(3) Website hits growth

Between quarter 1 and quarter 2 the growth in website hits has been: 863,492/690,789 = 1.25 = 25%

Case: Evaluating Value for Money and Performance Indicators in Public Fire Services

(a) Outline the meaning of the phrase "Value for Money" and explain how the concepts underpinning it may be used to evaluate organisational performance.

(b) Evaluate the following four measures, which have been suggested by a working party as published performance indicators of a publicly funded and operated fire-fighting and rescue service: (i) Annual cost of the service; (ii) Cost per emergency call-out; (iii) Average response time to arrive at incident; (iv) Fire deaths per thousand head of population.

Answer:
(a) Meaning of VFM
Interested parties need to be able to make judgements about the performance of the organisation with which they are concerned. Commercial organisations can usually be evaluated by a range of profitability and other financial measures that are suitable for organisations that are subject to competitive pressures in terms of their markets and funding requirements. In organisations that operate in a monopoly situation or do not charge for the goods or services that they provide such measures are either inappropriate or impossible to calculate. Alternative measures of performance have been developed over time to evaluate such organisations and these have given rise to the general concept of value for money. VFM is usually assessed through three groupings of performance indicators which are used to measure economy, efficiency and effectiveness. These are often referred to as the "3 Es". Economy is concerned with the amount of resources that an organisation has used in its operations; put bluntly the question is "how much did it cost?" It should be noted that economy is primarily concerned with inputs. Efficiency is concerned with the relationship between the resources used and the output of goods and services. It follows that the outcome of this measure can be affected by changing either the inputs and/or outputs. Therefore, such measures are equivalent to, say, the cost of a unit produced in a factory. Often, though, the measure to use is not so clear-cut and so a range of effectiveness measures is often used in response to this problem. Effectiveness concerns the achievement of intended results; are the policy objectives being achieved? Effectiveness measures are therefore concerned only with outputs, regardless of inputs. Since they are concerned with objectives and goals they are often "soft" measures rather than those that can be objectively quantified. Again a range of measures is usually appropriate. In summary, economy is concerned with inputs, effectiveness with outputs and efficiency with the relationship between the two. In order to use VFM to evaluate performance it is necessary to use all of the three types of measures and to take an overview based upon the results. Such performance indicators give an insight into performance when used comparatively, both within and between organisations. An example of the relationship between the three types of measure may be useful to illustrate the points: Imagine one was attempting to evaluate the performance of a hospital. A measure of economy may be "cost per member of staff". Changing the relative grades of staff employed can clearly change this ratio. Moving towards lower grades of staff will reduce the ratio but may not be in the interest of patients. A measure of effectiveness may be "length of waiting list for surgery". No doubt waiting times could be reduced if more resources were made available. A measure of efficiency may be "cost per hip-replacement operation". This measure can be affected either by reducing the cost of the hip-replacement team or by the team replacing more hips within a given cost.

(b) Evaluation of measures
(i) Annual cost of service
This is a measure of economy since it is based on inputs. Whilst a low cost may be favourable in terms of public funding requirements, it may not produce a generally acceptable level of service.
(ii) Cost per call-out

This is measure of efficiency since it links inputs to outputs. Managers in the service could work to improve this ratio by cost reduction measures and by affecting, where possible, the services they can provide and so maximise call- outs relative to the fixed costs.

(iii) Average response time to arrive at incident

This is a measure of effectiveness in that responding to calls for help is the output of the organisation. Response times could be improved with more resources, for example more fire stations, vehicles and personnel.

(iv) Fire deaths per thousand head of population

Again, a measure of effectiveness since reducing casualties would certainly figure in the policy objectives. Managers could influence this ratio through a variety of measures, both critical and preventative. In general terms such measures are only useful when taken together since manipulation of, or response to, one will usually affect others. In this case more measures should probably be developed to attempt to evaluate the service. One of the key qualitative characteristics of published accounting information is comparability and this is relevant to the considerations of the working party. As for all performance indicators, users may be expected to make comparisons between organisations. Because of this, it would be useful if there were consensus in respect of standard methods of calculating and presenting these performance indicators across relevant organisations. If standardisation cannot be achieved then individual organisations could increase the usefulness of their performance with indicators by stating the methods of calculation that they have used. Benchmarking against the most successful organisations would also give meaningful context to the figures and help both internal and external users of such published information in making informed assessments on an entity's performance.

