2013

Management Accounting

A key to your success at the exam

V.V. Dobrynskaya, V.V. Poleshchuk

International College of Economics and Finance

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Allocation of overheads

Problem 1

Orielplc manufactures UPVC windows for the building trade. The production process is classified into two cost centres, the Fabrication Department and the Finishing Department. These are supported by two service cost centres the Canteen and the Maintenance Department.

Forecast information for the year ended 31st March 2011 was as follows:

	Total	**Fabrication**	**Finishing**	**Canteen**	**Maintenance**
	£	**£**	**£**	**£**	**£**
Indirect labour	340,000	120,000	140,000	30,000	50,000
Consumables	82,000	24,000	32,000	20,000	6,000
Heating and lighting	24,000				
Rent and rates	36,000				
Depreciation	60,000				
Supervision	48,000				
Power	40,000				
	630,000				

The following information is also available:

	Total	**Fabrication**	**Finishing**	**Canteen**	**Maintenance**
	£	**£**	**£**	**£**	**£**
Floor space (sq metres)	60,000	20,000	24,000	6,000	10,000
Book value of machinery(£)	600,000	300,000	240,000	20,000	40,000
Number of employees	160	80	60	10	10
Kilowatt hours	20,000	9,000	8,000	1,000	2,000
Direct materials (£)		100,000	50,000		
Direct labour (£)		50,000	42,000		
Maintenance hours		8,000	6,000		
Labour hours		12,640	8,400		
Machine hours			15,700		

The production process requires a range of materials and involves workers with differing hourly wage rates.

Required:

(a) Prepare an overhead cost statement which clearly shows the bases of apportionment.

(b) Calculate the labour hour overhead absorption rate for the Fabrication Department and the machine hour overhead absorption rate for the Finishing Department.

(c) A batch of 200 windows for a customer is estimated to require the following resources:

Direct material	£3,000
Direct labour	
Fabrication Dept.	100 hours at £8 per hour
Finishing Dept.	40 hours at £6 per hour
Machine hours	
Fabrication Dept.	20 hours
Finishing Dept.	80 hours

Calculate the selling price per window if Orielplc adds a 40% mark up on total production cost.

(d) The production manager has suggested that the company could simplify its costs by using a percentage mark up for overheads based on direct material cost or direct labour cost or prime cost. Discuss this suggestion.

☺ **Solution:**

(a) Here you should prepare a statement showing all indirect production costs allocated or apportioned as between production centres. It is the first stage of a traditional two-stage allocation process that should be used to assign overheads costs to the product. In this stage total production overheadsof £630,000which were classified into 7 groups (indirect labour, consumables, heating and lighting, rent and rates, depreciation, supervision and power cost) should be assigned to production cost centres. This can be done in two steps. First step is to allocate the overheads to the departments (production and service centres). In this problem we have four departments: the Fabrication Department, the Finishing Department (these departments are purely involved in production, so they are production cost centres), the Canteen and the Maintenance Department (these departments help the productiondepartments to function, so they are service cost centres). It should be recalled that indirect overhead costs are those which cannot be directly associated with any particular cost centre. Allocation base, therefore, are needed to apportion them to the four cost centres. Two overhead costs (indirect labour and consumables) have been already allocated to the departments. You need to choose an allocation basis for the rest (heating and lighting, rent and rates, depreciation, supervision and power). The question tests your ability to apply allocation assumptions (to decide what basis to use) to a data set. You should know that allocation base should reflect the benefits received by the departments from these costs. For example, since heating and lighting cost ismainly related to the total floor space of the building, the cost obtained by each department can be ascertained according to the proportion of floor area which it occupies. The total floor area of the company is 60,000 square

meters, so heating and lighting cost £24,000is apportioned on the basis of £24,000÷60,000 square meters = £0.4 per square meter. The Fabrication Department occupies 20,000 squaremeters. Therefore, £8,000heating and lighting cost (= 20,000 squaremeters× £0.4 per square meter) should be assigned to the Fabrication Department. The Finishing department gets £9,600 heating and lighting cost (= 24,000 squaremeters× £0.4 per square meter), the Canteen – £2,400 heating and lighting cost (= 6,000 squaremeters× £0.4 per square meter) and the Maintenance £4,000 heating and lighting cost (= 10,000 squaremeters× £0.4 per square meter).

Rent and rates cost£36,000 is also related to the floor space, so the cost can be apportioned on the basis of £36,000÷60,000 square meters = £0.6 per square meter: The Fabrication Department is assigned £12,000 rent and rates cost (= 20,000 squaremeters× £0.6 per square meter), the Finishing department gets £14,400 rent and rates cost (= 24,000 squaremeters× £0.6 per square meter), the Canteen – £3,600 heating and lighting cost (= 6,000 squaremeters× £0.6 per square meter) and the Maintenance £6,000 heating and lighting cost (= 10,000 squaremeters× £0.6 per square meter).

Depreciation cost £60,000 is related to the book value of the machinery, so it is apportioned on the basis of £60,000÷£600,000 = £0.1per 1£ of book value of machinery. The Fabrication Department is assigned £30,000 depreciation cost (= £300,000 book value of machinery × £0.1 per 1£ of book value of machinery), the Finishing department is assigned £24,000 depreciation cost (= £240,000 book value of machinery × £0.1 per 1£ of book value of machinery), the Canteen – £2,000 depreciation cost (= £20,000 book value of machinery × £0.1 per 1£ of book value of machinery) and the Maintenance £4,000 depreciation cost (= £40,000 book value of machinery × £0.1 per 1£ of book value of machinery).

Cost of supervision £48,000 depends on number of employees in each centre, the cost is apportioned on the basis of £48,000÷160 employees = £300 per employee.

Power cost depends on kWh usage, apportion rate is £40,000÷20,000 kWh = £2 per kWh.

Applying these bases to the apportionment of indirect factory overhead costs to the four cost centres, the following distributions are obtained:

Production overheads	Basis of allocation	Total	Fabrication	Finishing	Canteen	Maintenance
			Production cost centre	Production cost centre	Service cost centre	Service cost centre
Indirect labour	n/a (given)	340,000	120,000	140,000	30,000	50,000
Consumables	n/a (given)	82,000	24,000	32,000	20,000	6,000
Heating and lighting	Floor space	24,000	8,000	9,600	2,400	4,000

Rent and rates	Floor space	36,000	12,000	14,400	3,600	6,000
Depreciation	Book value of machinery	60,000	30,000	24,000	2,000	4,000
Supervision	Number of employees	48,000	24,000	18,000	3,000	3,000
Power	Kilowatt hours	40,000	18,000	16,000	2,000	4,000
Total		630,000	236,000	254,000	63,000	77,000

Now all production overheads for Orielplc have been assigned to the departments.

Step two is to reallocate the costs that have been assigned to service cost centres to production cost centres. Orielplc has two service centres. They are the Canteen and the Maintenance department. These service centres render essential services that support the production process, but they do not deal directly with the products. To assign costs to products traditional costing systems reallocate service centre costs to production centres that actually work on the product. In this problem you should once again decide what reallocation basis to use. The method that is chosen to allocate service centre costs to production centre should be related to the benefits that the production centres derive from the service rendered. Let us start with the Canteen department. This department provides catering services to the employees of the Fabrication, the Finishing and the Maintenance departments, so the costs of Canteen department can be reallocated to these departments proportionate to numbers of employees. In the Fabrication, the Finishing and the Maintenance departments work 150 people (80 employees in the Fabrication, 60 employees in the Finishing and 10 employees in the Maintenance), the reallocation rate is £63,000/150 employees = £0.42 per employee.

Therefore, £33,600 (=80 employees × £0.42 per employee) of the Canteen Department cost should be reallocated to the Fabrication Department, £25,200 (=60 employees × £0.42 per employee) to the Finishing department and£4,200 (=10 employees × £0.42 per employee) to the Maintenance department.

The number of maintenance hours provides a suitable approximation of the benefits that each production centre receives from the Maintenance department. The Maintenance department cost reallocation rate = £81,200/(8,000+6,000) maintenance hours = £5.8per maintenance hour. Since the Fabrication department consumes 8,000 maintenance hours £46,400=(8,000 maintenance hours × £5.8per maintenance hour) should be reallocated from the Maintenance department to the Fabrication department. £34,800 = (6,000 maintenance hours × £5.8per maintenance hour) should be reallocated to the Finishing department. This completes the first stage of the two-stage allocation process.

Expense	Basis of reallocation	Total	Fabrication	Finishing	Canteen	Maintenance
Total		630,000	236,000	254,000	63,000	77,000
Canteen	Number of employees	0	33,600	25,200	(63,000)	4,200
		630,000	269,600	279,200	0	81,200
Maintenance	Maintenance hours	0	46,400	34,800	–	(81,200)
		630,000	316,000	314,000	–	–

(b) The second stage of the two-stage allocation process is to allocate overheads of each production centre to products passing through that centre. You are explicitly given the allocation bases that you should use. You should calculate the labour hour overhead absorption rate for the Fabrication Department and the machine hour overhead absorption rate for the Finishing Department.

Fabrication Department absorption rate = £316,000 theFabrication Department production overheads ÷ 12,640the Fabrication department direct labour hours = £25 per labour hour.

Thus, for every direct labour hour which is spent on fabrication a unit of Orielplc product (a window), that unit will attract £25 of manufacturing overheads.

Finishing department overhead absorption rate = £314,000 the Finishing department production overheads ÷ 15,700the Finishing department machine hours = £20 per machine hour.

Thus, for every machine hour which is spent on finishing a unit of Orielplc product (a window), that unit will attract £20 of manufacturing overheads.

(c) Let us calculate a selling price of one window:

Batch (200 windows) cost:	£
Direct materials	3,000
Direct labour:	
Fabrication Department: 100 direct labour hours × £8 per hour	800
Finishing Department: 40 direct labour hours × £6 per hour	240
Manufacturing overheads:	
Fabrication Department 100 direct labour hours × £25 per hour	2,500
Finishing 80machine hours × £20 per hour	1,600
Total batch (200 windows) cost	8,140
Cost per window (÷ 200)	40.70
Mark up 40%	16.28
Selling price	56.98

You should remember that you should use labour hour overhead absorption rate for the Fabrication Department and the machine hour overhead absorption rate for the Finishing Department. For every hour of direct labour spend on the production of the batch in the Fabrication department the batch will attract £25 direct indirect overhead costs. Hence, if the batch needs 100 direct labour hours, the overhead costs apportioned would be £2,500 = 100 direct labour hours × £25 per hour.

For every machine hour spent on the production of the batch in the Finishing department, the batch will attract £20 of production overheads. Hence, if the Finishing department spent 80 hours of machining, the overheads costs apportioned would be £1,600 = 80 machine hours × £20 per hour.

(d)The choice of one particular overhead rate as against the others may substantially affect the amount of overhead costs apportioned to a unit of a product. The "best" rate to use depends on the particular circumstances facing the firm.

Direct material cost percentage is best used when the price of materials is constant and there is a direct relationship between the materials and labour costs incurred to manufacture the product. In the case of Oriel the production uses a range of materials and this method would be inappropriate.

Direct wages cost percentage is best used when the wages rates are the same throughout the company and the same for each job. In the case of Oriel the production involves differing hourly rates and this method would be inappropriate.

Prime cost percentage rate is the method that combines the faults of the direct materials cost percentage and the direct labour cost percentage rates.

The direct labour hours method used in the Fabrication department is one of the best methods to use because most factory overheads are more related to time than to other factors (cost of direct materials of wages). Labour hours method could have been also used in the Finishing department but this department is obviously machine-intensive and, therefore, machine hours should be more appropriate.

Problem 2

The budget for Ukridge Ltd provides the following estimates for the current year ending 31st October 2006 for the factory and assembly production departments.

	Factory	Assembly
Machine hours	48,000	6,000
Direct labour hours	18,000	15,000

Hourly wage rate	£6.00	£5.00
Production overhead	£120,000	£60,000

Overheads are to be absorbed at departmental level using either machine or labour rate dependent upon which is the larger hourly resource used.

In response to a request for a quotation from Corky Ltd the estimating department has provided the following costs and timings:

Direct materials	£144.00
Direct labour - factory	1 hour
Direct labour – assembly	2 hours
Machine hours - factory	4 hours
Machine hours - assembly	0.5 hours

Required:

Calculate the price to quote to Corky Ltd., given that profit is added at 15% of total costs.

☺ **Solution:**

The key phrase in the question is that the relevant absorption rate is dependent 'upon which is the larger hourly resource used'. The factory uses more machine than labour hours and therefore a machine hour rate should be used:

Factory overhead absorption rate = £120,000 factory production overheads ÷48,000 factory machine hours = £2.5 per machine hour.

Thus, for every hour which is spent on machining a unit of Ukridge ltd product in the factory, that unit will attract £2.5 of factory overheads.

Conversely for assembly, labour hours are used to absorb production overheads into the product unit costs:

Assembly overhead absorption rate = £60,000 assembly production overheads ÷15,000 assembly direct labour hours = £4 per labour hour.

Thus, for every hour of direct labour spent on making a unit of Ukridge ltd product in the assembly, that unit will attract £4 of assembly overheads.

Now we can calculate total costs of an order received from Corky ltd and price of the quotation:

Direct materials	£144.00
Direct labour – factory: 1 direct labour hour × £6.00	£6.00
Direct labour – assembly: 2direct labour hours × £5.00	£10.00
Production overheads – factory: 4 machine hour × £2.5	£10.00
Production overheads – assembly: 2 direct labour hours × £4	£8.00
Total cost	£178.00

Mark-up (15%)	£26.70
Price to quote to Corky ltd:	£204.70

Problem 3

Newman Marine Ltd undertakes a range of work, including making sails for small sailing boats on a made-to-measure basis. The following costs are expected to be incurred by the business during next month:

Direct materials cost	£3,000
Direct labour costs	£30,000
Depreciation of machinery	£3,000
Heating, lighting and power	£2,000
Indirect labour cost	£9,000
Indirect materials	£400
Direct labour time	6,000 hours
Machine time	2,000 hours

The business has received an enquiry about a sail and it is estimated that the sail will take 12 direct labour hours to make and will require 20 square metres of sail-cloth (which costs £2 per square metre). The business normally uses a direct-labour-hour basis of charging overheads to individual jobs.

The production manager has suggested that for this job a machine hour basis of overhead recovery might be more appropriate. The sail will take 5 machine hours.

Required:

(a) Calculate the full cost of making the sail on the normal overhead recovery basis.

(b) Calculate, and briefly comment on the effect of the production manager's suggestion.

☺ **Solution:**

(a) First of all we should calculate production overheads (indirect production costs). Depreciation of machinery, heating, lighting and power, indirect labour cost and indirect materials are indirect production cost. Thus, production overheads are £3,000+£2,000+£9,000+£400=£14,400.

The business normally uses a direct-labour-hour basis of apportioning production overheads to products.

Production overhead absorption rate = £14,400 production overheads ÷6,000 direct labour hours = £2.4 per direct labour hour.

Full cost of making a sail on a direct-labour-hour basis:

Direct material cost (20 sq.m. of sail cloth ×£2 per sq.m.)	£40.00
Direct labour costs (12 direct labour hours × £5 per hour =£30,000/6,000)	£60.00
Indirect overheads (12 direct labour hours × 2.4 per hour	£28.80
Total cost	£128.80

(b) Production overhead absorption rate on machine-hour basis =£14,400 production overheads ÷ 2,000 machine hours = £7.2 per machine hour.

