



ASSOCIATION OF ACCOUNTING TECHNICIANS OF SRI LANKA

LEVEL I EXAMINATION - JULY 2024

(102) BUSINESS MATHEMATICS AND STATISTICS

• Instructions to candidates (Please Read Carefully):

- (1) **Time:** 03 hours.
- (2) **All questions should be answered.**
- (3) **Answers should be in one language, in the medium applied for, in the booklets provided.**
- (4) **Submit all workings and calculations. State clearly assumptions made by you, if any.**
- (5) **Use of Non-programmable calculators is only permitted.**
- (6) **Mathematical Tables will be provided.**
- (7) **Action Verb Check List with definitions is attached. Each question will begin with an action verb excluding OTQ's. Candidates should answer the questions based on the definition of the verb given in the Action Verb Check List.**
- (8) **Formulae Sheets are attached.**
- (9) **100 Marks.**

18-08-2024

Morning

[09.00 – 12.00]

No. of Pages : 09

No. of Questions : 06

SECTION A

Objective Test Questions (OTQs)

(Total 40 marks)

Question 01

Select the most correct answer for question No. 1.1 to 1.10. Write the number of the selected answer in your answer booklet with the number assigned to the question.

1.1 Factor of, $7x^2 + 12x + 5$ are:

- (1) $(7x + 7)(x + 5)$ (2) $(7x + 12)(x + 5)$
(3) $(7x + 5)(x + 1)$ (4) $(x + 12)(x + 5)$ (03 marks)

1.2 Asiri obtained a 4 year loan of Rs.500,000/- from a bank for his higher studies at an annual interest rate of 12% per annum, compounded annually. The total amount of interest on the loan at the end of the 4th year would be (to the nearest integer):

- (1) Rs.786,760/- (2) Rs.286,760/- (3) Rs.240,000/- (4) Rs.235,000/- (03 marks)

1.3 Silva invests Rs.60,000/- in a savings account at the end of each year for 5 years at the interest of 5% per annum, compounded annually. The present value of the annuity at the end of 5th year would be (to the nearest integer):

- (1) Rs.315,000/- (2) Rs.379,764/- (3) Rs.259,740/- (4) Rs.304,535/- (03 marks)

1.4 The prices of three types of rice in a shop in 2020 and 2024 are given below:

Type of Rice	Price in Rs. (2020)	Price in Rs. (2024)
Nadu	100	170
Samba	160	240
Basmathi	250	500

The price relative of Samba rice considering the year 2020 as the base year is:

- (1) 67% (2) 200% (3) 150% (4) 170%
(03 marks)

1.5 The following summary statistics are provided in relation to variables x and y :

$$\Sigma x = 26, \Sigma y = 62, \Sigma xy = 249, \Sigma x^2 = 104, \Sigma y^2 = 604, n = 8$$

Based on the above data, the correlation co-efficient between x and y would be:

- (1) 0.9679 (2) 1.033 (3) -0.9679 (4) -1.033
(03 marks)

1.6 A box contains six (6) white cards and four (4) black cards and all cards are equal size. Two cards are drawn randomly as one by one without replacement from the box. What is the probability that both cards are white?

- (1) $\frac{1}{5}$ (2) $\frac{1}{3}$ (3) $\frac{2}{15}$ (4) $\frac{2}{5}$
(03 marks)

1.7 The table below shows the probability distribution of the discrete random variable X :

X	(-2)	(-1)	0	1	2	3
Probability P(x)	0.1	0.25	0.15	0.16	0.24	0.1

The probability that X is less than 1 would be:

- (1) 0.16 (2) 0.5 (3) 0.66 (4) 0.34
(03 marks)

1.8 You are given the following frequency distribution:

x	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59
f	7	10	19	12	6	6

The mode of the above frequency distribution is (approximately):

- (1) 23 (2) 24 (3) 25 (4) 27
(03 marks)

1.9 A person has a fixed deposit of Rs.200,000/- in a bank at an annual interest rate of 12% compounded quarterly. The maturity value of the fixed deposit after 3 years is:

- (1) Rs.276,800/- (2) Rs.285,200/- (3) Rs.280,000/- (4) Rs.293,600/-
(03 marks)

1.10 The following table shows the average annual sales of mobile phones at a leading retailer over a period of six years from 2018 to 2023:

Year	2018	2019	2020	2021	2022	2023
Number of Units Sold	1,250	1,450	1,800	2,150	2,050	2,100

The trend equation for sale of mobile phones has been arrived as:

$$T = 1,160 + 182.86x \text{ (where } x \text{ is the time)}$$

The forecasted average annual sales (in units) for the year 2024 (7th year) would be:

- (1) 2,257 (2) 2,140 (3) 2,440 (4) 1,891
(03 marks)

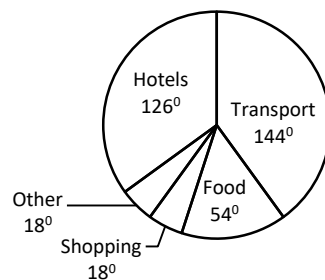
Write the answers for question No. **1.11** to **1.13** in your answer booklet with the number assigned to the question.

1.11 Relate the terms given on the left hand side of the following table with the number of the appropriate explanation given on the right hand side:

Term	Explanation
(A) Mutually exclusive events	(1) All outcomes of two events.
(B) Paasche's Price index	(2) The base year quantities must be chosen as weights.
(C) Laspeyre's price index	(3) Two events cannot occur at the same time.
(D) Union of events	(4) The current year quantities must be chosen as weights.

(01 mark each, 04 marks)

1.12 The following pie chart shows the expenses to be incurred by **Manju** during his holiday:



If he spends a total of Rs.36,000/- during his holiday, calculate the amount to be spent for the hotels. (02 marks)

1.13 Find the 9th term of the following geometric progression:

5, 10, 20 (02 marks)

State whether each of the following statements (**1.14** and **1.15**) is **True** or **False**. Write the answer (True/False) in your answer booklet with the number assigned to the question:

1.14 When the variables x and y move in the same direction, the correlation between x and y is negative. (01 mark)

1.15 Trend, seasonal variations, cycle variation and random movements are the components of time series. (01 mark)

(Total 40 marks)

SECTION B

(Total 40 marks)

Question 02

- (a) **Dilan** sold tickets for a stage drama organized by the Art Society. A price of student's ticket is Rs.30/- per ticket and price of an adult ticket is Rs.50/- per ticket. He sold 830 tickets and the total income earned on tickets was Rs.31,040/-.

You are required to:

Calculate the number of students' tickets sold and number of adults' tickets sold by **Dilan** separately. (04 marks)

- (b) **Silva** is a self-employed manufacturer of clay pots. The production cost of a certain type of clay pot is Rs.1,500/-, which consists of material cost, labour cost and other overheads. Other overhead cost per clay pot is Rs.300/- and the ratio between the material cost and labour cost of a clay pot is 3 : 2 respectively.

You are required to:

Calculate the material cost and labour cost of a clay pot separately. (03 marks)

- (c) You have given the following equation:

$$8x - 11 = 2x + 25$$

You are required to:

Calculate the value of x . (03 marks)

(Total 10 marks)

Question 03

- (a) A firm produces Product A. Fixed cost per month is Rs.6,000/- and Variable Cost (VC) function and Demand (P) function per month are as follows:

$$VC = q^2 + 1,220q$$

$$P = -3q + 1,660$$

Where " q " is the number of units produced per month.

You are required to:

- (i) **Identify** the Total Revenue (TR) function and Total Cost (TC) function of the firm. (03 marks)
- (ii) **Calculate** the number of units at which the profit is maximized. (04 marks)

(b) Total Cost (TC) function per month of Product N is given below:

$$TC = 12q^2 - 24q + 480,000$$

(Where q is the number of units produced during the month in thousands)

You are required to:

Calculate the number of units at which the cost is minimized.

(03 marks)

(Total 10 marks)

Question 04

A company engaged in travel agent business has analyzed their sales revenue (x) and profit (y) generated over the last 8 months as shown in the below table:

Sales Revenue (Rs.'000) (x)	80	50	30	60	40	45	20	70
Profit (Rs.'000) (y)	8	5	3	6	4	5	2	7

Using the above data:

You are required to:

(a) **Identify** the least squares regression line given by, $y = a + bx$ to represent the relationship between sales revenue and profit. (07 marks)

(b) **Calculate** and expected profit if the sales revenue is Rs.90,000/-.

