Management Accounting Pillar

Managerial Level Paper

P1 – Management Accounting – Performance Evaluation

20 November 2007 – Tuesday Morning Session

Instructions to candidates

You are allowed three hours to answer this question paper.
You are allowed 20 minutes reading time **before the examination begins** during which you should read the question paper and, if you wish, highlight and/or make notes on the question paper. However, you will **not** be allowed, **under any circumstances**, to open the answer book and start writing or use your calculator during the reading time.
You are strongly advised to carefully read ALL the question requirements before attempting the question concerned (that is, all parts and/or sub-questions). The requirements for the questions in Section C are contained in a dotted box.
ALL answers must be written in the answer book. Answers or notes written on the question paper will **not** be submitted for marking.
Answer the ONE compulsory question in Section A. This has 16 sub-questions and is on pages 2 to 8.
Answer ALL SIX compulsory sub-questions in Section B on pages 10 and 11.
Answer ONE of the two questions in Section C on pages 12 to 15.
Maths Tables and Formulae are provided on pages 17 to 21. These pages are detachable for ease of reference.
The list of verbs as published in the syllabus is given for reference on the inside back cover of this question paper.
Write your candidate number, the paper number and examination subject title in the spaces provided on the front of the answer book. Also write your contact ID and name in the space provided in the right hand margin and seal to close.
Tick the appropriate boxes on the front of the answer book to indicate which questions you have answered.

P1 – Performance Evaluation

TURN OVER

SECTION A – 40 MARKS

[the indicative time for answering this section is 72 minutes]

ANSWER *ALL* SIXTEEN SUB-QUESTIONS

Instructions for answering Section A:

The answers to the sixteen sub-questions in Section A should ALL be written in your answer book.

Your answers should be clearly numbered with the sub-question number then ruled off, so that the markers know which sub-question you are answering. **For multiple choice questions, you need only write the sub-question number and the letter of the answer option you have chosen.** You do not need to start a new page for each sub-question.

For sub-questions **1.11 to 1.16** you should show your workings as marks are available for the method you use to answer these sub-questions.

Question One

1.1 T Ltd uses a standard labour hour rate to charge its overheads to its clients' work. During the last annual reporting period production overheads were under-absorbed by £19,250. The anticipated standard labour hours for the period were 38,000 hours while the standard hours actually charged to clients were 38,500. The actual production overheads incurred in the period were £481,250.

The budgeted production overheads for the period were

A £456,000

B £462,000

C £475,000

D None of the above.

(2 marks)

Section A continues on the opposite page

1.2 Operation B, in a factory, has a standard time of 15 minutes. The standard rate of pay for operatives is £10 per hour. The budget for a period was based on carrying out the operation 350 times. It was subsequently realised that the standard time for Operation B included in the budget did not incorporate expected time savings from the use of new machinery from the start of the period. The standard time should have been reduced to 12 minutes.

Operation B was actually carried out 370 times in the period in a total of 80 hours. The operatives were paid £850.

The operational labour efficiency variance was

A £60 adverse

B £75 favourable

C £100 adverse

D £125 adverse

(2 marks)

1.3 JP manufactures two joint products X and Y, and a by-product Z, in a single continuous process. The following information is available for period 3:

Raw materials input	20,000 litres
Raw material costs	$52,000
Conversion costs	$56,000
Outputs	10,000 litres of X, selling price $8 per litre
	8,000 litres of Y, selling price $6 per litre
	2,000 litres of Z, selling price $1 per litre

Process costs are apportioned on a sales value basis. There was no opening and closing inventory of raw materials. The revenue from the by-product is used to reduce the process costs.

What was the cost per litre of joint product X?

A $5·889

B $6·523

C $6·625

D $6·646

(2 marks)

Section A continues on the next page

1.4 A company has budgeted break-even sales revenue of £800,000 and fixed costs of £320,000 for the next period.

The sales revenue needed to achieve a profit of £50,000 in the period would be

A £850,000

B £925,000

C £1,120,000

D £1,200,000

(2 marks)

1.5 The production volume ratio in a period was 95%.

Which statement will always be true?

