



Management Accounting Pillar

Managerial Level Paper

P1 – Management Accounting – Performance Evaluation

23 May 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 is comprised of 21 sub-questions and is on pages 2 to 11.
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 14 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 TWENTY ONE SUB-QUESTIONS

Instructions for answering Section A:

The answers to the twenty one 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 1.21** you should show your workings as marks are available for the method you use to answer these sub-questions.

Question One

1.1

Definition 1: “A system that converts a production schedule into a listing of materials and components required to meet the schedule so that items are available when needed.”

Definition 2: “An accounting system that focuses on ways by which the maximum return per unit of bottleneck activity can be achieved.”

Which of the following pairs of terms correctly matches definitions 1 and 2 above?

	<i>Definition 1</i>	<i>Definition 2</i>
A	Manufacturing resources planning (MRP2)	Backflush accounting
B	Material requirements planning (MRP1)	Throughput accounting
C	Material requirements planning (MRP1)	Theory of constraints
D	Supply chain management	Throughput accounting

(2 marks)

Sub-question 1.2 is on the opposite page

1.2 Which of the following statements is/are true?

- (i) Enterprise Resource Planning (ERP) systems use complex computer systems, usually comprehensive databases, to provide plans for every aspect of a business.
- (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) Just-in-time (JIT) purchasing requires the purchasing of large quantities of inventory items so that they are available immediately when they are needed in the production process.

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

(2 marks)

1.3 Which of the following statements apply to feedforward control?

- (i) It is the measurement of differences between planned outputs and actual outputs.
- (ii) It is the measurement of differences between planned outputs and forecast outputs.
- (iii) Target costing is an example.
- (iv) Variance analysis is an example.

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

(2 marks)

Section A continues on the next page

TURN OVER

- 1.4 The final stage of production adds Material Z to units that have been transferred into Process D and converts them to the finished product. There are no losses in Process D. Data for Process D in the latest period are shown below:

	<i>Units</i>
Opening work in progress	225
Material Z: 80% complete	
Conversion costs: 80% complete	
Units transferred in	500
Units transferred out	575
Closing work in progress	150
Material Z: 60% complete	
Conversion costs: 40% complete	

The equivalent units to be used in the calculations of the cost per equivalent unit for Material Z and Conversion Costs, assuming first-in-first-out (FIFO) costing are:

	<i>Material Z</i>	<i>Conversion costs</i>
A	485	455
B	485	500
C	575	455
D	575	500

(2 marks)

- 1.5 If the budgeted fixed costs increase, the **gradient** of the line plotted on the budgeted Profit/Volume (P/V) chart will

- A** increase.
- B** decrease.
- C** not change.
- D** become curvi-linear.

(2 marks)

Section A continues on the opposite page

- 1.6** A company operates a standard costing system and prepares monthly financial statements. All materials purchased during February were used during that month. After all transactions for February were posted, the general ledger contained the following balances:

	<i>Debit</i>	<i>Credit</i>
	£	£
Finished goods control	27,450	
Materials price variance	2,400	
Materials usage variance		8,400
Labour rate variance	5,600	
Labour efficiency variance		3,140
Variable production overhead variance	2,680	
Fixed production overhead variance		3,192

The standard cost of the goods produced during February was £128,500.

The actual cost of the goods produced during February was

- A** £96,998
- B** £124,448
- C** £132,552
- D** £160,002

(2 marks)

- 1.7** 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

TURN OVER

1.8 The following extract is taken from the production cost budget of L plc:

Output	2,000 units	3,500 units
Total cost	£12,000	£16,200

The budget cost allowance for an output of 4,000 units would be:

- A** £17,600
- B** £18,514
- C** £20,400
- D** £24,000

(2 marks)

1.9 A company uses time series and regression techniques to forecast future sales. It has derived a seasonal variation index to use with the multiplicative (proportional) seasonal variation model. The index values for the first three quarters are as follows:

Quarter	Index value
Q1	80
Q2	80
Q3	110

The index value for the fourth quarter (Q4) is:

- A** -270
- B** -269
- C** 110
- D** 130

(2 marks)

Section A continues on the opposite page

1.10 The budgeted profit statement for a company, with all figures expressed as percentages of revenue, is as follows:

	%
Revenue	100
Variable costs	30
Fixed costs	<u>22</u>
Profit	<u>48</u>

After the formulation of the above budget it has now been realised that the sales volume will only be 60% of that originally forecast.

