



CERTIFIED PUBLIC ACCOUNTING

FOUNDATION LEVEL 1 EXAMINATION

F1.1: BUSINESS MATHEMATICS AND QUANTITATIVE METHODS

DATE: THURSDAY 29, AUGUST 2024

INSTRUCTIONS:

1. **Time allowed: 3 hours and 15 minutes.** (15 minutes reading and 3 hours writing).
2. This paper 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 and formulas, where applicable.
5. The question paper should not be taken out of the examination room.

QUESTION ONE

- a) Musanze company Ltd. has hired Mr. Turinayo to conduct market research, Mr. Turinayo decided to conduct the research in Musanze city within a period of four days.

Required:

State four reasons why the researcher might find it useful to use samples than conducting a survey on entire population of Musanze city. (4 Marks)

- b) **Outline three disadvantages of simple random sampling.** (3 Marks)

- c) In Financial Accounting unit, 31 students were examined and the following results obtained:

61	71	46	44	26	23	32	85
52	44	38	37	49	59	58	63
31	29	37	48	76	61	46	31
38	41	49	52	56	75	61	

Required:

Find the median score (2 Marks)

- d) Group the frequency distribution from the table in c) above into 7 equal continuous intervals starting from 20-30,30-40 and so on

Required:

- i) **Calculate the Mode** (1 Mark)

- ii) **Compute the Arithmetic Mean** (2 Marks)

- e) The data below was recorded in Karongi district by a tourist firm.

Items	Food	Drink	Travel	Research	Marketing
Price	150	130	200	120	180
Weight	8	6	5	2	3

Required:

- i) **Calculate the weighted mean.** (2 Marks)

- ii) **Discuss three types of curves that describe Kurtosis or peaked-ness of a distribution in mathematics and list three properties of a normal distribution curve.** (6 Marks)

(Total: 20 Marks)

QUESTION TWO

a) Akazi and Habirama are Certified Public Accountants who have recently started to give business pieces of advice to their clients. Acting as consultants at Kigali city, they have estimated the demand curve of a client's firm to be;

$$AR=200-8Q$$

Where AR is average revenue in millions of FRW in millions and Q is the output in units.

Investigation of the client firm's cost profile in millions shows that marginal cost (MC) is given by:

$$MC = Q^2 - 28Q + 211$$

Further investigations have shown that the firm's cost when not producing output is FRW10,000,000

Required:

i) Formulate the equation of total cost. (3 Marks)

ii) Compute the equation of total revenue. (3 Marks)

b) Demand function for Turinayo company ltd is given by the following functions

$$P = 12 - 0.4Q$$

P is the price of the product in FRW, Q is the quantity demanded, and the total cost (C) in FRW is given by

$$C = 5 + 4Q + 0.6Q^2$$

Required:

Compute the price and quantity that will help the firm to maximize the profit. (6 Marks)

c) David buys 2 scones and 2 cups of coffees in a shop and the cost is FRW 18. Ellie buys 3 scones and 2 cup of coffees in the same shop and the cost is FRW 22.

Required:

Form a pair of simultaneous equation and find the cost of scones and coffee. (4 Marks)

d) **Find the first order derivative and the second order derivative of**

i) $10Q^2 - 30Q + 100$. (2 Marks)

ii) $8Q^3 - 10Q - 20,000$. (2 Marks)

(Total: 20 Marks)

QUESTION THREE

a) **State two components of time series** (2 Marks)

b) A financial consultancy firm demands that to qualify for an interview, the applicant must have scored 380 points in an interview test which is normally distributed and a standard deviation of 30 points.

Required:

Calculate the probability that a particular applicant scored below 400 points. (3 Marks)

c) The weights of patients in Wimana hospital are normally distributed with a mean weight of 68 kgs and a standard deviation of 3. Mr. Kurinayo is one of the patients who weigh 77kgs.

Required:

Calculate the Z score using the above analysis. (3 Marks)

d) A potato crisps making factory at western province buys potatoes from farmers in order to produce, a random sample of 750 potatoes was picked and revealed that the mean weight is 358 g with a standard deviation of 50g.

Required:

i) Compute the standard error of the mean. (3 Marks)

ii) Outline three benefits of standard error. (3 Marks)

e) For the purpose of stopping malaria. A sample of 200 patients affected by malaria were selected. The following results were obtained.

