



Performance Pillar

P2 – Performance Management

20 November 2013 – Wednesday Afternoon Session

**Instructions to candidates**

You are allowed three hours to answer this question paper.
You are allowed 20 minutes reading time <b>before the examination begins</b> during which you should read the question paper and, if you wish, make annotations on the question paper. However, you will <b>not</b> be allowed, <b>under any circumstances</b> , 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).
ALL answers must be written in the answer book. Answers written on the question paper will <b>not</b> be submitted for marking.
You should show all workings as marks are available for the method you use.
ALL QUESTIONS ARE COMPULSORY.
Section A comprises 5 questions and is on pages 2 to 6.
Section B comprises 2 questions and is on pages 8 to 11.
Maths tables and formulae are provided on pages 13 to 16.
The list of verbs as published in the syllabus is given for reference on page 19.
Write your candidate number, the paper number and examination subject title in the spaces provided on the front of the answer book. Also write your contact ID and name in the space provided in the right hand margin and seal to close.
Tick the appropriate boxes on the front of the answer book to indicate which questions you have answered.

**P2 – Performance Management**

TURN OVER

## SECTION A – 50 MARKS

[You are advised to spend no longer than 18 minutes on each question in this section.]

ANSWER ALL FIVE QUESTIONS IN THIS SECTION. EACH QUESTION IS WORTH 10 MARKS. YOU SHOULD SHOW YOUR WORKINGS AS MARKS ARE AVAILABLE FOR THE METHOD YOU USE.

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### Question One

PWR is a manufacturing company that is about to launch a new product: Product Z. Details of the variable costs incurred in producing one unit of Product Z are as follows:

Labour	\$25 per hour
Materials	\$52 per unit
Variable overheads	\$5 per labour hour

#### Learning curve

Product Z is produced in batches of 10 units. The first batch of 10 units is expected to take 15 labour hours. There will be 95% learning curve that will continue until 64 batches have been produced.

Note: The learning index for a 95% learning curve = -0.074

*Required:*

(a)

(i) **Calculate** the time required to produce the 64<sup>th</sup> batch of Product Z.

*(3 marks)*

(ii) **Calculate** the total variable cost of the 64<sup>th</sup> batch of Product Z.

*(2 marks)*

(b) **Explain** THREE conditions that must exist in the production process of Product Z for the learning curve effect to be realised.

*(5 marks)*

*(Total for Question One = 10 marks)*

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## Question Two

SXL is a specialist car manufacturer that produces various models of car. The organisation is due to celebrate its 100<sup>th</sup> anniversary next year. To mark the occasion, SXL intends to produce a sports car; the Model S. As this will be a special edition, production will be limited to 1,000 Model S cars.

SXL is considering using a target costing approach and has conducted market research to determine the features that consumers require in a sports car. Based on this market research and knowledge of competitors' products, SXL has decided to price the Model S at \$19,950. SXL requires an operating profit margin of 25% of the selling price of the car. Details for the forthcoming year are as follows:

### Forecast direct costs for a Model S car

Labour	\$5,000
Material	\$9,500

### Forecast annual overhead costs

	\$	Cost driver
Production line cost	4,630,000	See note 1
Transportation costs	1,800,000	See note 2

#### Note 1

The production line that would be used for Model S has a capacity of 60,000 machine hours per year. The production line time required for Model S is 6 machine hours per car. This production line will also be used to make other cars and will be working at full capacity.

#### Note 2

Some models of cars are delivered to showrooms using car transporters. 60% of the transportation costs are related to the number of deliveries made. 40% of the transportation costs are related to the distance travelled.

The car transporters are forecast to make a total of 640 deliveries in the year and carry 10 cars each time. The car transporter will always carry its maximum capacity of 10 cars.

The total annual distance travelled by car transporters is expected to be 225,000km. 50,000km of this is for the delivery of Model S cars only. All 1,000 Model S cars that will be produced will be delivered in the year using the car transporters.

#### Required:

(a)

- (i) **Calculate** the forecast total cost of producing and delivering a Model S car using activity based costing principles to assign the overhead costs.

