Management Accounting Pillar

Managerial Level Paper

P1 – Management Accounting – Performance Evaluation

24 May 2005 – 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, make annotations 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 this reading time.
You are strongly advised to carefully read the question requirement before attempting the question concerned. The requirements for the questions in Section C are contained in a dotted box.
Answer the ONE compulsory question in Section A. This is comprised of 19 sub-questions and is on pages 2 to 9.
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.
Write your full examination number, paper number and the examination subject title in the spaces provided on the front of the examination 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.

SECTION A – 50 MARKS

[the indicative time for answering this section is 90 minutes]

ANSWER *ALL* NINETEEN SUB-QUESTIONS

Instructions for answering Section A:

The answers to the nineteen 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 sub-questions **1.11 to 1.18** you should show your workings as marks are available for the method you use to answer these sub-questions.

Question One

The following data are given for sub-questions 1.1 and 1.2 below.

Summary financial statements are given below for one division of a large divisionalised company.

Summary Divisional Financial Statements for the year to 31 December

Balance sheet		*Income statement*	
	£000		*£000*
Non-current assets	1,500	Revenue	4,000
Current assets	600	Operating costs	3,600
Total assets	2,100	Operating profit	400
		Interest paid	70
Divisional equity	1,000	Profit before tax	330
Long-term borrowings	700		
Current liabilities	400		
Total equity and liabilties	2,100		

The cost of capital for the division is estimated at 12% each year.
Annual rate of interest on the long term loans is 10%.
All decisions concerning the division's capital structure are taken by central management.

1.1 The divisional Return on Investment (ROI) for the year ended 31 December is

A 19·0%

B 19·4%

C 23·5%

D 33·0%

(2 marks)

Sub-question 1.2 is on the opposite page

1.2 The divisional Residual Income (RI) for the year ended 31 December is

A £160,000

B £196,000

C £230,000

D £330,000

(2 marks)

The following data are given for sub-questions 1.3 and 1.4 below

X40 is one of many items produced by the manufacturing division. Its standard cost is based on estimated production of 10,000 units per month. The standard cost schedule for one unit of X40 shows that 2 hours of direct labour are required at £15 per labour hour. The variable overhead rate is £6 per direct labour hour. During April, 11,000 units were produced; 24,000 direct labour hours were worked and charged; £336,000 was spent on direct labour; and £180,000 was spent on variable overheads.

1.3 The direct labour rate variance for April is

A £20,000 Favourable

B £22,000 Favourable

C £24,000 Adverse

D £24,000 Favourable

(2 marks)

1.4 The variable overhead efficiency variance for April is

A £12,000 Adverse

B £12,000 Favourable

C £15,000 Adverse

D £15,000 Favourable

(2 marks)

TURN OVER

1.5 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)

1.6 Summary results for Y Limited for March are shown below.

	£000	*Units*
Sales revenue	820	
Variable production costs	300	
Variable selling costs	105	
Fixed production costs	180	
Fixed selling costs	110	
Production in March		1,000
Opening inventory		0
Closing inventory		150

Using ***marginal costing***, the profit for March was

A £170,000

B £185,750

C £197,000

D £229,250

(2 marks)

1.7 The CIMA definition of zero-based budgeting is set out below, with two blank sections.

"Zero-based budgeting: A method of budgeting which requires each cost element _____, as though the activities to which the budget relates _____."

Which combination of two phrases correctly completes the definition?

	Blank 1	*Blank 2*
A	to be specifically justified	could be out-sourced to an external supplier
B	to be set at zero	could be out-sourced to an external supplier
C	to be specifically justified	were being undertaken for the first time
D	to be set at zero	were being undertaken for the first time

(2 marks)

1.8 *Definition A*: "A technique where the primary goal is to maximise throughput while simultaneously maintaining or decreasing inventory and operating costs."

Definition B: "A system whose objective is to produce or procure products or components as they are required by a customer or for use, rather than for inventory."