(03 marks)

(Total 10 marks)

Question 05

The following table shows the distance travelled to work by 50 employees in an office:

Distance (km)	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59
No. of Employees (f)	7	9	14	8	7	5

Using the above data,

You are required to:

Calculate the following:

(a) Mean. (03 marks)

(b) Standard Deviation. (04 marks)

(c) Coefficient of Variation. (03 marks)

(Total 10 marks)

End of Section B

SECTION C

(Total 20 marks)

Question 06

- (A) **Amal** borrowed a loan of Rs.500,000/- from a bank at an interest rate of 13% per annum, and it is to be settled in equal annual installments of 5 years.

You are required to:

Calculate the annual installment of the loan. (03 marks)

- (B) An export company is trying to choose the best investment project from Project **X** and Project **Y**. The initial investment cost is Rs.500,000/- for each project and net cash inflows for next 3 years are as follows:

Project \ Year	Year 1	Year 2	Year 3
X	150,000	220,000	260,000
Y	190,000	210,000	300,000

The discounting factor (cost of capital) of the company is 12% per annum.

You are required to:

- (a) **Calculate** the Net Present Value (NPV) of each project. (06 marks)
- (b) **Identify** the best investment option with reasons based on the NPV. (02 marks)
- (C) A manufacturing company of electric equipments buys electronic circuits from two suppliers, **X** and **Y**.

The information about 100 circuits bought by the company during the last month is as follows:

	Supplier X	Supplier Y
Faulty	2	4
Good	43	51

You are required to:

- (a) **Calculate** the probability that a randomly selected circuit is faulty. (02 marks)
- (b) **Calculate** the probability that a randomly selected circuit is faulty given that the circuit is from company **X**. (03 marks)
- (D) The weight of a certain type of packages delivered by a logistics company is normally distributed with a mean of 540 g and a standard deviation of 48 g.

You are required to:

Calculate the probability that a randomly selected package has weight less than 465g. (04 marks)

(Total 20 marks)

End of Section C

ACTION VERBS CHECK LIST

Level of Competency	Description	Action Verbs	Verb Definitions
Knowledge (1)	Recall Facts and Basic Concepts.	Draw	Produce a picture or diagram.
		Relate	Establish logical or causal connections.
		State	Express details definitely or clearly.
		Identify	Recognize, establish or select after consideration.
		List	Write the connected items.

Level of Competency	Description	Action Verbs	Verb Definitions
Comprehension (2)	Explain & Elucidates Ideas and Information.	Recognize	Show validity or otherwise, using knowledge or contextual experience.
		Interpret	Translate into understandable or familiar terms.
		Describe	Write and communicate the key features.
		Explain	Make a clear description in detail using relevant facts.
		Define	Give the exact nature, scope or meaning.

Level of Competency	Description	Action Verbs	Verb Definitions
Application (3)	Use and Adapt Knowledge in New Situations.	Reconcile	Make consistent / compatible with another.
		Graph	Represent by graphs.
		Assess	Determine the value, nature, ability or quality.
		Solve	Find solutions through calculations and/or explanation.
		Prepare	Make or get ready for a particular purpose.
		Demonstrate	Prove or exhibit with examples.
		Calculate	Ascertain or reckon with mathematical computation.
		Apply	Put to practical use.

Level of Competency	Description	Action Verbs	Verb Definitions
Analysis (4)	Draw Connections Among Ideas and Solve Problems.	Communicate	Share or exchange information.
		Outline	Make a summary of significant features.
		Contrast	Examine to show differences.
		Compare	Examine to discover similarities.
		Discuss	Examine in detail by arguments.
		Differentiate	Constitute a difference that distinguishes something.
		Analyze	Examine in details to find the solution or outcome.

FORMULAE SHEETS

Mathematical Fundamentals:

Quadratic equation:

The solutions of a quadratic equation, $ax^2 + bx + c = 0$ is given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Arithmetic sequence:

Term of an arithmetic sequence:

$$T_n = a + (n - 1)d$$

The sum of first n terms of an AP:

$$S = \frac{n}{2} \{2a + (n - 1)d\}$$

Geometric sequence:

The term of a geometric sequence,

$$T_n = ar^{n-1}$$

The sum of first n terms of a GP:

$$S = a \frac{\{r^n - 1\}}{\{r - 1\}} \quad \text{if } r > 1$$

$$S = a \frac{\{1 - r^n\}}{\{1 - r\}} \quad \text{if } r < 1$$

$$S = na \quad \text{Otherwise } r = 1$$

Quantitative Finance:

Simple interest:

$$S = X(1 + nr)$$

Compound Interest:

$$S = X\{1 + r\}^n$$

Discounting:

$$\text{Present Value} = \text{Future Value} \times \frac{1}{(1+r)^n}$$

Repayment of mortgage / Loan:

$$A = \frac{SR^n(R - 1)}{\{R^n - 1\}}$$

Effective Interest Rate:

$$\text{EIR} = \{(1 + r)^n - 1\} 100\%$$

Numerical Descriptive Measures:

Mean \bar{x} :

For ungrouped data: $\frac{\sum x}{n}$

For grouped data: $\frac{\sum fx}{\sum f}$

Median:

For Ungrouped data $M_d = \frac{(n + 1)^{\text{th}} \text{ term}}{2}$

For Grouped data $M_d = L_1 + \left\{ \frac{\frac{n}{2} - F_c}{f_m} \right\} \times C$

Mode:

Grouped data $M_0 = L_1 + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times C$

Standard deviation σ :

For ungrouped data:

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \text{or} \quad \sqrt{\frac{\sum x^2}{n} - \bar{x}^2}$$

For grouped data:

$$\sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} \quad \text{or} \quad \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

Coefficient of variation (CV):

$$\frac{\text{Standard deviation}}{\text{Mean}} = \frac{\sigma}{\bar{x}} \times 100$$

Coefficient of skewness = $\frac{3(\text{Mean} - \text{Median})}{\text{Standard Deviation}}$

Comparing Two Quantitative Variables:

Correlation coefficient (r):

$$\frac{[n \sum xy - \sum x \sum y]}{\sqrt{\{[n \sum x^2 - (\sum x)^2] \times [n \sum y^2 - (\sum y)^2]\}}}$$

Regression line under least square method (a and b):

$$b = \frac{[n \sum xy - \sum x \sum y]}{[n \sum x^2 - (\sum x)^2]}$$

$$a = \bar{y} - b\bar{x}$$

Comparison over time with Economic variables

Index Numbers:

$$\text{Price Relative} = \frac{p_1}{p_0} \times 100$$

$$\text{Quantity Relative} = \frac{q_1}{q_0} \times 100$$

$$\text{Value Relative } V_{1/0} = \frac{p_1 q_1}{p_0 q_0} \times 100$$

$$\text{Simple aggregate price index} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$\text{Simple aggregate quantity index} = \frac{\sum q_1}{\sum q_0} \times 100$$

$$\text{Average price relative} = \frac{1}{n} \sum \frac{p_1}{p_0} \times 100$$

$$\text{Average quantity relative} = \frac{1}{n} \sum \frac{q_1}{q_0} \times 100$$

Weighted aggregate indices

1) Base-weighted / Laspeyre's:

$$\text{Price index} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$\text{Quantity index} = \frac{\sum q_1 p_0}{\sum q_0 p_0} \times 100$$

2) Current-weighted / Paasche's:

$$\text{Price index} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$\text{Quantity index} = \frac{\sum q_1 p_1}{\sum q_0 p_1} \times 100$$

3) Using standard weights

$$\text{Price index} = \frac{\sum p_1 w}{\sum p_0 w} \times 100$$

$$\text{Quantity index} = \frac{\sum q_1 w}{\sum q_0 w} \times 100$$

Weighted average of relatives

$$\text{Price index} = \frac{\sum [w \times I_p]}{\sum w} \times 100$$

$$\text{Quantity index} = \frac{\sum [w \times I_q]}{\sum w} \times 100$$

Time Series:

Multiplicative Model

$$Y = T \times S \times C \times R$$

Sets and Probability

U - Union; A ∪ B defines all elements in A plus all elements in B, no element being counted twice.

∩ - Intersection; A ∩ B defines all elements included in both A and B.

P (A) - Probability of event A

P (A/B) - Probability of event A, given B

General rules:

$$P (A \cup B) = P (A) + P (B) - P (A \cap B)$$

$$P (A/B) = \frac{P(A \cap B)}{P(B)}$$

Expectation and Variance of a discrete random variable:

$$E(X) = \sum (\text{probability} \times \text{pay off}) = \sum p \times x$$

$$VAR(X) = \sum px^2 - (\sum px)^2$$

Normal Distribution:

$$Z = \frac{x - \mu}{\sigma}$$