The revised profit, expressed as a percentage of the revised revenue will be:

- A** 20%
- B** 33.3%
- C** 60%
- D** 80%

(2 marks)

The following data are given for sub-questions 1.11 and 1.12 below

A company has a process in which three inputs are mixed together to produce Product S. The standard mix of inputs to produce 90 kg of Product S is shown below:

	\$
50 kg of ingredient P at \$75 per kg	3,750
30 kg of ingredient Q at \$100 per kg	3,000
20 kg of ingredient R at \$125 per kg	<u>2,500</u>
	<u>9,250</u>

During March 2,000 kg of ingredients were used to produce 1,910 kg of Product S. Details of the inputs are as follows:

	\$
1,030 kg of ingredient P at \$70 per kg	72,100
560 kg of ingredient Q at \$106 per kg	59,360
410 kg of ingredient R at \$135 per kg	<u>55,350</u>
	<u>186,810</u>

1.11 Calculate the materials mix variance for March.

(3 marks)

1.12 Calculate the materials yield variance for March.

(2 marks)

Section A continues on the next page

TURN OVER

1.13 Division L has reported a net profit after tax of £8·6m for the year ended 30 April 2006. Included in the costs used to calculate this profit are the following items:

- interest payable of £2·3m;
- development costs of £6·3m for a new product that was launched in May 2005, and is expected to have a life of three years;
- advertising expenses of £1·6m that relate to the re-launch of a product in June 2006.

The net assets invested in Division L are £30m.

The cost of capital for Division L is 13% per year.

Calculate the Economic Value Added® for Division L for the year ended 30 April 2006.

(3 marks)

1.14 The following details have been taken from the debtor collection records of W plc:

Invoices paid in the month after sale	60%
Invoices paid in the second month after sale	20%
Invoices paid in the third month after sale	15%
Bad debts	5%

Customers paying in the month after the sale are allowed a 10% discount.

Invoices for sales are issued on the last day of the month in which the sales are made.

The budgeted credit sales for the final five months of this year are:

<i>Month</i>	<i>August</i>	<i>September</i>	<i>October</i>	<i>November</i>	<i>December</i>
<i>Credit sales</i>	\$80,000	\$100,000	\$120,000	\$130,000	\$160,000

Calculate the total amount budgeted to be received in December from credit sales.

(2 marks)

1.15 State four aims of a transfer pricing system.

(3 marks)

Section A continues on the opposite page

1.16 Process 2 takes transfers from Process 1 and converts them to finished goods. Additional materials are added during the process. An abnormal loss occurred part way through the process in April. Output data for April are shown below:

	Kg	Equivalent units (Kg)		
		From P1	Materials	Conversion
Transferred to finished goods	2,800	2,800	2,800	2,800
Normal loss	200			
Abnormal loss	100	100	100	50
Closing work in progress	700	700	700	150

The losses cannot be sold.

Costs incurred during April were:

Transfer from Process 1	£34,200
Materials added	£16,200
Conversion costs	£26,700

There was no opening work in progress at the beginning of the month.

Calculate the value of the abnormal loss that will be debited to the abnormal loss account.

(3 marks)

1.17 D plc operates a retail business. Purchases are sold at cost plus 25%. The management team are preparing the cash budget and have gathered the following data:

1. The budgeted sales are as follows:

Month	£000
July	100
August	90
September	125
October	140

2. It is management policy to hold inventory at the end of each month which is sufficient to meet sales demand in the next half month. Sales are budgeted to occur evenly during each month.

3. Creditors are paid one month after the purchase has been made.

Calculate the entries for "purchases" that will be shown in the cash budget for

- (i) August
- (ii) September
- (iii) October

(3 marks)

Section A continues on the next page

TURN OVER

1.18 ZY is an airline operator. It is implementing a balanced scorecard to measure the success of its strategy to expand its operations. It has identified two perspectives and two associated objectives. They are:

Perspective	Objective
Growth	Fly to new destinations
Internal capabilities	Reduce time between touch down and take off

(i) For the “growth perspective” of ZY, recommend a performance measure and briefly justify your choice of the measure by explaining how it will reflect the success of the strategy.

(2 marks)

(ii) For the “internal capabilities perspective” of ZY, state data that you would gather and explain how this could be used to ensure the objective is met.

(2 marks)

The following data are given for sub-questions 1.19 and 1.20 below

Q plc uses standard costing. The details for April were as follows:

Budgeted output	15,000	units
Budgeted labour hours	60,000	hours
Budgeted labour cost	£540,000	
Actual output	14,650	units
Actual labour hours paid	61,500	hours
Productive labour hours	56,000	hours
Actual labour cost	£522,750	

1.19 Calculate the idle time variance for April.

(2 marks)

1.20 Calculate the labour efficiency variance for April.

(2 marks)

Section A continues on the opposite page

1.21 S plc produces and sells three products, X, Y and Z. It has contracts to supply products X and Y, which will utilise all of the specific materials that are available to make these two products during the next period. The revenue these contracts will generate and the contribution to sales (c/s) ratios of products X and Y are as follows:

	<i>Product X</i>	<i>Product Y</i>
Revenue	£10 million	£20 million
C/S ratio	15%	10%

Product Z has a c/s ratio of 25%.