Which of the following pairs of terms correctly matches the definitions A and B above?

	Definition A	*Definition B*
A	Manufacturing resource planning	Just-in-time
B	Enterprise resource planning	Material requirements planning
C	Optimised production technology	Enterprise resource planning
D	Optimised production technology	Just-in-time

(2 marks)

1.9 Division P produces plastic mouldings, all of which are used as components by Division Q. The cost schedule for one type of moulding – item 103 – is shown below.

Direct material cost per unit	£3·00
Direct labour cost per unit	£4·00
Variable overhead cost per unit	£2·00
Fixed production overhead costs each year	£120,000
Annual demand from Division Q is expected to be	20,000 units

Two methods of transfer pricing are being considered:

(i) Full production cost plus 40%
(ii) A two-part tariff with a fixed fee of £200,000 each year

The transfer price per unit of item 103 transferred to Division Q using both of the transfer pricing methods listed above is

	(i) Full production cost plus 40%	*(ii) Two-part tariff*
A	£21·00	£9
B	£21·00	£15
C	£15·00	£19
D	£12·60	£9

(2 marks)

Section A continues on the next page

1.10 Which of the following statements is/are true?

(i) Computer-integrated manufacturing (CIM) brings together advanced manufacturing technology and modern quality control into a single computerised coherent system.

(ii) Flexible manufacturing systems (FMS) are simple systems with low levels of automation that offer great flexibility through a skilled workforce working in teams.

(iii) Electronic data interchange (EDI) is primarily designed to allow the operating units in an organisation to communicate immediately and automatically with the sales and purchasing functions within the organisation.

A (i) only

B (i) and (ii) only

C (i) and (iii) only

D (ii) and (iii) only

(2 marks)

1.11 D Limited manufactures and sells musical instruments, and uses a standard cost system. The budget for production and sale of one particular drum for April was 600 units at a selling price of £72 each. When the sales director reviewed the results for April in the light of the market conditions that had been experienced during the month, she believed that D Limited should have sold 600 units of this drum at a price of £82 each. The actual sales achieved were 600 units at £86 per unit.

Calculate the following variances for this particular drum for April:

(a) Selling price planning variance
(b) Selling price operating variance

(4 marks)

1.12 A plastics company operates a process in which all materials are added at the beginning of the process. At the beginning of March, the work-in-process in a plastic moulding machine was 200 units, which were 25% complete with respect to conversion costs. During March, 1,400 units were completed and transferred to the next process. Also during March, 50 units were scrapped due to an operator error at the end of the process, although it is unusual for this to occur. At the end of March, there were 200 units in process, which were 50% complete with respect to conversion costs.

Using the First-in-First-out (FIFO) method, calculate the equivalent units of production for the month of March that would be used in the computation of the cost per equivalent unit for

(a) Material costs
(b) Conversion costs

(4 marks)

1.13 A company has a process in which the standard mix for producing 9 litres of output is as follows:

	$
4·0 litres of D at $9 per litre	36·00
3·5 litres of E at $5 per litre	17·50
2·5 litres of F at $2 per litre	5·00
	58·50

A standard loss of 10% of inputs is expected to occur. The actual inputs for the latest period were:

	$
4,300 litres of D at $9·00 per litre	38,700
3,600 litres of E at $5·50 per litre	19,800
2,100 litres of F at $2·20 per litre	4,620
	63,120

Actual output for this period was 9,100 litres.

You are required to calculate

(a) the total materials mix variance
(b) the total materials yield variance

(4 marks)

Section A continues on the next page

TURN OVER

The following data are given for sub-questions 1.14 to 1.16 below

SM makes two products, Z1 and Z2. Its machines can only work on one product at a time. The two products are worked on in two departments by differing grades of labour. The labour requirements for the two products are as follow:

	Minutes per unit of product	
	Z1	*Z2*
Department 1	12	16
Department 2	20	15

There is currently a shortage of labour and the maximum times available each day in Departments 1 and 2 are 480 minutes and 840 minutes, respectively.