Case: Performance Assessment of Eatwell Restaurant Using Fitzgerald and Moon's Framework
The owners of Eatwell Restaurant have diversified business interests and operate in a wide range of commercial areas. Since buying the restaurant in 20X1 they have carefully recorded the data below:

	20X2	20X3	20X4	20X5
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 N	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 (minutes)	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 revenue	83,000	124,500	137,000	185,000	
Revenue 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 revenue of all restaurants in locality	895,000	1,234,000	980,000	1,056,000

Required: (a) Assess the overall performance of the business using Fitzgerald and Moon's dimensions of performance. (b) Identify any additional information that should be of assistance in assessing the performance of Eatwell Restaurant in comparison with another restaurant. Give reasons for your selection, clearly showing how they relate to the key performance area categories used in (a).

Answer:
(a) Overall business performance
Tutorial note: According to Fitzgerald and Moon the performance can be categorised into the key areas of 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 fivefold increase.
· Profits growing faster than revenue create an increasing net profit margin from 14% in 20X2 to 30.9% in 20X5. This may have arisen from improved resource utilisation (see below) resulting in a gradual decrease in the ratio of fixed costs to revenues.
Competitiveness
This is concerned with market share and growing new business areas. Market share is measured by the rate of restaurant turnover to the turnover of all restaurants in the locality. This commences with 9.3% in 20X2 and continually increases to 17.5% in 20X5. 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 20X2 to 66% in 20X5. 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 considering:

the 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 tin 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 20X4 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 (20X2), 204 (20X3), 155 (20X4), 168 (20X5). A brief attempt was made in 20X4 to extend the opening hours and increase the hourly utilisation of the premises.

(b) Additional information to assess performance

Financial

· The value of assets required to generate the profits - to calculate the ROCE.

· Details of cost categories (e.g. labour, food overheads - to assess comparative financial ratios).

· Whether the increase in capacity in 20X4 required additional capital investment - to assess the marginal return:

· The level of business risk inherent in alternative business and the associated expected return.

Competitiveness

· National trends in restaurant attendance and revenues provide broader comparisons.

· Data on/customer surveys of restaurants in targeted customer groups.

Quality of service

· To assess various intangible factors (e.g. politeness of staff, atmosphere and décor, responsiveness to customer requests).

· Food writers or expert ratings.

Innovation/Flexibility

· Staff training and the potential for multi-skilled activities to provide greater operational flexibility.

· The ability to cope with non-standard requests (e.g. special dietary needs and respond to customer needs).

Resources utilisation

· Data on employee numbers would facilitate the calculation of business activity per employee.

· Data on floor area per customer.

Case: Assessing Squarize's Strategic Shifts Using the Balanced Scorecard Framework

Squarize is a large company which, for many years, operated solely as a pay-TV broadcaster. However, five years ago, it started product bundling, offering broadband and telephone services to its pay-TV customers. Customers taking up the offer were then known in the business as "bundle customers" and they had to take up both the broadband and telephone services together with the pay-TV service. Other customers were still able to subscribe to pay-TV alone but not to broadband and telephone services without the pay-TV service. All contracts to customers of Squarize are for a minimum three-month period. The pay-TV box is sold to the customer at the beginning of the contract; however, the broadband and telephone equipment is only rented to them. In the first few years after product bundling was introduced, the company saw a steady increase in profits. Then, Squarize saw its revenues and operating profits fall. Consequently, staff bonuses were not paid, and staff became dissatisfied. Several reasons were identified for the deterioration of results:

1. In the economy as a whole, discretionary spending had been severely hit by rising unemployment and inflation. In a bid to save cash, many pay-TV customers were cancelling their contracts after the minimum three-month period as they were then able to still keep the pay-TV box. The box comes with a number of free channels, which the customer can still continue to receive free of charge, even after the cancellation of their contract.