The total fixed costs of S plc are £5.5 million during the next period and management have budgeted to earn a profit of £1 million.

Calculate the revenue that needs to be generated by Product Z for S plc to achieve the budgeted profit.

(3 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 manufacturing company uses a standard costing system. Extracts from the budget for April are shown below:

Sales	1,400 units	
Production	2,000 units	
		\$
Direct costs	15	per unit
Variable overhead	4	per unit

The budgeted fixed production overhead costs for April were \$12,800.

The budgeted profit using marginal costing for April was \$5,700.

- (i) Calculate the budgeted profit for April using absorption costing. (3 marks)
- (ii) Briefly explain two situations where marginal costing is more useful to management than absorption costing. (2 marks)

(Total for sub-question (a) = 5 Marks)

- (b) The standard cost schedule for hospital care for a minor surgical procedure is shown below.

Standard Cost of hospital care for a minor surgical procedure

Staff: patient ratio is 0.75:1

	£
Nursing costs: 2 days x 0.75 x £320 per day	480
Space and food costs: 2 days x £175 per day	350
Drugs and specific materials	115
Hospital overheads: 2 days x £110 per day	<u>220</u>
Total standard cost	<u>1,165</u>

The actual data for the hospital care for one patient having the minor surgical procedure showed that the patient stayed in hospital for three days. The cost of the drugs and specific materials for this patient was £320. There were 0.9 nurses per patient on duty during the time that the patient was in hospital. The daily rates for nursing pay, space and food, and hospital overheads were as expected.

Prepare a statement that reconciles the standard cost with the actual costs of hospital care for this patient. The statement should contain **five** variances that will give useful information to the manager who is reviewing the cost of hospital care for minor surgical procedures.

(5 Marks)

- (c) C plc uses a just-in-time (JIT) purchasing and production process to manufacture Product P. Data for the output of Product P, and the material usage and material price variances for February, March and April are shown below:

Month	Output (units)	Material usage variance	Material price variance
February	11,000	£15,970 Adverse	£12,300 Favourable
March	5,100	£5,950 Adverse	£4,500 Favourable
April	9,100	£8,400 Adverse	£6,200 Favourable

The standard material cost per unit of Product P is £12.

Prepare a sketch (not on graph paper) of a percentage variance chart for material usage and for material price for Product P for the three month period. (Note: your workings must show the co-ordinates of the points that would be plotted if the chart was drawn accurately.)

(5 Marks)

- (d) Briefly discuss **three** reasons why standard costing may **not** be appropriate in a modern business environment.

(5 Marks)

- (e) Compare and contrast marginal costing and throughput accounting.

(5 Marks)

- (f) T plc is a large insurance company. The Claims Department deals with claims from policy holders who have suffered a loss that is covered by their insurance policy. Policy holders could claim, for example, for damage to property, or for household items stolen in a burglary. The Claims Department staff investigate each claim and determine what, if any, payment should be made to the claimant.

The manager of the Claims Department has decided to benchmark the performance of the department and has chosen two areas to benchmark:

- the detection of false claims
- the speed of processing claims

For each of the above two areas:

- state and justify a performance measure
- explain how relevant benchmarking data could be gathered.

(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

M plc designs, manufactures and assembles furniture. The furniture is for home use and therefore varies considerably in size, complexity and value. One of the departments in the company is the Assembly Department. This department is labour intensive; the workers travel to various locations to assemble and fit the furniture using the packs of finished timbers that have been sent to them.

Budgets are set centrally and they are then given to the managers of the various departments who then have the responsibility of achieving their respective targets. Actual costs are compared against the budgets and the managers are then asked to comment on the budgetary control statement. The statement for April for the Assembly Department is shown below.

	<i>Budget</i>	<i>Actual</i>	<i>Variance</i>	
Assembly labour hours	6,400	7,140		
	\$	\$	\$	
Assembly labour	51,970	58,227	6,257	Adverse
Furniture packs	224,000	205,000	19,000	Favourable
Other materials	23,040	24,100	1,060	Adverse
Overheads	<u>62,060</u>	<u>112,340</u>	<u>50,280</u>	Adverse
Total	<u>361,070</u>	<u>399,667</u>	<u>38,597</u>	Adverse

Note: the costs shown are for assembling and fitting the furniture (they do not include time spent travelling to jobs and the related costs). The hours worked by the Manager are not included in the figure given for the assembly labour hours.