Full cost of making a sail on a machine-hour basis:

Direct material cost (20 sq.m. of sail cloth × 2 per sq.m.)	£40.00
Direct labour costs (12 direct labour hours × £5 per hour)	£60.00
Indirect overheads (5 machine hours × 7.2 per hour	£36.00
Total cost	£136.00

A you can see the full cost of making of sail is higher if machine-hour rate is selected. However, the choice of overhead recovery rate should be based on the principal resource usage of the factory. With more labour hours (a) could be preferred. However, if there is a greater reliance on machinery rather than on labour, machine-hour rate may be the most suitable base for absorbing costs into products and calculation (b) is correct.

Relevant costs for decision-making

Problem 4

Ives Ltd is a construction company, which specialises in building schools. Currently Ives Ltd manufactures the desks to go into these schools and has budgeted for sales of 3,600 desks for the year ended 30th June 2010. The budgeted costs of production are as follows:

	£
Direct materials	84,000
Direct labour	18,000
Variable overhead	3,000
Fixed production overhead	15,000
Depreciation of equipment	13,500
Corporate power cost allocation	4,500

An outside supplier has quoted for supply of all desks throughout the year at a price of £32.50 per desk. If Ives Ltd accepts this offer it will incur additional inspection and storage costs of £9,000 per annum. The equipment used to make desks can be used for other purposes.

Required:

Prepare a financial statement to assist Ives Ltd in making the decision whether or not to accept the offer. State any assumptions, which you have made in preparing the financial statement.

☺ **Solution:**

Relevant costs (and revenues) are those that will be affected (changed) by the decision under consideration. When making the decision, managers should only pay attention to those costs which are relevant. They should ignore all other costs. The key features of relevant costs are that they are future incremental cash flows. This has three main implications:

• Relevant costs arise in the future, hence costs that have arisen in the past (even if the cash has not yet changed hands) are not relevant. Costs that have arisen in the past are sometimes called sunk costs.

• Relevant costs are incremental, hence costs that will not change whatever decision is made are not relevant. Costs that will not change are sometimes called committed costs.

• Relevant costs are cash flows, hence costs that are purely accounting (profit) flows are not relevant.

Fixed costs are usually committed, and hence irrelevant. But sometimesfixed costs will change as a result of the decision – in which case the incremental fixed costs become relevant. So

relevant and irrelevant costs are not the same thing as fixed and variable costs – sometimes fixed costs are relevant, and sometimes variable costs are irrelevant.

Let us consider the options available for Ives Ltd. This company can manufacture desks or can buy-in desks from a supplier. If the company manufactures desks, relevant cost will be:

Manufacturing desks:	£
Direct costs – materials	84,000
– labour	18,000
Variable overhead	3,000
Allocated power costs	4,500
Total relevant costs	109,500

We assume here that variable overheads and allocated power cost are incremental;they arise only in the management decided for manufacturing desks.

Depreciation represents an accounting flow, it is an allocation of past, committed cost to future periods. Therefore it is irrelevant. We assume that there are no opportunity costs of using machines for manufacture.

Cost of buy-in desks will be:

Buy-in desks:	£
Cost of purchase 3,600 × £32.50	117,000
Additional costs	9,000
Total relevant costs	126,000

We assume that fixed production overhead is not reduced by ceasing manufacture, they are committed costs and should not be taken in consideration.

We assumed earlier variable overheads and allocated power cost were incremental; they arise only in the management decided for manufacturing desks.

Therefore, the company benefits from manufacturing desks, because the costs of producing desks are £16,500 lower, than the costs of buying-in desks.

Problem 5

Baldwin Limited is involved in supply and maintenance of office equipment. One of its activities is the sale of copiers. It offers a follow-up service to companies that wish to upgrade their copiers to give a wider range and speed of output. The work needed to upgrade copiers is carried out at customers' premises. The upgrade involves the same work for most copiers and therefore a standard price is used, as follows.

Copier upgrade – standard price

	£
Components	75
Labour involved in travel to customers:	
½ hr at £24 per hour	12
Labour: 2 hours at £24 per hour	48
Overhead: 200% of labour cost	120
Total cost	255
Profit mark-up at 20% on cost	51
Standard price	306

A customer has asked Baldwin to quote for a special upgrading for 100 copiers at their offices. Using the standard price gave a total quote of £30,600 which was rejected by the customer. The customer's response was that a price of £15,000 was what they had in mind. Baldwin is in the process of changing to a different copier manufacturer. As this is probably the last major upgrade of the old manufacturer's copiers the sales director of Baldwin is keen to accept the order and recommends that a break-even price be calculated in order to provide information for further negotiation.

The following information has been obtained:

(1) The standard upgrade requires three components (X, Y and Z) with a total cost of £75. Component X has a standard cost of £22 and will not be used when thechange of manufacturer occurs. There is no alternative use for this componentand it has no realisable value. Baldwin has 200 of these in stock. Components Yand Z will be compatible with the new manufacturer's copier. The special natureof the upgrade required by the customer requires a further component, W, whichwill have to be ordered from the current manufacturer at £34 per upgrade.

(2) The estimated total labour time travelling to the customer for the upgrade of allof the copiers is 10 hours.

(3) The repetitive nature of the work means that the labour time for upgrading eachcopier would be only 1½ hours. The operations manager has suggested that 25%of the work could be carried out by trainees who are charged at half the hourlyrate of qualified engineers.

(4) The type of copier in question requires use of a special machine during upgrade.This will not be needed for the copiers from the new manufacturer. An offer tobuy the machine for £800 has been received from another company; howeverthey require immediate delivery or will not buy the machine.

(5) Overheads are all fixed.

Required:

Prepare a brief report for the sales director of Baldwin Ltd which includes

(a) A calculation of the break-even price for its special job and an explanation of thefigures used.

(b) Comment on the factors which the sales director should consider when decidingon the price to quote for the special job.

☺ **Solution:**

(a) This question requires analysis of a complex set of information in order to determine the relevant costs for a decision on acceptance of a special job. This involves recognition of relevant, incremental and opportunity costs and setting aside of any sunk costs or costs not relevant to the decision. You should explain why each individual costs were or were not included in the calculations.

Calculation of break-even price	£ per unit	£
Components	75	
Less: Components X	(22)	
Component W	34	
	87 × 100=	8,700
Travel time 10 hours at £24		240
Labour		
1½ hours × 75% ×£24	27	
1½ hours × 25% ×£12	4.5	
	31.5×100 =	3,150
Overheads		
Opportunity cost of special machine		800
Break-even price		12,890

• Component X is a sunk cost which has already been paid for, is obsolete for future purposes and has no resale value.Therefore it is irrelevant for decision making and should not be included into break-even price calculation.

• Component W is an additional incremental cost of this special order, should be included.

• The standard cost would have charged for 50 hours but only 10 will actually be incurred and only these 10 hours should be included in the calculation. The cost per hour is assumed to be unchanged (£24 per hour).

• Labour costs need to reflect the lower number of hours and the use of trainees.

• The overheads are fixed and so not relevant costs for the purposes of this decision.

• The opportunity cost of using the special machine is the loss of the resale value.

(b) Factors to be considered in setting a price should include:

• The break-even price (minimum price) is below the price suggested by the customer. This price gives a contribution of £2,110 which represents a 16% margin of safety on the estimated costs. This reduces the financial risk of accepting the order.

• The cost estimates on a one-off special order do contain an element of risk.

• With a change in manufacturer would it be a better strategy to cease upgrades of old copiers?

• Will there be enough staff for the job and the introduction of new copiers? Is it sensible to have trainees working on old types of copier?

• If this is a large customer would we lose goodwill if we refused the upgrade? Could this damage future relationships and other sales possibilities?

Absorption and Variable Costing

Problem 6

Remington plc has prepared the following data for a new product to be launched in January:

Standard costs per unit:

Direct materials	£10.40
Direct labour	£18.20
Variable production overhead	£7.80
Standard variable cost	£36.40

Other data:

Fixed production overhead	£975,000 per month
Selling price	£67.60 per unit

Budgeted production data:	January
Opening stock	0
Production	190,000 units
Sales	160,000 units
Closing stock	30,000 units

Required:

Prepare budgeted profit statements for January on the basis of:

(a) Marginal costing.

(b) Total absorption costing.

☺ **Solution:**

Before proceeding, it is necessary to calculate unit cost of production under each method of costing.

Under full (absorption) costing, the cost of each unit produced will include both variable and fixed production cost, so unit production cost will be £41.53 per unit =£10.40 direct materials per unit (variable production cost) +£18.20 direct labour per unit (variable production cost) +£7.80 variable production overheads per unit +£975,000 total production overhead/190,000 units produced.

In contrast, under marginal (variable) costing each unit produced will only include variable manufacturing cost= £10.40+£18.20+£7.80 = £36.40 per unit. Fixed production cost is allocated

separately as a lump sum and is not included in the cost of sales figure. Profit and loss statements will be as follows:

Remington plcbudgeted profit and loss statements for January:	£	£
(a) under marginal costing		
Sales (£67.60 per unit × 160,000 units sold)		10,816,000
Cost of sales:		
Opening stock	0	
Cost of production(£36.40 per unit × 190,000 units produced)	6,916,000	
Closing stock (£36.40 per unit × 30,000 units in stock)	(1,092,000)	5,824,000
Contribution		4,992,000
Fixed overheads		975,000
Profit for month		4,017,000
(b) under total absorption costing		
Sales (£67.60 per unit × 160,000 units sold)		10,816,000
Cost of sales:		
Opening stock	0	
Cost of production (£41.53 per unit× 190,000 units produced)	7,890,700	
Closing stock (£41.53 per unit × 30,000 units in stock)	(1,245,900)	6,644,800
Profit for month		4,171,200

Problem 7

Van plc commenced trading on 1st January 2003. The accountant has produced the following information regarding the corporate cost structure for 2003 and 2004:

	£
Selling price per unit	42
Factory costs of production:	
Direct labour per unit produced	12
Direct materials per unit produced	8
Fixed production overhead per year	17,500
Non-production cost:	
Variable selling cost per unit sold	5
Fixed administration cost per unit	12,000

There were no stocks of finished goods at 1st January 2003. Van plc uses FIFO for stock valuation purposes.

Unit produced and sold during the first two years were as follows:

	2003	2004
Total sales in units	2,800	3,000
Total production in units	3,500	2,500

Required:

(a) Prepare profit and loss accounts for 2003 and 2004 using absorption costing principles.

(b) Prepare profit and loss accounts for 2003 and 2004 using marginal costing principles.

(c) Calculate the combined profit of 2003 and 2004 under (i) marginal costing and (ii) absorption costing.Explain the difference between the two profit figures.

(d) Comment on the relative suitability of marginal and absorption costing principles, giving reasons for their use in particular situations.

☺ **Solution:**

(a) Sales in the year 2003 = £42 selling price ×2,800 units sold = £117,600.

Under absorption costing, manufacturing (or production) cost includes both variable and fixed production cost. You should remember not to include non-manufacturing cost (selling and administrative) in cost of production and inventory valuation for both variable and absorption costing.

Total manufacturing cost in the year 2003 = (£12 directlabour(variablecost) per unit + £8 direct material (variable cost) per unit) × 3,500 units produced + £17,500 fixed production overhead = £87,500.

Manufacturing cost per unit in the year 2003 = £87,500 total manufacturing cost ÷3,500 units produced= £25 per unit.

Closing inventory at the end of the year 2003 = 0 units opening inventory + 3,500 units produced – 2,800 units sold = 700 units.

Value of closing inventory at the end of the year 2003 = £25 manufacturing cost per unit × 700 units in stock = £17,500.

Pay your attention that variable selling costs vary with sales and not production. Variable selling costs in the year 2003 = £5 selling and distribution cost per unit × 2,800 units sold = £14,000.

Sales in the year 2004 = £42 sales price × 3,000 units sold = £126,000.

Total manufacturing cost in the year 2004 = (£12 direct labour cost + £8 direct material cost) × 2,500 units produced + £17,500 fixed manufacturing costs = £67,500.

Manufacturing cost per unit in the year 2004 = £50,000 total manufacturing cost ÷2,500 units produced = £27 per unit.

Closing inventory at the end of the year 2004 = 700 units opening inventory + 2,500 units produced – 3,000 units sold = 200 units.

Value of closing inventory at the end of the year 2004 = £27 manufacturing cost per unit × 200 units in stock = £4,000.

Year 2004 variable selling costs = £5 cost per unit × 3,000 units sold = £15,000.

Van plc profit and loss accounts for 2003 and 2004 under absorption costing:

	2003		2004	
	£'000	£'000	£'000	£'000
Sales		117.6		126
Cost of sales				
Opening inventory	-		17.5	
Manufacturing costs	87.5		67.5	
Closing inventory	(17.5)	70	(5.4)	79.6
Gross profit		47.6		46.4
Selling and distribution				
Variable costs		(14)		(15)
Fixed costs		(12)		(12)
Net (Operating) profit		21.6		19.4

(b) Under marginal costing manufacturing costs will only include variable manufacturing cost: direct labour £12 per unit and direct materials £8 per unit.

Manufacturing costs in the year 2003 = £20manufacturing cost per unit × 3,500 units produced = £70,000

Value of closing inventory at the end of the year 2003 = £20manufacturing cost per unit× 700 units in stock = £14,000

Direct manufacturing costs in the year 2004 = £20 manufacturing cost per unit× 2,500 units produced = £50,000

Value of closing inventory at the end of the year 2004 = £20manufacturing cost per unit× 200 units in stock = £4,000

Van plc profit and loss accounts for 2003 and 2004 under marginal costing:

	2003		2004	
	£'000	£'000	£'000	£'000
Sales		117.6		126
Cost of sales				
Opening inventory	-		14	
Manufacturing costs (variable)	70		50	
Closing inventory	(14)	56	(4)	60

Manufacturing contribution	61.6	66
Variable selling and distribution cost	(14)	(15)
Contribution	47.6	51
Fixed manufacturing costs	(17.5)	(17.5)
Fixed selling and distribution costs	(12)	(12)
Net (Operating) profit	18.1	21.5

(c) Combined profit of 2003 and 2004 under full costing = £21,600 + £19,400 = £41,000

Combined profit of 2003 and 2004 under marginal costing = £18,100 + £21,500 = £39,600

Total profit under marginal costing is lower than profit under full costing because some of the fixed manufacturing costs are not expensed in 2003-2004 and are being carried forward to the year 2005 in the valuation of closing inventory at the end of 2004 under full costing, whereas they have been wholly charged against profits 2003-2004 under marginal costing.

Let us go back to the calculation of unit manufacturing cost for the year 2004. Unit manufacturing cost under absorption costing was £27 per unit and it included £12 direct labour cost per unit, £8 direct material cost per unit and £7 of fixed manufacturing cost per unit = £17,500 fixed manufacturing costs ÷ 2,500 units produced.A closing inventory on 200 units at the end of the year 2004 means that a £1,400 fixed overhead (£7 × 200 units) has to be deducted from total production cost for the period (because they are included in the value of unsold, closing inventory at the end of 2004) and brought forward to the year 2005 (in opening stock 2005) under absorption costing. Meanwhile marginal costing charges all £17,500 fixed production cost in the year 2004. As a general rule, it production (3,500 units + 2,500 units) is in excess of sales (2,800 units + 3,000 units), and stock is rising (from 0 to 200 units), the absorption costing system will show a higher profit that the variable costing system.