A Actual hours worked exceeded the budgeted hours.

B Actual hours worked exceeded the standard hours of output.

C Budgeted hours exceeded the standard hours of output.

D Budgeted output was less than the actual output.

(2 marks)

1.6 Two CIMA definitions follow:

1. A system that converts a production schedule into a listing of the materials and components required to meet that schedule so that adequate stock levels are maintained and items are available when needed.

2. An accounting oriented information system, generally software driven, which aids in identifying and planning the enterprise-wide resources needed to resource, make, account for and deliver customer orders.

Which of the following pairs of terms matches the definitions?

	Definition 1	*Definition 2*
A	Material requirements planning	Enterprise resource planning
B	Manufacturing resource planning	Material requirements planning
C	Material requirements planning	Manufacturing resource planning
D	Manufacturing resource planning	Enterprise resource planning

(2 marks)

1.7 The fixed overhead volume variance is defined as

A the difference between the budgeted value of the fixed overheads and the standard fixed overheads absorbed by actual production.

B the difference between the standard fixed overhead cost specified for the production achieved, and the actual fixed overhead cost incurred.

C the difference between budgeted and actual fixed overhead expenditure.

D the difference between the standard fixed overhead cost specified in the original budget and the same volume of fixed overheads, but at the actual prices incurred.

(2 marks)

1.8 Overheads will always be over-absorbed when

A actual output is higher than budgeted output.

B actual overheads incurred are higher than the amount absorbed.

C actual overheads incurred are lower than the amount absorbed.

D budgeted overheads are lower than the overheads absorbed.

(2 marks)

Section A continues on the next page

The following data are given for sub-questions 1.9 and1.10 below

A manufacturing company recorded the following costs in October for Product X:

	$
Direct materials	20,000
Direct labour	6,300
Variable production overhead	4,700
Fixed production overhead	19,750
Variable selling costs	4,500
Fixed distribution costs	16,800
Total costs incurred for Product X	72,050

During October 4,000 units of Product X were produced but only 3,600 units were sold. At the beginning of October there was no inventory.

1.9 The value of the inventory of Product X at the end of October using marginal costing was:

A $3,080

B $3,100

C $3,550

D $5,075

(2 marks)

1.10 The value of the inventory of Product X at the end of October using throughput accounting was

A $630

B $1,080

C $1,100

D $2,000

(2 marks)

1.11 A company has the following budgeted sales figures:

Month 1	£90,000
Month 2	£105,000
Month 3	£120,000
Month 4	£108,000

80% of sales are on credit and the remainder are paid in cash. Credit customers paying within one month are given a discount of 1·5%. Credit customers normally pay within the following time frame:

Within 1 month	40% of credit sales
Within 2 months	70% of credit sales
Within 3 months	98% of credit sales

There is an expectation that 2% of credit sales will become bad debts.

Outstanding receivables at the beginning of month 1 includes £6,000 expected to be received in month 4.

Calculate the total receipts expected in month 4.

(4 marks)

1.12 The budgeted total costs for two levels of output are as shown below:

Output	25,000 units	40,000 units
Total cost	£143,500	£194,000

Within this range of output it is known that the variable cost per unit is constant but fixed costs rise by £10,000 when output exceeds 35,000 units.

Calculate for a budgeted output of 36,000 units:

(i) the variable cost per unit;
(ii) the total fixed costs.

(3 marks)

1.13 A company can produce many types of product but is currently restricted by the number of labour hours available on a particular machine. At present this limitation is set at 12,000 hours per annum. One type of product requires materials costing $5 which are then converted to a final product which sells for $12. Each unit of this product takes 45 minutes to produce on the machine. The conversion costs for the factory are estimated to be $144,000 per annum.

Calculate the throughput accounting ratio for this product and state the significance of the result.

(3 marks)

TURN OVER

1.14 A company manufactures three joint products in a continuous single process. Normal losses are 10% of inputs and do not have any value. Budget data is available for the month of January as follows:

Opening and closing work in progress	NIL
Direct materials input	20,000 kg at a cost of £36,000
Direct labour costs	3,000 hours @ £6 per hour
Variable production overheads	3,000 hours @ £1 per hour

Fixed production overheads are absorbed at a rate of £8 per direct labour hour.

