ASSOCIATION OF ACCOUNTING TECHNICIANS OF SRI LANKA

AA1 EXAMINATION - JANUARY 2019

(AA12) QUANTITATIVE METHODS FOR BUSINESS

- **Instructions to candidates** (Please Read Carefully)**:**

  (1)   **Time allowed:** *Reading   -   15 minutes.*

  Writing   -   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.*

SECTION A

Objective Test Questions (OTQs)

Fifteen (15) compulsory questions

(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   If $5x + 7 = 23 + x$, the value of x is:

(1)   5 $\qquad\qquad$ (2)   4 $\qquad\qquad$ (3)   3 $\qquad\qquad$ (4)   7 $\qquad$ (03 marks)

1.2   **Manoj** obtained a mortgage loan of Rs.100,000/- from a bank at the interest rate of 18% per annum and repayable in 4 equal annual instalments at the end of every year. The value of the instalment to be paid per annum for the loan would be *(to the nearest integer)*:

(1)   Rs.43,000/-. $\quad$ (2)   Rs.43,428/-. $\quad$ (3)   Rs.31,978/-. $\quad$ (4)   Rs.37,174/-.

(03 marks)

1.3 If the monthly Total Revenue Function of a new product is given by TR = 4,500 + 30q − 3q², the Marginal Revenue Function (MR) of that product would be:

(1) $30 - 6q$ (2) $30q - 6q^2$

(3) $4,500 + 30q - 6q^2$ (4) $4,500 - 6q^2$ (03 marks)

1.4 **Kasun** deposited Rs.150,000/- in a bank for 5 years at a simple interest rate of 12.25% per annum. The total interest earned by him for 5 years would be:

(1) Rs.98,175/-   (2) Rs.91,875/-   (3) Rs.58,125/-   (4) Rs.18,375/-

                                                                          (03 marks)

1.5 The marks obtained by a student for his seven assignments were as follows:

$$50, \ 52, \ 54, \ 56, \ 58, \ 60, \ x$$

If the mean of the marks obtained by him for the assignments is 56, the value of "x" would be:

(1) 57   (2) 62   (3) 64   (4) 68

                                                                           (03 marks)

1.6 The number of hours spent (x) for studying for an examination by 12 students, together with the marks obtained (y) by them in the particular examination, are summarized below:

$$\sum x = 76 \quad \sum x^2 = 560 \quad \sum y = 913 \quad \sum y^2 = 75,153 \quad \sum xy = 6,425 \quad n = 12$$

Based on the above data, the correlation coefficient between (x) and (y) is:

(1) -0.96 (2) 0.96 (3) -0.69 (4) 0.69 (03 marks)

1.7 The following table shows the prices of three items **P**, **Q** and **R** for the year 2015 and 2017:

Item	Price per kg (Rs.)	
	2015	2017
P	200	250
Q	160	200
R	540	660

Based on the above data, the simple aggregate price index for the year 2017, considering the year 2015 as the base year, would be *(to the nearest integer)*:

(1) 123%   (2) 120%   (3) 118%   (4) 111%

                                                                           (03 marks)

1.8 The price of a share (x) of a particular company on any given day is known to vary according to the following probability (p) distribution:

Price of share, Rs. (x)	60.00	62.50	65.00	67.50	80.00
Profitability (p)	0.05	0.2	0.1	... a ...	0.4

The value of 'a' would be:

(1)   0.55   (2)   0.25   (3)   0.025   (4)   0.0025

(03 marks)

1.9 The following table summarizes the results of an interview conducted by a reputed company to recruit Management Trainees for the year 2019:

	Male	Female	Total
Pass	18	22	40
Fail	20	40	60
Total	38	62	100

The probability that the chosen candidate who passes the interview, if he is a male would be *(approximately)*:

(1)   0.27   (2)   0.35   (3)   0.47   (4)   0.51

(03 marks)

1.10 The value of the common difference of the arithmetic sequence generated by $T_n = 18 - 5n$ would be:

(1)   13   (2)   5   (3) -8 (4) -5 (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   **PQR Company** is in the process of evaluating projects to select the best project from 3 different projects **A, B** and **C** using the Net Present Value (NPV) and the computed NPV of each project is as follows:

Project	NPV (Rs.)
A	98,000
B	90,000
C	(99,500)

