CERTIFIED PUBLIC ACCOUNTANT

FOUNDATION LEVEL 1 EXAMINATIONS

F1.1: BUSINESS MATHEMATICS AND QUANTITATIVE METHODS

DATE: THURSDAY 27, NOVEMBER 2025

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 and formulas, where applicable.
5. The question paper should not be taken out of the examination room.

QUESTION ONE

Musanze Ltd, a company dealing in poultry, is considering three options for its facility for the next three years. The company can expand the current facility, acquire a new one or make no change. There are 3 market conditions to consider when planning. These are a favourable market, a moderate market and an unfavourable market. With a favourable market, the annual profit is expected to be FRW 6,500,000, FRW 8,000,000 and FRW 4,000,000 for expansion, acquisition and making no change to the facility respectively. With a moderate market, the profit will be FRW 3,100,000, FRW 4,500,000 and FRW 2,000,000 for expansion, acquisition and making no change respectively. With an unfavourable market, the company's payoff will be FRW (3,900,000), FRW (5,500,000) and FRW 1,000, 000 for expansion, acquisition and making no change respectively.

Required:

a) Determine the best decision alternative for Musanze Ltd using Hurwicz criterion. (Alpha coefficient, α is provided as 0.7) (3 Marks)

b) If the probabilities for a favourable market, a moderate market and an unfavourable market are 0.25, 0.40 and 0.35 respectively, then calculate:

i) The expected monetary value (EMV) and give your advice on the optimal decision to take. (3 Marks)

ii) The expected opportunity loss (EOL) and give your advice on the optimal decision to take. (7 Marks)

c) Advise the company using a decision tree if the probabilities of the three market conditions were 50%, 30% and 20% for a favourable market, a moderate market and an unfavourable market respectively. (7 Marks)

(Total: 20 Marks)

QUESTION TWO

a) Mrs NZINZA is considering building an apartment complex. He knows that if the complex contains x apartments the maintenance costs for the building, landscaping etc. will be $C(x) = 400 - 14x + 0.02x^2$. The land to be purchased can hold a complex of at most 500 apartments.

Required:

How many apartments should the complex have in order to minimize the maintenance costs? (5 Marks)

b) Randa Ltd is a productive company. Its production costs $C(x)$ per week of producing x quantities given by $C(x) = 4000 - 32x + 0.08x^2 + 0.00006x^3$, expressed in thousands Rwandan francs, and its demand function for the quantities is given by, $p(x) = 250 + 0.02x - 0.001x^2$,

Required:

What is the marginal cost, marginal revenue and marginal profit when $x = 200$ and

$x = 400$? (9 Marks)

c) Consider a product with the Selling Price, variable cost and fixed cost of frw 200, frw 140 and frw 800,000 respectively

Required:

Determine the following

i) The breakeven sales unit. (2 Marks)
ii) The profit if sales are 10,000 units. (2 Marks)
iii) Sales units required to make a profit of FRW $2,000,000$ (2 Marks)
(Total: 20 Marks)

QUESTION THREE

MAHWI Grain Millers Ltd (MGM) deals in the manufacturing of maize flour since the year of 2025. The company was formed through a merger arrangement where Gikondo Millers Ltd and Akanoze Grain Ltd joined together to form a strong entity. Despite being located in Kigali industrial park, MGM has three warehouses; Muhanga(M), Kigali (Ki) and Rubavu (R). The following table shows inventories of maize flour in these three warehouses.

Warehouse	M	K	R
Inventory (Bags)	62	118	120

MGM is required to supply three provinces; Southern province(S) with 140 bags, Kigali City(Ki) with 60 bags and Western(W) with 100 bags of maize flour. The table below shows the transportation cost of one bag of maize flour from the warehouse to the client in thousands Rwandan francs.

Warehouse	**Clients**		
	S	Ki	W
Muhanga (M)	50	40	60
KIgali (Ki)	70	40	70
Rubavu (R)	80	60	70

Required:

a) Determine the minimum total transportation cost using Vogel's Approximation Method. (9 Marks)
b) Identify five procedures to be adopted in solving a linear programming problem with graphical method. **(**5 Marks)
c) Differentiate north-west corner, Least cost and Vogel's approximation methods of solving transportation problems with reference to their algorithms. (6 Marks)
(Total: 20 Marks)

QUESTION FOUR

a) To make a considerable decision, you need to rely on sources of evidences while deciding, not only the quantitative aspect but also its quality. Sometimes to use 100% data seems to be very hard, it is in this context adaptation of samples appear.

Required:

i) Examine the advantages and disadvantages of stratified sampling techniques. (5 Marks)
ii) Indicate the limitations of systematic sampling. (2 Marks)

b) Given tables below.