	Expected outputs	*Selling price per kg*
Joint product A	9,000 kg	£8
Joint product B	6,000 kg	£6
Joint product C	3,000 kg	£4

Joint costs are apportioned on a physical unit basis.

Calculate the gross profit margin for each of the joint products.

(3 marks)

1.15 A company has the following balance sheet totals at the end of its most recent financial year:

	£million
Non-current assets	3·64
Current assets	0·42
Share capital and reserves*	2·69
Long term debt	1·00
Current liabilities	0·37

* Includes retained profit for the year of £320,000 after deducting:

Ordinary share dividends	£200,000
Interest on long term debt	£100,000
Taxation	£70,000

Calculate the Return on Investment (ROI) of the company for the year (using end year balance sheet values for investment).

(3 marks)

1.16 A division is considering the purchase of a new machine which costs $1,500,000 and is expected to generate cost savings of $450,000 a year. The asset is expected to have a useful life of five years with no residual value. Depreciation is charged on a straight line basis. Divisional performance is evaluated on Residual Income (RI). The division's cost of capital is 10%.

Calculate for this machine for each of the five years:

(i) the Residual Income (RI);
(ii) the Return on Investment (ROI).

Note: When calculating performance measures the division always uses capital values as at the start of the year.

(4 marks)

(Total for Section A = 40 marks)

Reminder

All answers to Section A must be written in your answer book.

Answers to Section A written on the question paper will **not** be submitted for marking.

Section B starts on the next page

SECTION B – 30 MARKS

[the indicative time for answering this section is 54 minutes]

ANSWER *ALL* SIX SUB-QUESTIONS. EACH SUB-QUESTION IS WORTH 5 MARKS

Question Two

The following data are given for sub-questions 2(a) and 2(b) below

QBQ produces one type of product. Details of the budgeted sales and production are given below.

Selling Price and Costs per unit

	£
Selling price	40
Material FX: 1·5kg @ £6 per kg	9
Conversion costs (variable)	8
Fixed production overheads	15

The fixed production overhead absorption rate is based on annual production overheads of £720,000 and budgeted annual output of 48,000 units. The fixed overheads will be incurred evenly throughout the year.

The company also incurs fixed costs for administration of £200,000 per year.

Budgeted Sales

Quarter	Units
1	10,000
2	12,000
3	14,000
4	12,000

Inventory

It has been decided that inventory levels are to be reduced. Details are as follows:

Finished goods: 5,500 units are currently held but it has been decided that the closing inventories for Quarters 1, 2 and 3 will be 45%, 40% and 35% of the following quarter's sales respectively.

Raw materials: 4,500 kg are currently held but it has been decided that the closing inventories for Quarters 1 and 2 will be 25% and 20% of the following quarter's production requirements respectively.

(a) Prepare a materials purchase budget for Quarter 1.

(5 Marks)

(b) In Quarter 3 the opening and closing inventories of finished goods will be 5,600 units and 4,200 units respectively. QBQ adjusts for any under- or over-absorption of overheads at the end of each quarter.

Assume that production and sales volumes were as budgeted and that inventory levels were as planned. Also assume that all costs and revenues were as budgeted.

(i) Calculate using marginal costing the profit for Quarter 3;
(ii) Calculate using absorption costing the profit for Quarter 3;
(iii) Explain the difference, if any, in the profits you have calculated.

(5 Marks)

(c) Explain, giving examples, how budgets can be used for feedback control and feed-forward control.

(5 Marks)

(d) Briefly explain **three** reasons why budgetary planning and control might be inappropriate in a rapidly changing business environment.

(5 Marks)

(e) Briefly explain Just-in-Time (JIT) and **two** major requirements for the successful operation of a JIT system.

