



Management Accounting Pillar

Managerial Level Paper

P1 – Management Accounting – Performance Evaluation

21 November 2006 – 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 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.
Answer the ONE compulsory question in Section A. This has 18 sub-questions and is on pages 2 to 10.
Answer ALL SIX compulsory sub-questions in Section B on pages 12 and 13.
Answer ONE of the two questions in Section C on pages 15 to 17.
Maths Tables and Formulae are provided on pages 19 to 23. 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.

TURN OVER

P1 – Performance Evaluation

SECTION A – 50 MARKS

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

ANSWER ALL EIGHTEEN SUB-QUESTIONS

Instructions for answering Section A:

The answers to the eighteen 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 1.18** 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 to 1.3 below

A company uses standard absorption costing. The following information was recorded by the company for October:

	<i>Budget</i>	<i>Actual</i>
Output and sales (units)	8,700	8,200
Selling price per unit	£26	£31
Variable cost per unit	£10	£10
Total fixed overheads	£34,800	£37,000

1.1 The sales price variance for October was

- A £38,500 favourable
- B £41,000 favourable
- C £41,000 adverse
- D £65,600 adverse

(2 marks)

Section A continues on the opposite page

1.2 The sales volume profit variance for October was

- A** £6,000 adverse
- B** £6,000 favourable
- C** £8,000 adverse
- D** £8,000 favourable

(2 marks)

1.3 The fixed overhead volume variance for October was

- A** £2,000 adverse
- B** £2,200 adverse
- C** £2,200 favourable
- D** £4,200 adverse

(2 marks)

1.4 A master budget comprises the

- A** budgeted income statement and budgeted cash flow only.
- B** budgeted income statement and budgeted balance sheet only.
- C** budgeted income statement and budgeted capital expenditure only.
- D** budgeted income statement, budgeted balance sheet and budgeted cash flow only.

(2 marks)

Section A continues on the next page

TURN OVER

The following data are given for sub-questions 1.5 and 1.6 below

The annual operating statement for a company is shown below:

	<i>£000</i>
Sales revenue	800
Less variable costs	<u>390</u>
Contribution	410
Less fixed costs	90
Less depreciation	<u>20</u>
Net income	<u>300</u>
Assets	£6.75m

The cost of capital is 13% per annum.

1.5 The return on investment (ROI) for the company is closest to

- A** 4.44%
- B** 4.74%
- C** 5.77%
- D** 6.07%

(2 marks)

1.6 The residual income (RI) for the company is closest to

- £000*
- A** (467)
 - B** (487)
 - C** (557)
 - D** (577)

(2 marks)

Section A continues on the opposite page

- 1.7** A company has reported annual operating profits for the year of £89·2m after charging £9·6m for the full development costs of a new product that is expected to last for the current year and two further years. The cost of capital is 13% per annum. The balance sheet for the company shows fixed assets with a historical cost of £120m. A note to the balance sheet estimates that the replacement cost of these fixed assets at the beginning of the year is £168m. The assets have been depreciated at 20% per year.

The company has a working capital of £27·2m.

Ignore the effects of taxation.

The Economic Value Added[®] (EVA) of the company is closest to

- A** £64·16m
- B** £70·56m
- C** £83·36m
- D** £100·96m

(2 marks)

-
- 1.8** Which of the following definitions are correct?

- (i) Just-in-time (JIT) systems are designed to produce or procure products or components as they are required for a customer or for use, rather than for inventory;
- (ii) Flexible manufacturing systems (FMS) are integrated, computer-controlled production systems, capable of producing any of a range of parts and of switching quickly and economically between them;
- (iii) Material requirements planning (MRP) systems are computer based systems that integrate all aspects of a business so that the planning and scheduling of production ensures components are available when needed.

- A** (i) only
- B** (i) and (ii) only
- C** (i) and (iii) only
- D** (ii) and (iii) only

(2 marks)

Section A continues on the next page

TURN OVER

1.9 RJD Ltd operates a standard absorption costing system. The following fixed production overhead data is available for one month:

Budgeted output	200,000	units
Budgeted fixed production overhead	£1,000,000	
Actual fixed production overhead	£1,300,000	
Total fixed production overhead variance	£100,000	Adverse

The actual level of production was

- A** 180,000 units.
- B** 240,000 units.
- C** 270,000 units.
- D** 280,000 units.

(2 marks)

1.10 WTD Ltd produces a single product. The management currently uses marginal costing but is considering using absorption costing in the future.

The budgeted fixed production overheads for the period are £500,000. The budgeted output for the period is 2,000 units. There were 800 units of opening inventory at the beginning of the period and 500 units of closing inventory at the end of the period.