The current selling prices and costs for the two products are shown below:

	Z1	*Z2*
	£ per unit	*£ per unit*
Selling price	50·00	65·00
Direct materials	10·00	15·00
Direct labour	10·40	6·20
Variable overheads	6·40	9·20
Fixed overheads	12·80	18·40
Profit per unit	10·40	16·20

As part of the budget-setting process, SM needs to know the optimum output levels. All output is sold.

1.14 Calculate the maximum number of each product that could be produced each day, and identify the limiting factor/bottleneck.

(3 marks)

1.15 Using traditional contribution analysis, calculate the 'profit-maximising' output each day, and the contribution at this level of output.

(3 marks)

1.16 Using a throughput approach, calculate the 'throughput-maximising' output each day, and the 'throughput contribution' at this level of output.

(3 marks)

1.17 A is a food processing company. The following data have been produced for one of its processes for April. There were no inventories in the process at the beginning or end of the month.

	£
Inputs: 2,400kg at £8 per kg	19,200
Process costs	4,800
Transferred to packing department: 2,060kg	22,889

There is usually a loss of 10% by weight of inputs during the process. The normal loss does not have a sale value.

During April there was an abnormal loss that was sold for £400.

Prepare the Process Account and the Abnormal Loss Account to record the events that occurred in this process during April.

(4 marks)

The following data are given for sub-questions 1.18 and 1.19 below

The summarised financial statements for P Limited, a potential major supplier, are shown below. Before a contract is signed, the financial performance of P Limited is to be reviewed.

Summary Balance Sheets for P Limited at year end

	2003	*2002*
	£000	*£000*
Non-current assets	1,600	1,400
Inventories	300	280
Trade receivables	200	210
Cash	50	10
Trade payables	(280)	(290)
Long-term borrowings	(900)	(800)
Net assets	970	810
Share capital	600	600
Retained earnings	370	210
	970	810

Summary Income Statements for the years

	2003	*2002*
	£000	*£000*
Sales	3,000	2,500
Cost of sales	1,600	1,300
Operating profit	600	450

1.18 Calculate the following financial statistics for P Limited for 2003

(a) Receivables days
(b) Payables days
(c) Inventory days

(3 marks)

1.19 Calculate the following financial statistics for P Limited for 2003

(a) Current ratio
(b) Acid test (quick ratio)

(2 marks)

(Total for Section A = 50 marks)

End of Section A

Section B starts on the next page

TURN OVER

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

(a) A general insurance company is about to implement a Balanced Scorecard. You are required to

(i) State the ***four*** perspectives of a Balanced Scorecard; and
(ii) Recommend ***one*** performance measure that would be appropriate for a general insurance company, for ***each*** of the four perspectives, and give a reason to support each measure. (You must recommend one measure only for each perspective.)

(5 marks)

(b) (i) Briefly explain the main features of Economic Value Added (EVA®) as it would be used to assess the performance of divisions.

(2 marks)

(ii) Briefly explain how the use of EVA® to assess divisional performance might affect the behaviour of divisional senior executives.

(3 marks)

(c) Briefly discuss ***three*** different circumstances where participation in setting budgets is likely to contribute to ***poor*** performance from managers.

(5 marks)

(d) W Limited designs and sells computer games. There are many other firms in this industry. For the last five years the senior management has required detailed budgets to be produced for each year with slightly less detailed plans for the following two years. The managing director of W Limited has recently attended a seminar on budgeting and heard the 'Beyond Budgeting' arguments that have been advanced by Hope and Fraser, among others.

You are required to

(i) Briefly describe the 'Beyond Budgeting' approach; and

(2 marks)

(ii) Advise the management of W Limited whether or not it should change its current budgeting system to a 'Beyond Budgeting' approach.

(3 marks)

Sub-questions (e) and (f) are on the opposite page

The following information is to be used to answer sub-questions (e) and (f)

C plc is a large company that manufactures and sells wooden garden furniture. It has three divisions:

The *Wood Division (WD)* purchases logs and produces finished timber as planks or beams. Approximately two-thirds of its output is sold to the Products Division, with the remainder sold on the open market.