(5 Marks)

(f) A nursing home uses incremental budgeting. The previous period's budget is adjusted by reference to a set of indices. It is adjusted firstly for 'volume changes' and then for changes in the cost of resources. The indices are referenced to the previous period's budget by using that budget as the base index number of 100. The index numbers to be used to prepare Period 3's budget from that of Period 2 are as follows:

	Index
Patient days	90
House-keeping costs	106
Nursing costs	105
Administration costs	104

The budget for Period 2 was:

	£
House-keeping costs (all variable)	125,000
Nursing costs (see below)	324,000
Administration costs (all fixed)	100,000

Nursing costs are semi-variable. The nursing costs for Period 2 were adjusted from the total nursing costs of £280,000 for Period 1 by using a Patient days index of 125 and a Nursing costs index of 108.

Prepare the budget for Period 3.

(5 marks)

(Total for Question Two = 30 marks)

(Total for Section B = 30 marks)

TURN OVER

SECTION C – 30 MARKS

[the indicative time for answering this section is 54 minutes]

ANSWER *ONE* OF THE TWO QUESTIONS

Question Three

WC is a company that installs kitchens and bathrooms for customers who are renovating their houses. The installations are either pre-designed 'off the shelf' packages or highly customised designs for specific jobs.

The company operates with three divisions: Kitchens, Bathrooms and Central Services. The Kitchens and Bathrooms divisions are profit centres but the Central Services division is a cost centre. The costs of the Central Services division, which are thought to be predominantly fixed, include those incurred by the design, administration and finance departments. The Central Services costs are charged to the other divisions based on the budgeted Central Services costs and the budgeted number of jobs to be undertaken by the other two divisions.

The budgeting and reporting system of WC is not very sophisticated and does not provide much detail for the Directors of the company.

Budget details

The budgeted details for last year were:

	Kitchens	*Bathrooms*
Number of jobs	4,000	2,000
	$	*$*
Average price per job	10,000	7,000
Average direct costs per job	5,500	3,000
Central Services recharge per job	2,500	2,500
Average profit per job	2,000	1,500

Actual details

The actual results were as follows:

	Kitchens	*Bathrooms*
Number of jobs	2,600	2,500
	$	*$*
Average price per job	13,000	6,100
Average direct costs per job	8,000	2,700
Central Services recharge per job	2,500	2,500
Average profit per job	2,500	900

The actual costs for the Central Services division were $17·5 million.

The requirements for Question Three are on the opposite page

Required:

(a) Calculate the budgeted and actual profits for each of the profit centres and for the whole company for the year.

(4 marks)

(b) Calculate the sales price variances and the sales mix profit and sales quantity profit variances.

(6 marks)

(c) Prepare a statement that reconciles the budgeted and actual profits and shows appropriate variances in as much detail as possible.

(10 marks)

(d) Using the statement that you prepared in part *(c)* above, discuss

(i) the performance of the company for the year; and
(ii) potential changes to the budgeting and reporting system that would improve performance evaluation within the company.

(10 marks)

(Total for Question Three = 30 marks)

Section C continues on the next page

Question Four

A multinational computer manufacturer has a number of autonomous subsidiaries throughout the world. Two of the group's subsidiaries are in America and Europe. The American subsidiary assembles computers using chips that it purchases from local companies. The European subsidiary manufactures exactly the same chips that are used by the American subsidiary but currently only sells them to numerous external companies throughout Europe. Details of the two subsidiaries are given below.

America

The American subsidiary buys the chips that it needs from a local supplier. It has negotiated a price of $90 per chip. The production budget shows that 300,000 chips will be needed next year.

Europe

The chip production subsidiary in Europe has a capacity of 800,000 chips per year. Details of the budget for the forthcoming year are as follows:

Sales	600,000 chips
	$ per chip
Selling price	105
Variable costs	60

The fixed costs of the subsidiary at the budgeted output of 600,000 chips are $20 million per year but they would rise to $26 million if output exceeds 625,000 chips.

Note: The maximum external demand is 600,000 chips per year and the subsidiary has no other uses for the current spare capacity.

Group Directive

The Managing Director of the group has reviewed the budgets of the subsidiaries and has decided that in order to improve the profitability of the group the European subsidiary should supply chips to the American subsidiary. She is also thinking of linking the salaries of the subsidiary managers to the performance of their subsidiaries but is unsure which performance measure to use. Two measures that she is considering are "profit" and the "return on assets consumed" (where the annual fixed costs would be used as the "assets consumed").