(4 marks)

- (ii) **Calculate** the value of any cost gap that currently exists between the forecast total cost and the target total cost of a Model S car.

(2 marks)

- (b) **Explain** TWO potential advantages to SXL of using target costing for the Model S car.

(4 marks)

(Total for Question Two = 10 marks)

### Question Three

HRS is a food producer that makes low cost processed food that it sells to supermarkets. HRS produces only one type of processed food product and production techniques have remained largely unchanged for a number of years.

Over recent months, sales have been falling steadily. Consumer tastes are changing to favour natural ingredients and supermarkets have reflected this in the products that they offer for sale.

HRS is keen to address the decline in sales and recently held a meeting to discuss the performance of the organisation. The Management Accountant suggested to the Managing Director that the performance of HRS could be improved by implementing Total Quality Management (TQM) principles and adopting Kaizen costing concepts. Currently the control systems of HRS focus on material price and usage.

The Managing Director is sceptical of the Management Accountant's suggestions and is unclear as to whether they are suitable for the company.

*Required:*

- (a) **Explain** TWO concepts of Kaizen costing.

*(4 marks)*

- (b) **Explain** THREE conditions that must exist for TQM to be successfully implemented at HRS.

*(6 marks)*

*(Total for Question Three = 10 marks)*

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*Section A continues on the opposite page*

#### Question Four

CHX is a retail bank. The lending division within CHX sells a loan product, Product L.

CHX is part owned by the Government and is required by the Government to produce 'Low' and 'High' gross profit forecast scenarios each year for comparison against actual performance.

Gross profit is calculated as:

**Total lending income less total funding cost**

**Total lending income** = total average balance multiplied by customer lending rate

**Total funding cost** = total average balance multiplied by funding rate

In order to calculate the total average balance for the 'Low' and 'High' forecast scenarios, CHX uses its actual total average balance from the previous year as a starting point.

	<b>Product L</b>
Previous year actual total average balance	\$1,650m
<b>'High' scenario assumptions</b>	
Total average balance (movement on previous year's actual)	+2%
Customer lending rate	8.8%
Funding rate	4.15%
<b>'Low' scenario assumptions</b>	
Total average balance (movement on previous year's actual)	-25%
Customer lending rate	<b>See note</b>
Funding rate	4.55%

**Note:** It is expected that during the year it will be necessary to lower the customer lending rate in order to compete with other banks. Therefore it is expected, that under the 'Low' scenario, that the customer lending rate will be 7.90% on 40% of the total average balance and 5.90% on the remainder of the total average balance.

*Required:*

- (a) **Produce** calculations to determine the forecast gross profit for Product L, under both the 'Low' forecast scenario and the 'High' forecast scenario.

*(6 marks)*

- (b) **Explain** the potential advantages and disadvantages of the use of spreadsheets by CHX in developing forecast scenarios.

*(4 marks)*

*(Total for Question Four = 10 marks)*

*Section A continues on the next page*

### Question Five

HIJ is a cosmetics company that produces perfume. The perfume market is very competitive and subject to frequent changes.

The finance team at HIJ prepare monthly rolling budgets as part of their planning and management control process.

The data for the forthcoming new budget period are as follows:

The variable cost of producing a bottle of perfume is \$21.

The planned selling price of a bottle of perfume is \$45 and at this selling price the demand for perfume is expected to be 125,000 bottles. Information from the marketing division at HIJ suggests that for every \$3 increase in the selling price the customer demand would reduce by 10,000 bottles, and that for every \$3 decrease in the selling price the customer demand would increase by 10,000 bottles.

Note: If  $P = a - bx$  then  $MR = a - 2bx$

*Required:*

(a) **Calculate** the revenue that HIJ would earn if the selling price of a bottle of perfume was set so that profits would be maximised for the forthcoming budget period.

*(6 marks)*

(b) **Discuss** the use of rolling budgets in the planning and management control process at HIJ.

*(4 marks)*

*(Total for Question Five = 10 marks)*

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*(Total for Section A = 50 marks)*

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*End of Section A  
Section B starts on page 8*

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## SECTION B – 50 MARKS

[You are advised to spend no longer than 45 minutes on each question in this section.]