The *Products Division* (PD) manufactures wooden garden furniture. The policy of C plc is that the PD must buy all its timber from the WD and sell all its output to the Trading Division.

The *Trading Division* (TD) sells wooden garden furniture to garden centres, large supermarkets, and similar outlets. It only sells items purchased from PD.

The current position is that all three divisions are profit centres and C plc uses Return on Investment (ROI) measures as the primary means to assess divisional performance. Each division adopts a cost-plus pricing policy for external sales and for internal transfers between divisions. The senior management of C plc has stated that the divisions should consider themselves to be independent businesses as far as possible.

(e) For each division suggest, with reasons, the behavioural consequences that might arise as a result of the current policy for the structure and performance evaluation of the divisions.

(5 marks)

(f) The senior management of C plc has requested a review of the cost-plus transfer pricing policy that is currently used.

Suggest with reasons, an appropriate transfer pricing policy that could be used for transfers **from PD to TD**, indicating any problems that may arise as a consequence of the policy you suggest.

(5 marks)
(Total for Question Two = 30 marks)

(Total for Section B = 30 marks)

End of Section B

Section C starts on the next page

TURN OVER

SECTION C – 20 MARKS

[the indicative time for answering this section is 36 minutes]

ANSWER *ONE* OF THE TWO QUESTIONS

Question Three

F plc supplies pharmaceutical drugs to drug stores. Although the company makes a satisfactory return, the directors are concerned that some orders are profitable and others are not. The management has decided to investigate a new budgeting system using activity based costing principles to ensure that all orders they accept are making a profit.

Each customer order is charged as follows. Customers are charged the list price of the drugs ordered plus a charge for selling and distribution costs (overheads). A profit margin is also added, but that does not form part of this analysis.

Currently F plc uses a simple absorption rate to absorb these overheads. The rate is calculated based on the budgeted annual selling and distribution costs and the budgeted annual total list price of the drugs ordered.

An analysis of customers has revealed that many customers place frequent small orders with each order requesting a variety of drugs. The management of F plc has examined more carefully the nature of its selling and distribution costs, and the following data have been prepared for the budget for next year:

Total list price of drugs supplied	£8m	
Number of customer orders	8,000	
Selling and Distribution Costs	*£000*	*Cost driver*
Invoice processing	280	See Note 2
Packing	220	Size of package – see Note 3
Delivery	180	Number of deliveries – see Note 4
Other overheads	200	Number of orders
Total overheads	880	

Notes:

1. Each order will be shipped in one package and will result in one delivery to the customer and one invoice (an order never results in more than one delivery).

2. Each invoice has a different line for each drug ordered. There are 28,000 invoice lines each year. It is estimated that 25% of invoice processing costs are related to the number of invoices, and 75% are related to the number of invoice lines.

3. Packing costs are £32 for a large package, and £25 for a small package.

4. The delivery vehicles are always filled to capacity for each journey. The delivery vehicles can carry either 6 large packages or 12 small packages (or appropriate combinations of large and small packages). It is estimated that there will be 1,000 delivery journeys each year, and the total delivery mileage that is specific to particular customers is estimated at 350,000 miles each year. £40,000 of delivery costs are related to loading the delivery vehicles, and the remainder of these costs are related to specific delivery distance to customers.

The management has asked for two typical orders to be costed using next year's budget data, using the current method, and the proposed activity-based costing approach. Details of two typical orders are shown below:

	Order A	*Order B*
Lines on invoice	2	8
Package size	small	large
Specific delivery distance	8 miles	40 miles
List price of drugs supplied	£1,200	£900

Required:

(a) Calculate the charge for selling and distribution overheads for Order A and Order B using:

(i) the current system; and
(ii) the activity-based costing approach.