Details	Treated patients	Not treated patients	Total
Cured patients	60	80	140
Not cured patients	40	20	60
Total	100	100	200

Required:

Use the chi square test at 95% level to test the hypothesis of the treatment. (6 Marks)
(Total: 20 Marks)

QUESTION FOUR

a) Rubavu accounting firm has noticed that of the companies it audits, 85% show no inventory shortage, 10% show small inventory shortage and 5% show large inventory shortage. Rubavu firm has established a new accounting test and has determined the following probabilities

$$P(\text{Company will pass test/no shortage}) = 0.90$$

$$P(\text{Company will pass test/small shortage}) = 0.50$$

$$P(\text{Company will pass test/large shortage}) = 0.20$$

Required:

Determine the probability of passing the test using a probability tree. (6 Marks)

b) Differentiate between a random variable and probability distribution and highlight two properties of random variables. (2 Marks)

c) Highlight four properties of binomial probability distribution. (4 Marks)

d) Rimer Bottlers Ltd produces natural mineral water called 'AMAZI'. The table below shows the cost incurred in the year ended 31/12/2023.

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Periods(X)	1	2	3	4	5	6	7	8	9	10	11	12
Cost, Y (FRW)	20	30	40	50	20	30	40	50	60	70	10	9

Required:

Forecast the cost for January 2024 using Linear regression equation method. (8 Marks)

(Total: 20 Marks)

QUESTION FIVE

a) Outline two importance of network diagram in quantitative methods. (2 Marks)

b) Differentiate between multiplicative model and additive model as applied in time series analysis. (2 Marks)

c) Mr. Yego deposited FRW 2,000 in a saving account earning 10% compound interest per annum for 2 years.

Required:

Calculate the amount of money at the end of the period if the interest is charged annually, quarterly and semi-annually. (6 Marks)

d) Suppose you invest FRW 4,000 at the beginning of a particular year and that you add FRW 5 000 at the end of the year to this investment, if interest is compounded at 10%.

Required:

Calculate the amount invested at the end of the first year. (2 Marks)

e) To produce an annual report of consumer price index, the institute of statistics produced the following table for Nyarugenge district showing the prices and quantities of four commodities for years 2022 and 2023.

Commodity	2022		2023	
	Price (FRW)	Quantity (Kgs)	Price (FRW)	Quantity (Kgs)
A	4	20	6	10
B	3	15	5	12
C	2	25	3	15
D	5	12	7	10

Required:

i) Calculate the Laspeyres price index and Paasche's price index (5 Marks)

ii) The price of rice in Huye market was FRW15,000 per kg in year 2023. In the year 2022, the price was FRW 12,000 per kg

Required:

Calculate the simple price index. (1 Mark)

iii) Distinguish term Fixed base and chain-based in index numbers. (2 Marks)

(Total: 20 Marks)

QUESTION SIX

a) Murakoze Ltd is considering development of a beauty product that will be manufactured and sold in the entire country as shown in the table below:

Details of the activities	Activity	Preceding activities	Time estimated (weeks)
Designing the product	A	-	3
Primary pricing analysis	B	-	1
Product designing and fixing	C	-	5
Costs analysis	D	A	1
Processing	E	C	6
Cost estimation	F	E	1
Profit loading	G	B, D, F	2
Demand analysis	H	G	8

Required:

i) Draw the network for this project and determine the project duration. (9 Marks)

ii) Determine the latest finish time for demand analysis activity. (1 Mark)

iii) Determine the critical path and interpret its meaning. (2 Marks)

b) A manufacturing company at Nyagatare district is considering its production capacity for its product called “air freshener”. The following are its states of nature and decision alternatives pay offs.

Decision alternatives	States of nature		
	High demand	Moderate demand	Little demand
Expand	150	225	250
Reduce	180	140	180
Do nothing	220	210	160

Determine the optimal decision using:

i) Max-min criterion. (1 Mark)

ii) Max-max criterion. (1 Mark)

iii) Min-max regret criterion. (3 Marks)

iv) Maximum expected payoff (assuming equal likelihood of states of nature). (3 Marks)

(Total: 20 Marks)

QUESTION SEVEN.

a) Outline the four advantages of linear programming. (4 Marks)

b) State four requirements of linear programming. (4 Marks)

c) A nutritionist at Uzima Hospital wishes to mix two types of foods for the patient’s diet in such a way that vitamin content of the mixture contains at least 10 units of vitamin B and 13 units of vitamin C. Food (F1) contains 1 unit per kg of vitamin B and 2 units per kg of vitamin C. Food(F2) contains 2units per kg of vitamin B and 1 unit of vitamin C. Food (F1) costs FRW 60 per kg and food (F2) costs FRW 80 per kg.

