



ASSOCIATION OF ACCOUNTING TECHNICIANS OF SRI LANKA

AA1 EXAMINATION - JANUARY 2018

(AA12) QUANTITATIVE METHODS FOR BUSINESS

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

- (1) **Time allowed:** Reading - 15 minutes.
Writing - 03 hours.

28-01-2018
Morning
[8.45 – 12.00]

- (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) **Graph Paper and 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.**

No. of Pages : 09
No. of Questions : 06

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 $2 + 3y = y + 14$, the value of y is:

- (1) 3 (2) 6 (3) 4 (4) 7

(03 marks)

1.2 A person has borrowed Rs.500,000/- from a Bank at an interest rate of 12% compounded annually. The total amount to be paid to settle the loan at the end of 2 years is:

- (1) Rs.512,072/-. (2) Rs.620,000/-. (3) Rs.627,200/-. (4) Rs.720,000/-.

(03 marks)

1.3 If the fixed cost is Rs.500/- and the variable cost function is $VC = 6x^2 - 4x$, the total cost function (TC) would be:

- (1) $TC = 6x^2 - 4x + 500.$ (2) $TC = 6x^2 - 4x - 500.$
 (3) $TC = 6x - 4.$ (4) $TC = 6x + 4.$ (03 marks)

1.4 The square root of the “variance” is known as:

- (1) Correlation coefficient. (2) Standard deviation.
 (3) Coefficient of variation. (4) Coefficient of determination. (03 marks)

1.5 Consider the following statements regarding the normal distribution:

- (a) Normal distribution curve touches x axis at 2 points.
 (b) Mean (μ) is the only parameter of the normal distribution.
 (c) Normal distribution curve is above the x axis.

Out of the above, the correct statement is:

- (1) (a) only. (2) (b) only.
 (3) (c) only. (4) (a) and (b) only. (03 marks)

1.6 The management team of a garment factory has identified their total revenue function (TR) as $TR = 30x$ and total cost function (TC) as $TC = 10x + 2,400$.

The break-even quantity of the factory is:

- (1) 60 (2) 120 (3) 90 (4) 100 (03 marks)

1.7 The prices of some consumer goods for the years 2014 and 2016 are given in the following table:

Year \ Item	Unit Price (Rs.)		
	A	B	C
2014	150	60	125
2016	180	72	200

Considering the year 2014 as the base year, the simple aggregate price index for the year 2016 would be (to the nearest integer):

- (1) 100% (2) 135% (3) 83% (4) 75% (03 marks)

1.8 Rs.1,000/- is deposited at the end of every year for three years at the interest rate of 12% per annum. Approximate present value of the annuity is (to the nearest integer):

- (1) Rs.3,401/-. (2) Rs.2,690/-. (3) Rs.2,402/-. (4) Rs.1,405/-. (03 marks)

Use the following information to answer question No. 1.9 and 1.10.

The profits (*in thousand rupees*) of an ice cream company for the last three weeks are as follows:

11, 12, 16

1.9 The mean profit of the last three weeks (*in thousand rupees*) is:

- (1) 11 (2) 13 (3) 14 (4) 15

(03 marks)

1.10 The standard deviation of profit for last three weeks (*in thousand rupees*) is:

- (1) 4.67 (2) 7.26 (3) 11 (4) 2.16

(03 marks)

Use the following information and the table below to answer question No. 1.11 to 1.15. Write the answers in your answer booklet with the number assigned to the question.

A leading commercial bank in Sri Lanka with 180 employees has 100 branches with the head office located in Colombo. The employees of the bank are categorized as Senior managers, Junior managers and Management Assistants. The following table illustrates the composition of the workforce along with their location of workplace namely, Colombo and out of Colombo:

Employee Category	Workplace		Total
	Colombo	Out of Colombo	
Senior managers	25	15	40
Junior managers	20	30	50
Management Assistants	35	55	90
Total	80	100	180

Moreover, it is given that 80% of senior managers, 60% of junior managers and 50% of Management Assistants are married.