The Manager of the Assembly Department is new to the job and has very little previous experience of working with budgets but he does have many years' experience as a supervisor in assembly departments. Based on that experience he was sure that the department had performed well. He has asked for your help in replying to a memo he has just received asking him to "explain the serious overspending in his department". He has sent you some additional information about the budget:

1. The budgeted and actual assembly labour costs include the fixed salary of \$2,050 for the Manager of the Assembly Department. All of the other labour is paid for the hours they work.
2. The cost of furniture packs and other materials is assumed by the central finance office of M plc to vary in proportion to the number of assembly labour hours worked.
3. The budgeted overhead costs are made up of three elements: a fixed cost of \$9,000 for services from central headquarters, a stepped fixed cost which changes when the assembly hours exceed 7,000 hours, and some variable overheads. The variable overheads are assumed to vary in proportion to the number of assembly labour hours. Working papers for the budget showed the impact on the overhead costs of differing amounts of assembly labour hours:

Assembly labour hours	5,000	7,500	10,000
Overhead costs	\$54,500	\$76,500	\$90,000

The actual fixed costs for April were as budgeted.

Required:

- (a) Prepare, using the additional information that the Manager of the Assembly Department has given you, a budgetary control statement that would be more helpful to him.

(7 marks)

(b)

- (i) Discuss the differences between **the format of the statement** that you have produced and that supplied by M plc.

(4 marks)

- (ii) Discuss the assumption made by the central office of M plc that costs vary in proportion to assembly labour hours.

(3 marks)

- (c) Discuss whether M plc should change to a system of participative budgeting.

(6 marks)

(Total for Question Three = 20 marks)

Section C continues on the next page

TURN OVER

Question Four

FP sells and repairs photocopiers. The company has operated for many years with two departments, the Sales Department and the Service Department, but the departments had no autonomy. The company is now thinking of restructuring so that the two departments will become profit centres.

The Sales Department

This department sells new photocopiers. The department sells 2,000 copiers per year. Included in the selling price is £60 for a one year guarantee. All customers pay this fee. This means that during the first year of ownership if the photocopier needs to be repaired then the repair costs are not charged to the customer. On average 500 photocopiers per year need to be repaired under the guarantee. The repair work is carried out by the Service Department who, under the proposed changes, would charge the Sales Department for doing the repairs. It is estimated that on average the repairs will take 3 hours each and that the charge by the Service Department will be £136,500 for the 500 repairs.

The Service Department

This department has two sources of work: the work needed to satisfy the guarantees for the Sales Department and repair work for external customers. Customers are charged at full cost plus 40%. The details of the budget for the next year for the Service Department revealed standard costs of:

Parts	at cost
Labour	£15 per hour
Variable overheads	£10 per labour hour
Fixed overheads	£22 per labour hour

The calculation of these standards is based on the estimated maximum market demand and includes the expected 500 repairs for the Sales Department. The average cost of the parts needed for a repair is £54. This means that the charge to the Sales Department for the repair work, including the 40% mark-up, will be £136,500.

Proposed Change

It has now been suggested that FP should be structured so that the two departments become profit centres and that the managers of the Departments are given autonomy. The individual salaries of the managers would be linked to the profits of their respective departments.

Budgets have been produced for each department on the assumption that the Service Department will repair 500 photocopiers for the Sales Department and that the transfer price for this work will be calculated in the same way as the price charged to external customers.

However the manager of the Sales Department has now stated that he intends to have the repairs done by another company, RS, because they have offered to carry out the work for a fixed fee of £180 per repair and this is less than the price that the Sales Department would charge.

Required:

- (a) Calculate the individual profits of the Sales Department and the Service Department, and of FP as a whole *from the guarantee scheme* if:
- (i) The repairs are carried out by the Service Department and are charged at full cost plus 40%;
 - (ii) The repairs are carried out by the Service department and are charged at marginal cost;
 - (iii) The repairs are carried out by RS.
- (8 marks)**
- (b)
- (i) Explain, with reasons, why a 'full cost plus' transfer pricing model may **not** be appropriate for FP.
- (3 marks)**
- (ii) Comment on other issues that the managers of FP should consider if they decide to allow RS to carry out the repairs.
- (4 marks)**
- (c) Briefly explain the advantages and disadvantages of structuring the departments as profit centres.
- (5 marks)**

(Total for Question Four = 20 marks)

(Total for Section C = 20 marks)

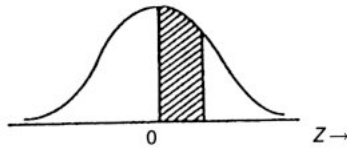
End of question paper
Maths Tables and Formulae are on pages 19 to 23

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

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

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

May 2006

Tuesday Morning Session