2. The company's customer service call centre, which is situated in another country, had been the cause of lots of complaints from customers about poor service, and, in particular, the number of calls it sometimes took to resolve an issue.

3. Some bundle customers found that the broadband service that they had subscribed to did not work. As a result, they were immediately cancelling their contracts for all services within the 14-day cancellation period permitted under the contracts.

In a response to the above problems and in an attempt to increase revenues and profits, Squarize made the following changes to the business:

1. It made a strategic decision to withdraw the pay-TV-broadband-telephone package from the market and, instead, offer each service as a standalone product.

2. It guaranteed not to increase prices for a 12-month period for each of its three services.

 =3. It transferred its call centre back to its home country and increased the level of staff training given for call centre workers.

4. It investigated and resolved the problem with customers' broadband service.

It is now one year since the changes were made and the finance director wants to use a balanced scorecard to assess the extent to which the changes have been successful in improving the performance of the business.

Required: (a) Identify two goals (objectives) together with a corresponding performance measure for each goal for each of the given perspectives below to assess whether the changes have been successful. Justify the use of each of the performance measures that you choose.

· Financial

· Customer

· Internal business processes

· Innovation and learning

(b) Discuss how the company could reduce the problem of customers terminating their pay-TV service after only three months.

Answer:

(a) Goals and measures

| Goals | Performance Measures | Reason |

| Financial perspective: | Percentage increase in total revenue |
The changes have been implemented partly in an attempt to increase revenues, so it is sensible to | Increase revenue
| measure the extent to which revenues have actually increased.

| Increase operating profit margin | Percentage increase in operating profit

| The changes have been implemented partly in an attempt to increase operating profit, so it is

| sensible to measure the extent to which operating profit has actually increased.

| Customer perspective:

| Increase customer acquisition | Total sales to new customers

| The fourth change (to standalone products) was made in an attempt to attract new customers. This

| |

| measure will help to assess whether the change has been successful.

| Reduce loss of customers | Customer churn rate

| The first three of the four changes made were made in an attempt to retain customers. This

| |
performance measure will help to assess whether the changes have been successful.

| Internal business processes:

| Reduce loss of customers

| Reduce number of broadband contracts cancelled. | Number of broadband contracts cancelled | This performance measure will enable Squarize to assess whether the improved broadband service

| | has resulted in a reduction of the number of contracts cancelled.

| Increase after sales service quality | Percentage of customer requests that are handled with a single call | Squarize transferred its call centre back to its home country. This measure will assess whether

| | that has improved the service quality to customers as a result.

| Innovation and learning perspective: | |

| Increase call centre workers' skill levels | Number of training hours per employee
| This measure will improve the likelihood of customers receiving an improved service. A better
|
| public image should result, leading to increased revenues as new customers are attracted to the
| business.
|

| Increase employees' satisfaction | Percentage decrease in staff turnover
| This measure will also help to improve customer service, thereby improving company image,
| attracting new customers and increasing revenues in the long term.

(b) How to reduce problems of termination after three months
Pay-tv customers currently own the boxes, meaning that a certain number of customers appear to cancel their contract after the first three months and just keep the set-top box with its free channels. Squarize may want to consider loaning the boxes rather than selling them to the customers at the beginning of the contract. The company only has a minimum contract period of three months. This seems very short and perhaps the company could consider increasing it to 12 months. Unnecessary administration costs must be arising because it takes time, and therefore money, to set up new customers. If these customers then leave three months later, the company has not had much opportunity to earn profits from the customers generating these costs.