If absorption costing principles were applied, the profit for the period compared to the marginal costing profit would be

- A** £75,000 higher.
- B** £75,000 lower.
- C** £125,000 higher.
- D** £125,000 lower.

(2 marks)

Section A continues on the opposite page

- 1.11 JJ Ltd manufactures three products: W, X and Y. The products use a series of different machines but there is a common machine that is a bottleneck.

The standard selling price and standard cost per unit for each product for the forthcoming period are as follows:

	W £	X £	Y £
Selling price	200	150	150
Cost			
Direct materials	41	20	30
Labour	30	20	36
Overheads	<u>60</u>	<u>40</u>	<u>50</u>
Profit	<u>69</u>	<u>70</u>	<u>34</u>
Bottleneck machine – minutes per unit	9	10	7

40% of the overhead cost is classified as variable

Using a throughput accounting approach, what would be the ranking of the products for best use of the bottleneck?

(3 marks)

- 1.12 X Ltd has two production departments, Assembly and Finishing, and two service departments, Stores and Maintenance.

Stores provides the following service to the production departments: 60% to Assembly and 40% to Finishing.

Maintenance provides the following service to the production and service departments: 40% to Assembly, 45% to Finishing and 15% to Stores.

The budgeted information for the year is as follows:

Budgeted fixed production overheads	
Assembly	£100,000
Finishing	£150,000
Stores	£ 50,000
Maintenance	£ 40,000
Budgeted output	100,000 units

At the end of the year after apportioning the service department overheads, the total fixed production overheads debited to the Assembly department's fixed production overhead control account were £180,000.

The actual output achieved was 120,000 units.

Calculate the under/over absorption of fixed production overheads for the Assembly department.

(4 marks)

Section A continues on the next page

TURN OVER

- 1.13** A company simultaneously produces three products (X, Y and Z) from a single process. X and Y are processed further before they can be sold; Z is a by-product that is sold immediately for \$6 per unit without incurring any further costs. The sales prices of X and Y after further processing are \$50 per unit and \$60 per unit respectively.

Data for October are as follows:

	\$
Joint production costs that produced 2,500 units of X, 3,500 units of Y and 3,000 units of Z	140,000
Further processing costs for 2,500 units of X	24,000
Further processing costs for 3,500 units of Y	46,000

Joint costs are apportioned using the final sales value method.

Calculate the total cost of the production of X for October.

(3 marks)

- 1.14** ZP Plc operates two subsidiaries, X and Y. X is a component manufacturing subsidiary and Y is an assembly and final product subsidiary. Both subsidiaries produce one type of output only. Subsidiary Y needs one component from subsidiary X for every unit of Product W produced. Subsidiary X transfers to Subsidiary Y all of the components needed to produce Product W. Subsidiary X also sells components on the external market.

The following budgeted information is available for each subsidiary:

	X	Y
Market price per component	\$800	
Market price per unit of W		\$1,200
Production costs per component	\$600	
Assembly costs per unit of W		\$400
Non production fixed costs	\$1.5m	\$1.3m
External demand	10,000 units	12,000 units
Capacity	22,000 units	
Taxation rates	25%	30%

The production cost per component is 60% variable. The fixed production costs are absorbed based on budgeted output.

X sets a transfer price at marginal cost plus 70%.

Calculate the post tax profit generated by each subsidiary.

(4 marks)

1.15 PP Ltd operates a standard absorption costing system. The following information has been extracted from the standard cost card for one of its products:

Budgeted production	1,500 units
Direct material cost: 7 kg x £4.10	£28.70 per unit

Actual results for the period were as follows:

Production	1,600 units
Direct material (purchased and used): 12,000 kg	£52,200

It has subsequently been noted that due to a change in economic conditions the best price that the material could have been purchased for was £4.50 per kg during the period.

- (i) Calculate the material price planning variance.
- (ii) Calculate the operational material usage variance.

(4 marks)

1.16 CJD Ltd manufactures plastic components for the car industry. The following budgeted information is available for three of their key plastic components:

	<i>W</i>	<i>X</i>	<i>Y</i>
	<i>£ per unit</i>	<i>£ per unit</i>	<i>£ per unit</i>
Selling price	200	183	175
Direct material	50	40	35
Direct labour	30	35	30
Units produced and sold	10,000	15,000	18,000

The total number of activities for each of the three products for the period is as follows:

Number of purchase requisitions	1,200	1,800	2,000
Number of set ups	240	260	300

Overhead costs have been analysed as follows:

Receiving/inspecting quality assurance	£1,400,000
Production scheduling/machine set up	£1,200,000

Calculate the budgeted profit per unit for each of the three products using activity based budgeting.

