CIMA

Management Accounting Pillar

Managerial Level Paper

P2 – Management Accounting - Decision Management

23 November 2005 – Wednesday 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 Sections B and C are contained in a dotted box.
Answer the ONE compulsory question in Section A. This is comprised of eight sub-questions and is on pages 2 to 4.
Answer ALL THREE compulsory questions in Section B on pages 5 to 7.
Answer TWO of the three questions in Section C on pages 8 to 13.
Maths Tables and Formulae are provided on pages 15 to 17. 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.

P2 – Decision Management

TURN OVER

SECTION A – 20 MARKS

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

ANSWER *ALL* EIGHT SUB-QUESTIONS

Instructions for answering Section A:

The answers to the eight sub-questions in Section A should ALL be written in your answer book.

Your answers should be clearly numbered with the sub-question number and 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 **1.6**, **1.7**, and **1.8** you should show your workings as marks are available for the method you use to answer these sub-questions.

Question One

1.1 A five year project has a net present value of $160,000 when it is discounted at 12%. The project includes an annual cash outflow of $50,000 for each of the five years. No tax is payable on projects of this type.

The percentage increase in the value of this annual cash outflow that would make the project no longer financially viable is closest to

A 64%

B 89%

C 113%

D 156%

(2 marks)

Question One continues on the opposite page

The following data are to be used when answering questions 1.2 and 1.3

A company expects to sell 1,000 units per month of a new product but there is uncertainty as to both the unit selling price and the unit variable cost of the product. The following estimates of selling price, variable costs and their related probabilities have been made:

Selling Price		*Unit Variable Cost*	
£ per unit	*Probability*	*£ per unit*	*Probability*
20	25%	8	20%
25	40%	10	50%
30	35%	12	30%

There are specific fixed costs of £5,000 per month expected for the new product.

1.2 The expected value of monthly contribution is

A £5,890

B £10,300

C £10,890

D £15,300

(2 marks)

1.3 The probability of monthly contribution from this new product exceeding £13,500 is

A 24·5%

B 30·5%

C 63·0%

D 92·5%

(2 marks)

1.4 PT has discovered that when it employs a new test engineer there is a learning curve with a 75% rate of learning that exists for the first 12 customer assignments. A new test engineer completed her first customer assignment in 6 hours.

Calculate the time that she should take for her 7th assignment to the nearest 0·01 hours.

Note: The index for a 75% learning curve is -0·415.

(2 marks)

Question One continues on the next page

The following data are to be used when answering questions 1.5 and 1.6

JKL plc has $1 million available for investment. It has identified three possible investments, J, K and L, which each have a life of three years. The three year period coincides with JKL plc's investment plans. JKL plc uses a 15% cost of capital when appraising investments of this type. Details of these investments are set out below:

	J *$000*	*K* *$000*	*L* *$000*
Initial investment	400	500	300
Net positive cashflows:			
Year 1	40	70	50
Year 2	80	90	50
Year 3	510	630	380
Net Present Value	31	43	31

1.5 Assuming that each of the investments is divisible, they are not mutually exclusive and cannot be invested in more than once, state the optimum investment plan for JKL plc.

(2 marks)

1.6 Calculate the Internal Rate of Return of an investment in project K to the nearest 0·01%.

(3 marks)

1.7 FH is an electronics company that has developed a new product for the video conferencing market. The product has successfully completed its testing phase and FH has now produced the first four production units. The first unit took 3 hours of labour time and the total time for the first four units was 8·3667 hours.

Calculate the learning curve improvement rate (rate of learning) to the nearest 0·1%.

(3 marks)

1.8 A baker is trying to decide the number of batches of a particular type of bread that he should bake each day. Daily demand ranges from 10 batches to 12 batches. Each batch of bread that is baked and sold yields a positive contribution of £50, but each batch of bread baked that is not sold yields a negative contribution of £20.

Assuming the baker adopts the *minimax regret* decision rule, calculate the number of batches of bread that he should bake each day. You must justify your answer.