If an employee is randomly selected:

1.11 Calculate the probability that he / she is a junior manager. (02 marks)

1.12 Calculate the probability that he / she is a management assistant. (02 marks)

1.13 Calculate the probability that he / she works out of Colombo. (02 marks)

1.14 Calculate the probability that he / she works in Colombo given that he / she is a Senior manager. (02 marks)

1.15 Calculate the probability that he / she is married. (02 marks)

(Total 40 marks)

End of Section A

SECTION B

Four (04) compulsory questions

(Total 40 marks)

Question 02

A manufacturing company has the following demand function and total cost function for a product:

$$\text{Demand Function } D_{(x)} = 66 - x$$

$$\text{Total Cost Function } C_{(x)} = 2x^2 + 18x + 500$$

(Here, x is the number of units produced)

You are required to:

- (a) **Identify** the Total Revenue Function. (03 marks)
 - (b) **Identify** the Profit Function. (03 marks)
 - (c) **Calculate** the quantity at which the profit is maximized. (04 marks)
- (Total 10 marks)

Question 03

The following table shows the prices and quantity of four items, Sugar, Chick peas, Green gram and Corn for the years 2016 and 2017:

Item	Price per unit (Rs.)		Quantity (kg)	
	2017 (p_1)	2016 (p_0)	2017 (q_1)	2016 (q_0)
Sugar	85	105	70	40
Chick peas	160	140	35	65
Green gram	200	250	45	20
Corn	60	70	75	50

Consider 2016 as the base year:

You are required to:

- (a) **Calculate** the base weighted aggregate price index (Laspeyre's Price Index) for the year 2017. (05 marks)
 - (b) **Calculate** the current weighted aggregate price index (Paasche's Price Index) for the year 2017. (05 marks)
- (Total 10 marks)

Question 04

The Human Resource Management division of a leading commercial bank examines how the time spent on studying by their employees affects the final performance of the promotion test. The management of the bank collects data corresponding to the number of hours per week of 10 employees spent on studying and the final score of them at the promotion test. Data are given in the following table:

Study hours per week (x)	9	4	10	14	7	5	12	22	1	17
Promotion Test Score (y)	58	31	65	73	44	37	60	91	20	84

The following figures have also been computed.

$$\sum x = 101, \quad \sum y = 563, \quad \sum x^2 = 1,385, \quad \sum y^2 = 36,521 \quad \text{and} \quad \sum xy = 6,981$$

You are required to:

- (a) **Draw** a Scatter diagram to represent the above data in a graph paper. (04 marks)
- (b) **Calculate** the correlation coefficient between x and y . (04 marks)
- (c) **Identify** the relationship between the time spent on studying and the final score at the promotion test. (02 marks)
- (Total 10 marks)

Question 05

- (a) A manufacturing company provides the following data on their production units (*in thousands*) for a period of ten (10) years:

Year (x)	1	2	3	4	5	6	7	8	9	10
Production units ('000) (y)	45	50	55	60	65	75	80	85	80	90

It is given that $\sum x = 55$, $\sum y = 685$, $\sum x^2 = 385$ and $\sum xy = 4,185$

You are required to:

Identify the regression line for the annual production using the least square regression line given by $y = a + bx$ using the above information. (06 marks)

- (b) **Best Labels Limited** wants to evaluate a new project to boost their profitability. The initial cost for purchasing a new machine is Rs.200,000/-. This would generate the annual cash inflows of the company by Rs.65,000/- each for next 4 years. Consider the discounting factor as 10% per annum.

You are required to:

Calculate the Net Present Value (NPV). (04 marks)

(Total 10 marks)

End of Section B

SECTION C

One (01) compulsory question

(Total 20 marks)

Question 06

- (A) A student saves Rs.30/- on the first day, Rs.60/- on the second day, Rs.120/- on the third day and so on from the money he receives daily from his parents.

Calculate the total amount he saves within the first 5 days. (04 marks)

- (B) Consider the following simultaneous equations:

$$2x + 8y = 72$$

$$4x + 4y = 96$$

You are required to:

Calculate the values of x and y . (05 marks)

- (C) (a) A person decides to build a fund of Rs.750,000/- for him and expects to deposit a certain amount to his savings account every quarter for five years. He receives interest at the rate of 12% per annum compounded quarterly.

Calculate the amount he should deposit quarterly to his savings account. (06 marks)

- (b) An amount of money was invested on 01st January 2017 such that it would generate Rs.500,000/- at the end of the year 2017. The interest rate on the particular investment is 13.2% per annum compounded monthly.

Calculate the amount of the original investment and the corresponding interest earned during the year 2017. (05 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:

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

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

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

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:

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

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: $\frac{\sum x}{n}$

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

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):

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

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):

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

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

FORMULAE SHEETS

(Continued)

Comparison over time with Economic variables

Index Numbers:

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

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

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

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

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

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

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

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:

Additive model

$$Y = T + S + C + R$$

Multiplicative Model

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

Sets and Probability

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

\cap - Intersection; $A \cap B$ 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:

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