(4 marks)

TURN OVER

- 1.17** CW Ltd makes one product in a single process. The details of the process for period 2 were as follows:

There were 800 units of opening work in progress valued as follows:

Material	£98,000
Labour	£46,000
Production overheads	£7,600

During the period 1,800 units were added to the process and the following costs were incurred:

Material	£387,800
Labour	£276,320
Production overheads	£149,280

There were 500 units of closing work in progress, which were 100% complete for material, 90% complete for labour and 40% complete for production overheads.

A normal loss equal to 10% of new material input during the period was expected. The actual loss amounted to 180 units. Each unit of loss was sold for £10 per unit.

CW Ltd uses weighted average costing.

Calculate the cost of the output for the period.

(4 marks)

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- 1.18** SS Ltd operates a standard marginal costing system. An extract from the standard cost card for the labour costs of one of its products is as follows:

Labour Cost	
5 hours x £12	£60

Actual results for the period were as follows:

Production	11,500 units
Labour rate variance	£45,000 adverse
Labour efficiency variance	£30,000 adverse

Calculate the actual rate paid per direct labour hour.

(4 marks)

(Total for Section A = 50 marks)

End of Section A

Section B starts on page 12

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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 scenario is given for sub-questions (a) to (f) opposite

X Plc manufactures specialist insulating products that are used in both residential and commercial buildings. One of the products, Product W, is made using two different raw materials and two types of labour. The company operates a standard absorption costing system and is now preparing its budgets for the next four quarters. The following information has been identified for Product W:

Sales

Selling price £220 per unit

Sales demand

Quarter 1	2,250 units
Quarter 2	2,050 units
Quarter 3	1,650 units
Quarter 4	2,050 units
Quarter 5	1,250 units
Quarter 6	2,050 units

Costs

Materials

A	5 kgs per unit @ £4 per kg
B	3 kgs per unit @ £7 per kg

Labour

Skilled	4 hours per unit @ £15 per hour
Semi-skilled	6 hours per unit @ £9 per hour

Annual overheads

£280,000
40% of these overheads are fixed and the remainder varies with total labour hours. Fixed overheads are absorbed on a unit basis.

Inventory holding policy

Closing inventory of finished goods	30% of the following quarter's sales demand
Closing inventory of materials	45% of the following quarter's materials usage

The management team are concerned that X Plc has recently faced increasing competition in the market place for Product W. As a consequence there have been issues concerning the availability and costs of the specialised materials and employees needed to manufacture Product W, and there is concern that these might cause problems in the current budget setting process.

(a) Prepare the following budgets for each quarter for X Plc:

(i) Production budget in units;

(ii) Raw material purchases budget in kgs and value for Material B.

(5 Marks)

(b) X Plc has just been informed that Material A may be in short supply during the year for which it is preparing budgets. Discuss the impact this will have on budget preparation and other areas of X Plc.

(5 Marks)

(c) Assuming that the budgeted production of Product W was 7,700 units and that the following actual results were incurred for labour and overheads in the year:

Actual production	7,250 units
Actual overheads	
Variable	£185,000
Fixed	£105,000
Actual labour costs	
Skilled - £16.25 per hour	£568,750
Semi-skilled - £8 per hour	£332,400

Prepare a flexible budget statement for X Plc showing the total variances that have occurred for the above four costs only.

(5 Marks)

(d) X Plc currently uses incremental budgeting. Explain how Zero Based Budgeting could overcome the problems that might be faced as a result of the continued use of the current system.

(5 Marks)

(e) Explain how rolling budgets are used and why they would be suitable for X Plc.

(5 Marks)

(f) Briefly explain how linear regression analysis can be used to forecast sales and briefly discuss whether it would be a suitable method for X Plc to use.

(5 marks)

(Total for Question Two = 30 marks)

(Total for Section B = 30 marks)

End of Section B

Section C starts on page 15

TURN OVER

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SECTION C – 20 MARKS

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

ANSWER ONE OF THE TWO QUESTIONS

Question Three

X Ltd uses an automated manufacturing process to produce an industrial chemical, Product P. X Ltd operates a standard marginal costing system. The standard cost data for Product P is as follows:

<i>Standard cost per unit of Product P</i>			
Materials			
A	10 kgs	@ £15 per kilo	£150
B	8 kgs	@ £8 per kilo	£64
C	5 kgs	@ £4 per kilo	£20
	<u>23 kgs</u>		
Total standard marginal cost			£234
Budgeted fixed production overheads			£350,000

In order to arrive at the budgeted selling price for Product P the company adds 80% mark-up to the standard marginal cost. The company budgeted to produce and sell 5,000 units of Product P in the period. There were no budgeted inventories of Product P.