(4 marks)

(Total for Section A = 20 marks)

End of Section A

Section B starts on the opposite page

SECTION B – 30 MARKS

[the indicative time for answering this section is 54 minutes]

ANSWER *ALL* THREE QUESTIONS

Question Two

The owner of a taxi company is considering the replacement of his vehicles. He is planning to retire in 6 years' time and is therefore only concerned with that period of time, but cannot decide whether it is better to replace the vehicles every two years or every three years.

The following data have been estimated (all values at today's price levels):

Purchase cost and trade in values

Taxi cost	£15,000
Trade-in value of taxi:	
after 2 years	£7,000
after 3 years	£4,000

Annual costs and revenues

Vehicle running cost	£20,000 per year
Fares charged to customers	£40,000 per year

Vehicle servicing and repair costs

Vehicle servicing and repair costs depend on the age of the vehicle. In the following table year 1 represents the cost in the first year of the vehicle's ownership; year 2 represents the cost in the second year of ownership, and so on:

Year 1	£500
Year 2	£2,500
Year 3	£4,000

Inflation

New vehicle costs and trade in-values are expected to increase by 5% per year.
Vehicle running costs and fares are expected to increase by 7% per year.
Vehicle servicing and repair costs are expected to increase by 10% per year.

Required:

Advise the company on the optimum replacement cycle for its vehicles and state the net present value of the opportunity cost of making the wrong decision. Use a discount rate of 12% per year. All workings and assumptions should be shown. Ignore taxation.

(10 marks)

Section B continues on the next page

Question Three

ML is an engineering company that specialises in providing engineering facilities to businesses that cannot justify operating their own facilities in-house. ML employs a number of engineers who are skilled in different engineering techniques that enable ML to provide a full range of engineering facilities to its customers. Most of the work undertaken by ML is unique to each of its customers, often requiring the manufacture of spare parts for its customers' equipment, or the building of new equipment from customer drawings. As a result most of ML's work is short-term, with some jobs being completed within hours while others may take a few days.

To date ML has adopted a cost plus approach to setting its prices. This is based upon an absorption costing system that uses machine hours as the basis of absorbing overhead costs into individual job costs. The Managing Director is concerned that over recent months ML has been unsuccessful when quoting for work with the consequence that there has been an increase in the level of unused capacity. It has been suggested that ML should adopt an alternative approach to its pricing based on marginal costing since *"any price that exceeds variable costs is better than no work".*

Required:

With reference to the above scenario

(i) briefly explain absorption and marginal cost approaches to pricing;
(ii) discuss the validity of the comment *"any price that exceeds variable costs is better than no work"*.

(10 marks)

Section B continues on the opposite page

Question Four

You are the assistant management accountant within PK plc. PK plc manufactures high quality self-assembly furniture from raw materials utilising highly skilled labour within a computer-controlled manufacturing facility. The company produces a range of furniture, and, because of the lead time to receive delivery of its raw materials, has a finished goods inventory policy of holding an average of two weeks estimated sales in inventory. Customer demand is seasonal and, as a consequence, this finished goods inventory level fluctuates throughout the year. The company also holds inventories of raw materials based upon estimates of its production requirements. An absorption costing system is used to attribute all manufacturing costs to output.

Increasingly PK plc is facing competition, particularly from overseas manufacturers and its sales team have to make decisions about the extent to which it can offer price discounts in order to win customer orders.

Required:

Prepare a report addressed to the Management Team of PK plc that explains the changing nature of cost structures in the modern manufacturing environment and the implications for PK plc's

(i) inventory valuation
(ii) short term decision making

(10 marks)

Note: There are 2 marks available for format and presentational style

(Total for Section B = 30 marks)

End of Section B

Section C starts on the next page

TURN OVER

SECTION C – 50 MARKS

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

ANSWER *TWO* QUESTIONS OUT OF THREE

Question Five

The MP Organisation is an independent film production company. It has a number of potential films that it is considering producing, one of which is the subject of a management meeting next week. The film which has been code named CA45 is a thriller based on a novel by a well respected author.