Reconciliation of profits under marginal and absorption costing:

	£'000
Combined profit under marginal (variable) costing:	39.6
Add: fixed production costs carried forward to the next year in closing stock value under absorption costing (200 units in shock at the end of 2004 × £17,500 / 2,500fixed manufacturing costs per unit in 2004)	1.4
Combined profit under full (absorption) costing:	51

(d) Comment on the relative suitability of marginal and absorption costing principles, giving reasons for their use in particular situations.

The advantage of variable costing is that it provides more useful information for decision-makingThe separation of fixed and variable costs helps to provide relevant information about costs for making decisions as we can see from others Chaptersof this book (Relevant cost for

decision-making and Cost-Volume-Profit analysis). However, there is no reason, why an absorption costing system cannot be used for financial reporting and costs can be analyzed into their fixed and variable elements for decision making.

Another advantage of variable costing is that it removes from profit the effect of inventory changes while full costing makes it possible to manipulate profits by unnecessarily increasing stock and deliberately deferring some of the fixed overhead to the next periods. If the company's profitability is used as a basis for measuring managerial performance, managers may deliberately alter company's inventory levels to influence profit under absorption costing.It is possible with absorption costing, when all other factors remain unchanged, for sales to decline and profit to increase. In contrast, with a variable costing system, when sales decline, profits also decline and vice versa.

The opponents of variable costing system argue that the production of goods is not possible if some fixed manufacturing costs are not incurred. Consequently, fixed manufacturing overheads should be allocated to units produced and included in the product full cost so that the product selling price could cover full cost of production.

Another advantage of absorption cost system is that it provides more logical profit calculation for a business that relies on seasonal sales and in which production is build up outside the sales season. Under variable costing sales value will be low during out-of-season months but fixed costs will be recorded as an expense. The result is that losses will be reported during the periods when goods are produced and large profits will be reported in the periods when the goods are sold. By contrast, full absorption costing system provides better matching of costs to revenues. Fixed overheads will be deferred and included in the closing inventory valuation and will be recorded as an expense only in the period in which the goods are sold.

Problem 8

The following data have been extracted from the budgets and standard costs of Eden Limited, a company which manufactures and sells a single product.

(1) The selling price and production costs per unit are as follows:

	£
Selling price	45.00
Direct material cost	10.00
Direct labour cost	4.00
Variable overhead cost	2.50

(2) Fixed production overhead costs are budgeted at £400,000 per annum. Normal production levels are estimated at 320,000 units per annum.

(3) Budgeted selling and distribution costs are as follows:

Variable £1.50 per unit sold.

Fixed £80,000 per annum.

(5) Budgeted administration costs are £120,000 per annum.

(6) The following pattern of sales and production is expected for the first two quarters of next year.

	1st quarter	2nd quarter
Sales (units)	60,000	90,000
Production (units)	70,000	100,000

There will be no opening stock at the beginning of the first quarter.

Required:

(a) Prepare forecast profit statements for each of the two quarters, in columnar form using:

i. marginal costing, and

ii. absorption costing.

(b) Reconcile the profits reported for the 1st and 2nd quarters in your answer to (a) above.

☺ **Solution:**

At the beginning of the first quarter there will be no opening stock. In the first quarter 70,000 units will be produced but only 60,000 units will be sold. Therefore 10,000 units will remain in stock at the end of the first quarter. The 10,000 units of closing inventory of the first quarter becomes the opening stock for the second quarter. The closing stock at the end of the second quarter will be 10,000 units (opening stock) +100,000 units (produced) -90,000 units(sold) = 20,000 units.

Sales revenue in the first quarter = £45.00 per unit × 60,000 units sold = £2,700,000

Sales revenue in the second quarter = £45.00 per unit × 90,000 units sold = £4,050,000

Under marginal costing unit production cost include only variable manufacturing (production) cost and will be £16.50 per unit (£10.00+£4.00+£2.50).

Total production cost in the first quarter = £16.50 per unit × 70,000 units produced = £1,155,000

Value of closing inventory at the end to the first quarter = £16.50 per unit × 10,000 units in stock = £165,000 = value of opening inventory at the beginning of the second quarter.

A closing stock value of £165,000 should be deducted from the production cost of £1,155,000, giving the first quarter cost of sales figure of £990,000.

Total production cost in the second quarter = £16.50 per unit × 100,000 units produced = £1,650,000.

Value of closing inventory at the end to the second quarter = £16.50 per unit × 20,000 units in stock = £330,000.

Cost of sales in the second quarter = £165,000 (opening stock) + £1,650,000 (cost of goods produced) - £330,000 (closing stock) = £1,485,000.

Variable selling and distribution costs in the first quarter = £1.50 per unit sold× 60,000 units sold = £90,000.

Variable selling and distribution costs in the second quarter = £1.50 per unit sold× 90,000 units sold = £135,000.

Total variable costs (cost of sales and selling and distribution) in the first quarter = £990,000 + £90,000 = £1,080,000, thus contribution = £2,700,000 (sales) – £1,080,000 (total variable costs) = £1,620,000.

Contribution in the second quarter = £4,050,000 (sales) – £1,620,000 (total variable costs) = £2,430,000.

Fixed cost should be deducted from contributions to obtain operating profits for the first and the second quarters.

Fixed production cost per quarter = £400,000 per annum ÷ 4 = £100,000 per quarter.

Fixed selling and distribution cost per quarter = £80,000 per annum ÷ 4 = £20,000 per quarter.

Fixed administration cost per quarter = £120,000 per annum ÷ 4 = £30,000 per quarter.

The question (a) explicitly asks for a columnarpresentation for the two statements using marginal and absorption methods, thus you should present your answer to (a) i as follows:

(a) i.Eden Limited profit and loss statement under marginal costing:

	1st quarter	2nd quarter
	£000	£000
Sales revenue	2,700	4,050
Opening stock	–	165
Production costs: variable (16.50 per unit)	1,155	1,650
Closing stock	(165)	(330)
	990	1,485
Selling and distribution costs		
variable	90	135
Total marginal cost	1,080	1,620
Contribution	1,620	2,430
Fixed costs		
Production	(100)	(100)
Selling and distribution	(20)	(20)
Administration	(30)	(30)

Profit	1,470	2,280

Let us now consider profit calculations when cost of production is valued on full absorption costing basis. Sales revenues do not change; production cost changes to include both variable and fixed production cost in unit cost of production.

The information (2) on annual estimated production overheads (£400,000 per annum) and activity (320,000 units per annum) sets up a typical, normal, standard overhead rate of £1.25 per unit (£400,000÷320,000 units). Most companies prefer to estimate an average, annualized overhead rate based on the relationship of total annual overhead to total annual activity, because it is more representative of typical relationships between total costs and volume than a quarterly rate which is affected by quarter-to-quarter fluctuations in production volume.

Total productioncost per unit = £10.00+£4.00+£2.50+£1.25 = £17.75

Total production cost in the first quarter = £17.75 per unit × 70,000 units produced = £1,242,500

Value of closing inventory at the end to the first quarter = £17.75 per unit × 10,000 units in stock = £177,500 = value of opening inventory at the beginning of the second quarter.

Cost of sales in the first quarter = £0 (opening stock) + £1,242,500 (cost of goods produced) - £177,500 (closing stock) = £1,065,000.

Total production cost in the second quarter = £17.75 per unit × 100,000 units produced = £1,775,000.

Value of closing inventory at the end to the second quarter = £17.75 per unit × 20,000 units in stock = £355,000.

Cost of sales in the second quarter = £177,500 (opening stock) + £1,775,000 (cost of goods produced) - £355,000 (closing stock) = £1,597,500.

Complications in this problem arise from expected levels of production which both in the first and the second quarters are not identical to normal production level of 80,000 units per quarter (320,000 units per annum÷4). If quarterly activity is different from the normal activity used to estimate the standard overhead rate there will be under- or over-recovery (under- or over-absorption) of overheads.

Consider the situation in the 1st quarter. Expected level of production in this quarter is 70,000 units, which is lower than normal (80,000 units). With a standard overhead rate of £1.25 only £87,500 of overheads will be charged to production (they are included into £1,242,500 cost of production), giving under-absorption of fixed overheads of £12,500 (£100,000 – £87,500). In the 2nd quarter the level of production (100,000 units) is higher than normal (80,000 units). There will be over-absorption of fixed overheads of £25,000 (£100,000 - 100,000 units × £1.25 per unit). Accounting regulations recommend that the under-recovery should be regarded as an

expense in the current accounting period whereas an over-recovery is recorded as a reduction in the expenses for the period.

ii. Eden Limited profit and loss statement under absorption costing:

	1st quarter	2nd quarter
	£000	£000
Sales revenues	2,700	4,050
Opening stock	–	177.5
Production costs: fixed and variable (17.75 per unit)	1,242.5	1,775.0
Closing stock	(177.5)	(355)
	1,065.0	1,597.5
Under-absorption of overhead	12.5	
Over-absorption of overhead		(25.0)
	1,077.5	1,572.5
Total selling and distribution costs (fixed and variable)	110.0	155.0
Fixed administration costs	30.0	30.0
Total costs	1,217.5	1,757.5
Profit	1,482.5	2,292.5

(b) Reconciliation of profits under marginal and absorption costing for the 1st and 2nd quarter:

	1st quarter	2nd quarter
	£000	£000
Profit under marginal (variable) costing:	1,470	2,280
Add: fixed production costs carried forward to the next quarter (in closing stock) under absorption costing	12.5	25
Less: fixed production costs brought forward from the previous quarter (in opening stock) under absorption costing		12.5
Profit under absorption costing:	1,482.5	2,292.5

Fixed production costs carried forward from the first quarter to the second quarter (in closing stock) under absorption costing = £1.25 overhead cost per unit × 10,000 units in stock = £12,500. Under absorption costing these costs have been carried forward as part of closing stock and not expensed in the first quarter. Under marginal costing all of the fixed production costs are seen as a periodic cost and as an expense of the first quarter.

Fixed production costs carried forward from the second quarter to the next (third) quarter (in closing stock) under absorption costing = £1.25 overhead cost per unit × 20,000 units in stock = £25,000.

Fixed production costs brought forward from the firts quarter to the second quarter (in opening stock) under absorption costing= £1.25 overhead cost per unit × 10,000 units in stock = £12,500.

Problem9

Boys Toys has just introduced two new products. The company's computerized cost accounting system has produced the following summarized financial statement showing the budgeted profit/(loss) earned on these products for the first year using absorption costing.

	Ernie	Bert
	£	£
Materials	60,000	10,000
Direct labour	80,000	25,000
Manufacturing overheads	300,000	150,000
Cost of sales	440,000	185,000
Sales	675,000	305,000
Gross profit	235,000	120,000
Selling and distribution overheads	230,000	125,000
Net profit/(loss)	5,000	(5,000)
	Units	Units
Budgeted sales	20,000	5,000
Budgeted closing stock of finished goods	10,000	1,000

During the first year, the actual level of sales and the closing stock of finished goods for each product were both exactly as budgeted. In other words, budgeted sales and actual sales were identical, and budgeted closing stock and actual closing stock were identical.

Further analysis shows that 60% of the manufacturing overhead charged to each product varies according to the level of production. The remaining 40% of the manufacturing overheads represents a product-related fixed cost that is absorbed into product cost using a constant per unit rate. 80% of the selling and distribution costs charged to each product represent an allocation of existing corporate overheads. The remaining 20% of the selling and distribution overhead varies with the level of sales of each product.

After studying the summary financial data the company's accountant is disappointed by the financial results of each of the new products, and believes that production of the Bert product should cease immediately due to its losses. As a computer virus has just rendered the company's cost accounting system unusable, the accountant has asked you to redraft the summary financial

statement in order to provide additional information about the financial performance of the two products.

Required:

(a) For each product, prepare a redrafted absorption costing statement that shows individual cost figures for:

i. the total cost of production,

ii. closing stock,

iii. fixed and variable manufacturing overheads, and

iv. fixed and variable selling and distribution overheads.

Hint: first calculate the total units produced during the period.

(b) For each product, prepare a financial statement using marginal (variable) costing principles that shows individual figures for:

i. manufacturing contribution

ii. contribution (after deducting variable selling and distribution overheads), and

iii. net profit.

(c) Explain, with the aid of calculations, why the net profit figures are different under absorption and marginal costing.

☺ **Solution:**

(a) The company expects to sell 20,000 unitsof Ernie product and 5,000 units of Bert product during the year, both products are new, there are no opening stocks;at the end of the year 10,000 unitsof Erniesand 1,000 units of Berts will remain inclosing stock, thus the company expects to produce 30,000 units of Ernie and 6,000 units of Berts in the year concerned.

We are given information on cost of sales. This cost should be split into cost of production and value of closing inventory. Let us first consider Ernie product:

Cost of sales = £440,000, 20,000 units are sold, cost per unit = £440,000÷20,000 units = £22 per unit. 30,000 units of Ernie are produced, total cost of production = £22 per unit×30,000 units =£660,000. This cost of production consists of £90,000 direct material cost (=£60,000÷20,000 units sold×30,000 units produced), £120,000 direct labourcost (=£80,000÷20,000 units sold×30,000 units produced) and 450,000 manufacturing overheads (=£300,000÷20,000 units sold×30,000 units produced). Value of closing inventory will be £220,000 = £22 per unit×10,000 units in stock.

We know that 60% (£270,000=£450,000×0.6) of the manufacturing cost are variable, 40% (£180,000=£450,000×0.4) are fixed. 20% (£46,000=£230,000×0.2) of the selling and distribution overhead varies with the level of sales, 80% (£184,000=£230,000×0.8) is fixed.

For Bert product cost of sales = £185,000, 5,000 units are sold, cost per unit = £185,000÷5,000 units = £37 per unit. 6,000 units of Bert are produced, total cost of production = £37 per unit×6,000 units =£222,000. This cost of production consists of £12,000 direct material cost (=£10,000÷5,000 units sold×6,000 units produced), £30,000 direct labourcost (=£25,000÷5,000 units sold×6,000 units produced) and 180,000 manufacturing overheads (=£150,000÷5,000 units sold×6,000 units produced). Value of closing inventory will be £37,000 = £37 per unit×1,000 units in stock. 60% (£108,000=£180,000×0.6) of the manufacturing cost are variable, 40% (£72,000=£180,000×0.4) are fixed. 20% (£25,000=£125,000×0.2) of the selling and distribution overhead varies with the level of sales, 80% (£100,000=£125,000×0.8) is fixed.

A redrafted absorption costing statement will be as follows:

	Ernie	Bert
	£	£
Sales	675,000	305,000
Cost of sales	440,000	185,000
Opening stock	0	0
Cost of production, including	660,000	222,000
Materials	90,000	12,000
Direct labour	120,000	30,000
Variable manufacturing overheads	270,000	108,000
Fixed manufacturing overheads	180,000	72,000
Closing stock	(220,000)	(37,000)
Gross profit	235,000	120,000
Fixed selling and distribution cost	(184,000)	(100,000)
Variable selling and distribution cost	(46,000)	(25,000)
Net profit/(loss)	5,000	(5,000)

(b) Unit cost of production under marginal costing includes only variable manufacturing cost.

Cost of 1 unit of Ernie = (£90,000 direct materials (variable cost) +£120,000 direct labour(variable cost) +£270,000 variable manufacturing overheads) ÷ 30,000 units produced = £16 per unit. Value of closing inventory = £16 per unit × 10,000 units in stock = £160,000.