The Manager of the European subsidiary has offered to supply the chips at a price of $95 each. He has offered this price because it would earn the same contribution per chip that would be earned on external sales (this is after adjusting for increased distribution costs and reduced customer servicing costs).

The requirements for Question Four are on the opposite page

Required:

(a) Assume that the 300,000 chips are supplied by the European subsidiary at a transfer price of $95 per chip. Calculate the impact of the profits on each of the subsidiaries and the group.

(5 marks)

(b) Calculate the minimum unit price at which the European subsidiary would be willing to transfer the 300,000 chips to the American subsidiary if the performance and salary of the Manager of the subsidiary is to be based on

(i) the profit of the subsidiary (currently $7 million)
(ii) the return on assets consumed by the subsidiary (currently 35%).

(9 marks)

(c) Write a report to the Managing Director of the group that discusses issues raised by the directive and the introduction of performance measures. (You should use your answers to parts *(a)* and *(b)*, where appropriate, to illustrate points in your report).

(10 marks)

(d) Briefly explain how multi-national companies can use transfer pricing to reduce their overall tax charge and the steps that national tax authorities have taken to discourage the manipulation of transfer prices.

(6 marks)
(Total for Question Four = 30 marks)

(Total for Section C = 30 marks)

End of question paper
Maths Tables and Formulae are on pages 17 to 21

TURN OVER

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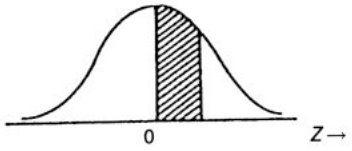
AREA UNDER THE NORMAL CURVE

This table gives the area under the normal curve between the mean and a point Z standard deviations above the mean. The corresponding area for deviations below the mean can be found by symmetry.



$Z = \frac{(x-\mu)}{\sigma}$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0159	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4430	.4441
1.6	.4452	.4463	.4474	.4485	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4762	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4865	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4980	.4980	.4981
2.9	.4981	.4982	.4983	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	**.49865**	.4987	.4987	.4988	.4988	.4989	.4989	.4989	,4990	,4990
3.1	**.49903**	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	**.49931**	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	**.49952**	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	**.49966**	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	**.49977**									

PRESENT VALUE TABLE

Present value of \$1, that is $(1+r)^{-n}$ where r = interest rate; n = number of periods until payment or receipt.

Periods (n)	Interest rates (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.837	0.790	0.746	0705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180
19	0.828	0.686	0.570	0.475	0.396	0.331	0.277	0.232	0.194	0.164
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149

Periods (n)	Interest rates (r)									
	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.079	0.065
16	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054
17	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045
18	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038
19	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031
20	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026

Cumulative present value of $1 per annum, Receivable or Payable at the end of each year for *n* years $\frac{1-(1+r)^{-n}}{r}$

Periods (*n*)	Interest rates (*r*)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.679	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365
20	18.046	16.351	14.878	13.590	12.462	11.470	10.594	9.818	9.129	8.514

Periods (*n*)	Interest rates (*r*)									
	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	6.492	6.194	5.918	5.660	5.421	5.197	4.988	7.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

Formulae

PROBABILITY

$A \cup B$ = ***A* or *B***. $A \cap B$ = ***A* and *B*** (overlap).

$P(B \mid A)$ = probability of *B*, **given** *A*.

Rules of Addition

If *A* and *B* are mutually exclusive: $P(A \cup B) = P(A) + P(B)$

If *A* and *B* are **not** mutually exclusive: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Rules of Multiplication

If *A* and *B* are *independent*: $P(A \cap B) = P(A) * P(B)$

If *A* and *B* are **not** *independent*: $P(A \cap B) = P(A) * P(B \mid A)$

$E(X) = \sum$ (probability * payoff)

Quadratic Equations

If $aX^2 + bX + c = 0$ is the general quadratic equation, the two solutions (roots) are given by:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

