CERTIFIED PUBLIC ACCOUNTANT

FOUNDATION LEVEL 1 EXAMINATION

F1.1: BUSINESS MATHEMATICS AND

QUANTITATIVE METHODS

DATE: THURSDAY, 26 AUGUST 2021

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 **should** 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) The time heavy weightlifters use to practice and the amount of milk each lifter consumes per session was evaluated at the end of the week and the results are shown in the table below:

Lifter	H1	H2	H3	H4	H5	H6	H7	H8	H9
Hours	3	0	2	5	8	5	10	2	1
Quantity of milk	48	8	32	64	10	32	56	72	48

Required:

Compute the Pearson product moment correlation coefficient for the above data and comment on the result. (10 Marks)

(b) Define the following as used in hypothesis testing.

    i. Type I error (1 Mark)

    ii. Type II error (1 Mark)

(c) A lighting company has decided to build a test sample of 1,000 light bulbs that are assumed to be a random sample before it begins full scale production. The sample results showed the mean of 704 hours and a standard deviation of 150 hours

Required:

Determine at 5% level of significance whether the mean life of the new light bulbs exceeds the old bulb average of 700 hours. (8 Marks)

(Total: 20 Marks)

QUESTION TWO

(a) State any four Rules governing construction of simple networks. (4 Marks)

(b) The table below shows a series of production activities of a new product to be launched at the market:

Activity	Description	Time (weeks)	Preceded by
A	Market research	15	-
B	Making drawings	15	-
C	Decide on Production Policy	3	A
D	Prepare sales programme	5	A
E	Prepare operation sheets	8	B, C
F	Buy Materials	12	B, C
G	Plan Labour force	1	E
H	Make tools	14	E
I	Schedule Production	3	D, G
J	Produce product	14	F, H, I

Required:

i.	**Draw the network of the production project.**	(5 Marks)
ii.	**Find the critical path and project duration.**	(3 Marks)
iii.	**Draw the Gantt chart for the project.**	(8 Marks)

(Total: 20 Marks)

QUESTION THREE

(a) State any Four limitations of the index numbers (2 Marks)

(b) Discuss any Six main factors for the construction of the index numbers. (3 Marks)

(c) Given the prices and quantities of Maize, Wheat and Beans for the year 2019 and 2020 in the table below:

	2019		2020	
Items	**Price (Frw)**	**Quantity (bags)**	**Price (Frw)**	**Quantity (bags)**
Maize	65	20	135	30
Wheat	95	8	160	7
Beans	150	5	320	8

Required:

Calculate the Fisher's Ideal Index Number. (7 Marks)

(d) Mr. Sekarema John went to a market to purchase 3 kg of sugar, 10 kg of wheat and 1kg of salt. In a shop near to Mr. Sekarema John's residence, these commodities are priced at Frw 2000, Frw 1000 and Frw 800 per kg whereas in the local market these commodities are priced at Frw 1500, Frw 800 and Frw 600 per kg respectively. Transport cost to the local market is Frw 2,500.

Required:

Use the matrix operations to find the net savings of Mr. Sekarema John from purchasing through local market. (8 Marks)

(Total: 20 Marks)

QUESTION FOUR

(a) Hero Bicycle Company is interested in diversifying into motorcycle manufacturing. The Chief Executive is not sure whether to start a small plant or a large plant. The market demand is uncertain and will become known only after the plant has been built. If the demand is indeed high and a small plant is built initially then it can be expanded to accommodate high demand. The marketing department has estimated that the probability of high demand is 0.70 and for low demand is 0.30. The cost benefit analysis has provided the following information:

Cost of building a large plant - Frw 6 million.

Cost of building a small plant - Frw 4 million.

Cost of expanding a small plant - Frw 3 million.

Revenue for high demand for large plant or small expand plant Frw 18 million.

Revenue for high demand without expansion of small plant Frw 11 million.

Revenue for low demand Frw 8 million.

Required:

What should be the optimal policy. (7 Marks)

(b) A juice making factory buys oranges from commercial fruit farmers strictly. In a bid to maintain high quality standards, a random sample of 750 oranges is picked and an investigation reveals that the mean weight is 358g with a standard deviation of 50g.

Required:

i.   **The standard error of the mean of the oranges bought.** (2 Marks)
ii. **The confidence interval of mean weight of the oranges at the level of confidence of 95%.** (2 Marks)

(c) From the training material of Business Mathematics and Quantitative Methods, the frequency distribution of the number of words per page is approximately normally distributed with a mean of 800 words and with a variance of 2,500. Three pages are selected at random.

Required:

What is the probability that none of them will have between 830 and 845 words?

(3 Marks)

(d) For the purpose of stopping the spread of Covid-19, Rwanda Bio-Medical Centre (RBC) developed a vaccine. A sample of 200 people affected by the pandemic were selected. Out of these, 100 were given a vaccine and others were not given and vaccine. The results are as follows:

	Treated	**Not treated**	**Total**
Cured	65	55	120
Not Cured	35	45	80
Total	100	100	200

Required:

Using Chi-Square test (X^2), test whether the vaccine is effective for the vaccine of

Covid-19 or not at 95%. (6 Marks)
(Total: 20 Marks)

QUESTION FIVE

(a) Give any two advantages and any two disadvantages of mean as the average

(2 Marks)

(b) From the table below, an accountant wanted to estimate the mean and mode of company's sales and forgot the frequency in the range of 20-30.