Cost of 1 Bert = (£12,000 direct materials +£30,000 direct labour +£108,000 variable manufacturing overheads) ÷6,000 units produced = £25 per unit. Closing stock = 25 per unit × 1,000 units in stock = £25,000.

Profit and loss statement under marginal costing statement:

	Ernie	Bert
	£	£
Sales	675,000	305,000
Cost of sales	320,000	125,000
Opening stock	0	0
Cost of production, including	480,000	150,000
Materials	90,000	12,000
Direct labour	120,000	30,000
Variable manufacturing overheads	270,000	108,000
Closing stock	(160,000)	(25,000)
Manufacturing contribution	355,000	180,000
Variable selling and distribution cost	(46,000)	(25,000)
Contributing	309,000	155,000
Fixed manufacturing overheads	(180,000)	(72,000)
Fixed selling and distribution cost	(184,000)	(100,000)
Net profit/(loss)	(55,000)	(17,000)

(c) Reconciliation of profits under marginal and absorption costing:

	Ernie	Bert
	£	£
Profit under marginal (variable) costing:	(55,000)	(17,000)
Add: fixed production costs carried forward to the next year (in closing stock) under absorption costing	60,000	12,000
Less: fixed production costs brought forward from the previous year (in opening stock) under absorption costing	-	-
Profit under absorption costing:	5,000	(5,000)

For Ernie fixed production costs carried forward to the next year in closing stock value under absorption costing = £180,000 × 10,000 units in stock ÷30,000 units produced = £60,000, for Bert = £72,000 × 1,000 units in stock ÷ 6,000 units produced = £12,000

Problem 10

Rondar Ltd manufacturing and sells gidgets. It uses an actual costing system in which unit costs are calculated on a monthly basis using FIFO. Data relating to March and April are given below.

	March	April
Unit data (in thousands)		
Opening stock	0	3
Production	10	13
Sales	7	15
Variable costs (£ per unit)		
Manufacturing	9	9
Selling and distribution	6	6
Fixed costs (£000s)		
Manufacturing	40	40
Selling and distribution	20	20

The selling price of each gadget is £25.

Required:

(a) Prepare a detailed monthly income statement for March and for April using absorption costing.

(b) Prepare a detailed monthly income statement for March and for April using marginal (variable) costing.

(c) Give calculations to show why the total net profit for the two month period is not the same in your answer to (a) and (b) above. Explain your answer.

☺ **Solution:**

(a) Rondar Ltd income statement for March and for April under absorption costing:

	March		April	
	£'000	£'000	£'000	£'000
Sales		175		375
Cost of sales				
Opening inventory	-		39	
Manufacturing costs	130		157	
Closing inventory	(39)	91	(12.08)	183.92
Gross profit		84		191.08
Selling and distribution				
Variable costs		(42)		(90)
Fixed costs		(20)		(20)
Net (Operating) profit		22		81.08

March sales = 7,000 units sold × £25 selling price = £175,000

Total manufacturing costs in March = £9/unit variable manufacturing costs × 10,000 units produced +£40,000 fixed manufacturing costs = £130,000

Manufacturing cost per unit in March = £130,000÷10,000 units produced= £13 per unit

Closing inventory at the end of March = 0 opening inventory + 10,000 produced – 7,000 sold = 3,000 units

Value of closing inventory at the end of March = £13/unit × 3,000 units = £39,000

March variable selling and distribution costs = 7,000 units sold × £6 cost per unit = £42,000

April sales = 15,000 units sold × £25 sales price = £375,000

Total manufacturing costs in April = £9/unit × 13,000 units produced + £40,000 fixed manufacturing costs = £157,000

Manufacturing cost per unit in April = £157,000÷13,000 units produced = £12.08 per unit

Closing inventory at the end of April = 3,000 opening + 13,000 produced – 15,000 sold = 1,000 units

Value of closing inventory at the end of April = £12.08/unit × 1,000 units = £12,080

April variable selling and distribution costs = 15,000 units sold × £6 cost per unit = £90,000

(b) Rondar Ltd income statement for March and for April under marginal costing:

	March		April	
	£'000	£'000	£'000	£'000
Sales		175		375
Cost of sales				
Opening inventory	-		27	
Manufacturing costs (variable)	90		117	
Closing inventory	(27)	63	(9)	135
Manufacturing contribution		112		240
Variable selling and distribution cost		(42)		(90)
Contribution		70		150
Fixed manufacturing costs		(40)		(40)
Fixed selling and distribution costs		(20)		(20)
Net (Operating) profit		10		90

March direct manufacturing costs = £9/unit ×10,000 units produced = £90,000

Value of closing inventory = £9/unit × 3,000 units = £27,000

April direct manufacturing costs = £9/unit × 13,000 units produced = £117,000

Value of closing inventory = £9/unit × 1,000 units = £9,000

(c) Total profit under full costing = £22,000 + £81,080 = £103,080

Total profit under marginal costing = £10,000 + £90,000 = £100,000

Total profit under full costing differs from total profit under marginal costing because some of the indirect manufacturing costs are being carried forward in the valuation of closing inventory at the end of April under full costing, whereas they have been wholly charged against profits under marginal costing (There is no opening inventory at the start of March).

Reconciliation of profits under marginal and absorption costing:

	£'000
Profit under marginal (variable) costing:	100
Add: fixed production costs carried forward to the next month (in closing stock) under absorption costing (1,000 units × £40,000 fixed production costs ÷13,000 units produced)	3.08
Profit under full (absorption) costing:	103.08

Cost-Volume-Profit Analysis

Problem 11

Explain the term 'Cost-Volume-Profit' analysis and explain the assumptions which are normally used in such analysis.

☺ **Solution:**

Cost-Volume-Profit or CVP analysis is a method of examining the relationship between changes in output (Volume) and changes in sales revenues, expenses (Cost) and net profit (Profit). The main objective of CVP analysis is to establish what will happen to the financial results if a specified level of activity or volume fluctuates. Knowledge of this relationship will enable management to identify the critical output level, such as the level at which neither a profit nor a loss will occur (break-even point).

CVP analysis simplifies the real-world conditions that a firm will face. It is subject to a number of underlying assumption and limitations. The most common assumptions are that costs can be classified as either fixed or variable, variable costs and sales increase in a linear relationship with activity and fixed costs do not vary with activity level in the given time period. Constant selling price per unit is also assumed. The assumption of linear variable costand constant fixed costs and constant selling price can be justified by the fact that CVP analysis applies only to a short short-term time horizon, thus the demand and the production capacity of the company cannot change substantially and economies of scale are not possible over the range of output considered.

Problem 12

Lugger Ltd is a small engineering company in which one department manufactures a specialised component for another company. Currently the annual demand for this component is 10,000 units and the price is £18 per unit. The annual budgeted costs for the component are set out below.

	£
Materials	60,000
Direct labour	30,000
Machine lease costs	25,000
Other fixed costs	45,000
Total costs	160,000

Direct labour represents the full cost of employing the two workers who operate the machine, their wages are not dependent on the level of production. Recently Lugger has discussed the possibility of leasing a different machine. This would enable cheaper raw materials to be used, costing only £3 per unit. The new machine would have an annual lease payment of £55,000.

Required:

(a) Calculate the break-even point and margin of safety for the present machine, using current demand. Give your answers in terms of units produced.Prepare a break-even chart illustrating a margin of safety.

(b) Comment on the proposal to lease the new machine, giving calculations to support your comments.

☺ **Solution:**

(a) The break-even point is the level of output (number of units) at which profit is exactly zero. Profit is always equal to total revenues, minus total costs. So, at the break-even point:

Total Revenues = Total Fixed Costs + Total Variable Costs

We can rewrite the first equation in terms of total contribution, which is Total Revenues minus Total Variable Costs:

Total Contribution = Total Fixed Costs or

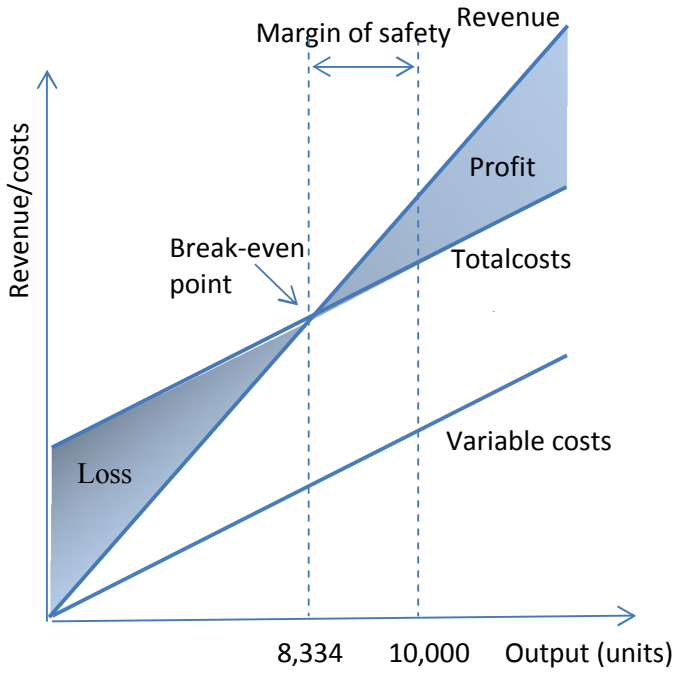
Contribution per unit = Total Fixed Costs ÷ Break-even Level of Output

Let us calculate unit contribution for Lugger Ltd product. Selling price = £18, variable costs per unit £6 = £60,000 direct materials ÷10,000 units, therefore the contribution per unit = £12= £18-£6. Note that direct labour cost is clearly identified as being not dependent on the level of production and thus a fixed cost for this calculation.

Total fixed costs = £30,000+£25,000+£45,000=£100,000.

Break-even level of output = £100,000÷£12per unit=8,334 units produced

The margin of safety is the difference between the actual sales revenue or output level, and the break-even sales revenue or output level, respectively. It shows how much sales revenues or output can fall before the business makes a loss. In our problem actual output is 10,000 units, break-even point is 8,334 units, and margin of safety is 10,000-8,334 = 1,666 units.



(b) Let us recalculate break-even point for the leasing proposal. The contribution per unit will change, because the new machine will enable cheaper row materials to be used. Contribution per unit = £18-£3=£15. Fixed costs will be £30,000+£55,000+£45,000=£130,000. The break-even point is higher (8.667 units = 130,000÷£15 per unit) and margin of safety is lower (1,333 units). At 10,000 units the current and proposed machines give the same total cost and profit figures. Thus, there is no compelling financial support for the leasing of the new machine.

Problem 13

Hardy Ltd manufactures specialist jewellery for fashion shops. For the last year the company has been operating at 60% of its capacity and its results were as follows:

	£
Sales (240,000 units at £12 each)	2,880,000
Variable cost of sales (£7.80 per unit)	1,872,000
Fixed costs	700,000

A major retailer has offered to purchase the excess capacity for the next three years at a price of £9.60 per unit. If the offer is accepted, fixed costs would increase by £150,000 per year.

Required:

Evaluate the offer form the major retailer, giving relevant computations.

☺ **Solution:**

First of all it is necessary to compute the level of unused capacity available. If 240,000 units are only 60% of production capacity, then 400,000 units are 100% capacity. If the company accepts the offer of the major retailer it can produce 160,000 more units (= 400,000-240,000) and sell it to the retailer at a price of £9.60. Variable cost of £7.80 per unit will not change. The sales price £9.60 less variable cost per unit £7.80 gives £1.80 contribution per unit and total contribution of £288,000 = (£1.80×160,000 units) for an offer. The additional fixed cost that will arise with the offer is £150,000. The offer would give an additional profit of £138,000 = £288,000-£150,000 and therefore be acceptable. But before accepting the offer the company should identify and analyse other factors, for example the impact of the new output on existing customers and markets. Additional supply of jewellery over the three years may result in a reduction of selling price per unit, therefore unit contribution may decrease and the profit may fall.

Problem 14

Peel Ltd makes and sells three products. The forecast costs and sales figures are as follows:

Product	A	B	C
Selling price per unit	£20	£30	£40
Maximum annual sales-units	40,000	30,000	50,000
Variable cost per unit	£8	£20	£30
Use of machine time per unit	1 hour	1 ½ hours	2 hours

The factory fixed costs are forecast at £500,000 for the year. The factory manager has estimated that at current levels there are 140,000 machine hours available for the year.

Required:

Give calculations to show the profit from the optimum mix of products for the year.

☺ **Solution:**

In the short term sales demand may be in excess of current productivity capacity. In this problem output is restricted by a shortage of machine capacity: only 140,000 machine hours are available for production, andthis is insufficient to meet the totalmaximum demand for products A, B and C. Maximum demand for product A is 40,000 units, 1 machine hour is required to produce 1 unit of A, so we need 40,000 machine hours to meet the maximum sales demand of product A. 45,000 machine hours are needed to meet themaximum demand of B (30,000 units), and 100,000 machine hours are needed to meet themaximum demand of C (50,000 units). Thus, 185,000 machine hours are needed for a total demand. Machine capacity is a scares resource responsible for limiting the output or a limiting factor in this problem.

Where limiting factors apply, profit is maximized when the greatest possible contributionis obtained each time the scarce of limiting factor is used. The way in which you should determine

the optimum production plan is to calculate the contribution per limiting factor for each component and then to rank the components in order of profitability based on this calculation:

Product	A	B	C
Contribution per unit	£12	£10	£10
Use of machine time per unit	1 hour	1 ½ hours	2 hours
Contribution per machine hour	£12	£6.67	£5
Ranking	1	2	3

The company should allocate the 140,000 scarce machine hours is accordance with the above rakings. The first choice should be to produce as much as possible of product A. The maximum sales are 40,000 units, the production of this quantity will result in the use of 40,000 machine hours, thus leaving 100,000 unused hours. The second choice should be to produce as much of product B as possible. The maximum sales of 30,000 units will result of use of 45,000 machine hours. Production of both A and B require 85,000 hours, leaving a balance of 140,000-85,000 = 55,000 for the production of C, which will enable 27,500 units of C to be produced. We can now summarize the allocation of the scarce machine hours:

Rank	Production	Machine hours used	Balance of machine hours available for further production
1	40,000 units of A	40,000	100,000
2	30,000 units of B	45,000	55,000
3	27,500 units of C	55,000	-

This production mix results in the following profit:

	£
40,000 units of A at £12 per unit contribution	480,000
30,000 units of B at £10 per unit contribution	300,000
27,500 units of B at £10 per unit contribution	275,000
Total contribution	1,055,000
Less: Fixed costs	500,000
Total profit	555,000

Budgeting

Problem 15

Explain the benefits and limitations of budgets in planning, co-ordination and control within an organization.

☺ **Solution:**

A budget is a formal plan, stating what is expected (or planned) to happen in the business over the next budget period. The main purposes and benefits of budgeting are:

• Planning and anticipation. Management are forced to think ahead and plan for future eventualities. Regular budget-setting and review procedures also lead to regular examination of the organisation's goals and decisions

• Communication and coordination. Preparation of budgets encourages communication between different parts of the organisation and different levels of management. A cohesive budget allows activities to be coordinated. For example, the production department needs to know how much the sales department is planning to sell in order to set its target for production

• Motivation. Budgets provide targets for management and employees to work towards.

• Authorisation and responsibility. Managers know that budgeted expenditure has been authorised and can act accordingly. Setting individual budgets for particular business activities or departments can be used to assign responsibility to individual managers for meeting those budgets

• Evaluation and control. Budgets provide plans against which subsequent performance can be judged. Management monitor and evaluate whether budgets are fulfilled. Managerial performance can also be assessed and rewarded on this basis.

