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QUALIFICATION : Bachelor of Technology : Accounting and Finance, Advanced Diploma in the Theory of Accounting, Bachelor of Accounting and Diploma in Accounting and Finance	
QUALIFICATION CODE: 23BACF, 07BACP, 06BDAF, 07ADTA	**NQF LEVEL:** 5
COURSE: QUANTITATIVE METHODS	**COURSE CODE:** QTM511S
DATE: NOVEMBER 2024	**SESSION:** 1
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY: EXAMINATION QUESTION PAPER

EXAMINER: Mr. Akser L Mpugulu

MODERATOR: Dr Dibaba Gemechu

INSTRUCTIONS:

1. There are 5 questions
2. Answer ALL questions on the separate answer sheet.
3. Please write neatly and legibly.
4. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
5. All written work must be done in blue or black ink and sketches must be done in pencil.
6. Number all answers clearly and show clearly all the steps used in the calculations.

PERMISSIBLE MATERIALS:

Non-Programmable Calculator without a cover.

This question paper consists of 6 pages including this front page and the formula sheet.

1. **Question 1:** **[25 Marks]**

1.1. Define the following terms as applicable in Quantitative Methods.

1.1.1. Interest (2)

1.1.2. Time Value of Money (2)

1.2. A nominal interest rate of 9% compounded quarterly is given. Calculate the equivalent effective interest rate per annum. (3)

1.3. A non-interest-bearing note of N$12,000, payable in one year, is sold today at a simple discount rate of 7%. What is the amount that the buyer will pay for the note? (4)

1.4. On February 5, a company signed a N$75,000 note with a simple interest rate of 11% for 180 days. The company made payments of N$15,000 on April 12 and N$20,000 on June 20. How much will the company owe on the maturity date? **(Use the USA rule).** (7)

1.5. An investor is comparing two investment opportunities:

- Investment A: Simple interest at 6% per annum for 3 years.
- Investment B: Compound interest at 5.5% per annum, compounded annually for 3 years.

Calculate the final amount for both investments and determine which one is a better option. (7)

2. **Question 2:** **[22 Mark]**

2.1. A company issues an interest-bearing debt with a future value of N$50,000, payable in 6 years, at an interest rate of 9% per annum, compounded annually. Calculate the present value of this debt. (4)

2.2. You wish to accumulate N$50,000 over 8 years by making monthly contributions to an account that pays 4% interest per annum, compounded monthly.

2.2.1. What should the monthly payment be? (6)

2.2.2. What is the total amount of interest earned? (2)

2.3. A company issues a debt of N$500,000 that must be repaid in 10 years. To accumulate the repayment amount, the company sets up a sinking fund earning 6% interest per annum, compounded semi-annually.

2.3.1. How much must be deposited into the sinking fund at the end of each six-month period to accumulate the N$500,000 in 10 years? (6)

2.3.2. What is the total amount deposited into the fund? (2)

2.3.3. How much interest will the company earn through the sinking fund? (2)

3. Question 3: **[17 Marks]**

3.1. For the following system of equations, determine if a unique solution exists:

$$2x + y - z = 4$$

$$x - y + 2z = 2$$

$$3x + 2y + z = 7$$

Formulate the augmented matrix and use row reduction to solve for the unknown. (8)

3.2. Solve the following inequality:

$$\frac{1}{2x+3} \leq \frac{5}{x-2} \leq \frac{4}{3x+1}$$ (9)

4. Question 4: **[25 Marks]**

4.1. A survey conducted by a university collected data on how far students commute to campus each day. The results are shown below:

Distance (km)	Number of students
0 – < 2	20
2 – < 4	25
4 – < 6	40
6 – < 8	30
8 - < 10	15

4.1.1. Compute and interpret the modal commuting distance for the students. (6)

4.1.2. Compute the interquartile range (IQR) for the commuting distances. (7)

4.2. A research group conducted a study and measured the reaction times (in seconds) of 20 participants. The recorded reaction times are:

0.67, 0.72, 0.71, 0.73, 0.69, 0.68, 0.74, 0.75, 0.71, 0.70, 0.72, 0.74, 0.69, 0.70, 0.73, 0.68, 0.71, 0.75, 0.70, 0.73.