Case: Evaluating Financial Performance and ROI Projections for Pace Co Stores
Pace Co (PC) runs a large number of wholesale stores and is increasing the number of these stores all the time. It measures the performance of each store on the basis of a target return on investment (ROI) of 15%. Store managers get a bonus of 10% of their salary if their store's annual ROI exceeds the target each year. Once a store is built there is very little further capital expenditure until a full four years have passed. PC has a store (store W) in the west of the country. Store W has historic financial data as follows over the past four years:

	20X8	20X9	20Y0	20Y1
Sales ($000)	200	200	180	170
Gross profit ($000)	80	70	63	51
Net profit ($000)	13	14	10	8
Net assets at start of year ($000)	100	80	60	40

The market in which PC operates has been growing steadily. Typically, PC's stores generate a 40% gross profit margin.
This part of the scenario relates to requirement (b).
PC has another store (store S) about to open in the south of the country for which the following information is provided: Sales in the first year will be 18,000 units. Sales volume will grow at

10% for years two and three but no further growth is expected in year 4. Sales price will start at $12 per unit for the first two years but then reduce by 5% per annum for each of the next two years. Gross profit will start at 40% but will reduce as the sales price reduces. All purchase prices on goods for resale will remain constant for the four years. Overheads, including depreciation, will be $70,000 for the first two years rising to $80,000 in years three and four. Store S requires an investment of $100,000 at the start of its first year of trading. PC depreciates non-current assets at 25% of cost. No residual value is expected on these assets.

Required: (a) Discuss the past financial performance of store W using ROI and any other measure you feel appropriate and, using your findings, discuss whether the ROI correctly reflects Store W's actual performance. (b) In respect of store S: (i) Calculate (in columnar form) the revenue, gross profit, net profit and ROI of store S over each of its first four years. (ii) Calculate the minimum sales volume required in year 4 (assuming all other variables remain unchanged) to earn the manager of S a bonus in that year.

Answer:
(a) Performance of store W

	20X8	20X9	20Z0	20Z1
ROI	13%	17.5%	16.7%	20%
Bonus paid?	No	Yes	Yes	Yes
Sales Growth		0%	-10%	-5.6%
Gross margin	40%	35%	35%	30%
Overheads	$67,000	$56,000	$53,000	$43,000
Net profit % on Sales	6.5%	7%	5.6%	4.7%

The performance of store W can be assessed in various ways:

Sales growth

Revenue growth is most unimpressive. The market in which PC operates is steadily growing and yet store W has shrunk in terms of sales over the last four years. This could be poor volumes or poor prices achieved. Given the reducing gross margin (see below), a falling sales price is likely. It is possible that W is subject to higher than normal levels of competition.

Gross margin

The gross margins have also shrunk. Reducing margins can result from sales price pressure or increases in the cost of sales levels being incurred. Suppliers might have increased prices or labour could have become more expensive. The level of margin has only reached the normal level once in the last four years. Clearly W is under performing.

Overhead control

The one area that is impressive is the apparent ability of the business to reduce overheads as sales and margin have shrunk. This is often difficult to do. It is possible that reducing these overheads could have contributed to the poor sales performance, if (for example) quality has been affected, or one could say it reflects flexible management.

Net margin

The net margin has also fallen, primarily due to falling gross margins as overheads have reduced. Clearly, this is a disappointing performance.

ROI

The ROI has improved in most years and has exceeded the 15% target in all but one year 20X8. This is simply due to the reducing asset base as the stores assets have gradually been depreciated. Net profit levels have fallen overall and yet ROI has increased. It is hard to argue that the ROI figures properly reflect the performance of the store. The ROI will tend to increase as assets get older and this will distort the financial performance picture. In a period of falling sales and weaker margins the manager of W has been awarded bonuses in three out of four years. This is hard to justify.

(b) Store S
i. Financial forecast

		Year 1	Year 2	Year 3	Year 4	
		$	$	$	$	
Sales	(WORKING 1)	216,000	237,600	248,292	235,877
Gross profit	(WORKING 2)	86,400	95,040	91,476	79,061
Overheads		70,000	70,000	80,000	80,000
Net profit		16,400	25,040	11,476	(939)
Investment		100,000	75,000	50,000	25,000
ROI		16.4%	33.39%	22.95%	-3.8%

WORKINGS
WORKING 1. Sales

	Year 1	Year 2	Year 3	Year 4
Sales volume (units)	18,000	19,800[a]	21,780	21,780
Sales price ($)	12.00	12.00	11.40	10.83
Revenue ($)	216,000	237,600	248,292	235,877