However, limitations and problems of budgets include:

• badly set budgets may result in dysfunctional behaviour, especially if managers are rewarded on, or business decisions taken in response to, performance relative to budget

• care must be taken to assign responsibility fairly as budgets are based on future expectations, they are subject to error and revisions are frequently required

• budgeting takes time and can therefore be costly

• budgets do not replace the need for managerial decision-making

• some important factors are not easily quantifiable (e.g. customer relations) and therefore may not be included in the budget.

Problem 16

Miles Ltd is considering the launch of a new venture. Although the board of directors is satisfied as to the profitability of the venture, the Finance Director suggests that it is essential for a cash budget to be prepared.

Budgeted Profit and Loss account to 30th April 2010

	Jan	Feb	March	April
	£000	£000	£000	£000
Credit Sales	120	130	84	132
Materials	40	42	28	46
Labour	34	34	26	36
Production costs	7	8	7	8
Administrative costs	8	8	8	8
Selling and distribution costs	8	9	6	10
Net profit	23	29	9	24

The following additional information is available:

1. There are no stocks of finished goods.

2. Cost of materials has been arrived at as follows:

	Jan	Feb	March	April
	£000	£000	£000	£000
Opening stock	0	22	30	42
Purchases	62	50	40	50
Less closing stock	22	30	42	46
Cost of raw materials	40	42	28	46

3. The period of credit allowed by suppliers of materials is one month.

4. To encourage early payment of invoices, Miles Ltd allows a cash discount of10% if payment is made within the month of sale. It is estimated that 10% of thedebtors of each month will pay in the month of sale and a further 50% of thedebtors will pay in the following month. The remaining 40% are expected to paytheir invoices in full, two months after the month of sale.

5. The overhead costs include the following items which have been allocated overthe year to give an equal monthly charge but which are payable as follows:

Costs	Monthly charge	Amount and date of payment

Production	£1,000	£4,000 in January
Administration	£800	£2,000 in January
Selling and distribution	£500	£1,500 in March

6. Depreciation has been charged and included in production overhead at £1,500 permonth.

7. The capital budget indicates that capital payments will be made as follows:

January £180,000 March £20,000.

8. Unless stated otherwise all items can be treated on a cash basis.

Required:

(a) Prepare a monthly cash budget to determine the finance required.

(b) Explain why the Finance Director's insistence on a cash budget is justified.

☺ **Solution:**

First of all you should remember to set out the format of the budget in columnar form, in this case for four months: from January 2010 to April 2010. The table should show cash receipts and payments in each month, net (receipts less payments) cash flow for each month and opening and closing cash balances for each month.

The next stage is to work through the data and identify cash inflows and outflows; care should be taken to ensure that any accruals-based data is adjusted to cash flows. You can do it by analysing the profit and loss statement line by line and taking into account additional information given in 1.-8.

Let us start with thefirst line of the the profit and loss account -Credit sales. The sales are calculated on accruals basis, we should adjust the figures to arrive to cash receipts from sales. You should take into consideration additional information given in 1.and 4.to be able to calculate the cash receipts from sales:

	Jan	Feb	Mar	Apr	May	June
	£'000	£'000	£'000	£'000	£'000	£'000
Sales:	120	130	84	132		
Cash receipts:						
- 10% of sales are paid in the month of sale (with a 10% cash discount)	10.8	11.7	7.56	11.88		
- 50% in 1 month after the month of sale	-	60	65	42	66	
- 40% in 2 months after the month of sale	-	-	48	52	33.6	52.8

Total cash receipts	10.8	71.7	120.56	105.88

Let us consider January sales of £120,000. As we can see from 4., the company will receive money for the goods sold in January in three instalments. 10% of customers pay their invoices in the month of sales. These customers receive a 10% cash discount for early payment of invoices. Thus the company should expect only £10,800 of cash receipts in January = £120,000×0.1×0.9. 50% of customers pay their invoices in the month following the sale; therefore £60,000 = £120,000×0.5 for the goods sold in January will be received in February. And the balance (40%) of January sales will be paid in March £48,000 = £120,000×0.4. The same logic should be applied to February, March and April sales.

As we can see for the table, Miles Ltd will receive £10,800 as a cash receipt from sale in January, £71,700 in February, £120,560 in March and £105,880 in April. £152,400 of the period sales will remain unpaid at the end of April (the money for these sales are expected to be received in May and June), thus the balance of receivables account at the end of April in the Miles Ltd statement of financial position will be £152,400.

Now let us calculate cash payments for purchases of materials. The line materials in the Profit and Loss statement represents the cost of sales, in 2.we are given information on purchases of materials and inventory changes.

	Jan	Feb	Mar	Apr	May
	£'000	£'000	£'000	£'000	£'000
Purchases:	62	50	40	50	
Payments for purchases:		62	50	40	50

From 3.we know that the company pays its purchases in 1 month. Purchases made in January will be paid in February, etc. At the end of April the balance trade payables account will be £50,000 (April's purchases that will be paid in May).

Labour costs can be treated as cash cost (from 8.) Labour expenses of 34,000 in January in Profit and loss statement correspond to a 34,000 wages payment in January in Cash budget.

Production, administrative and selling and distribution costs include costs that are paid in advance or in arrears. Let us first consider production cost. From 6.we know that production costs include monthly depreciation of £1,500 that is non-cash charge. A monthly charge of £1,000 is paid in January (from 5.) The rest of production costs can be regarded as cash costs (from 8.)

	Jan	Feb	March	April
	£000	£000	£000	£000
Production costs, including	7	8	7	8

Depreciation	1.5	1.5	1.5	1.5
Charge that is paid January	1	1	1	1
Other cash charges	4.5	5.5	4.5	5.5
Production costs payments:				
Payment in January for a monthly charge of £1,000	4			
Cash charges (paid as incurred)	4.5	5.5	4.5	5.5
Total payments:	8.5	5.5	4.5	5.5

Payments for administrative and selling and distribution costs (From 5. and 8.):

	Jan	Feb	March	April
	£000	£000	£000	£000
Administrative costs, including	8	8	8	8
Charge that is paid January	0.8	0.8	0.8	0.8
Other cash charges	7.2	7.2	7.2	7.2
Administrative costs payments:				
Payment in January for a monthly charge of £800	2			
Cash charges (paid as incurred)	7.2	7.2	7.2	7.2
Total payments:	9.2	7.2	7.2	7.2

	Jan	Feb	March	April
	£000	£000	£000	£000
Selling costs, including	8	9	6	10
Charge that is paid March	0.5	0.5	0.5	0.5
Other cash charges	7.5	8.5	5.5	9.5
Administrative costs payments:				
Payment in January for a monthly charge of £800			1.5	
Cash charges (paid as incurred)	7.5	8.5	5.5	9.5
Total payments:	7.5	8.5	7.0	9.5

(a) CashBudget for the four months ended 30April 2010

	Jan	Feb	Mar	Apr

	£	£	£	£
Receipts:				
Sales	10,800	71,700	120,560	105,880
Payments:				
Purchases		62,000	50,000	40,000
Labour / wages payments	34,000	34,000	26,000	36,000
Capital Expenditure	180,000	–	20,000	
Production Expenses	8,500	5,500	4,500	5,500
Administration Expenses	9,200	7,200	7,200	7,200
Selling and Distribution	7,500	8,500	7,000	9,500
	239,200	117,200	114,700	98,200
Net cash flow	(228,400)	(45,500)	5,860	7,680
Balance b/f	0	(228,400)	(273,900)	(268,040)
Balance c/f	(228,400)	(273,900)	(268,040)	(260,360)

(b) The cash budget is a vital management planning tool, for it addresses the critical problem of cash flow management and financing of planned expenditures. As we can see from the (a) though the new venture is profitable from the very beginning (projected net profit for January – April is positive) but it needs large investments, so it will have a deficit of cash and a sources of financing should be found. The maximum deficit of (£273,900) will be reached in February, so the company should be able either to invest £273,900 of its own cash assets into the new project or to attract credit facilities with a limit of at least £273,900. In March monthly cash flow becomes positive, but if we assume future monthly cash flows to be equal to April's the company will be able to repay the credit (or to recover the deficit of cash) in 34-month-time starting from May 2010 (=£260,360 /7,680 = 34 months), in February 2013.

Problem 17

Segno Limited prints and sells music tuition books. The company is currently preparing budgetsfor the period July to September 2010. Sales for July are predicted to be £15,000 and increases of20% per month compounded are expected thereafter. Monthly information on costs is:

	Printing costs	Expenses	Depreciation	Marketing costs
	£	£	£	£
July	5,500	4,000	1,000	1,000
August	6,000	4,500	1,000	1,500

September	7,500	5,000	1,200	2,000

Further information is as follows:

(1) Gross profit is expected to be 60% of sales assuming printing costs are the only cost of sales.

(2) Trading expenses are paid one month in arrears, while marketing costs are paid as incurred.

(3) 50% of printing costs are for materials which are on credit and one month's credit is taken.The balance of printing costs is for wages which are paid as incurred.

(4) 80% of sales are cash transactions and the remainder is sold on one month's credit.

(5) Royalty payments of 10% of sales are incurred and these are paid at the commencement ofthe following quarter.

(6) In August an asset with a written down value of £3,200 will be sold for £2,650 in cash. Areplacement will be required immediately for £7,000 cash. The depreciation for this purposeis already included in the above figures.

(7) The following is a statement of working capital at the end of June 2010.

	£
Working capital	
Stock	4,000
Debtors	3,000
Bank	900
Creditors: Materials	(2,500)
Expenses	(3,000)
Royalties	(4,820)
	(2,420)

Required:

(a) Prepare a budget for Segno Ltd., which shows sales, cost of sales, gross profit, net profit andclosing stock for each month of the quarter ended 30thSeptember 2010.

(b) Calculate the working capital for Segno Ltd as at 30thSeptember 2010.

(c) Explain the terms "bottom-up" budgets and "top-down" budgets and give one potentialadvantage of each approach.

☺ **Solution:**

In this problem in (a) you should prepare a budget that show sales, cost of sales, gross and net profit, and stocks for each month of the quarter ended 30th September 2010. It means that a budgeted profit and loss statement and not a cash budget is required. But you should also calculate working capital as at the end of September 2010in (b). It means that you should analyze cash receipts and payments during the period July-September to be able to calculate the balances of Debtors, Bank and Creditors accounts as at the end of September. So, even if you are not

explicitly asked to prepare a cash budget in this problem you should do it to simplify your calculations of working capital.

Let us start with sales and receipts from sales. Sales for July are predicted to be £15,000 and increases of 20% per month compounded are expected thereafter. It means that sales in August are expected to be £18,000 = £15,000×1.2 and sales in September £21,600 = £15,000×1.2×1.2.From (4) we learn that 80% of sales are cash transactions (are paid in the month of sales) and 20% are paid in the month following the month of sale. Let us consider July sales of £15,000. The company should expect to receive the money for the books sold in July in two installments. A payment of £12,000 = £15,000×0.8 will be received in July (representing 80% of July sales).The remainderbalance £3,000 = £15,000×0.2 will be received in August(20% of July sales). The sales of August will be also received in two installments: £14,400 = £18,000×0.8 will be received in August (80% of August sales) and £3,600 = £18,000×0.2 will arrive in September (20% of August sales). Finally, in September the company will collect 80% of money due for books sold in September = £17,280 = £21,600×0.8. The remainder balance of £4,320 of September sales will remain unpaid at the end of September and is expected to be received in October. It means that Debtors account balance at the end of September will be £4,320. You will need this information to calculate working capital in (b).

Let us summarize the calculation in the table:

	Jul	Aug	Sep	Oct
	£	£	£	£
Sales:	15,000	18,000	21,600	
Cash receipts:				
- 80% of sales are paid in the month of sale	12,000	14,400	17,280	
- 20% in 1 month after the month of sale	3,000	3,000	3,600	4,320
Total cash receipts	15,000	17,400	20,880	

You should note that in July the company will receive the 80% of July sales (£12,000) and 20% of June sales (£3,000). This figure is the balance of Debtors account at the end of June given in (7).

Now let us consider cost of sales and changes in stock. From (1) we know that gross profit margin is 60% and the cost of sales represent 40% of sales (gross profit margin = (sales – cost of sales) ÷ sales). We can calculate cost of sales and gross profit:

	Jul	Aug	Sep
	£	£	£
Sales	15,000	18,000	21,600
Cost of sales (40%)	6,000	7,200	8,640

Gross profit (60%)	9,000	10,800	12,960

Printing costs are the only cost of manufacturing music tuition books and the only costs included in the cost of sales. As we know cost of production and cost of sales we can calculate the value of closing stock at the end of each month starting from the stock balance of £4,000 at the end of June given in (7). Opening stock at the beginning of July = closing stock at the end of June = £4,000. Printing cost in July = £5,500 (given). It means that the value of closing stock at the end of July should be £3,500 to arrive to July cost of sales of £6,000 that we calculated earlier:

	Jul	Aug	Sep
	£	£	£
Opening stock	4,000	3,500	2,300
Cost of goods manufactured (Printing costs)	5,500	6,000	7,500
Closing stock	(3,500)	(2,300)	(1,160)
Cost of sales	6,000	7,200	8,460

Please note that closing stock value £1,160at the end of September will be needed for calculation of working capital in (b).

	Jul	Aug	Sep	Oct
	£	£	£	£
Printing costs, including	5,500	6,000	7,500	
50% Materials	2,750	3,000	3,750	
50% Wages	2,750	3,000	3,750	
Production costs payments:				
Materials	2,500	2,750	3,000	3,750
Wages	2,750	3,000	3,750	
Total payments:	5,250	5,750	6,750	

50% of printing costs are for materials and 50% are for wages. Materials are paid one month in arrearsand wages are paid as incurred. Please note that materials purchased in September for £3,750 will remain unpaid at the end of September and will be included in Creditors balance as at September 30, 2010. And in July material purchased in June for £2,500 are paid.

Royalty payments of 10% of sales are incurred and these are paid at the commencement of the following quarter.

	Jul	Aug	Sep	Oct
	£	£	£	£
Sales	15,000	18,000	21,600	

Royalties (10%) of sales	1,500	1,800	2,160	
Royalties payments:	4,820			5,460

Royalties for July, August and September will be £5,460 and this amount will be paid in October (at the commencement of the following quarter). Thus, this amount will be included into Creditors balance at the end of September. Royalties for the previous quarter are paid in July £4,820. This amount is included into Creditors account balance as at June 30, 2010 given in (7).

Trading expenses are paid one month in arrears, while marketing costs are paid as incurred.

	Jul	Aug	Sep	Oct
	£	£	£	£
Trading expenses	4,000	4,500	5,000	
Marketing expenses	1,000	1,500	2,000	
Trading expenses payments	3,000	4,000	4,500	5,000
Marketing expenses payments	1,000	1,500	2,000	

September trading expenses of £5,000 will remain unpaid at the end of September and will be included into Creditors balance as at the end of September. June trading expenses of £3,000 will be paid in July.

Depreciation is a non-cash charge; it will appear in budgeted profit and loss statement. There will be no corresponding payment in cash budget.