DESCRIPTIVE STATISTICS

Arithmetic Mean

$$\bar{x} = \frac{\sum x}{n} \qquad \bar{x} = \frac{\sum fx}{\sum f} \quad \text{(frequency distribution)}$$

Standard Deviation

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \qquad \text{SD} = \sqrt{\frac{\sum \text{fx}^2}{\sum \text{f}} - \overline{\text{x}^2}} \quad \text{(frequency distribution)}$$

INDEX NUMBERS

Price relative = 100 * P_1/P_0 Quantity relative = 100 * Q_1/Q_0

Price: $$\frac{\sum \text{w} * \left(\frac{\text{P}_1}{\text{P}_o}\right)}{\sum \text{w}} \text{x}\,100$$

Quantity: $$\frac{\sum w * \left(\frac{Q_1}{Q_o}\right)}{\sum w} \text{x}\,100$$

TIME SERIES

Additive Model

Series = Trend + Seasonal + Random

Multiplicative Model

Series = Trend * Seasonal * Random

LINEAR REGRESSION AND CORRELATION

The linear regression equation of Y on X is given by:

$$Y = a + bX \quad or \quad Y - \overline{Y} = b(X - \overline{X})$$

where

$$b = \frac{\text{Covariance (XY)}}{\text{Variance (X)}} = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

and

$$a = \overline{Y} - b\overline{X}$$

or solve

$$\sum Y = na + b\sum X$$
$$\sum XY = a\sum X + b\sum X^2$$

Coefficient of correlation

$$r = \frac{\text{Covariance (XY)}}{\sqrt{\text{Var(X).Var(Y)}}} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{\{n\sum X^2 - (\sum X)^2\}\{n\sum Y^2 - (\sum Y)^2\}}}$$

$$\text{R(rank)} = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

FINANCIAL MATHEMATICS

Compound Interest (Values and Sums)

Future Value S, of a sum of X, invested for n periods, compounded at r% interest

$$S = X[1 + r]^n$$

Annuity

Present value of an annuity of £1 per annum receivable or payable for n years, commencing in one year, discounted at r% per annum:

$$PV = \frac{1}{r}\left[1 - \frac{1}{[1+r]^n}\right]$$

Perpetuity

Present value of £1 per annum, payable or receivable in perpetuity, commencing in one year, discounted at r% per annum:

$$PV = \frac{1}{r}$$

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LIST OF VERBS USED IN THE QUESTION REQUIREMENTS

A list of the learning objectives and verbs that appear in the syllabus and in the question requirements for each question in this paper.

It is important that you answer the question according to the definition of the verb.

LEARNING OBJECTIVE	VERBS USED	DEFINITION
1 KNOWLEDGE		
What you are expected to know.	List	Make a list of
	State	Express, fully or clearly, the details of/facts of
	Define	Give the exact meaning of
2 COMPREHENSION		
What you are expected to understand.	Describe	Communicate the key features
	Distinguish	Highlight the differences between
	Explain	Make clear or intelligible/State the meaning of
	Identify	Recognise, establish or select after consideration
	Illustrate	Use an example to describe or explain something
3 APPLICATION		
How you are expected to apply your knowledge.	Apply	To put to practical use
	Calculate/compute	To ascertain or reckon mathematically
	Demonstrate	To prove with certainty or to exhibit by practical means
	Prepare	To make or get ready for use
	Reconcile	To make or prove consistent/compatible
	Solve	Find an answer to
	Tabulate	Arrange in a table
4 ANALYSIS		
How you are expected to analyse the detail of what you have learned.	Analyse	Examine in detail the structure of
	Categorise	Place into a defined class or division
	Compare and contrast	Show the similarities and/or differences between
	Construct	To build up or compile
	Discuss	To examine in detail by argument
	Interpret	To translate into intelligible or familiar terms
	Produce	To create or bring into existence
5 EVALUATION		
How you are expected to use your learning to evaluate, make decisions or recommendations.	Advise	To counsel, inform or notify
	Evaluate	To appraise or assess the value of
	Recommend	To advise on a course of action

Management Accounting Pillar

Managerial Level

P1 – Management Accounting – Performance Evaluation

November 2007

Tuesday Morning Session