18,000 (1.1)=19,800
19,800 (1.1)=21,780
12.00 (0.95)=11.40
11.40 (0.95)=10.83

2. Gross profit

Year 1	40% (given)	Total gross profit = $216,000 * 0.4 = $86,400
Year 2	40% (given)	Total gross profit = $237,600 * 0.4 = $95,040
Year 3	35/95 = 36.8421052%	
		Total gross profit = $248,292 * 0.368421052 = $91,476
Year 4	30.25/90.25 = 33.5180055%	
		Total gross profit = $235,877 * 0.335180055 = $79,061

Tutorial note: Alternatively, given that variable costs are said to be constant over the four years, calculate variable cost in year one and hold for the four years. Gross profit is then simply revenue less variable costs. Variable costs in year one:
$216,000 - (18,000 * unit VC) = $86,400
VC per unit = $7.20
So year two's gross profit will be: $237,600 - 19,800 * 7.2 = $95,040

ii. Minimum sales volume

In order for a bonus to be paid in year four a ROI of 15% is needed. This implies a net profit of $25,000 * 15% = $3,750.

Adding overheads of $80,000 to this net profit means that $83,750 of gross profit is needed. At a gross profit % of 33.518% this implies sales of $249,866.

At a price of $10.83, this suggests sales volume of 23,072 units.

Case: Performance Measurement and Investment Decisions: Implementing the Balanced Scorecard and Residual Income Approaches

a. Brace Co is an electronics company specialising in the manufacture of home audio equipment. Historically, the company has used solely financial performance measures to assess the performance of the company as a whole. The company's Managing Director has recently heard of the "balanced scorecard approach" and is keen to learn more. Required: Describe the balanced scorecard approach to performance measurement.

b. Brace Co is split into two divisions, A and B, each with their own cost and revenue streams. each of the divisions is managed by a divisional manager who has the power to make all investment decisions within the division. The cost of capital for both divisions is 12%. Historically, investment decisions have been made by calculating he return on investment (ROI) of any opportunities and at present, the return on investment of each division is 16%. A new manager who has recently been appointed in division A has argued that using residual income (RI) to make investment decisions would result in "better goal congruence" throughout the company. Each division is currently considering the following separate investments:

	Project for Division B	Project for Division A
Capital required for investment	$82.8 million	$40.6 million
Sales generated by investment	$44.6 million	$21.8 million
Net profit margin	28%	33%

The company is seeking to maximise shareholder wealth. Calculate both the return on investment and residual income of the new investment for each of the two divisions. Comment on these results, taking into consideration the manager's views about residual income.

Answer:

(a) Balanced scorecard

The balanced scorecard is a strategic management technique for communicating and evaluating the achievement of the strategy and mission of an organisation. It comprises an integrated framework of financial and non-financial performance measures that aim to clarify, communicate and manage strategy implementation. It translates an organisation's strategy into objectives and performance measurements for the following four perspectives:

Financial perspective

The financial perspective considers how the organisation appears to shareholders. How can it create value for its shareholders? Kaplan and Norton, who developed the balanced scorecard, identified three core financial themes that will drive the business strategy: revenue growth and mix, cost reduction and asset utilisation.

Customer perspective

The customer perspective considers how the organisation appears to customers. The organisation should ask: "to achieve our vision, how should we appear to our customers?" The customer perspective should identify the customer and market segments in which the business units will compete. There is a strong link between the customer perspective and the revenue objectives in the financial perspective. If customer objectives are achieved, revenue objectives should be too.

Internal perspective

The internal perspective requires the organisation to ask: "what must we excel at to achieve our financial and customer objectives?" It must identify the internal business processes that are critical to the implementation of the organisation's strategy. Kaplan and Norton identify a generic process value chain consisting of three processes; the innovation process, the operations process and the post-sales process.

Learning and growth perspective

The learning and growth perspective requires the organisation to ask whether it can continue to improve and create value. If an organisation is to continue having loyal, satisfied customers and make good use of its resources, it must keep learning and developing. It is critical that an organisation continues to invest in its infrastructure (i.e. people, systems and organisational procedures) in order to provide the capabilities that will help the other three perspectives to be accomplished.