A loss on disposal of £550 = £3,200-£2,650 will be recognized in a budgeted profit and loss statement in August. A receipt of £2,650 for a sold car and a payment of £7,000 for a new one will appear in a cash budget in August. Let us summarize all receipts and payments in a cash budget:

Segno Ltd cash budgetfor the quarter ended 30th September 2010 (monthly):

	July	August	September
	£	£	£
Receipts			
Sales	15,000	17,400	20,880
Disposal of fixed assets	_____	2,650	_____
	15,000	20,050	20,880
Payments			
Materials	2,500	2,750	3,000
Wages	2,750	3,000	3,750
Royalties	4,820		
Expenses	3,000	4,000	4,500

Marketing	1,000	1,500	2,000
Acquisition of fixed assets	_____	7,000	_____
	14,070	18,250	13,250
Net cash flow	930	1,800	7,630
Balance b/f	900	1,830	3,630
Balance c/f	1,830	3,630	11,260

As we can see from the cash budget bank balance as at September 30, 2010 is expected to be £11,260.

(a) Segno Ltdprofit and loss statementfor the quarter ended 30th September 2010 (monthly):

	July	August	September
	£	£	£
Sales	15,000	18,000	21,600
Cost of sales (40%)	(6,000)	(7,200)	(8,640)
Opening stock	4,000	3,500	2,300
Cost of production	5,500	6,000	7,500
Closing stock	(3,500)	(2,300)	(1,160)
Gross profit (60%)	9,000	10,800	12,960
Royalties	(1,500)	(1,800)	(2,160)
Expenses	(4,000)	(4,500)	(5,000)
Marketing	(1,000)	(1,500)	(2,000)
Depreciation	(1,000)	(1,000)	(1,200)
Loss on disposal	____	(550)	____
Net profit	1,500	1,450	2,600

(b) Working capital at 30 September 2010:

		£
Stock		1,160
Debtors		4,320
Bank		11,260
Creditors:	Materials	(3,750)
	Expenses	(5,000)
	Royalties	(5,460)
		2,530

(c) Bottom-up involves starting with lower-level employees and management, collecting information that can be used to set detailed budgets, and standard quantities and costs, by consultation. These detailed, low-level budgets can then be collated into overall budgets for the

organization. In contrast, top-down budgets are determined by high-level management, and the detailed low-level budgets are calculated based on the overall budgets that they produce.

Bottom-up budgets can be more motivating as lower-level managers and employees are involved in the budget-setting process. This can mean they feel more 'ownership' of the resulting targets and are, therefore, more likely to want to try to achieve them. They are also more likely to feel that the targets are fair, realistic and attainable. Indeed, the targets may actually be more realistic, as lower-level workers may have more detailed and accurate knowledge of their area of the business.

Top-down budgets should be consistent with the goals and objectives of the business as a whole, and more likely to result in well-coordinated plans.

Variance Analysis

Problem 18

Blandings Ltd manufactures high quality giftware. One of its current items is a hand finished commemorative mug. This is manufactured by machinery using very little labour, but finishing and painting are done by hand. A standard cost schedule for one mug is shown below. Blandings budgets to sell 10,000 mugs per month.

Standard cost for one mug

	£
Material: 0.1 kg at £44 per kg.	4.40
Labour: 0.4 hours at £12 per hour	4.80
Variable overheads: 0.4 hours at £6 per hour	2.40
Fixed overheads: 0.4 hours at £21 per hour	8.40
	20.00
Profit mark-up at 50% of cost	10.00
Selling price	30.00

Actual results for April 2006

	£	£
Sales: 12,000 mugs		336,000
Material: 1,400 kg	56,000	
Labour: 5,750 hours	71,875	
Variable overheads	32,640	
Fixed overheads	75,000	235,515
Profit for April		100,485

Required:

(a) Prepare an operating statement, reconciling budgeted profit with actual profit, for BlandingsLtd's commemorative mugs for April 2006, showing two variances for sales and for each cost category.

(b) Discuss how useful the standard unit cost of an item would be in setting the price for a one-off additional order.

☺ **Solution:**

Let us start with an analysis of actual results for April 2006:

The actual selling price per unit was £28 per mug = £336,000/12,000 mugs.

The actual usage of material was 0.1167 kg per 1 mug = 1,400 kg /12,000 mugs at the actual price of £40 per kg =£56,000/1,400 kg.

The actual usage of labour was 0.4792 hours per 1 mug = 5,750 hours /12,000 mugs at the actual price of £12.5 per hour =£71,875/5,750 hours. Now we can proceed with the solution of the problem.

In this problem we should reconcile actual profit £100,485 with a budgeted profit of £100,000 (£10 budgeted mark-up per unit ×10,000 units of budgeted output). The answer should be presented in a form of an operating statement, showing two variances for sales and for each cost category.

Operating statement for Blandings Ltd would appear as follows:

	Favourable	Adverse	
	£	£	£
Budgeted profit			100,000
Sales price variance		24,000	
Sales margin volume variance	20,000		
	20,000	24,000	(4,000)
Standard profit			96,000
Cost Variances			
Materials			
price	5,600		
efficiency		8,800	
Labour			
price		2,875	
efficiency		11,400	
Var OH			
spending	1,860		
efficiency		5,700	
Fix. OH			
spending	9,000		
volume	16,800		
	33,260	28,775	4,485
Actual profit			100,485

Sales price variance = Actual quantity sold × Actual price per unit – Actual quantity sold × Standard price per unit = AQ × AP – AQ × SP = 12,000×28 - 12,000×30 = -24,000. This

variance isolates the effect of the change in the selling price. The difference calculated is negative, the actual price is lower than the standard budgeted price and the variance is adverse or unfavorable (A).

Two variances can be calculated to isolate the effect of change in output:

Sales contribution volume variance = Actual quantity sold × Standard contribution per unit – Standard quantity sold × Standard contribution per unit = AQ × SC – SQ × SC

Sales margin volume variance = Actual quantity sold × Standard profit margin per unit – Standard quantity sold × Standard profit margin per unit = AQ × SM – SQ × SM

Remember, that you should only calculate one of these sales volume variances. If you are asked to calculate two variances for each category, then you should calculate the sales margin volume variance, as this will mean that you also need to calculate the fixed overhead volume variance.

Sales margin volume variance = Actual quantity sold × Standard profit margin per unit – Standard quantity sold × Standard profit margin per unit = AQ × SM – SQ × SM = 12,000 × 10.00 – 10,000 × 10.00 = 20,000. The difference calculated is positive, actual quantity is higher than expected quantity, so the business has been able to sell more units, and the variance is favorable (F).

As well as sales we can now calculate two variances for each category of costs.

Materials price variance = Actual quantity of resource used × Actual price per one unit of resource – Actual quantity of resource used × Standard price per one unit of resource = AQ × AP – AQ x SP = 1,400×40-1,400×44 = -5,600. The difference calculated is negative, so the variance must be favorable (F), because the actual price paid for one unit of resource is lower than budgeted.

Materials efficiency variance = Actual quantity of resource used × Standard price per one unit of resource – Standard quantityof resource that would have been used for actual output × Standard price per one unit of resource = AQ × SP – SQ × SP = 1,400 × 44 – 0.1 × 12,000 × 44 = 8,800. This variance is positive, thus it should be adverse (A), because the actual quantity of resources used is higher than the standard quantity would have been.

Here we should calculate the quantity of materials that would have been used for actual output of mugs if the usage of materials had been on budgeted level of 0.1 kg per mug. To produce 12,000 mugs the company would have needed 1,200 kg of material = 0.1 × 12,000.

Labour price variance = Actual quantityof resource used x Actual price per one unit of resource – Actual quantity of resource used × Standard priceper one unit of resource = AQ × AP – AQ x SP = 5,750 × 12.5 – 5,750 × 12 = 2,875 (A)

Labour efficiency variance = Actual quantity of resource used × Standard price per one unit of resource – Standard quantityof resource that would have been used for actual output × Standard

price per one unit of resource = AQ × SP – SQ × SP= 5,750 × 12 –0.4 ×12,000 × 12=11,400 (A)The quantity of labour that would have been used for actual output of mugs if the usage of labour had been on budgeted level of 0.4 hours per mug would be 4,800 hours = 0.4 × 12,000.

Variable overheads are allocated in proportion to labour hours.

Variable overheads spending variance = Actual variable overheads – Actual quantity of labour used× Standard variable overhead rate = AQ × AP – AQ × SP = 32,640 – 5,750×6 = -1,860. The difference calculated is negative, so the actual variable overhead rate is lower than the standard and the variance is favorable (F)

Variable overheads efficiency variance = Actual quantity of labour used × Standard variable overhead rate – Standard quantity of labour that would have been used for actual output × Standard variable overhead rate = AQ × SP – SQ × SP = 5,750×6-4,800×6 = 5,700. The difference calculated is negative, the variance is adverse (A).

Fixed overhead spending variance = Actual fixed overhead expense – Original budgeted fixed overhead expense = AC – SC = 75,000 – 8,400× 10,000=-9,000 (F)

Fixed overhead volume variance = Budgeted fixed overhead expense – Applied fixed overhead expense = SC – Actual output × SP/unit =84,000 – 12,000*8.4 =-16,800 (F)

b. The price of a one-off order that is additional to normal production but within the capacity of the firm should be set in relation to the relevant costs for that order (i.e. those that will change as a result of accepting the order). The standard cost analysis produces a variable cost of £11.60 per unit (materials £4.40 + direct labour£4.80 + variable overheads £2.40) and that is a good basis, or starting point, for setting the minimum price for such an order. Any price over £11.60 would add to the company's profit on the assumption that it has spare capacity.

Clearly the company should try and get as high a price as it can which may require negotiation. To insist on a minimum price of £20 per mug (the standard total cost per unit) might lose the order. However, it should be recognized that to sell similar products at different prices, and thus selling a one-off order below the standard selling price (£30), may lead to strong pressure to reduce prices for other orders.

The company should also make sure that the standard costs are up-to-date and correctly reflect the incremental cost of producing and selling an additional unit.

Problem 19

Thompson plc operates a standard costing system. The standard cost specification for the company's principal product line shows the following information for labour cost per unit:

2 hours at £5.50 per hour

Budgeted production for April 2009 was 900 units.

The relevant data for actual production of the product for April 2009 was as follows:

Actual production 780 units

Labour costs 1710 hours at £5.80 per hour.

The factory manager has informed you that due to a power failure workers were unable to work for a total of 100 man-hours but were paid for these hours and are included inthe 1710 hours.

Required:

Calculate labour variances for April 2009 for the management of Thompson plc.

☺ **Solution:**

Labour price variance = Actual quantity of resource used x Actual price per one unit of resource – Actual quantity of resource used × Standard price per one unit of resource = AQ × AP – AQ x SP = 1,710 × 5.80 – 1,710 × 5.50 = 513 (Adverse).

The only complication in the question is the time lost due to a power failure and good answers would calculate a separate variance for this idle time.

Labour efficiency variance (based on hours worked and paid) = Actual quantity of resource used (excluding idle time) × Standard price per one unit of resource – Standard quantity of resource that would have been used for actual output × Standard price per one unit of resource = AQ × SP – SQ × SP= 1,610 × 5.50 – 2 ×780 × 5.50 =275 (Adverse).

Power cut idle time variance = Time lost due to power cut × Standard price per one unit of resource = 100 × 5.50 = 550 (Adverse).

Problem 20

Mercia Manufacturers Co. has the following details for the variable overheads on its product MM7 for the year to 31st March 2010. Each MM7 was expected to take three labour hours and variable overheads were expected to be £4.25 per labour hour. The company expected to make and sell 200,000 units of MM7. Budgeted fixed overheads were £25,000. In fact, inthe year ended 31stMarch 2010 the company made 180,000 MM7s using 630,000 labourhours. The actual cost of variable overheads was £2,800,000 and fixed overheads £23,000.

Required:

Calculate the following variances for Mercia Manufacturers Co. for the year ended 31st March 2010:

i. variable overhead price variance,

ii. variable overhead efficiency variance,

iii. fixed overhead spending variance,

iv. fixed overhead volume variance.

☺ **Solution:**

i. Variable overheads spending variance = Actual variable overheads – Actual quantity of labour used × Standard variable overhead rate = AQ × AP – AQ × SP = 2,800,000 – 630,000×4.25 = 122,500. The difference calculated is positive, so the actual variable overhead rate is higher than the standard and the variance is adverse (A).

ii. Variable overheads efficiency variance = Actual quantity of labour used × Standard variable overhead rate – Standard quantity of labour that would have been used for actual output × Standard variable overhead rate = AQ × SP – SQ × SP = 630,000 × 4.25 – 180,000 × 3 × 4.25 = 382,500. The difference calculated is negative, the variance is adverse (A).

iii. Fixed overhead spending variance = Actual fixed overhead expense – Original budgeted fixed overhead expense = AC – SC = 23,000 – 25,000 = - 2,000 (F)

iv. Fixed overhead volume variance = Budgeted fixed overhead expense – Applied fixed overhead expense = SC – Actual output × SP/unit = 25,000 – 180,000 × 25,000/200,000 = 2,500 (A)

Problem 21

The Strudel Company makes a single product and has forecast that for the financial year ended 30th April 2011 it will sell 400,000 units at a price of £40 each.

Below is an extract from the annual budget:

Material	**Total usage**	**Total**
	000s kilos	**£000s**
A	2,000	8,000
B	1,200	2,400
	000s hours	
Labour - Assembly	400	1,200
Variable overhead		
Apportioned on assembly labour hours	-	400

For the month of May 2010 the following results were recorded:

- Planned production and sales for the month were 40,000 units. In fact, only 36,000 units were produced and all were sold for a total of £1,512,000.
- Total spending on material used was £886,000 of which material A accounted for £690,000. 180,000 kilos of material A were used, material B cost £1.75 per kilo.
- 46,000 hours were worked for total wages of £128,000.
- Variable overhead spend was £38,000.
- There are no fixed overheads.

Required:

(a) Determine the standard cost and standard profit per unit for the year ended 30th April 2011.

(b) Prepare an operating statement reconciling budgeted and actual profit for the month of May2010 showing a detailed variance analysis.

(c) Briefly comment on the sales materials and labour variances and on any possibleinterrelationships between them.

☺ **Solution:**

Standard cost per unit

	£
Material A: 5 kg (=2,000,000/400,000) at £4 per kg. (=8,000,000/2,000,000)	20.00
Material A: 3 kg (=1,200,000/400,000) at £2 per kg. (=2,400,000/1,200,000)	6.00
Labour: 1 hour (=400,000/400,000) at £3 per hour (=1,200,000/400,000)	3.00
Variable overheads: 1 hour at £1 per hour (=400,000/400,000)	1.00
Total cost	30.00
Profit mark-up	10.00
Selling price	40.00

Sales price variance = Actual quantity sold × Actual price per unit – Actual quantity sold × Standard price per unit = AQ × AP – AQ × SP = 36,000×42–36,000×40 = 72,000. This variance isolates the effect of the change in the selling price. The difference calculated is positive, the actual price is higher than the standard budgeted price and the variance is favorable (F).

Sales margin volume variance = Actual quantity sold × Standard profit margin per unit – Standard quantity sold × Standard profit margin per unit = AQ × SM – SQ × SM = 36,000 × 10.00 – 40,000 × 10.00 =- 40,000. The difference calculated is negative, actual quantity is lower than expected quantity; the variance is adverse (A).

As well as sales we can now calculate two variances for each category of costs.

Material A price variance = Actual quantity of resource used × Actual price per one unit of resource – Actual quantity of resource used × Standard price per one unit of resource = AQ × AP – AQ × SP = 690,000–180,000×4 = -30,000. The difference calculated is negative, so the variance must be favorable (F), because the actual price paid for one unit of resource is lower than budgeted.