Sales	Items
0-10	15
10-20	20
20-30	?
30-40	14
40-50	16

Required:

Given that the median is 24 find:

i.	**The missing frequency.**	(3 Marks)
ii.	**Mean of the sold items**	(3 Marks)
iii.	**Mode of the dataset**	(1 Mark)
iv.	**The Interquartile range**	(3 Marks)

(c) Rwanda National football Team (Amavubi) is preparing to join CAN 2021 and hired the new coach for preparations. The new coach selected two best strikers basing on the last 8 matches played by Striker X and Striker Y. Below is the table summarizing the scores they scored in the last 8 matches for Amavubi.

Striker(X)	7	5	5	6	4	6	9	6
Striker (Y)	3	8	9	6	4	6	5	7

Required:

Based on the appropriate statistical measure, advice the new coach on best striker to use in the next match (3 Marks)

(d) The mean salary paid to 100 employees of Musanze Transport Company Ltd (MTC Ltd) was found to be Frw 180,000. Later on, after disbursement of salary it was discovered that the salary of two employees was wrongly entered as Frw 297,000 and Frw 165,000. The correct salaries were Frw 197,000 and Frw 185,000.

Required:

Find the correct arithmetic mean salary of the company. (5 Marks)

(Total: 20 Marks)

QUESTION SIX

(a) IT Solutions company Ltd has four machines (A, B, C and D) that are used for four Operators ((I, II, III and IV). Each job can be assigned to one and only one machine. The cost of assigning any one operator to any one machine is given in the following table:

$$\begin{array}{c c c c c} & \text{I} & \text{II} & \text{III} & \text{IV} \quad \text{in Frw "000"} \\ \begin{bmatrix} A \\ B \\ C \\ D \end{bmatrix} & \begin{matrix} 10 \\ 3 \\ 10 \\ 5 \end{matrix} & \begin{matrix} 5 \\ 9 \\ 7 \\ 11 \end{matrix} & \begin{matrix} 13 \\ 18 \\ 3 \\ 9 \end{matrix} & \begin{matrix} 15 \\ 3 \\ 2 \\ 7 \end{matrix} \end{bmatrix} \end{array}$$

Required:

Find the optimal assignment (10 Marks)

(b) The following table gives the input-output coefficients for two sector economy consisting of Agriculture and Industry:

Production Sector	Purchase Sector		Projected demand
	Agriculture	Industry	
Agriculture	300	600	100
Industry	400	1,200	400

Required:

If the projected demand changes to 200 and 800 units respectively, what would be the gross output of each sector in order to meet the new demands (10 Marks)

(Total: 20 Marks)

QUESTION SEVEN

(a) Kicukiro Milk Industry Ltd (KMI Ltd) is planning to invest in a particular Milk project in Nyagatare District and it has been estimated that after **x** months of running, the cumulative profit (Frw 000, 000) from the project is given by the function $31.5x-3x^2-80$, where **x** represents time in months. The project can run for nine months at the most.

Required:

i.   **What is the initial cost of the project?** (3 Marks)
ii. **Find the best time to end the project** (4 Marks)
iii. **Calculate the" break-even" time points for the project.** (3 Marks)

(b) The actual demand of ABC Ltd company over six months period is shown in the table below:

Period	Actual demand
1	2,700
2	2,950
3	2,660
4	2,980
5	3,010
6	3,140
7	-

Required:

i. **Forecast the demand for Seven-month period for α = 0.3 by using exponential smoothing method and find the absolute errors for each period.** (6 Marks)

ii. **Discuss any four main components of time series with examples.** (4 Marks)
(Total: 20 Marks)

End of question paper

LIST OF FORMULAS AND TABLES FOR THE STUDENTS FORMULAS

❖ The Pearson product moment correlation coefficient: r =

$$\frac{n\sum(XY)-(\sum X)(\sum Y)}{\sqrt{n(\sum X^2)-(\sum(X)^2)(n\sum Y^2-\sum Y^2)}}$$

❖ Test statistics: $Z=\frac{X-\mu}{\sigma/\sqrt{n}}$

❖ The Fisher's Ideal Index Number: $\sqrt{\frac{\sum P1Qo}{\sum P0Q0}X\frac{\sum P1Q1}{\sum P0Q1}}X100$

❖ Standard error: S. Error $=\frac{S}{\sqrt{n}}$

❖ The Median class for Grouped data: $me = L + \frac{\frac{N}{2}-Cf}{f}xi$

❖ The mean $\overline{X} = \sum\frac{xi*fi}{N}$

❖ $Mode = Lmo + (\frac{D1}{D1+D2})C$

❖ Q1= $Lq1 + \left(\frac{n-F}{fq1}\right)c$

❖ Q3=$Lq3 + \frac{\frac{3}{4}-F}{fq3}$

Confidence level	Z-Score
90%	1.645
95%	1.96
98%	2.33
99%	2.575