(10 marks)

(b) Write a report to the management of F plc in which you

(i) assess the strengths and weaknesses of the proposed activity-based costing approach for F plc; and

(5 marks)

(ii) recommend actions that the management of F plc might consider in the light of the data produced using the activity-based-costing approach.

(5 marks)

(Total for requirement (b) = 10 marks)

(Total for Question Three = 20 marks)

Section C continues on the next page

Question Four

S Limited installs complex satellite navigation systems in cars, at a very large national depot. The standard cost of an installation is shown below. The budgeted volume is 1,000 units installed each month**.** The operations manager is responsible for three departments, namely: purchasing, fitting and quality control. S Limited purchases navigation systems and other equipment from different suppliers, and most items are imported. The fitting of different systems takes differing amounts of time, but the differences are not more than 25% from the average, so a standard labour time is applied.

Standard cost of installation of one navigation system

	£	*Quantity*	*Price (£)*
Materials	400	1 unit	400
Labour	320	20 hours	16
Variable overheads	140	20 hours	7
Fixed overheads	300	20 hours	15
Total standard cost	1,160		

The Operations Department has gathered the following information over the last few months. There are significant difficulties in retaining skilled staff. Many have left for similar but better paid jobs and as a result there is a high labour turnover. Exchange rates have moved and commentators have argued this will make exports cheaper, but S Limited has no exports and has not benefited. Some of the fitters have complained that one large batch of systems did not have the correct adapters and would not fit certain cars, but this was not apparent until fitting was attempted. Rent, rates, insurance and computing facilities have risen in price noticeably.

The financial results for September to December are shown below.

Operating Statement for S Limited for September to December

	September £	*October* £	*November* £	*December* £	*4 months* £
Standard cost of actual output	1,276,000	1,276,000	1,102,000	1,044,000	4,698,000
Variances					
Materials					
Price	5,505F	3,354F	9,520A	10,340A	11,001A
Usage	400A	7,200A	800A	16,000A	24,400A
Labour					
Rate	4,200A	5,500A	23,100A	24,000A	56,800A
Efficiency	16,000F	0	32,000A	32,000A	48,000A
Variable overheads					
Expenditure	7,000A	2,000A	2,000F	0	7,000A
Efficiency	7,000F	0	14,000A	14,000A	21,000A
Fixed overheads					
Expenditure	5,000A	10,000A	20,000A	20,000A	55,000A
Volume	30,000F	30,000F	15,000A	30,000A	15,000F
Actual costs	1,234,095	1,267,346	1,214,420	1,190,340	4,906,201

A = adverse variance F = favourable variance

Required:

(a) Prepare a report to the operations manager of S Limited commenting on the performance of the company for the four months to 31 December. State probable causes for the key issues you have included in your report and state the further information that would be helpful in assessing the performance of the company.

(15 marks)

(b) Prepare a short report to the operations manager of S Limited suggesting ways that the budgeting system could be used to increase motivation and improve performance.

(5 marks)

(Total for Question Four = 20 marks)

(Total for Section C = 20 marks)

End of question paper

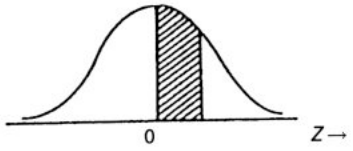
Maths Tables and Formulae are on pages 17 to 21

TURN OVER

[this page is blank]

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	Interest rates (r)									
(n)	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	Interest rates (r)									
(n)	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	Interest rates (*r*)									
(*n*)	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	Interest rates (*r)*									
(*n*)	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

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

INDEX NUMBERS

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

Price: $$\frac{\sum w * \left(\frac{p_1}{P_o}\right)}{\sum w} \text{ x } 100$$

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:

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

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

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

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

FINANCIAL MATHEMATICS

Compound Interest (Values and Sums)

Future Value of 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:

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

[this page is blank]

[this page is blank]

Management Accounting Pillar

Managerial Level

P1 – Management Accounting – Performance Evaluation

May 2005

Tuesday Morning Session