ANSWER *BOTH* QUESTIONS IN THIS SECTION. EACH QUESTION IS WORTH 25 MARKS. YOU SHOULD SHOW YOUR WORKINGS AS MARKS ARE AVAILABLE FOR THE METHOD YOU USE.

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### Question Six

DLW is a company that builds innovative, environmentally friendly housing. DLW's houses use high quality materials and the unique patented energy saving technology used in the houses has been the result of the company's own extensive research in the area.

DLW is planning to expand into another country and has been asked by a prominent person in that country for a price quotation to build them a house. The Board of Directors believes that securing the contract will help to launch their houses in the country and have agreed to quote a price for the house that will exactly cover its relevant cost.

The following information has been obtained in relation to the contract:

1. The Chief Executive and Marketing Director recently met with the potential client to discuss the house. The meeting was held at a restaurant and DLW provided food and drinks at a cost of \$375.
2. 1,200 kg of Material Z will be required for the house. DLW currently has 550 kg of Material Z in its inventory purchased at a price of \$58 per kg. Material Z is regularly used by DLW in its houses and has a current replacement cost of \$65 per kg. The resale value of the Material Z in inventory is \$35 per kg.
3. 400 hours of construction worker time are required to build the house. DLW's construction workers are paid an hourly rate of \$22 under a guaranteed wage agreement and currently have spare capacity to build the house.
4. The house will require 90 hours of engineer time. DLW engineers are paid a monthly salary of \$4,750 each and do not have any spare capacity. In order to meet the engineering requirement for the house, DLW can choose one of two options:
  - (i) Pay the engineers an overtime rate of \$52 per hour to perform the additional work.
  - (ii) Reduce the number of engineers' hours available for their existing job, the building of Product Y. This would result in lost sales of Product Y.

Summary details of the existing job the engineers are working on:

#### Information for one unit of Product Y

Sales revenue	\$4,860
Variable costs	\$3,365

Engineers' time required per unit                      30 hours

5. A specialist machine would be required for 7 weeks for the house build. DLW have 4 weeks remaining on the 15 week specialist machine rental contract that cost \$15,000. The machine is currently not in use. The machine can be rented for an additional 15 weeks at a cost of \$15,250. The specialist machine can only be rented in blocks of 15 weeks.

Alternatively, a machine can be purchased for \$160,000 and sold after the work on the house has been completed for \$140,000.



6. The windows required for the house have recently been developed by DLW and use the latest environmentally friendly insulating material. DLW produced the windows at a cost of \$34,950 and they are currently the only ones of their type. DLW were planning to exhibit the windows at a house building conference. The windows would only be used for display purposes at the conference and would not be for sale to prospective clients.
- DLW has had assurances from three separate clients that they would place an order for 25 windows each if they saw the technology demonstrated at the conference. The contribution from each window is \$10,450. If the windows are used for the contract, DLW would not be able to attend the conference. The conference organisers will charge a penalty fee of \$1,500 for non-attendance by DLW. The Chief Executive of DLW can meet the clients directly and still secure the orders for the windows. The meetings would require two days of the Chief Executive's time. The Chief Executive is paid an annual salary of \$414,000 and contracted to work 260 days per year.
7. The house build requires 400kg of other materials. DLW currently has none of these materials in its inventory. The total current purchase price for these other materials is \$6,000.
8. DLW's fixed overhead absorption rate is \$37 per construction worker hour.
9. DLW's normal policy is to add a 12% mark-up to the cost of each house.

*Required:*

- (a) **Produce** a schedule that shows the minimum price that could be quoted for the contract to build the house.

Your schedule should show the relevant cost of each of the nine items identified above. You should also explain each relevant cost value you have included in your schedule and why any values you have excluded are not relevant.

*(17 marks)*

- (b) **Explain** TWO reasons why relevant costing may not be a suitable approach to pricing houses in the longer term for DLW.

*(4 marks)*

- (c) **Recommend**, with justifications, a pricing strategy for DLW to use to price the innovative, environmentally friendly houses when they are launched in the new country.