The actual results for the period were as follows:

Actual production and sales		5,450 units
Actual sales price		£445 per unit
Material usage and cost		
A	43,000 kgs	£688,000
B	37,000 kgs	£277,500
C	<u>23,500 kgs</u>	£99,875
	103,500 kgs	
Fixed production overheads		£385,000

Required:

- (a) Prepare an operating statement which reconciles the budgeted profit to the actual profit for the period. (The statement should include the material mix and material yield variances).

(12 marks)

- (b) The Production Manager of X Ltd is new to the job and has very little experience of management information. Write a brief report to the Production Manager of X Ltd that

- (i) interprets the material price, mix and yield variances;
- (ii) discusses the merits, or otherwise, of calculating the materials mix and yield variances for X Ltd.

(8 marks)

(Total for Question Three = 20 marks)

TURN OVER

Question Four

The ZZ Group has two divisions, X and Y. Each division produces only one type of product: X produces a component (C) and Y produces a finished product (FP). Each FP needs one C. It is the current policy of the group for C to be transferred to Division Y at the marginal cost of £10 per component and that Y must buy all the components it needs from X.

The markets for the component and the finished product are competitive and price sensitive. Component C is produced by many other companies but it is thought that the external demand for the next year could increase to 1,000 units more than the sales volume shown in the current budget for Division X.

Budgeted data, taken from the ZZ Group Internal Information System, for the divisions for the next year is as follows:

Division X

Income statement

Sales	£70,000
Cost of sales	
Variable costs	<u>£50,000</u>
Contribution	£20,000
Fixed costs (controllable)	<u>£15,000</u>
Profit	<u>£ 5,000</u>

Production/Sales (units)	5,000	(3,000 of which are transferred to Division Y)
External demand (units)	3,000	(Only 2,000 of which can be currently satisfied)
Capacity (units)	5,000	
External market price per unit	£20	

Balance sheet extract

Capital employed	£60,000
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Other information

Cost of capital charge	10%
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Division Y

Income statement

Sales	£270,000
Cost of sales	
Variable costs	<u>£114,000</u>
Contribution	£156,000
Fixed costs (controllable)	<u>£100,000</u>
Profit	<u>£ 56,000</u>

Production/Sales (units)	3,000
Capacity (units)	7,000
Market price per unit	£90

Balance sheet extract

Capital employed	£110,000
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Other information

Cost of capital charge	10%
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Four measures are used to evaluate the performance of the Divisional Managers. Based on the data above, the budgeted performance measures for the two divisions are as follows:

	<i>Division X</i>	<i>Division Y</i>
Residual income	(£1,000)	£45,000
Return on capital employed	8·33%	50·91%
Operating profit margin	7·14%	20·74%
Asset turnover	1·17	2·46

Current policy

It is the current policy of the group for C to be transferred to Division Y at the marginal cost of £10 per component and that Y must buy all the components that it needs from X.

Proposed policy

ZZ Group is thinking of giving the Divisional Managers the freedom to set their own transfer price and to buy the components from external suppliers but there are concerns about problems that could arise by granting such autonomy.

Required:

- (a) If the transfer price of the component is set by the Manager of Division X at the current market price (£20 per component), recalculate the budgeted performance measures for each division. *(8 marks)*
- (b) Discuss the changes to the performance measures of the divisions that would arise as a result of altering the transfer price to £20 per component. *(6 marks)*
- (c) (i) Explain the problems that could arise for each of the Divisional Managers and for ZZ Group as a whole as a result of giving full autonomy to the Divisional Managers.
- (ii) Discuss how the problems you have explained could be resolved without resorting to a policy of imposed transfer prices. *(6 marks)*

(Total for Question Four = 20 marks)

(Total for Section C = 20 marks)

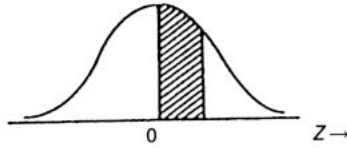
End of question paper
Maths Tables and Formulae are on pages 19 to 23

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	0.705	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	4.793	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

$A \cup B = A \text{ or } B$. $A \cap B = A \text{ and } B$ (overlap).

$P(B | A)$ = 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**: $P(A \cap B) = P(A) * P(B | A)$

$E(X) = \sum (\text{probability} * \text{payoff})$

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

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

Standard Deviation

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

INDEX NUMBERS

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

Price:
$$\frac{\sum w * \left(\frac{P_1}{P_0}\right)}{\sum w} * 100$$

Quantity:
$$\frac{\sum w * \left(\frac{Q_1}{Q_0}\right)}{\sum w} * 100$$

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:

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

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

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

or solve

$$\begin{aligned} \sum Y &= na + b \sum X \\ \sum XY &= a \sum X + b \sum X^2 \end{aligned}$$

Coefficient of correlation

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

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

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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Management Accounting Pillar

Managerial Level

P1 – Management Accounting – Performance Evaluation

November 2006

Tuesday Morning Session