4.2.1. Compute the sample mean. (3)

4.2.2. Compute the sample variance. (5)

4.2.3. Compute the sample standard deviation. (2)

4.2.4. Compute the coefficient of variation. (2)

5. Question 5 **[11]**

5.1. Differentiate between the cyclical component and the irregular component as defined in time series. (4)

5.2. A student is preparing for a multiple-choice exam. The probability that the student studies for the exam is 0.7. If the student studies, the probability that they pass the exam is 0.9. If the student does not study, the probability that they pass is 0.3.

5.2.1. What is the probability that the student passes the exam? (3)

5.2.2. What is the probability that the student studied given that they passed the exam? (4)

END OF QUESTION PAPER

SUMMARY OF FORMULAE QTM511S: 2024

Simple Interest: $I = Prt$, $A = P(1+rt)$

Discount: $P = A(1-dt)$, $D = Adt$

Compound Interest: $A = P(1+i)^n$, $A = P\left(1+\frac{r}{m}\right)^{mt}$

Simple discount Rate: $d = \frac{r}{1 + rt}$

Effective Interest Rate: $r_{eff} = \frac{r}{1-rt}$

Effective Interest Rate: $r_{eff} = \left(1+\frac{r}{m}\right)^m - 1$

Nominal Interest Rate: $r = m\left[\left(1+r_{eff}\right)^{\frac{1}{m}} - 1\right]$

Annuity: $S_n = R\left[\frac{\left(1+\frac{r}{m}\right)^n - 1}{\frac{r}{m}}\right] \leftarrow S_{\overline{n}|i}$ $A_n = R\left[\frac{1-\left(1+\frac{r}{m}\right)^{-n}}{\frac{r}{m}}\right]$

Period: $t = \frac{\log S - \log P}{m \log\left(1+\frac{r}{m}\right)}$, $n = \frac{\log 2}{\log\left(1+\frac{r}{m}\right)}$ $t = \frac{N-1}{r}$ *for* $N \geq 2$

$$n = \frac{\log(\frac{iS_n}{R} + 1)}{\log(1+i)} \qquad n = -\frac{\log(1 - \frac{iA_n}{R})}{\log(1+i)}$$

Measures of Central Tendency

Mean $\bar{x} = \dfrac{\sum x_i}{n}$, $\bar{x} = \dfrac{\sum f_i x_i}{\sum f_i}$

Median $M_d = l_{Md} + h\left(\dfrac{\frac{n}{2} - F}{f}\right)$

Mode $M_0 = l_{Mo} + h\left[\dfrac{f_1 - f_o}{2f_1 - f_o - f_2}\right]$,

Measures of dispersion

$Variance = \dfrac{\sum f_i x_i^2 - n(\bar{x})^2}{n-1}$ or $Variance = \dfrac{\sum\left(x_i - \bar{x}\right)^2}{n-1}$ coefficient of variation $= \left(\dfrac{S}{\bar{x}}\right) \times 10$

$Standard\ deviation = \sqrt{variance}$, **Quartile** $M_k = l + \dfrac{h}{f}\left(\dfrac{kn}{4} - F\right)$

Index Numbers

$Laspeyres\ price\ index = \dfrac{\sum(p_1 \times q_0)}{\sum(p_0 \times q_o)} \times 100\%$ $Paasche\ price\ index = \dfrac{\sum(p_1 \times q_1)}{\sum(p_0 \times q_1)} \times 100\%$

$Laspeyres$ quantity $index = \dfrac{\sum(p_0 \times q_1)}{\sum(p_0 \times q_o)} \times 100\%$ $Paasche$ quantity $index = \dfrac{\sum(p_1 \times q_1)}{\sum(p_1 \times q_0)} \times 100\%$

Time Series

$\hat{y} = a + bx$ $b = \dfrac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$ $a = \dfrac{\sum y - b\sum x}{n}$

Probability

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $P(A \cap B) = P(A)P(B)$ $P(B|A) = \dfrac{P(A \cap B)}{P(A)}$