Table1

Class	0-20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	Total
Frequency	10	15	15	20	8	8	6	8	90

Table2

Years	1991	1992	1993	1994	1995
Production (in tons)	45	40	42	55	50

Required:

i) Compute the median from the data given in table1. (2 Marks)
ii) Represent the data in the table2 by a bar chart. (2 Marks)

a) An examination paper is composed by 60 questions. Eight students have already completed 32, 35, 37, 30, 33, 36, 35, and 37. Use assumed mean of 25

Required:

Find the standard deviation of questions yet to be completed by them using assumed mean method. (9 Marks)

(Total: 20 Marks)

QUESTION FIVE

a) The following table shows the prices and quantities of selected food products

Commodity Item	Base year		Current year	
	Price (FRW)/Kg	Quantity (Kgs)	Price (FRW)/Kg	Quantity (Kgs)
Rice	400	30	700	30
Potatoes	175	50	100	54
Flour	1000	24	750	30
Wheat	1500	36	1000	40

Required:

Compute Laspeyre's price index, Paasche's price index and Marshall Edge Worth's Price Index from the data provided in the table above and Interpret the answers. (9 Marks)

b) The following activities have been listed by Engineer BUGINGO Samuel who is overseeing the renovation of Amahoro national stadium. All activities to be performed were identified and coded for a proper supervision of works.

Activity	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
Predecessor(s)	-	-	A	A	A	B, C	B, C	E, F	E, F	E, F	D, H	G, J
Completion time(months)	3.5	5	2	15	3.5	6	7.5	5.5	12.5	3	10.5	12.5

Required:

i) Draw a network diagram and determine the project completion time and its critical path **(**7 Marks)

ii) Define the term "Gantt Chart" and outline any two benefits of it in project management (4 Marks)

(Total: 20 Marks)

QUESTION SIX

a) Given the following data on sales in different period.

Year	2000	2001	2002	2003	2004
Sales	35	56	79	80	40

Required:

Determine the trend line by using the least square method of the above information. (10 Marks)

b) An economy produces only coal and steel. The two commodities serve as intermediate inputs in each other's production. 0.4 ton of steel and 0.7 ton of coal are needed to produce a ton of steel. 0.1 ton of steel and 0.6 ton of coal are required to produce a ton of coal. No capital inputs are needed.

Required:

i) Do you think that the system is viable? (2 Marks)

ii) 2 and 5 labor days are required to produce a ton of coal and steel respectively. If the economy needs 100 tons of coal and 50 tons of steel, calculate the gross output of the two commodities and the total labour required. (4 Marks)

iii) Determine the equilibrium price if the wage rate is RWF100,000. (4 Marks)

(Total: 20 marks)

QUESTION SEVEN

a) An economy has two sectors: Farming and Fishing. For each unit of output, Farming requires 0.6 units from its own sector and 0.3 units from Fishing. Meanwhile, Fishing requires 0.4 units from Farming and 0.3 units from its own sector to produce one unit of Fishing.

Required:

i) **Determine the consumption matrix C for the economy from the information provided above.** **(**2 Marks)

ii) **State the Leontief input - output equation relating to the production (X) and final demand (D).** (1 Marks)

iii) **Use an inverse matrix to determine the production necessary to satisfy a final demand of FRW 2,000 units of farming and 4,000 units of fishing.** (6 Marks)

b) A prestigious academic institution is orchestrating the arrangement of five (5) distinguished students for a formal class photograph. The school administration is particularly interested in determining the total number of possible linear configurations in which these students can be positioned in a single row. Each student is considered unique and distinguishable, and the sequence of placement is critically important due to visual symmetry and aesthetic considerations. A main committee consists of 12 members, one of whom has been designated as the chairperson candidate. A sub-committee of six members is to be formed, and the chairperson of the sub-committee must be this designated member.

Required:

i) **Distinguish the permutation and combination under techniques of counting** (2 Marks)

ii) **Find the number of different ways to arrange 5 students by using the permutation.** (3 Marks)

iii) **Determine the total number of distinct ways in which such a sub-committee, including the chair person, can be constituted.** (6 Marks)

(Total: 20 marks)

End of Question Paper

Standard Normal Distribution Table

Area in the Body to the Left of Z

z	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.00	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.10	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.20	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.30	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.40	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.50	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.60	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.70	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.80	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.90	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.00	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.10	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.20	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.30	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.40	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.50	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.60	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.70	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.80	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.90	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.00	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.10	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.20	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.30	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.40	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.50	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.60	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.70	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.80	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.90	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.00	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

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