

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.



Performance Pillar

## P2 – Performance Management

Thursday 28 August 2014

### *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 7.
Section B comprises 2 questions and is on pages 8 to 11.
Maths tables and formulae are provided on pages 15 to 18.
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

QLJ is planning to expand its product range by producing two new products: Product X and Product Y.

Product X and Product Y will be produced from different combinations of the same resources. Only products X and Y use these resources. Details of the estimated selling price and cost per unit for each product are shown below:

	Product X	Product Y
Selling price	\$ 229	\$ 260
Material A (\$8 per kg)	40	16
Material B (\$20 per kg)	20	60
Labour (\$25 per hour)	75	100
Variable overhead (\$16 per machine hour)	32	48

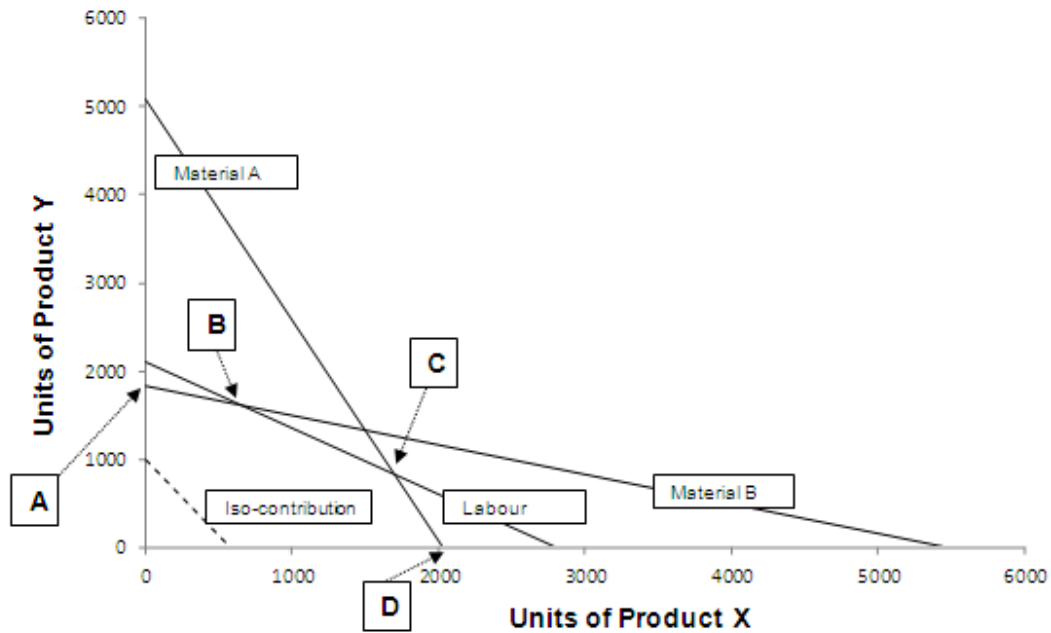
The total fixed costs of producing X and Y will be \$70,000 per month.

The management accountant at QLJ is in the process of producing a linear programming model to determine the optimal monthly production plan for the two new products. The management accountant has established that the following resources are available in each month and has produced the following graph (on page 3):

#### Resources available

Material A	10,150 kg
Material B	5,500 kg
Labour	8,400 hours

Linear programming graph for Products X and Y



The objective of QLJ is to earn the maximum total profit possible per month from the production of products X and Y.

*Required:*

- (a) **Interpret** the graph to determine the optimum monthly production plan and the maximum total profit per month from products X and Y.

Note: You are required to use simultaneous equations to determine the exact quantities of Product X and Product Y to be produced.

*(6 marks)*

- (b) **Calculate** the minimum change in the selling price of Product X that would cause the optimum production plan to change to Point B shown on the graph.

*(4 marks)*

*(Total for Question One = 10 marks)*

TURN OVER

## Question Two

A company has recently launched a new product. The following information is available for the first month of production:

	<b>Budget</b>	<b>Actual</b>	<b>Variance</b>
Production volume (units)	300	256	44 A
Direct material cost (\$)	11,400	10,500	900 F
Direct labour cost (\$)	15,000	4,000	11,000 F
Variable overhead cost (\$)	6,000	1,750	4,250 F
Fixed costs (\$)	125,000	115,000	10,000 F

The standard labour cost per unit of \$50 that was used to calculate the budgeted labour cost was made up of 2 hours at \$25 per hour. However this ignored the impact of a learning curve which was expected to apply for the first 300 units produced. The learning rate was expected to be 90%.

The variable overhead absorption rate is based on direct labour hours.

The actual rate of pay during the month was \$25 per labour hour.

Note: The learning index for a 90% learning curve = -0.152.