Material A efficiency variance = Actual quantity of resource used × Standard price per one unit of resource – Standard quantityof resource that would have been used for actual output × Standard price per one unit of resource = AQ × SP – SQ × SP = 180,000 × 4 – 5 × 36,000 × 4 = 0. The actual quantity of resources used is exactly the same than the standard quantity.

Material B price variance = Actual quantity of resource used × Actual price per one unit of resource – Actual quantity of resource used × Standard price per one unit of resource = AQ × AP – AQ × SP = 196,000–112,000×2 = -28,000. The difference calculated is negative, so the variance must be favorable (F), because the actual price paid for one unit of resource is lower than budgeted.

Material B efficiency variance = Actual quantity of resource used × Standard price per one unit of resource – Standard quantityof resource that would have been used for actual output × Standard price per one unit of resource = AQ × SP – SQ × SP = 112,000 × 2 – 3 × 36,000 × 2 = 8,000. This variance is positive, thus it should be adverse (A), because the actual quantity of resources used is higher than the standard quantity would have been.

Labour price variance = Actual quantityof resource used x Actual price per one unit of resource – Actual quantity of resource used × Standard priceper one unit of resource = AQ × AP – AQ × SP = 128,000 – 46,000 × 3 = -10,000 (F)

Labour efficiency variance = Actual quantity of resource used × Standard price per one unit of resource – Standard quantityof resource that would have been used for actual output × Standard price per one unit of resource = AQ × SP – SQ × SP= 46,000 × 3 – 1 ×36,000 × 3=30,000 (A)

Variable overheads spending variance = Actual variable overheads – Actual quantity of labour used× Standard variable overhead rate = AQ × AP – AQ × SP = 38,000 – 46,000×1 = -8,000. The difference calculated is negative, so the actual variable overhead rate is lower than the standard and the variance is favorable (F)

Variable overheads efficiency variance = Actual quantity of labour used × Standard variable overhead rate – Standard quantity of labour that would have been used for actual output × Standard variable overhead rate = AQ × SP – SQ × SP = 46,000×1-36,000×1×1 = 10,000. The difference calculated is positive, the variance is adverse (A).

Operating statement for The Strudel Company for May 2010 would appear as follows:

	Favorable	Adverse	
	£	£	£
Budgeted profit (40,000×10)			400,000
Sales price variance	72,000		
Sales margin volume variance		40,000	
	72,000	40,000	32,000
Standard profit			432,000
Cost Variances			
Material A			

price	30,000		
efficiency		-	
Material B			
price	28,000		
efficiency		8,000	
Labour			
price	10,000		
efficiency		30,000	
Var OH			
spending	8,000		
efficiency	_____	10,000	
	76,000	48,000	28,000
Actual profit			460,000

Problem 22

Big Margin Ltd has been using marginal costing system for years. The following information relates to the budgeted and actual results for the month of January 2009:

	Budgeted	Actual
Units of output and sale	1,000 units	1,200 units
Fixed overheads	$15,000	$16,000
Per unit information:	$	$
Selling price	150	152
Direct labour	50	49
Direct materials	25	30
Variable overheads	13	12

Required:

(a) Calculate the following variances (indicating clearly whether they are favorable or adverse

i. sales price variance,

ii. sales contribution volume variance,

iii. sales margin volume variance,

(b) Explain why the sales contribution volume variance differs from the sales margin volume variance.

☺ **Solution:**

	Budgeted	Actual
Per unit information:	$	$
Selling price	150	152
Direct labour	50	49
Direct materials	25	30
Variable overheads	13	12
Contribution	62	61
Fixed overheads	15	13.33
Margin	47	47.67

Sales price variance = Actual quantity sold × Actual price per unit – Actual quantity sold × Standard price per unit = AQ × AP – AQ × SP = 1,200×152 - 1,200×150 = 2,400. This variance isolates the effect of the change in the selling price. The difference calculated is positive, the actual price is higher than the standard budgeted price and the variance is favorable (F).

Two variances can be calculated to isolate the effect of change in output:

Sales contribution volume variance = Actual quantity sold × Standard contribution per unit – Standard quantity sold × Standard contribution per unit = AQ × SC – SQ × SC = 1,200×62 – 1,000×62=12,400

Sales margin volume variance = Actual quantity sold × Standard profit margin per unit – Standard quantity sold × Standard profit margin per unit = AQ × SM – SQ × SM =1,200×47 – 1,000×47=9,400

(b) To ascertain the effect of changes in the sales volume on the difference between the budgeted and the actual contribution, we must multiply the difference in the budgeted and actual sales volume by the standard contribution margin.To find out the effect of changes in the sales volume on the difference between the budgeted and the actual profit a sales margin volume variance is calculated.

Changes in output will change a fixed overhead absorption rate. If actual output differs from budget a fixed overhead volume variance will arise. Fixed overhead volume variance = Budgeted fixed overhead expense – Applied fixed overhead expense = SC – Actual output × SP/unit = 15,000 – 1,200 × 15,000/1,000 = 3,000.

Investment Appraisal

Problem 23

Hayek Plc is considering investing in either project P or project Q:

	Time (years)	Project P £	Project Q £
Equipment cost	0	100,000	100,000
Expected annual profit/loss	1	34,000	4,000
	2	24,000	4,000
	3	14,000	12,000
	4	4,000	16,000
	5	(36,000)	4,000
Estimated resale value of equipment	5	20,000	20,000

Hayek Plc depreciates equipment on the straight-line basis. Profits and losses are earned evenly throughout the year.

Required:

(a) Calculate the payback period for each project and on this basis advise Hayek Plcwhich project to invest in.

(b) Briefly explain two disadvantages of payback period as a method of investmentappraisal.

☺ **Solution:**

(a) The payback method is one of the simplest and most frequently used methods of investment appraisal. It is defined at the length of time that isrequired for a stream of cash proceeds from an investment to recover the initial cash outlay (the initial investment) under the project.

You need to remember that payback period method is based on cash flows. If the informationabout the projects is presented in terms of expected annual profits or losses, these figures must be adjusted to represent the expected cash flows. To do this, we need to adjust for non-cash charges as depreciation.

Straight-line depreciation for projects P and Q = (£100,000-£20,000) ÷ 5 years = £16,000 per annum

The amount of annual depreciation needs to be added back to the annual profit or loss figures to give us the cash flows expected for each project:

	Time	Project P	Project Q

	(years)	£	£
Initial capital expenditure	0	(100,000)	(100,000)
Expected annual cash inflow (outflow)	1	50,000	20,000
	2	40,000	20,000
	3	30,000	28,000
	4	20,000	32,000
	5	(20,000)	20,000
Proceeds from sale of equipment	5	20,000	20,000

To determine the payback period for each project, we need to look at thecumulative cash flows.

	End of year	Project P	Project Q
		£	£
Expected cumulative cash flow	0	(100,000)	(100,000)
	1	(50,000)	(80,000)
	2	(10,000)	(60,000)
	3	20,000	(32,000)
	4	40,000	0
	5	20,000	20,000
	5	40,000	40,000

You can see from the table that Project P has a payback period of between two and three years and Project Q has a payback of exactly four years. Assuming that cash flows under the project P arise evenly throughout the year (as do profits and losses), it recovers the initial cash outlay after two years and four months (or 2 and 1/3 years).

(b) Payback period method of investment appraisalhas a number of limitations. In particular, it does not provide an absolute measure which means that it is necessary to compare one payback period to another in order to make a decision (in isolation, there is no way to know if a payback period of 2 and 1/3 years is ‘good’ or ‘bad’), it ignores the absolute size of the investment outlay and subsequent cash flows. It also ignores the size and direction of cash flows occurring after the payback period. Finally it does not take account of the ‘time value’ of money.

Problem 24

Proa Ltd is considering whether or not to invest in a project to develop and sell a new product. Initial expenditure on a range of development expenses will be £150,000 at the start of year 1 to

get the project up and running. Sales of the product will start in year 2, and it is anticipated that annual net cash inflows will be as follows:

Year	£
2	68,000
3	71,000
4	54,000
5	28,000
6	10,000

Demand for the product is expected to decline after year 6 to the point where it will not be worth continuing production.

The £150,000 of initial expenditure is treated as a fixed asset, to be depreciated on a straight-line basis over six years, with an assumption of nil residual value at the end of year six.

Required:

(a) Calculate the average accounting rate of return over the life of the project.

(b) Calculate the payback period for the project.

☺ **Solution:**

(a) Accounting Rate of Return (ARR) is the ratio of the average annual profit of the project, to the investment in the project.

ARR = (Average annual profit ÷ Average investment) × 100%,

where Average investment = (Initial investment at start + Amount recovered at end) ÷ 2

ARR is based on the expected accounting profit of the project. In this problem net cash flows are given, so it is necessary to adjust the annual cash flows for depreciation or other non-cash flows to give annual profits.

Straight-line depreciation for the project = (£150,000-£0) ÷ 6 years = £25,000 per annum

Annual depreciation charges should be subtracted from anticipated annual cash flows to get annual profits:

Expected annual profit/(loss)	Year	£
	1	(25,000)
	2	43,000
	3	46,000
	4	29,000
	5	3,000
	6	(15,000)
Average annual profit		13,500

Average investment = (Initial investment at start + Amount recovered at end) ÷ 2 = (£150,000+£0)÷2 = £75,000.

Thus average ARR is 18 per cent= £13,500 ÷ £75,000 ×100%.

In part (b) no adjustments are needed to the annual cash flows to give a payback period.

	Year	£
Initial capital expenditure	1	(150,000)
Expected annual cash inflow	2	68,000
(outflow)	3	71,000
	4	54,000
	5	28,000
	6	10,000

To determine the payback period, we need to look at thecumulative cash flows:

Expected cumulative cash flow	End of Year	£
	1	(150,000)
	2	(82,000)
	3	(11,000)
	4	43,000
	5	71,000
	6	81,000

Assuming that cash flows under the project arise evenly throughout the year, it recovers the initial cash outlay after three years and two months.

In year 3 the project receives £71,000 per year or £5,916 a month, thus two months are needed to cover the cash deficit of (£11,000) at the beginning of year 3.

Problem 25

The management team of Tennyson Ltd has two projects for consideration. In the past, they have evaluated projects against payback period. The following information is available:

	Project A	Project B
Capital outlay	75,000	140,000
Net cash inflows (assume all at the end of the year)		
Year 1	30,000	45,000
Year 2	20,000	45,000
Year 3	15,000	45,000
Year 4	10,000	45,000

Year 5	10,000	45,000

Required:

(a) Evaluate the projects using each of the following methods:

i payback period

ii Net present value, assuming a cost of capital of 6% per year.

iii Internal rate of return. Answers to one place of decimals.

(b) Prepare notes for a report to the Chairman of the management team explaining each of the evaluation methods. You are required to make a recommendation of the method(s) which should be used by the company for future project evaluation.

☺ **Solution:**

(a) To determine the payback period, we need to look at the cumulative cash flows:

	Project A	Project B
Expected cumulative cash flow	(75,000)	(140,000)
Year 1	(45,000)	(95,000)
Year 2	(25,000)	(50,000)
Year 3	(10,000)	(5,000)
Year 4	0	40,000
Year 5	10,000	85,000

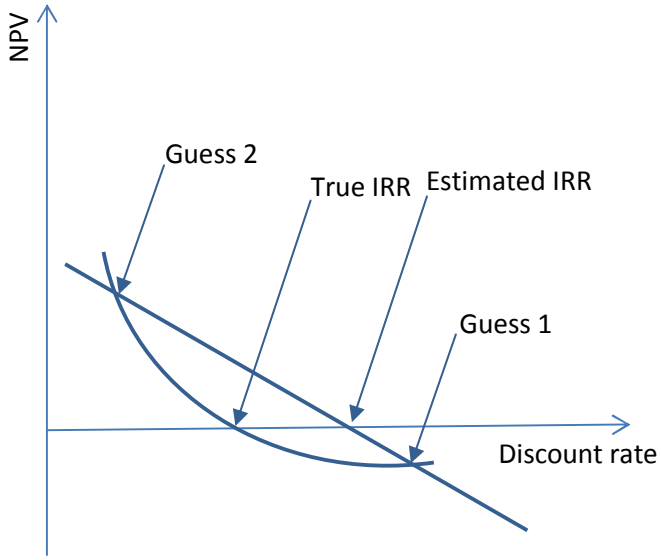
Payback period for Project A is exactly four years, for Project B (assuming all cash flows under the project arise at the end of the year) is also four years.

(b)

Net cash flows:			Discounted cash flows:		
	Project A	Project B	Discount rate	Project A	Project B
			6%		
Year 0	(75,000)	(140,000)	1.000	(75,000)	(140,000)
Year 1	30,000	45,000	0.943	28,290	42,435
Year 2	20,000	45,000	0.890	17,800	40,050
Year 3	15,000	45,000	0.840	12,600	37,800
Year 4	10,000	45,000	0.792	7,920	35,640
Year 5	10,000	45,000	0.747	7,470	33,615
			NPV	(920)	49,540

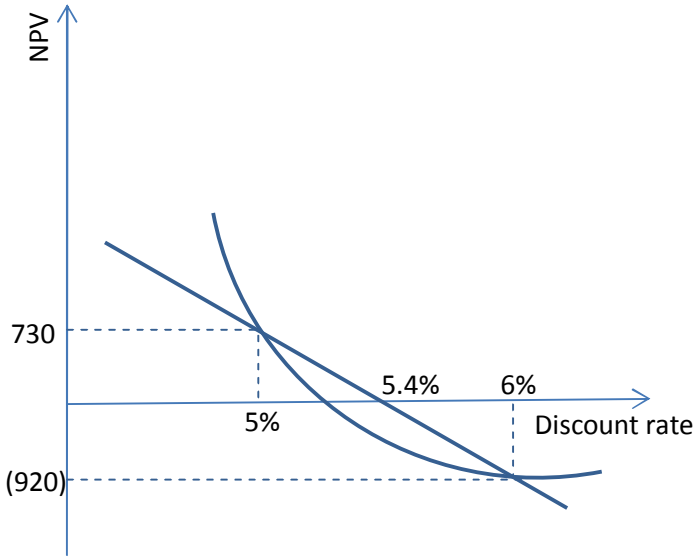
(c) The quickest way to estimate the IRR for projects without a financial calculator which is not allowed at your exam is to use linear interpolation. To do this you need to make just two discount rate guesses. Linear interpolation assumes that a straight line can be drawn between the two NPVs corresponding to your two discount rate guesses on a graph of NPV against discount

rate. The point where this straight line crosses the x axis gives you an estimate of the true IRR for a project.



We have already calculated the NPV of projects with a discount rate of 6%. For Project A this NPV was negative. We will get the best estimate from linear interpolation if we manage to guess a second discount rate that will give us a positive NPV. In this case, we need to pick a lower discount rate. Let's choose discount rate of 5%. NPV for Project A at a discount rate of 5 % will be 730:

	Project A	Discount rate	Project A
		5%	
Year 0	(75,000)	1.000	(75,000)
Year 1	30,000	0.952	28,290
Year 2	20,000	0.907	17,800
Year 3	15,000	0.864	12,600
Year 4	10,000	0.823	7,920
Year 5	10,000	0.784	7,470
		NPV	730



For Project A NPV at 6% is £(920) and at 5% is £730. Linear interpolation gives the IRR as roughly 5.4% = 5 + 730* (6-5) ÷ (730+920).