Required:

i) Formulate the linear programming (6 Marks)

ii) Solve for the minimum cost using the graphical method. (6 Marks)

(Total: 20 Marks)

End of Question Paper

Chi-square Distribution Table

d.f.	.995	.99	.975	.95	.9	.1	.05	.025	.01
1	0.00	0.00	0.00	0.00	0.02	2.71	3.84	5.02	6.63
2	0.01	0.02	0.05	0.10	0.21	4.61	5.99	7.38	9.21
3	0.07	0.11	0.22	0.35	0.58	6.25	7.81	9.35	11.34
4	0.21	0.30	0.48	0.71	1.06	7.78	9.49	11.14	13.28
5	0.41	0.55	0.83	1.15	1.61	9.24	11.07	12.83	15.09
6	0.68	0.87	1.24	1.64	2.20	10.64	12.59	14.45	16.81
7	0.99	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48
8	1.34	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09
9	1.73	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67
10	2.16	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21
11	2.60	3.05	3.82	4.57	5.58	17.28	19.68	21.92	24.72
12	3.07	3.57	4.40	5.23	6.30	18.55	21.03	23.34	26.22
13	3.57	4.11	5.01	5.89	7.04	19.81	22.36	24.74	27.69
14	4.07	4.66	5.63	6.57	7.79	21.06	23.68	26.12	29.14
15	4.60	5.23	6.26	7.26	8.55	22.31	25.00	27.49	30.58
16	5.14	5.81	6.91	7.96	9.31	23.54	26.30	28.85	32.00
17	5.70	6.41	7.56	8.67	10.09	24.77	27.59	30.19	33.41
18	6.26	7.01	8.23	9.39	10.86	25.99	28.87	31.53	34.81
19	6.84	7.63	8.91	10.12	11.65	27.20	30.14	32.85	36.19
20	7.43	8.26	9.59	10.85	12.44	28.41	31.41	34.17	37.57
22	8.64	9.54	10.98	12.34	14.04	30.81	33.92	36.78	40.29
24	9.89	10.86	12.40	13.85	15.66	33.20	36.42	39.36	42.98
26	11.16	12.20	13.84	15.38	17.29	35.56	38.89	41.92	45.64
28	12.46	13.56	15.31	16.93	18.94	37.92	41.34	44.46	48.28
30	13.79	14.95	16.79	18.49	20.60	40.26	43.77	46.98	50.89
32	15.13	16.36	18.29	20.07	22.27	42.58	46.19	49.48	53.49
34	16.50	17.79	19.81	21.66	23.95	44.90	48.60	51.97	56.06
38	19.29	20.69	22.88	24.88	27.34	49.51	53.38	56.90	61.16
42	22.14	23.65	26.00	28.14	30.77	54.09	58.12	61.78	66.21
46	25.04	26.66	29.16	31.44	34.22	58.64	62.83	66.62	71.20
50	27.99	29.71	32.36	34.76	37.69	63.17	67.50	71.42	76.15
55	31.73	33.57	36.40	38.96	42.06	68.80	73.31	77.38	82.29
60	35.53	37.48	40.48	43.19	46.46	74.40	79.08	83.30	88.38
65	39.38	41.44	44.60	47.45	50.88	79.97	84.82	89.18	94.42
70	43.28	45.44	48.76	51.74	55.33	85.53	90.53	95.02	100.43
75	47.21	49.48	52.94	56.05	59.79	91.06	96.22	100.84	106.39
80	51.17	53.54	57.15	60.39	64.28	96.58	101.88	106.63	112.33
85	55.17	57.63	61.39	64.75	68.78	102.08	107.52	112.39	118.24
90	59.20	61.75	65.65	69.13	73.29	107.57	113.15	118.14	124.12
95	63.25	65.90	69.92	73.52	77.82	113.04	118.75	123.86	129.97
100	67.33	70.06	74.22	77.93	82.36	118.50	124.34	129.56	135.81

Table of the standard normal distribution values ($z \geq 0$)

