
CERTIFIED PUBLIC ACCOUNTANT

FOUNDATION LEVEL 1 EXAMINATION

F 1.1 : BUSINESS MATHEMATICS AND QUANTITATIVE **METHODS**

WEDNESDAY : 11 JUNE 2014

INSTRUCTIONS:

- 1. Time Allowed : 3 hours 15 minutes (15 minutes reading and 3 hours writing).**
- 2. This examination has seven questions and only five questions are to be attempted.**
- 3. Marks allocated to each question are shown at the end of the question.**
- 4. Show all your workings, where applicable.**

QUESTION ONE

- (a) State clearly what is meant by two events being statistically independent? **(2 Marks)**
- (b) In a certain factory which employs 500 men, 20% of all employees have a minor accident in a given year. Of these, 30% had safety instructions whereas 80% of all employees had no safety instructions

Required :

Find the probability of an employee being accident-free given that he had :

- (i) No safety instructions **(5 Marks)**
- (ii) Safety instructions **(5 Marks)**
- (c) An electric utility company has found that the weekly number of occurrences of lightning striking the transformers is a poisson distribution with mean 0.4.

Required :

- (i) The probability that no transformer will be struck in a week. **(3 Marks)**
- (ii) The probability that at most two transformers will be struck in a week. **(5 Marks)**

(Total: 20 Marks)

QUESTION TWO

- (a) Define the following terms used in game theory :

- (i) Dominance. **(2 Marks)**
- (ii) Saddle point **(2 Marks)**
- (iii) Mixed strategy **(2 Marks)**
- (iv) Value of the game **(2 Marks)**

- (b) Consider the two person zero sum game between Bahati and Furaha given by the following pay-off table:

	1	2	3	4
Bahati Strategies	2	2	3	-1
Furaha Strategies	4	3	2	6

Required :

- (i) Using minimax rule, is it possible to determine the value of the game? Give reasons. **(3 Marks)**
- (ii) Use graphical method to determine the value of the game. **(9 Marks)**

(Total: 20 Marks)

QUESTION THREE

- (a) Data below show the monthly share price of Microsofti Limited for the year ended 30 November 2013.

Month	Share price (Frw)
December 2012	80
January 2013	76
February 2013	78
March 2013	82
April 2013	72
May 2013	82
June 2013	68
July 2013	74
August 2013	70
September 2013	74
October 2013	80
November 2013	82

Required:

The share price forecast for the month of December 2013 using exponential smoothing (use a smoothing constant of 0.3) **(4 Marks)**

(b) (i) Outline any three assumptions of the linear programming model. **(3 Marks)**

(ii) Explain the importance of slack variables in linear programming. **(3 Marks)**

(c) A company produces two products, A and B. The standard revenues and costs per unit of the products are :

	Product A		Product B	
	Frw	Frw	Frw.	Frw
Selling price		200		180
Variable costs:				
Material Z (Frw.10 per kilogram)	40		40	
Direct labour (Frw. 8 per hour)	32		16	
Packaging (Frw 12 per hour)	12		24	
Other variable costs	<u>76</u>		<u>70</u>	
		(160)		(150)
Fixed overheads (Frw.12 per hour) of direct labour		<u>(28)</u>		<u>(14)</u>
Standard profit		12		16

Additional information :

- Packaging is a separate automated activity and the cost relates to materials electricity.
- The maximum available inputs per week are limited as follows:

Material Z – 120 Kilograms

Direct labour – 100 Hours

Packaging time – 50 Hours

3. The profit of the company could be increased by increasing the selling price of product B.

Required:

(i) Formulate and solve the above linear programming problem. **(5 Marks)**

(ii) Determine the maximum selling price of product B at which the solution in (i) above would still remain optimal. **(5 Marks)**

(Total 20 Marks)

QUESTION FOUR

(a) The data below relate to products A and B, manufactured by Mauzo Limited.

$Q_1 = 2(p_2 - p_1) + 4$ is the demand function for product A.

$Q_2 = p_1/4 - 5/2p_2 + 52$ is the demand function for product B.

Q_1 is the quantity of product A

Q_2 is the quantity of product B.

P_1 is the selling price per unit of product A

P_2 is the selling price per unit of product B.

The variable costs per unit are Frw 9 and Frw. 12 for products A and B

Required:

i) Total revenue **(2 Marks)**

ii) Total cost **(2 Marks)**

iii) Profit function **(2 Marks)**

iv) Units for max profits **(2 Marks)**

v) Maximum profits **(2 Marks)**

(b) Ice Making Limited manufactures eight models of refrigerators. A panel of experts tested the refrigerators for quality and ranked them beginning with the refrigerator model having the highest quality. The table below shows the ranking of the eight refrigerators model and their retail prices.