*Required:*

(a)

- (i) **Prepare** a performance report for the first month of production taking into account the learning effect. *(4 marks)*

- (ii) **Calculate** the labour efficiency planning variance for the first month of production. *(2 marks)*

- (b) **Calculate** the actual rate of learning that occurred during the first month of production assuming that the actual time taken to produce the first unit was 2 hours. *(4 marks)*

*(Total for Question Two = 10 marks)*

### Question Three

JMM is a car manufacturer. It is a relatively new company and the directors are keen to establish a reputation for high quality. The management of JMM recognises the need to establish a culture of Total Quality Management (TQM) at the company.

The management accounting team at JMM has collected the following actual information for the most recent quarter of the current year:

#### Cost data

	\$
Customer support centre cost per hour	58
Equipment testing cost per hour	30
Manufacturing rework cost per car	380
Warranty repair cost per car	2,600

#### Volume and activity data

Cars requiring manufacturing rework	800 cars
Cars requiring warranty repair	650 cars
Customer support centre time	500 hours
Production line equipment testing time	400 hours

#### **Additional information**

JMM undertook a quality review of its existing suppliers during the quarter at a cost of \$60,000.

Due to the quality issues in the quarter, the car production line experienced periods of unproductive 'down time' which cost \$375,000.

#### *Required:*

- (a) **Produce** a Cost of Quality report for JMM using the four recognised quality cost headings. *(6 marks)*
- (b) **Explain** how a Cost of Quality report would support the development of a TQM culture at JMM. *(4 marks)*

*(Total for Question Three = 10 marks)*

TURN OVER

#### Question Four

TSH provides courses for students who are studying for accountancy examinations. The accountancy education sector is extremely competitive; it is dominated by a small number of national organisations but there is also a large number of smaller regional training providers.

The majority of TSH students are part-time students and fit their studies around their employment. TSH has developed a reputation for understanding its students' needs and delivering a high quality service that meets their requirements.

TSH has grown in recent years from a small regional company to a position where it now has colleges in several of the country's large cities. The company directors now wish TSH to grow further and have implemented a strategy to achieve the objective of becoming "the largest accountancy study provider in the country".

TSH's board of directors currently uses financial reports to monitor the company's performance but are thinking about implementing a Balanced Scorecard approach to performance management.

*Required:*

(a) **Explain** the disadvantages of using financial performance indicators alone to assess performance. *(4 marks)*

(b) **Explain** TWO non-financial performance measures, each from a different perspective of the Balanced Scorecard, which TSH could use to measure the performance of the business against the new strategy. (You must state the perspectives that your measures relate to and explain why the measures would be effective.) *(6 marks)*

*(Total for Question Four = 10 marks)*

### Question Five

PBB is a toy manufacturer and retailer. PBB sells toys to consumers through its large network of retail outlets in its home country and via the company's website.

PBB purchases the materials and components that it needs to manufacture toys from a number of different suppliers. All of the purchases are delivered to PBB's raw material store at its factory and are held there until they are needed for production.

Finished toys are transported from the factory to PBB's retail outlets by PBB's fleet of vehicles. The vehicles follow the same schedule each week irrespective of the load they are carrying. Finished toys that are destined for sale via the company's website are transported to PBB's distribution centre.

PBB has recently won the contract to manufacture and sell a new toy. The new toy, Toy Z, is a doll based on a character from a very popular international children's film. PBB is free to set the selling price of Toy Z as it sees fit, but must pay a royalty fee of 15% of the selling price to the film company. PBB intends to sell Toy Z through its network of retail outlets.

PBB plans to adopt a target costing approach for Toy Z. Market research has determined that the selling price will be \$25 per Toy Z. PBB requires a profit margin of 25% of the selling price of Toy Z.

The forecast costs per Toy Z are:

	\$
Component A	2.15
Component B	1.75
Other materials	see note below for additional information
Labour (0.4 hours at \$15 per hour)	6.00
Product-specific production overhead cost	1.89
Product-specific selling and distribution cost	2.38

Note: Each Toy Z requires 0.6kg of 'other materials'. These 'other materials' are purchased from a supplier at a cost of \$4 per kg and 4% of all materials purchased are found to be substandard.

*Required:*

(a) **Calculate** the cost gap that exists between the forecast total cost per unit and the target cost per unit of Toy Z. (3 marks)

(b) **Discuss** how PBB could reduce costs in THREE primary activities in its value chain. (7 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*

## 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

PPP is a theme park. The following information is available for the forthcoming month:

#### Forecast daily ticket sales and prices

	Ticket sales	Price per ticket
Pre-booked Discounted Ticket	1,500	\$29
Standard Ticket	8,000	\$39
Premium Family Ticket (admits 4 people)	675	\$185

The theme park will be open for 30 days in the month.

#### Costs

Variable costs per person per day are forecast to be \$12.50.

Fixed costs for the month are forecast to be \$6,500,000.

#### Pricing information

The sales of pre-booked discounted tickets and standard tickets will be restricted to 1,500 and 8,000 per day respectively for the forthcoming month. It is forecast that all of these tickets will be sold.