The script has already been written at a cost of $10,000 and preliminary discussions have been held with the lead actors. The MP Organisation has incurred travel and other incidental costs of $4,000 to date. The following additional costs have been estimated in order to produce the film:

	$000
Production director's fee	100
Set design	10
Costumes and wardrobe	20
Actors' fees	50
Musician / Songwriter for soundtrack	5
Camera and equipment hire	20
Actors' travel and accommodation costs	10
Other production costs	5

Production of the film is estimated to take 16 weeks, and all of the above costs would be incurred during this period, though there is some uncertainty about the accuracy of these cost estimates. These cost values are those most likely to be incurred. With the exception of the payment to the production director which is a fixed fee, the other costs could be up to 10% higher or lower than the values estimated.

In addition there will be advertising, promotion and marketing costs of $15,000 immediately, $10,000 in each of years 1 and 2, and then $5,000 during each of the next three years. These figures are not subject to any uncertainty.

The film is expected to have a life of five years. During the first three years the film will be sold to cinemas through distributors and MP will receive 25% of the gross revenues. The film will be sold as a DVD for the remaining two years and MP will receive 100% of these revenues. The expected gross revenues are as follows:

Year	*Source*	*Gross revenue*	*MP's share*
1	Cinema	$400,000	25%
2	Cinema	$600,000	25%
3	Cinema	$450,000	25%
4	DVD	$50,000	100%
5	DVD	$30,000	100%

However it is thought that the gross revenues could vary by as much as 20% higher or lower than those stated, depending on the popularity of the film. The initial level of popularity will continue for all five years.

The MP Organisation evaluates new films using a cost of capital of 15% per year.

Required:

(a) Prepare calculations for each combination of the most likely, optimistic and pessimistic cost **and** revenue values to evaluate whether or not the MP Organisation should continue with the production of the film. Discuss your analysis and make a recommendation to MP.

(15 marks)

(b) Prepare notes for the management meeting that explain how probabilities can be used

(i) to calculate the expected NPV; and
(ii) in a simulation model to evaluate the risk of a long term decision.

(10 marks)

(Total for Question Five = 25 marks)

Section C continues on the next page

Question Six

QP plc is a food processing company that produces pre-prepared meals for sale to consumers through a number of different supermarkets. The company specialises in three particular pre-prepared meals and has invested significantly in modern manufacturing processes to ensure a high quality product. The company is very aware of the importance of training and retaining high quality staff in all areas of the company and, in order to ensure their production employees' commitment to the company, the employees are guaranteed a weekly salary that is equivalent to their normal working hours paid at their normal hourly rate of £7 per hour.

The meals are produced in batches of 100 units. Costs and selling prices per batch are as follows:

Meal	*TR* *£/batch*	*PN* *£/batch*	*BE* *£/batch*
Selling Price	340	450	270
Ingredient K (£5/kg)	150	120	90
Ingredient L (£10/kg)	70	90	40
Ingredient M (£15/kg)	30	75	45
Labour (£7/hour)	21	28	42
Factory costs absorbed	20	80	40

QP plc has adopted throughput accounting for its short-term decisions.

Required:

(a) State the principles of throughput accounting and the effects of using it for short-term decision making.

(6 marks)

(b) QP plc is preparing its production plans for the next three months and has estimated the maximum demand from its customers to be as follows:

TR	500 batches
PN	400 batches
BE	350 batches

These demand maximums are amended figures because a customer has just delayed its request for a large order and QP has unusually got some spare capacity over the next three months. However, these demand maximums do include a contract for the delivery of 50 batches of each to an important customer. If this minimum contract is not satisfied then QP plc will have to pay a substantial financial penalty for non-delivery.

