
CERTIFIED PUBLIC ACCOUNTANT

FOUNDATION LEVEL 1 EXAMINATION

F1.1: BUSINESS MATHEMATICS AND QUANTITATIVE METHODS

THURSDAY: 3 DECEMBER 2020

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) A businessman has two investment opportunities: project A and project B. If he invests in project A, there is a 25% chance that he will lose Rwf 5,000,000; a 60% chance that he will lose Rwf 1,000,000, and a 15% chance that he will make a profit of Rwf 30,000,000. If he invests in project B, there is a 15% chance that he will lose Rwf 7,000,000, a 25% chance that he will lose Rwf 1,000,000, and a 60% chance that he will make a profit of Rwf 8,000,000.

Required:

If his decision is to be based on expected value comparisons, which project should he choose?

(4 Marks)

- (b) A survey conducted at a college wishes to derive a relationship between the attendance (x) and the final marks (y) obtained by seven (7) randomly selected students from an accounting class.

Student	A	B	C	D	E	F	G
Attendance (x)	6	2	15	9	12	5	8
Final marks (y)	82	86	43	74	58	90	78

Required:

- (i) **Construct a scatter plot for the data** (2 Marks)
(ii) **Compute the value of the correlation coefficient for the data;** (3 Marks)
(iii) **Use regression analysis to derive an equation for the final marks in terms of the attendance, and hence deduce the final mark for the student whose attendance is 3.**

(5 Marks)

- (c) Suppose that the matrix game will be played over and over, and assume that player C will play each column 50% of the time. While payer R use 80% and 20% of the time to play the first row (Strategy a) and the second row (Strategy b) respectively. payoff matrix of the game is as follow:

$$\begin{matrix} & \text{C} \\ \text{R} & \begin{bmatrix} 3 & -4 \\ 0 & 5 \end{bmatrix} \end{matrix}$$

Required:

Determine what is the best strategy for the player R.

(6 Marks)

(Total 20 Marks)

QUESTION TWO

(a) Define briefly the following concepts:

- (i) **Random experiment;** (1 Marks)
- (ii) **Outcome;** (1 Marks)
- (iii) **Sample space;** (1 Marks)
- (iv) **Event.** (1 Marks)

(b) The probability that a student can pass a financial accounting test is 0.20. If seven (7) students are selected at random, find the probability that:

- (i) Less than 3 can pass; (3 Marks)
- (ii) Exactly 3 are able to pass; (2 Marks)
- (iii) At least 3 are able to pass. (2 Marks)

(c) In a tea shop, 70% of customers order milk tea, 20% lemon tea and 10% order just tea. Of those taking milk tea, $\frac{3}{5}$ take sugar, of those taking lemon tea, $\frac{1}{4}$ take sugar, and of those taking just tea, $\frac{11}{20}$ take sugar. A customer is chosen at random.

Required:

- (i) **Represent the information given on a tree diagram and use it to find the probability that the customer takes sugar.** (3 Marks)
- (ii) **Find the probability that the customer takes milk or sugar or both.** (3 Marks)
- (iii) **Find the probability that the customer takes sugar and milk, and hence deduce the probability that the customer takes milk given that he or she takes sugar.**

(3 Marks)

(Total 20 Marks)

QUESTION THREE

(a) Explain the following:

- (i) Index numbers and their uses; (3 Marks)
- (ii) The importance of time series analysis. (2 Marks)

(b) Consider the data given in the following table to answer the following questions:

Years	1979	1979	1986	1986
Particulars	Price (Rwf)	Quantity (Bags)	Price (Rwf)	Quantity (Bags)
Maize	65	20	135	30
Wheat	95	8	160	7
Beans	150	5	320	8

Taking 1979 as the base year, calculate the following index numbers for 1986 using:

- (i) Lasperyre's method. (3 Marks)
(ii) Paasche's method. (3 Marks)

- (c) A financial adviser suggests that his client select one of the two types of bonds in which to invest Rwf 5,000,000. Bond X pays a return of 4% and has a default rate of 2%. Bond Y has a return of 2.5% and a default rate of 1%. Find the expected rate of return and decide which bond would be a better investment. When the bond defaults, the investor loses the investment. (4 Marks)
- (d) The main purpose of time series is forecasting. How does a decision-maker know which forecasting technique is the best in predicting the future? One way is to compare forecast values with actual values and determine the amount of forecasting error a technique produces. Several techniques can be used to measure the overall error. List them. (5 Marks)

(Total 20 Marks)

QUESTION FOUR

- (a) A bank account number consists of seven of the digits from 0 to 9, possibly with repetitions. How many different account numbers are possible? (4 Marks)
- (b) A company manufactures two types of boxes, corrugated and ordinary cartons. The boxes undergo two major processes: cutting and pinning operations. The profits per unit are Rwf 60 and Rwf 40 respectively. Each corrugated box requires 2 minutes for cutting and 3 minutes for pinning operation; whereas each carton box requires 2 minutes for cutting and 1 minute for pinning. The availability operating time is 120 minutes and 60 minutes for cutting and pinning machines.