(b) Divisional performance

ROI

Division A

Net profit = $44.6m * 28% = $12.488m

ROI = $12.488m/$82.8m = 15.08%

Division B

Net profit = $21.8m * 33% = $7.194m

ROI = $7.194m/$40.6m = 17.72%

Residual income

Division A

Divisional profit = $12.488m

Capital employed = $82.8m

Imputed interest charge = $82.8m * 12% = $9.936m

Residual income = $12.488m - $9.936m = $2.552m

Division B

Divisional profit = $7.194m

Capital employed = $40.6m

Imputed interest charge = $40.6m * 12% = $4.872m

Residual income = $7.194m - $4.872m = $2.322m

Comments

If a decision about whether to proceed with the investments is made based on ROI, it is possible that the manager of Division A will reject the proposal whereas the manager of Division B will accept the proposal. This is because each division currently has a ROI of 16% and since the

Division A investment only has a ROI of 15.08%, it would bring the division's overall ROI down to less than its current level. On the other hand, since the Division B investment is higher than its current 16%, the investment would bring the division's overall ROI up. Considering what would actually be best for Brace as a whole; both investments have a healthy return and should therefore be accepted. Hence, the fact that ROI had been used as a decision-making tool has led to a lack of goal congruence between Division A and the company as whole. This backs up what the new manager of Division A is saying. If residual income was used in the decision-making process, both proposals would be accepted by the divisions since both have a healthy RI. In this case, RI helps the divisions to make decisions that are in line with the best interests of Brace. This also supports the new manager's view. It is important to note, however, that each of the methods has numerous advantages and disadvantages that have not been considered here.

Case: Strategic Transfer Pricing: Balancing Internal and External Market Demands
a. The transfer pricing system operated by a divisional company has the potential to make a significant contribution towards the achievement of corporate financial objectives. Required State the potential benefits of operating a transfer pricing system within a divisionalised company.
b. A company operates two divisions, Able and Baker.Able manufactures two products X and Y. Product X is sold to external customers for $42 per unit. The only outlet for product Y is Baker.
c. Baker supplies an external market and can obtain its semi-finished supplies (product Y) from either Able or an external source. Baker currently has the opportunity to purchase product Y from an external supplier for $38 per unit. The capacity of division Able 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 Able to division Baker under the following conditions: (i) When division Able has spare capacity and limited external demand for product X; (ii) When division Able is operating at full capacity with unsatisfied external demand for product X. c. The design of an information system to support decision-making in transfer pricing necessitates the inclusion of specific data Identify the data that needs to be collected and how it may be used.

Answer:
(a) Potential benefits
· Achieving global/corporate profit optimality.
· Goal congruence between divisions and group.
· Fostering divisional autonomy and local decision making.
· The measurement of divisional financial performance via the generation of a recognised income figure.

· The provision of "pricing signals" that induce decisions to improve corporate profitability.

(b) Transfer price
(i) Spare capacity
When division Able 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 Able supplies Y. The transfer price should be fixed at a price above $35, to provide an incentive for Able to supply and generate a contribution towards the recovery of fixed costs and below $38 to encourage Baker 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) Full capacity
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 Baker, Able 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 Baker with one unit of product Y. It is therefore better for the company to purchase product Y from the external supplier for $38. This can be ensured by fixing the transfer price of Y above $38, to discourage Baker from buying it from Able. At a price of $40, Baker would not choose to buy from Able, and it would not be in the interest of Able to sell to the other division.

(c) Data to be collected
· Unit variable costs to identify the incremental costs of producing the different products and services;
· Sales prices in the external market to assess potential contribution towards overheads and profit;
· Current and maximum capacity levels to ascertain the opportunity cost of lost sales;
· The limiting factors that are constraining the capacity so that the managers can take appropriate action to expand capacity;
· The value of the shadow prices so that the managers can evaluate whether it is worthwhile to acquire specific resources;
· The availability and prices of obtaining supplies from external suppliers (for make or buy decisions).