A Premium Family Ticket admits four people to the theme park and allows them to go to the front of the queues in the theme park. The price of a Premium Family Ticket has been set at \$185 in order to maximise the profit from the sale of these tickets for the month. Market information shows that for every \$5 increase in the selling price of a Premium Family Ticket the demand would reduce by 25 tickets, and that for every \$5 decrease in the selling price the demand would increase by 25 tickets.

The theme park has adequate capacity to accommodate any level of demand for Premium Family Tickets. It is to be assumed that four people would always be admitted on every Premium Family Ticket sold.

Sales of the different ticket types are independent of each other.

#### Equipment hire

PPP is considering hiring some automated ticket reading equipment for the forthcoming month. The hire of this equipment would increase fixed costs by \$250,000 for the month. However, variable costs per person would be reduced by 8% during the period of the hire.



*Required:*

- (a) **Calculate** the financial benefit of hiring the equipment for the forthcoming month given its impact on variable cost and therefore the price charged for Premium Family Tickets.

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

*(13 marks)*

It has now been realised that a competing theme park is planning to offer discounted ticket prices during the forthcoming months. It is thought that this will reduce the demand for PPP's Standard Tickets. PPP will not be able to reduce the price of the Standard Tickets for the forthcoming month.

- (b) **Discuss** the sensitivity of the decision to hire the equipment to a change in the number of Standard Tickets sold per day. (Note: your answer should include the calculation of the sensitivity).

*(4 marks)*

PPP produces an annual budget. The annual budget includes details of budgeted ticket sales volumes, revenues and costs for each month. Each month PPP compares actual performance against the budget for that month.

At the start of every month, PPP conducts a review of its competitors to produce a revised forecast for ticket sales. This revised sales forecast is used to devise pricing policies and promotional campaigns to ensure that budgeted targets are met.

*Required:*

- (c) **Compare** and **contrast** the use of feedforward control and feedback control, using the information given above about PPP to illustrate your answer.

*(8 marks)*

*(Total for Question Six = 25 marks)*

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*Section B continues on the next page*

TURN OVER

## Question Seven

MNP is a divisionalised organisation. Some of the divisions are in overseas countries. Divisional performance is assessed by the trend in the Return on Capital Employed (ROCE) and the Residual Income (RI) generated by each division based on their year-end values.

The following summary financial information is available for Division M:

Year ending 31st August	2014	2013	2012
	\$000	\$000	\$000
Revenue	6,450	6,200	6,000
Direct costs	<u>1,070</u>	<u>1,040</u>	<u>1,000</u>
Gross profit	5,380	5,160	5,000
Other operating costs	<u>3,350</u>	<u>3,600</u>	<u>3,800</u>
Operating profit	<u>2,030</u>	<u>1,560</u>	<u>1,200</u>
Capital employed as at the year end	3,200	4,000	5,000

MNP has a cost of capital of 5% per annum.

The figures shown above for the capital employed are the net book values of the division's non-current assets.

Other operating costs include depreciation.

There have been no additions or disposals of non-current assets within Division M during the three year period. No additions or disposals are expected in 2015.

For the year ending 31 August 2015 it is expected that the revenues and costs (excluding depreciation) will be the same as those in 2014.

*Required:*

(a) **Calculate** for Division M the Return on Capital Employed (ROCE) and the Residual Income (RI) for:

- (i) 2014
- (ii) 2015

*(4 marks)*

The board of directors of MNP have identified what they believe is a profitable project. The project would require a capital investment of \$2,000,000. The details of the project are as follows:

Annual revenue	\$750,000
Annual costs (excluding depreciation)	\$225,000
Non-current assets	\$2,000,000
Life of the project	5 years

The new assets would be depreciated in the same way as all other assets in MNP. At the end of the project the new assets would have no resale value.

The board of MNP have suggested that Division M should undertake the project but the manager of Division M is reluctant to do so.

*Required:*

- (b) **Calculate** the forecast ROCE and RI for Division M for the year ending 31 August 2015 if the project is undertaken by Division M. (Assume that the project started on 1 September 2014).

*(6 marks)*

- (c) **Discuss**, using appropriate calculations based on the above scenario, why the use of ROCE and RI as performance measures can cause incorrect capital investment decisions to be taken.

*(8 marks)*

The project would enable MNP to produce components that could be used by several of the divisions in the manufacture of their products. However the Board are aware that the setting of international transfer prices can be problematic and that transfer prices can be disputed by taxation authorities.

- (d) **Explain** how international transfer prices should be set to avoid taxation disputes. (Your answer should explain each of the three acceptable methods.)

*(7 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 15 to 18*

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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 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

$$\text{Series} = \text{Trend} + \text{Seasonal} + \text{Random}$$

Multiplicative Model

$$\text{Series} = \text{Trend} * \text{Seasonal} * \text{Random}$$

## 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

## 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*

*September 2014*

*Thursday*