Required:

- (i) Let x and y be the number of corrugated and ordinary boxes respectively. Write down the objective function, that is, the total profit function. (2 Marks)
- (ii) Write down the constraints for the corrugated cartons and the ordinary cartons. (3 marks)
- (iii) Deduce, by graphical method, the optimum quantities of the two boxes to maximize the profits. (4 marks)

- (c) A quick survey of 1,000 children in a medical center produced the following results:

- 320 children were fed on beans,
- 200 children were fed on rice,
- 450 children were fed on potatoes,
- 150 children were fed on beans and potatoes,
- 70 children were fed on beans and rice,
- 100 children were fed on rice and potatoes,
- 300 children were fed on none of the three types of food.

Required:

- (i) Present the above information in the form of a Venn diagram. (2 Marks)
- (ii) The number of children who were fed on all of the three types of food. (2 Marks)
- (iii) The number of children who were fed on exactly one of the three types of food. (3 Marks)

(Total 20 Marks)

QUESTION FIVE

- (a) (i) Distinguish between linear equation and quadratic equation? (1 Mark)
(ii) Explain how differential calculus could be used in solving optimization problems. (2 Marks)
- (b) The following are the times, in minutes, that a group of nine students took to answer a question: 5, 4, 11, 8, 43, 10, 7, 12. Calculate an appropriate measure of location to summarize these times. Explain why the other measures are not suitable. (4 Marks)
- (c) A restaurant serves its clients as first-class, second class and third class, each attracting a tip of Rwf 7,000, Rwf 5,000 and Rwf 4,000 respectively. On a certain day, the restaurant received 100 clients both at lunch and dinner time. The total amount collected in tips at lunch time was Rwf 630,000. Compared to lunch time, the clients served at dinner as first-class were less by 20, those served as a second class was more by 10 and those served as third-class were twice as many.

Required:

Determine the number of clients in each class. (5 Marks)

- (d) The rate of sales tax as a percentage of sales, paid by 400 shopkeepers of a market during an assessment year ranged from 0 to 25%. The sales tax paid by 18% of them was not greater than 5%. The median rate of sales tax was 10% and the 75th percentile rate of sales tax was 15%. If only 8% of the shopkeepers paid sales tax at a rate greater than 20% but not greater than 25%.

Required:

- (i) Summarize the above information in a frequency distribution. (5 Marks)

Class Intervals	Number of Shopkeepers

- (ii) Deduce the modal rate of sales tax and the median rate of sales tax. (3 Marks)

(Total 20 Marks)

QUESTION SIX

- (a) List any two advantages and two limitations of a network analysis. (4 Marks)
- (b) Network analysis incorporates a variety of techniques used in planning, scheduling and controlling a number of interrelated activities with use of limited resources namely, men, machine, materials, money and time for projects. Assume a project schedule has the following characteristics as shown in the below table:

Activity	Name	Time (days)	Activity	Name	Time (days)
1 - 2	A	4	5 - 6	G	4
1 - 3	B	1	5 - 7	H	8
2 - 4	C	1	6 - 8	I	1
3 - 4	D	1	7 - 8	J	2
3 - 5	E	6	8 - 10	K	5
4 - 9	F	5	9 - 10	L	7

Required:

- (i) Construct a PERT network for this project. (4 Marks)
- (ii) Compute the earliest start time T_E and the latest start time T_S for each activity. (4 Marks)
- (iii) Determine the critical path for the network. (4 Marks)
- (c) In a company, 40% of the female and 30% of male workforce belong to the management cadre.

Required:

- (i) Complete the following table (2 Marks)

	Female	Male	Total
Management cadre			
Non-management cadre			
Total			100

- (ii) If a management cadre worker is selected at random, what is the probability that she is a female. (2 Marks)

(Total 20 Marks)

QUESTION SEVEN

- (a) There are two types of errors that can occur when a hypothesis test is carried out. State and explain them. **(2 Marks)**
- (b) A student deposits Rwf 100,000 into an account paying 8% annual simple interest. He or she makes two more deposits of Rwf 200,000: the first in 3 months and the second in 6 months. How much will be in the account at the end of the year if he or she makes no other deposits and no withdrawals during this time. **(4 Marks)**
- (c) An IQ (=Intelligence Quotient) test, established some years ago, was designed to have a mean score of 100. A researcher puts forward a theory that people are more intelligent (as measured by this particular test). He or she selects a random sample of 150 people, all of whom take the test. The results of the tests, where x represents the score obtained, are $n=150$, $\sum x = 15,483$, $\sum x^2 = 1,631,680$.

REQUIRED

- (i) **Find the unbiased estimates for the mean and standard deviation.** **(2 Marks)**
- (ii) **Carry out a suitable hypothesis test on the researcher's theory, at the 1% significance level. You may assume that the test scores are normally distributed.** **(4 Marks)**
- (d) The following information relates to M. Harerimana, a dealer of smart phones: He realized profits of Rwf 120,000 from 7 smart phones and Rwf 113,000 from 4 smart phones sold respectively. M. Harerimana has approached you for assistance in forecasting future profits. The profit function is assumed to be quadratic in nature.

REQUIRED

- (i) **Derive the profit function.** **(4 Marks)**
- (ii) **Deduce the profit maximizing output and the maximum profit.** **(4 Marks)**
- (Total 20 Marks)**