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.50000	0.50399	0.50798	0.51197	0.51595	0.51994	0.52392	0.52790	0.53188	0.53586
0.1	0.53983	0.54380	0.54776	0.55172	0.55567	0.55962	0.56356	0.56749	0.57142	0.57535
0.2	0.57926	0.58317	0.58706	0.59095	0.59483	0.59871	0.60257	0.60642	0.61026	0.61409
0.3	0.61791	0.62172	0.62552	0.62930	0.63307	0.63683	0.64058	0.64431	0.64803	0.65173
0.4	0.65542	0.65910	0.66276	0.66640	0.67003	0.67364	0.67724	0.68082	0.68439	0.68793
0.5	0.69146	0.69497	0.69847	0.70194	0.70540	0.70884	0.71226	0.71566	0.71904	0.72240
0.6	0.72575	0.72907	0.73237	0.73565	0.73891	0.74215	0.74537	0.74857	0.75175	0.75490
0.7	0.75804	0.76115	0.76424	0.76730	0.77035	0.77337	0.77637	0.77935	0.78230	0.78524
0.8	0.78814	0.79103	0.79389	0.79673	0.79955	0.80234	0.80511	0.80785	0.81057	0.81327
0.9	0.81594	0.81859	0.82121	0.82381	0.82639	0.82894	0.83147	0.83398	0.83646	0.83891
1.0	0.84134	0.84375	0.84614	0.84849	0.85083	0.85314	0.85543	0.85769	0.85993	0.86214
1.1	0.86433	0.86650	0.86864	0.87076	0.87286	0.87493	0.87698	0.87900	0.88100	0.88298
1.2	0.88493	0.88686	0.88877	0.89065	0.89251	0.89435	0.89617	0.89796	0.89973	0.90147
1.3	0.90320	0.90490	0.90658	0.90824	0.90988	0.91149	0.91308	0.91466	0.91621	0.91774
1.4	0.91924	0.92073	0.92220	0.92364	0.92507	0.92647	0.92785	0.92922	0.93056	0.93189
1.5	0.93319	0.93448	0.93574	0.93699	0.93822	0.93943	0.94062	0.94179	0.94295	0.94408
1.6	0.94520	0.94630	0.94738	0.94845	0.94950	0.95053	0.95154	0.95254	0.95352	0.95449
1.7	0.95543	0.95637	0.95728	0.95818	0.95907	0.95994	0.96080	0.96164	0.96246	0.96327
1.8	0.96407	0.96485	0.96562	0.96638	0.96712	0.96784	0.96856	0.96926	0.96995	0.97062
1.9	0.97128	0.97193	0.97257	0.97320	0.97381	0.97441	0.97500	0.97558	0.97615	0.97670
2.0	0.97725	0.97778	0.97831	0.97882	0.97932	0.97982	0.98030	0.98077	0.98124	0.98169
2.1	0.98214	0.98257	0.98300	0.98341	0.98382	0.98422	0.98461	0.98500	0.98537	0.98574
2.2	0.98610	0.98645	0.98679	0.98713	0.98745	0.98778	0.98809	0.98840	0.98870	0.98899

2.3	0.98928	0.98956	0.98983	0.99010	0.99036	0.99061	0.99086	0.99111	0.99134	0.99158
2.4	0.99180	0.99202	0.99224	0.99245	0.99266	0.99286	0.99305	0.99324	0.99343	0.99361
2.5	0.99379	0.99396	0.99413	0.99430	0.99446	0.99461	0.99477	0.99492	0.99506	0.99520
2.6	0.99534	0.99547	0.99560	0.99573	0.99585	0.99598	0.99609	0.99621	0.99632	0.99643
2.7	0.99653	0.99664	0.99674	0.99683	0.99693	0.99702	0.99711	0.99720	0.99728	0.99736
2.8	0.99744	0.99752	0.99760	0.99767	0.99774	0.99781	0.99788	0.99795	0.99801	0.99807
2.9	0.99813	0.99819	0.99825	0.99831	0.99836	0.99841	0.99846	0.99851	0.99856	0.99861
3.0	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99896	0.99900
3.1	0.99903	0.99906	0.99910	0.99913	0.99916	0.99918	0.99921	0.99924	0.99926	0.99929
3.2	0.99931	0.99934	0.99936	0.99938	0.99940	0.99942	0.99944	0.99946	0.99948	0.99950
3.3	0.99952	0.99953	0.99955	0.99957	0.99958	0.99960	0.99961	0.99962	0.99964	0.99965
3.4	0.99966	0.99968	0.99969	0.99970	0.99971	0.99972	0.99973	0.99974	0.99975	0.99976
3.5	0.99977	0.99978	0.99978	0.99979	0.99980	0.99981	0.99981	0.99982	0.99983	0.99983

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