The Production Director is concerned at hearing news that two of the ingredients used are expected to be in short supply for the next three months. QP plc does not hold inventory of these ingredients and although there are no supply problems for ingredient K, the supplies of ingredients L and M are expected to be limited to:

Ingredient L	7,000 kilos
Ingredient M	3,000 kilos

The Production Director has researched the problem and found that ingredient V can be used as a direct substitute for ingredient M. It also costs the same as ingredient M. There is an unlimited supply of ingredient V.

Required:

Prepare calculations to determine the production mix that will maximise the profit of QP plc during the next three months.

(10 marks)

(c) The World Health Organisation has now announced that ingredient V contains dangerously high levels of a chemical that can cause life-threatening illnesses. As a consequence it can no longer be used in the production of food.

As a result, the production director has determined the optimal solution to the company's production mix problem using linear programming. This is set out below:

Objective function value	110,714
TR value	500
PN value	357
BE value	71
TR slack value	0
PN slack value	43
BE slack value	279
L value	3
M value	28

Required:

Explain the meaning of each of the values contained in the above solution.

(9 marks)

(Total for Question Six = 25 marks)

Section C continues on the next page

TURN OVER

Question Seven

ZP plc is a marketing consultancy that provides marketing advice and support to small and medium sized enterprises. ZP plc employs 4 full time marketing consultants who each expect to deliver 1,500 chargeable hours per year and each receive a salary of £60,000 per year. In addition the company employs 6 marketing support/administration staff whose combined total salary cost is £120,000 per year.

ZP plc has estimated its other costs for the coming year as follows:

	£000
Office premises: rent, rates, heating	50
Advertising	5
Travel to clients	15
Accommodation whilst visiting clients	11
Telephone, fax, communications	10

ZP plc has been attributing costs to each client (and to the projects undertaken for them) by recording the chargeable hours spent on each client and using a single cost rate of £75 per chargeable hour. The same basis has been used to estimate the costs of a project when preparing a quotation for new work.

ZP plc has reviewed its existing client database and determined the following three average profiles of typical clients:

Client profile	*D*	*E*	*F*
Chargeable hours per client	100	700	300
Distance (Miles) to client	50	70	100
Number of visits per client	3	8	3
Number of clients in each profile	10	5	5

The senior consultant has been reviewing the company's costing and pricing procedures. He suggests that the use of a single cost rate should be abandoned and, where possible, activities should be costed individually. With this is mind he has obtained the following further information:

- It is ZP plc's policy that where a visit is made to a client and the distance to the client is more than 50 miles, the consultant will travel the day before the visit and stay in local accommodation so that the maximum time is available for meeting the client the following day.
- The cost of travel to the client is dependent on the number of miles travelled to visit the client.
- Other costs are facility costs – at present the senior consultant cannot identify an alternative basis to that currently being used to attribute costs to each client.

Required:

(a) Prepare calculations to show the cost attributed to each client group using an activity based system of attributing costs.

(7 marks)

(b) Discuss the differences between the costs attributed using activity based costing and those attributed by the current system and advise whether the senior consultant's suggestion should be adopted.

(9 marks)

(c) In a manufacturing environment activity based costing often classifies activities into those that are: unit; batch; product sustaining; and facility sustaining. Discuss, giving examples, how similar classifications may be applied to the use of the technique in consultancy organisations such as ZP plc.

(9 marks)

(Total for Question Seven = 25 marks)

(Total for Section C = 50 marks)

End of question paper

Maths Tables and Formulae are on pages 15 to 17

TURN OVER

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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	0705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180
19	0.828	0.686	0.570	0.475	0.396	0.331	0.277	0.232	0.194	0.164
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149

Periods (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	7.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

FORMULAE

Time series

Additive model:

Series = Trend + Seasonal + Random

Multiplicative model:

Series = Trend*Seasonal*Random

Regression analysis

The linear regression equation of Y on X is given by:

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

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

$$\sum Y = na + b\sum X$$

$$\sum XY = a\sum X + b\sum X^2$$

Exponential $Y = ab^x$

Geometric $Y = aX^b$

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.

Management Accounting Pillar

Managerial Level

P2 – Management Accounting – Decision Management

November 2005

Wednesday Morning Session