A	3	55
B	4	50
C	6	45
D	2	60
E	8	40
F	5	52
G	7	42
H	1	54

Required:

- (i) The rank correlation coefficient. Interpret your result. **(5 Marks)**
- (ii) The coefficient of determination. Comment on your result. **(5 Marks)**

(Total 20 Marks)

QUESTION FIVE

- (a) Distinguish between the following sets of terms as used in quantitative analysis.
 - (i) Union of set **(2 Marks)**
 - (ii) Right-tailed test and left-tailed test. **(2 Marks)**
- (b) Describe the Bayers' Theorem of probability **(2 Marks)**
- (c) Jane, a green grocer, buys and sells strawberries in boxes. The strawberries have no value after the first day of purchase and the daily demand for the strawberries is uncertain. Jane purchases the strawberries at Frw.30 per box and sells them at Frw. 80 per box.

The following information about the probability distribution of the daily demand for the strawberries is provided

Daily demand (boxes)	Probability
10	0.2
11	0.4
12	0.3
13	0.1

Required :

- (i) The optimal stock level using the expected monetary value approach **(3 Marks)**
- (ii) The optimal stock level using the expected opportunity loss approach **(3 Marks)**
- (d) The table below shows the dividends per share of nine companies quoted on Utopia Stock Exchange, for the years 2012 and 2013:

Company	Dividends per share	
	2012	2013
A	0.69	1.24
B	0.63	0.75
C	1.82	2.30
D	1.75	1.53
E	1.24	1.06
F	1.61	1.40
G	0.53	0.80
H	0.99	0.46
I	1.36	0.24

Required:

Determine whether there was a significant difference in the dividends per share of the companies between years 2012 and 2013. (use a significance level of 5%). **(8 Marks)**

(Total 20 Marks)

QUESTION SIX

- a) Differentiate between resource allocation and resource leveling of activities. **(2 Marks)**
- b) Consider a project which has been modeled as follows :

Activity	Immediate Predecessor(s)	Completion Time (weeks)
A	-	7
B	-	10
C	A	4
D	A	30
E	A	7
F	B,C	12
G	B,C	15
H	E,F	11
I	E,F	25
J	E,F	6
K	D,H	21
L	G,J	25

Required:

- (a) Determine the project’s expected completion time and its critical path. **(14 Marks)**
 - (b) Can activities E and G be performed at the same time without delaying the completion of the project? **(2 Marks)**
 - (c) Can one person perform A, G and I without delaying the project? **(2 Marks)**
- (Total: 20 Marks)**

QUESTION SEVEN

- (a) Explain the applications of simulation in business **(6 Marks)**
- (b) Gatonye Limited purchases toys from Dubai and resells to retail stores. The company is considering adopting a stock management system based on the economic order quantity (EOQ) model. The company estimates the stock management costs as follows:

Costs	Percentage of purchase price per annum
Storage	3
Insurance	1
Handling	1
Obsolescence	3
Opportunity costs of funds	10

Additional information :

1. Fixed costs associated with placing each order are Frw 31,154
2. The purchase price per toy is Frw 450
3. The selling price per toy is Frw 630
4. There is two week delay between the order and delivery of toys
5. The variable selling cost per toy is Frw 30
6. The average weekly demand of the toy is 10,000. However, the weekly demand of the toys has recently varied between 6,000 and 14,000 toys.
7. The probability of sales in the recent past, over a two-week period has been estimated as follows :

Sales	Probability
12,000	0.05
16,000	0.20
20,000	0.50
24,000	0.20
28,000	0.05

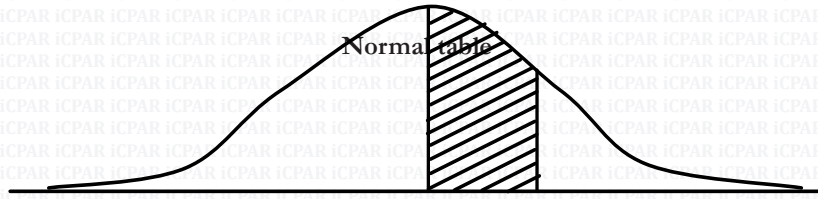
8. Approximately 25 per cent of orders are lost if adequate stock is not available when demanded in any two week period while 75 per cent of customers would be willing to wait until new stock arrives.
9. Assume a 52 week year

Required:

- (i) The optimal order quantity of the toys over a one-year period, based on the EOQ model. **(3 Marks)**
- (ii) The quantity of safety stock that should be maintained by GATONYE Limited. **(6 Marks)**
- (iii) If GATONYE Limited was to be offered a quantity discount of 1 per cent for orders of 30,000 toys or more, advise the company on whether to accept or reject the discount. **(5 Marks)**

(Total 20 Marks)

End of question paper



Area between 0 and z

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0	0.004	0.008	0.012	0.016	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.091	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.148	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.17	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.195	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.219	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.258	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.291	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.334	0.3365	0.3389
1	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.377	0.379	0.381	0.383
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.398	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.437	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.475	0.4756	0.4761	0.4767
2	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.483	0.4834	0.4838	0.4842	0.4846	0.485	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.489
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.492	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.494	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.496	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.497	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.498	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.499	0.499