For Project B NPV at 6% was positive. We need to pick a much higher discount rate that will give us a positive NPV. Let's choose 20%.

	Project B	Discount rate	Project B
		20%	
Year 0	(140,000)	1.000	(140,000)
Year 1	45,000	0.833	37,485
Year 2	45,000	0.694	31,230
Year 3	45,000	0.579	26,055
Year 4	45,000	0.482	21,690
Year 5	45,000	0.402	18,090
		NPV	(5,450)

For Project B NPV at 20% is £(5,450) and at 6% is £49,540. Linear interpolation gives the IRR as roughly 18.6% = 6 + 49,540* (20-6) ÷ (49,540+5,450).

(a) –(c) gave the following results:

	Project A	Project B
Payback period	4 years	4 years
NPV	(920)	49,540
IRR	5.4%	18.6%

Thus Project B is preferable using all three methods.

Part (b) of this question required brief notes for a report and might well have been presented using a bullet point format. The question required the recommendation of a preferred method,

such as NPV, and a good answer would back this up by clearly stating the factors which influenced the recommendation.

Both NPV and IRR:

• recognise the time value of money

• use relevant costs and revenues.

As such, both DCF methods are superior to payback period.

However, NPV is the best DCF method to use for investment appraisal because it:

• considers the magnitude of a project (projects with positive NPVs increase wealth, and projects with greater positive NPVs increase wealth more than those with smaller positive NPVs). The NPV is additive and allows managers to determine the total sum of NPV of a group of investments. The IRR of a group of investments does not equal to the sum of IRR of each individual investment.

In contrast:

• IRR cannot distinguish between projects involving investment (initial cash outflows) and projects involving borrowing (initial cash inflows).

• IRR does not provide an absolute measure. It is necessary to compare the IRR with a discount rate, in order to make a decision (it is impossible to know whether an IRR of, say, 12%, makes a project worthwhile or not, without also at least knowing the appropriate discount rate to apply).

IRR cannot distinguish between mutually exclusive projects. If two projects have IRRs of, say, 15% and 20%, we cannot assume that the project with the highest IRR is also the one with the highest NPV at a particular discount rate.

• IRR ignores the absolute size of project cash flows.

• IRR may not be unique (certain projects may have more than one IRR).

Problem 26

Nixon plc produces a range of exercise and fitness equipment. Recently it has developed a new type of exercise equipment unit for the home and the directors of the company are now considering whether this product should be put into production. The followinginformation has been produced to help evaluate the commercial viability of the newproduct.

(1) The cost of developing the new product was £125,000. In addition, marketresearch was carried out by a firm of marketing consultants at a cost of £80,000.

The development costs have all been paid and the market research costs are duefor payment next month.

(2) The company expects to sell 10,000 units per year for each of the next five years.The selling price of each unit will be £65.

(3) Machinery which originally cost £1,500,000 and which has a written down valueof £950,000 will be required to produce the new exercise equipment. Ifproduction does not go ahead, the machinery will be sold immediately for £790,000. If however production goes ahead the machinery will be sold at theend of five years for £70,000.

(4) Additional working capital of £150,000 will be required immediately in order tosupport production of the new product. This can be released at the end of theproduction period.

(5) To produce the new product, two types of material will be required. Type Amaterial is used throughout the product range of the business and 20,000 kilos arealready in stock at a purchase cost of £14 per kilo. Recently, however, thesupplier of the material has raised the price to £15 per kilo. Type B material isalso in stock although there is no further use for this material except for use in theproduction of the new product. There are 12,000 kilos in stock at a purchase costof £2 per kilo; however the replacement cost is £2.50 per kilo. If production doesnot go ahead, the existing stock will be sold immediately for £1.50 per kilo. Eachunit requires one kilo of Type A material and three kilos of Type B material.

(6) Labour costs are estimated at £12 per unit. If the new product is not producedsome existing employees will be made redundant immediately at a cost of£50,000 to the company. If, however, the new product is produced, theseemployees will be used to produce the new product and will be made redundantat the end of the production period at a cost of £80,000 to the company.

(7) Total fixed costs apportioned to the new product will be £200,000 per annum ofwhich £60,000 per annum is estimated to arise as a direct result of the decision toproduce the new product.

(8) The company has a cost of capital of 12% per year.

Assume cash flows occur at the end of the year concerned unless indicated otherwise.

Taxation is to be ignored.

Required:

(a) Advise the directors of Nixon plc whether or not the company should produceand sell the new type of exercise equipment using the net present value (NPV)method of investment appraisal. Present your main calculations in the form of atable.

☺ **Solution:**

(a). It is important to adopt a well-organized approach to layout of an answer. You should prepare a table of relevant cash flows and calculate present values net cash flows for each of the relevant years.

(1) The cost of developing the new product and market research cost are sunk costs; they have arisen in the past. The fact that market research cost has not yet been paid does not matter. The payment will be effected anyway whatever decision is made.

(2) Cash flows from sales =10,000 units × £65 = £650,000. Cash flows occur at the end of the year concerned; the cash receipts for the first year will arrive one year from now and should be discounted.

(3) Original cost of machinery is sunk. Depreciation is not a cash flow and therefore it is an irrelevant cost. 790,000 is an opportunity cost. And £70,000 is an incremental flow, it will arise if production goes ahead.

(4) We should take into consideration working capital of £150,000 that is required immediately and will be released at the end of the year 5.

(5) Each unit of the new product requires 1 kg of material A, the stock of 20,000 kg material A is enough for the company to produce its new product for two year. But type A material is used throughout the product range of the business. If the company uses the stock of material A to manufacture its new product then it will have to buy this material at £15 for its other products. So in the year 1 and 2 the company we should take in consideration opportunity cost of its stock. 10,000 units × 1 kg × £15= £150,000. And in years 3 – 4 the company should buy material A 10,000 units × 1 kg × £15 = £150,000

Type B material is also in stock although there is no further use for this material except for use in the production of the new product. Thus the value of 12,000 kilos in stock can be regarded as sunk cost. For first year the company should by 18,000 kilo of materials at £2.50 per kilo. 18,000 kg × £2.50= £45,000. For the second and subsequent years the company will by 10,000 units × 3 kg × £2.50 = £75,000 We should also consider opportunity costs of using 12,000 kg of stock for manufacturing new product. It this cast the company will not be able to sell the stock immediately for £1.50 per kilo. 12,000 kg.× £1.50 = £18,000

(6) Labour costs are estimated at £12 per unit, thus the labour costs will be 10,000 units × £12 = £120,000. If production goes ahead the company will save £50,000 because it will not make redundant some of the existing employees. These employees will be made redundant at the end of the production period at a cost of £80,000 to the company.

(7) Of £200,000 total fixed costs only £60,000 are incremental and will change as a result of the decision. Thus only £60,000 per annum are relevant.

The annual net cash flows are calculated as follows:

Year	0	1	2	3	4	5
	£000	£000	£000	£000	£000	£000
Sales		650	650	650	650	650
Sale of machinery	(790)					70

Working capital	(150)					150
Material – A		(150)	(150)	(150)	(150)	(150)
Material – B	(18)	(45)	(75)	(75)	(75)	(75)
Labour costs	50	(120)	(120)	(120)	(120)	(200)
Fixed costs		(60)	(60)	(60)	(60)	(60)
Incremental cash flows	(908)	275	245	245	245	385
Discount rate 12%	1.00	0.893	0.797	0.712	0.636	0.567
Present value	(908.0)	245.6	195.3	174.4	155.8	218.3
NPV	81.4					

NPV = 81.4.

Discount factors can either be calculated using the formula, or you can simply look them up in an interest table. Interest tables are provided in the examination. Using interest tables can save you time, but you must make sure you are looking at the correct page.

At a discount rate of 12% NPV is positive thus the cash inflows exceed the cash outflows and the project is worthwhile.

Problem 27

New College plc is an electronic game manufacturer. The company has recently developed a new game and the directors are considering whether to proceed with production. The development costs incurred were £220,000.

A market research report costing £30,000 was received and paid for in May 2010. The report suggested that the game had an expected four year market life and provided forecasts of demand. On the basis of these the following forecast profit and loss accounts have been prepared:

Forecast profit and loss accounts for the year ended 30 June

	2011	**2012**	**2013**	**2014**
	£	**£**	**£**	**£**
Sales	500	640	480	320
Costofgoodssold	(200)	(256)	(192)	(128)
Grossprofit	300	384	288	192
Variableoverheads	(100)	(128)	(96)	(64)
Fixedoverheads	(50)	(50)	(50)	(50)
Depreciation	(130)	(130)	(130)	(130)
Netprofit (loss)	20	76	12	(52)

In order to commence production on the new game a machine costing £550,000 will have to be purchased at the end of June 2010. The salvage value of this machine at the end of four years is

estimated to be £30,000. Additional working capital of £40,000 will also be required at the end of June 2010.

Fixed overheads of £40,000 per annum have been charged as a result of a reallocation of existing overheads. The remaining £10,000 p.a. represents additional fixed overheads resulting from the decision to undertake production of the new game.

The chairman of New College plc called a meeting of the product development team soon after receiving the forecast profit figures. At this meeting he said:

"I am sorry to say that the forecast profit figures for the new product are very disappointing. In three out of the four years of the product's life the net profit margin is less than 5 per cent. However, the cost of capital to finance the new product is 10 per cent. The projected profit margins are particularly disappointing given that the development costs, market research costs and new equipment costs total £800,000. It does not seem, therefore, that the product is financially viable."

Required

(a) Set out in tabular format a calculation of the net present value of manufacturing and selling the new game using the information provided above. Identify and explain any costs not included in your analysis.

(b) Describe any two assumptions which underlie your calculations in (a).

(c) If New College plc could lease the machine for five equal annual payments commencing immediately, instead of buying it, what is the maximum annual lease payment the company should be prepared to pay?

(d) Briefly explain how sensitivity analysis can contribute to management decision making.

☺ **Solution:**

This type of question requires use of a significant amount of data and it is very important that your work is clearly presented and that al workings are legible and understandable. You should construct a columnar table in which relevant cash flows can be inserted:

(a)

	2010	2011	2012	2013	2014
	£000	£000	£000	£000	£000
Machinery	(550)				30
Working capital	(40)				40
Sales		500	640	480	320
Cost of sales		(200)	(256)	(192)	(128)
Variable costs		(100)	(128)	(96)	(64)

Fixed costs		(10)	(10)	(10)	(10)
Net cash flows	(590)	190	246	182	188

Excluded from the table:

developmentand market research costs– sunk costs.

depreciation – not a cash flowand therefore it is an irrelevant cost;

£40,000 fixed overhead – allocations, thus not incremental costs.

Having determined the net cash flow for each year these are discounted using the discount factors taken from the tables provided:

Net cash flows	(590)	190	246	182	188
Discount factor	1.0	0.909	0.826	0.751	0.683
Present value	(590)	172.7	203.2	136.7	127.8
NPV	50.4				

A positive NPV indicates that the project is expected to earn more than the opportunity cost of capital of the finance providers.

(b) Assumptions which were made include

• Year-end timing of cash flows

• No inventories. If no inventories then you can easily derive payments for purchased materials from cost of sales.

• No other changes in working capital

• 10 per cent is appropriate cost of capital.

(c) The company will be indifferent between buying the machine and leasing the machine if the present values of the associated cash flows in each case are exactly equal. The present value of the cash flows associated with buying the machine is

	2010	2011	2012	2013	2014
	£000	£000	£000	£000	£000
Machinery	(550)				30
Net cash flows	(550)				30
Discount factor	1.0	0.909	0.826	0.751	0.683
Present value	(550)				20.49
NPV	(529.51)				

If x is the annual lease cost, the present value of five cash flows at a discount rate of 10% will be given by x + x * PV of annuity for 4 years for 10% = x + x*3.170 = x * 4.170 (the first lease payment occurs immediately, in July 2010). Therefore, if we need this to be equal to 529.51, x

must be equal to 529.51 / 4.170 = 126.98. So the maximum annual payment New College plc would pay would be 129.98.

(d)Sensitivity analysis identifies each of the key variables influencing the investment decision and examines the extent to which they could change before affecting the viability of the project. The approach gives managers a feel for the margin of error that is available for each variable; however, it does not provide a clear indication of whether to accept or reject the project. This is left to managerial judgement.

When making any decisions about the future, managers have to rely on their expectations of future events. As no one can perfectly predict the future, investment decisions are affected by uncertainty.

The uncertainty can affect the amount or timing of future cash flows, as well as deciding which discount rate is appropriate (when using DCF techniques). Sensitivity analysis involves looking at just one of the individual estimates or forecasts involved in the project, and seeing how much it would need to change in order to change the decision. For example, how much would future sale revenue need to fall by in order for a project to no longer be worthwhile?

Problem 28

Wilkes Ltd has spent £20,000 researching the prospects for a new range of products. If it were decided that production is to go ahead an investment of £240,000 in capital equipment on 1st January 2009 would be required.

The accounts department has produced budgeted profit and loss statements for each year of the project's five-year life. At the end of the fifth year the capital equipment will be sold and production will cease.

The capital equipment is expected to be sold for scrap on 31 December 2013 for £40,000.

	Year end 31.12.2009 £000's	Year end 31.12.2010 £000's	Year end 31.12.2011 £000's	Year end 31.12.2012 £000's	Year end 31.12.2013 £000's
Sales	400	400	400	320	200
Materials	(240)	(240)	(240)	(192)	(120)
Other variable costs	(40)	(40)	(40)	(32)	(20)
Fixed overheads	(20)	(20)	(24)	(24)	(24)
Depreciation	(40)	(40)	(40)	(40)	(40)
Net profit/(loss)	60	60	56	32	(4)

When production is started it will be necessary to raise material stock levels by £30,000 and other working capital by £20,000 immediately. These sums will be released at the end of the project.

Customers receive one year's credit from the firm so that sales in 2009, for example, will be paid for at the end of 2010.

The fixed overhead figures in the budgeted accounts have two elements – 60 per cent is due to a reallocation of existing overheads, 40 per cent is directly incurred because of the take-up of the project.

For the purposes of this appraisal you may regard all receipts and payments as occurring at the year-end to which they relate, unless otherwise stated.

The company's cost of capital is 12% per year.

Required

Use the net present value method of project appraisal to advise the management of Wilkes Ltd whether to go ahead with the proposed project.

☺ **Solution:**

It is important to adopt a well-organized approach to the layout of an answer. You should produce a table of cash flows and present values for each of the relevant years as follows:

	2009 start	2009 end	2010 end	2011 end	2012 end	2013 end	2014 end
	£000	£000	£000	£000	£000	£000	£000
Sales			400	400	400	320	200
Equipment	(240)					40	
Stock	(30)					30	
Working capital	(20)					20	
Overheads		(8)	(8)	(9.6)	(9.6)	(9.6)	
Material		(240)	(240)	(240)	(192)	(120)	
Variable costs		(40)	(40)	(40)	(32)	(20)	
Net cash flows	(290)	(288)	112	110.4	166.4	260.4	200
Discount factor	1.0	0.893	0.797	0.712	0.636	0.567	0.507
Present value	(290)	(257.2)	89.3	78.6	105.8	147.6	101.4
NPV	-24.5						

A negative NPV indicates that the project is expected to earn less than the opportunity cost of capital of the finance providers. This firm would serve its shareholders best by not proceeding with this project.

Research (£20,000) is a sunk cost which is irrelevant for the NPV calculation. Depreciation charges are not cash flows so they are also irrelevant for the NPV calculation.