*(4 marks)*

*(Total for Question Six = 25 marks)*

*Section B continues on the next page*

TURN OVER

## Question Seven

CD is a producer of soft drinks. The company has two divisions: Division C and Division D.

Division C manufactures metal cans that are sold to Division D and also to external customers. Division D produces soft drinks and sells them to external customers in the cans that it obtains from Division C.

CD is a relatively new company. Its objective is to grow internationally and challenge the existing global soft drinks producers. CD aims to build its brand based on the distinct taste of its soft drinks.

<b>Division C annual budget information</b>	<b>\$</b>
Market selling price per 1,000 cans	130
Variable costs per can	0.04
Fixed costs	2,400,000
Net assets	4,000,000
Production capacity	40,000,000 cans
External demand for cans	38,000,000 cans
Demand from Division D	20,000,000 cans
<b>Division D annual budget information</b>	<b>\$</b>
Selling price per canned soft drink	0.50
Variable costs per canned soft drink (excluding the can)	0.15
Cost of a can (from Division C)	At transfer price
Fixed costs	1,750,000
Net assets	12,650,000
Sales volume	20,000,000 canned soft drinks

### Transfer Pricing Policy

Division C is required to satisfy the demand of Division D before selling cans externally. The transfer price for a can is full cost plus 20%.

### Performance Management Targets

Divisional performance is assessed on Return on Investment (ROI) and Residual Income (RI). Divisional managers are awarded a bonus if they achieve the annual ROI target of 25%. CD has a cost of capital of 7%.

*Required:*

- (a) **Produce** a profit statement for each division detailing sales and costs, showing external sales and inter-divisional transfers separately where appropriate.

*(6 marks)*

- (b) **Calculate** both the ROI and the RI for Division C and Division D.

*(4 marks)*

The directors of CD are concerned about the future performance of the company and, together with the divisional managers, have now agreed the following:

- A machine that would increase annual production capacity to 50,000,000 cans at Division C will be purchased. The purchase of this machine will increase the net assets of Division C by \$500,000. Assume that there is no impact on unit variable costs or fixed costs resulting from this purchase.
- Inter-divisional transfers will be priced at opportunity cost.

*Required:*

- (c) **Produce** a revised profit statement for each division detailing sales and costs, showing external sales and inter-divisional transfers separately where appropriate.

*(6 marks)*

It has now been decided that inter-divisional transfers are not required to be priced at opportunity cost.

- (d) **Calculate** the minimum transfer price per can that Division C could charge for the 20 million cans required by Division D in order for Division C to achieve the target ROI.

*(5 marks)*

- (e) **Explain** TWO non-financial measures that could also be used to monitor the performance of the manager of Division D against the objectives of CD company.

*(4 marks)*

*(Total for Question Seven = 25 marks)*

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*(Total for Section B = 50 marks)*

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*End of question paper*

*Maths tables and formulae are on pages 13 to 16*

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## PRESENT VALUE TABLE

Present value of 1 unit of currency, 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 TABLE

Cumulative present value of 1 unit of currency 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

$A \cup B = \mathbf{A \text{ or } B}$ .       $A \cap B = \mathbf{A \text{ and } B}$  (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**:       $P(A \cap B) = P(A) * P(B | A)$

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

### 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

## 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:

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

## LEARNING CURVE

$$Y_x = aX^b$$

where:

$Y_x$  = the cumulative average time per unit to produce  $X$  units;

$a$  = the time required to produce the first unit of output;

$X$  = the cumulative number of units;

$b$  = the index of learning.

The exponent  $b$  is defined as the log of the learning curve improvement rate divided by log 2.

## INVENTORY MANAGEMENT

Economic Order Quantity

$$EOQ = \sqrt{\frac{2C_o D}{C_h}}$$

where:  $C_o$  = cost of placing an order  
 $C_h$  = cost of holding one unit in inventory for one year  
 $D$  = annual demand



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## LIST OF VERBS USED IN THE QUESTION REQUIREMENTS

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

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

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

*Performance Pillar*

*Management Level Paper*

*P2 – Performance Management*

*November 2013*

*Wednesday Afternoon Session*