Case: Evaluating Transfer Prices and Profitability Using Costing Methods
Wash Co assembles and sells two types of washing machines - the Spin (S) and the Rinse (R). The company has two divisions: the assembly division, and the retail division. The company's policy is to transfer the machines from the assembly division to the retail division at full cost plus 10%. This has resulted in internal transfer prices, when S and R are being transferred to the retail division, of $220.17 and $241.69 respectively. The retail division currently sells S to the general public for $320 per machine and R for $260 per machine. Assume it incurs no other

costs except for the transfer price. The retail division's manager is convinced that, if he could obtain R at a lower cost and therefore reduce the external selling price from $260 to $230 per unit, he could significantly increase sales of R, which would be beneficial to both divisions. He has questioned the fact that the overhead costs are allocated to the products on the basis of labour hours; he thinks it should be done using machine hours or even activity based costing. You have obtained the following information for the last month from the assembly division:

	Product S	Product R
Production and sales (units)	3,200	5.450
Materials cost	$117	$95
Labour cost (at $12 per hour)	$6	$9
Machine hours (per unit)	2	1
Total no. of production runs	30	12
Total no. of purchase orders	82	64
Total no. of deliveries to retail division	64	80
Overhead costs:	$	
Machine set-up costs	306,435	
Machine maintenance costs	415,105	
Ordering costs	11,680	
Delivery costs	144,400	
Total	877,620	

Required: (a) Using traditional absorption costing, calculate new transfer prices for S and R if machine hours are used as a basis for absorption rather than labour hours. Note: round all workings to 2 decimal places. (b) Using activity based costing to allocate the overheads, recalculate the transfer prices for S and R. (c) Calculate last month's profit for each division, showing it both for each product and in total, if activity based costing is used.

Answer:
(a) Transfer price using machine hours
Total overhead costs = $877,620
Total machine hours = (3,200 * 2) + (5,450 * 1) = 11,850
Overhead absorption rate = $877,620/11,850 = $74.06
Overhead cost for S =2 * $74.06 = $148.12 and for R= 1 * $74.06= $74.06.

	Product S	Product R
	$	$
Materials cost	117.00	95.00
Labour cost (at $12 per hour)	6.00	9.00
Overhead costs	148.12	74.06
Total cost	271.12	178.06
10% mark-up	27.11	17.81
Transfer price using machine hours	298.23	195.87

(b) Transfer price using ABC
Machine set up costs: driver = number of production runs.
30 + 12 = 42.

Therefore cost per set up = $306,435/42 = $7,296.07
Machine maintenance costs: driver = machine hours: 11,850 (S = 6,400; R = 5,450)
$415,105/11,850= $35.03
Ordering costs: driver = number of purchase orders
82 + 64 = 146.
Therefore cost per order = $11,680 + 146 = $80
Delivery costs: driver = number of deliveries.
64 + 80 = 144.
Therefore cost per delivery = $144,400/144 = $1,002.78
Allocation of overheads to each product

	Product S	Product R	Total
	$	$	
Machine set-up costs	218,882	87,553	306,435
Machine maintenance costs	224,192	190,913	415,105
Ordering costs	6,560	5,120	11,680
Delivery costs	64,178	80,222	144,400
Total overheads allocated	513,812	363,808	877,620
Number of units produced	3,200	5,450	8,650
	$	$	
Overhead cost per unit	160.57	66.75	
Transfer price per unit:			
Materials cost	117.00	95.00	
Labour cost	6.00	9.00	
Overhead costs	160.57	66.75	
Total cost	283.57	170.75	
Add 10% mark up	28.36	17.08	
Transfer price under ABC	311.93	187.83	

(c) Profit allocation
Using ABC transfer price from part (b):

Assembly division	Product S	Product R	Total
Production and sales	3,200	5,450	
	$	$	
10% mark up	28.36	17.08	
Profit	90,752	93,086	183,838

Retail division	Product S	Product R	Total
Production and sales	3,200 $	5,450	
	$	$	
Selling price	320	260	
Cost price	(311.93)	(187.83)	
Profit per unit	8.07	72.17	
Total profit	25,824	393,327	419,151