Identify the best project with justification for selection.   (02 marks)
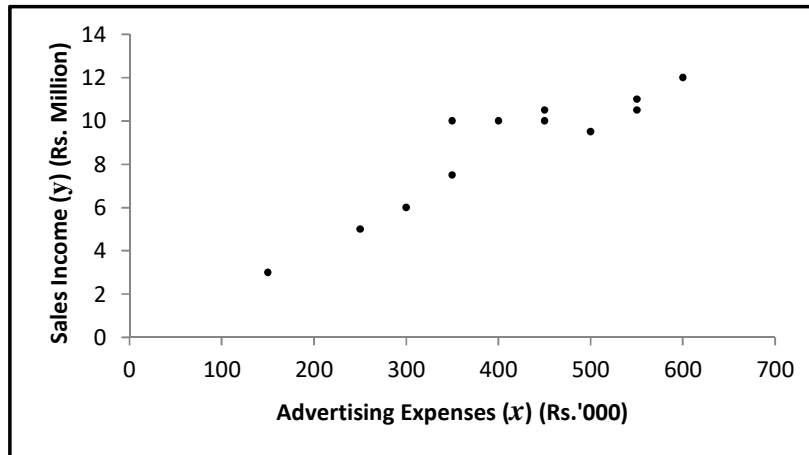
1.12   Rs.850,000/- was divided among **A, B** and **C**. **A's** share was Rs.10,000/- less than that of **B's** share and **C's** share was twice of **A's** share.

Calculate the share of **C**.   (02 marks)

1.13   The value of the correlation coefficient, **r** is 0.95 for the relationship between advertising expenditure and sales income shown in the scatter diagram plotted below:

Identify the relationship between advertising expenses and sales income.   (02 marks)

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

1.14   Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.   (02 marks)

1.15   Two events which can happen simultaneously on a single trial are called as mutually exclusive events.   (02 marks)
                                                                     (Total 40 marks)

——————————————— *End of Section A* ———————————————

SECTION B

Four (04) compulsory questions

(Total 40 marks)

Question 02

(a) A person deposited Rs.225,000/- in a savings account of a bank for 2 years, at the simple interest rate of 14% per annum.

You are required to:

Calculate the total amount in his account at the end of 2 years.   (03 marks)

(b) **Perera** intends to purchase an air conditioner from **ABC Ltd.** and the company agrees to sell it paying Rs.500,000/- in cash immediately and the balance amount of Rs.200,000/- is repayable in equal two annual instalments with an interest rate of 8% per annum.

You are required to:

(i)   **Calculate** the total amount to be paid by **Perera** to **ABC Ltd.** at the end of 2 years for the purchase of the air conditioner if interest is compounded annually.   (03 marks)

(ii) **Calculate** the amount being paid to **ABC Ltd.** as the interest at the end of 2 years if the interest is compounded quarterly.   (04 marks)

(Total 10 marks)

Question 03

(a) You are given the following Total Revenue (TR) Function and Total Cost (TC) Function:

$$TR = 700q$$

$$TC = 12{,}500 + 450q$$

where 'q' is the number of units.

You are required to:

(i)   **Identify** the profit function.   (03 marks)

(ii) **Calculate** the break-even quantity.   (03 marks)

(b) The total profit function for a commodity is given by:

$$P_{(x)} = -2x^2 + 100x + 600$$

Where x is the number of units sold.

You are required to:

Calculate the number of units at which the profit is maximized.   (04 marks)

(Total 10 marks)

Question 04

The management of **MCSL Restaurant** wanted to identify the waiting time taken to process each food order. Accordingly, they have recorded the waiting time for 50 food orders that were placed with them last Saturday night and tabulated below:

Minutes	No. of orders (f)
01 – 03	06
04 – 06	11
07 – 09	12
10 – 12	13
13 – 15	8

You are required to:

Calculate the following:

(a)   Mean.   (04 marks)

(b)   Standard Deviation.   (04 marks)

(c)   Coefficient of variation   (02 marks)

of the waiting time.   (Total 10 marks)

Question 05

The following table shows the retail selling prices of electrical items (x) and the volume of sales (y) at different prices of an electrical goods warehouse:

Selling Price (x) (Rs.)	60	80	100	120	140	160	200	220	240	260
Sales Volume (y) (in thousands)	400	300	275	250	210	190	150	100	50	0

$$\sum x = 1,580 \quad \sum y = 1,925 \quad \sum xy = 229,300 \quad \sum x^2 = 293,200 \quad \sum y^2 = 503,325$$

(a)   **Identify** the least square regression line given by $y = a + bx$ to determine the linear relationship between the above two variables: (07 marks)

(b)   **Calculate** the expected sales volume of the item, if the selling price is Rs.150/-.   (03 marks)

(Total 10 marks)

───────────────── *End of Section B* ─────────────────

SECTION C

One (01) compulsory question

(Total 20 marks)

Question 06

(A) The following table presents the quarterly sales, 4 quarter moving average and centered moving average figures of a software product. Assume **a multiplicative model** in which there are no cyclical and random variations, $(R = 1 \;, \; C = 1)$:

Year	Quarter	t	Y	4 Quarter Moving Average	Centered Moving Average (T)	Y/T
2015	1	1	120			
	2	2	135			
				137.5		
	3	3	150		140	1.071
				142.5		
	4	4	145		140.625	1.031
				138.75		
2016	1	5	140		132.5	1.057
				126.25		
	2	6	120		121.875	0.985
				117.5		
	3	7	100		115	0.87
				112.5		
	4	8	110		115	0.957
				_ _ (a) _ _		
2017	1	9	120		_ _ (d) _ _	0.932
				_ _ (b) _ _		
	2	10	140		_ _ (e) _ _	0.957
				_ _ (c) _ _		
	3	11	190			
	4	12	160			

7 | P a g e

You are required to:

(a) **Identify** the respective values for (a) to (e) of the above table.   (05 marks)

(b) **Compute** the seasonal index corresponding to the third quarter to fill the below table which shows the quarterly seasonal indices computed for the above data:

Quarter	Seasonal Index
Q1	0.9945
Q2	0.971
Q3	……….
Q4	0.994

(04 marks)

(B) The probability that a worker comes to work by Train, Bus, Motor Bicycle to his office are 3/10, 3/5, 1/10 respectively. The probability that he will be late to office if he comes by Train, Bus, Motor Bicycle are 1/4, 1/3 and 1/12 respectively:

You are required to:

(a) **Draw** a tree diagram to represent the above information.   (04 marks)

(b) **Calculate** the probability that the worker comes to work on time.   (04marks)

(C) It was observed that 80% of the students passed in mathematics paper, 60% of students passed in science paper and 40% of students passed in both these subjects in a monthly examination.

You are required to:

Calculate the probability of a student passing the mathematics paper if he passed the science paper.   (03 marks)

(Total 20 marks)

———— *End of Section C* ————

ACTION VERB CHECK LIST

Knowledge Process	Verb List	Verb Definitions
Level 01 Comprehension Recall & explain important information	**Define**	Describe exactly the nature, scope, or meaning.
	Draw	Produce (a picture or diagram).
	Identify	Recognize, establish or select after consideration.
	List	Write the connected items one below the other.
	Relate	To establish logical or causal connections.
	State	Express something definitely or clearly.
	Calculate/Compute	Make a mathematical computation
	Discuss	Examine in detail by argument showing different aspects, for the purpose of arriving at a conclusion.
	Explain	Make a clear description in detail revealing relevant facts.
	Interpret	Present in an understandable terms.
	Recognize	To show validity or otherwise, using knowledge or contextual experience.
	Record	Enter relevant entries in detail.
	Summarize	Give a brief statement of the main points (in facts or figures).

Knowledge Process	Verb List	Verb Definitions
Level 02 Application Use knowledge in a setting other than the one in which it was learned / Solve closed-ended problems	**Apply**	Put to practical use.
	Assess	Determine the value, nature, ability, or quality.
	Demonstrate	Prove, especially with examples.
	Graph	Represent by means of a graph.
	Prepare	Make ready for a particular purpose.
	Prioritize	Arrange or do in order of importance.
	Reconcile	Make consistent with another.
	Solve	To find a solution through calculations and/or explanation.

Knowledge Process	Verb List	Verb Definitions
Level 03 Analysis Draw relations among ideas and compare and contrast / Solve open-ended problems.	**Analyze**	Examine in detail in order to determine the solution or outcome.
	Compare	Examine for the purpose of discovering similarities.
	Contrast	Examine in order to show unlikeness or differences.
	Differentiate	Constitute a difference that distinguishes something.
	Outline	Make a summary of significant features.

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:

The sum of first n terms of an AP:
$S = \frac{n}{2}\{2a + (n-1)d\}$

Geometric sequence:

The sum of first n terms of a GP:

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

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

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

Quantitative Finance:

Simple interest:
$S = X(1 + nr)$

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

Discounting:

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

Repayment of mortgage:

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

Internal Rate of Return:

$$IRR = \frac{[N_1 r_2 - N_2 r_1]}{[N_1 - N_2]}\%$$
Or
$$IRR = a\% + \frac{NPV_A}{[NPV_A - NPV_B]}(b - a)\%$$

Numerical Descriptive Measures:

Mean $\bar{x}$:

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

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

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):

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

Comparing Two Quantitative Variables:

Pearson's Product Moment Correlation.

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 coefficients (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

<u>Index Numbers:</u>

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

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

Value Relative $= \frac{v_1}{v_0} \times 100$

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

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

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

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

Weighted aggregate indices
1) <u>Base-weighted / Laspeyre's:</u>

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

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

2) <u>Current-weighted / Paasche's:</u>

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

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

3) <u>Using standard weights</u>

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

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

Weighted average of relatives

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

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

<u>Time Series:</u>

Additive model
Y = T + S + C + R

Multiplicative Model

Y = T × S × C × R

Sets and Probability

∪ - 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

<u>General rules:</u>
P (A∪B) = P (A) + P (B) – P (A∩B)

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

<u>Expectation and Variance of a discrete random variable:</u>

$E(X) = \sum(probability \times pay\,off) = \sum p \times x$

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

<u>Normal Distribution:</u>

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