



ASSOCIATION OF ACCOUNTING TECHNICIANS OF SRI LANKA

AA1 EXAMINATION - JULY 2017

(AA12) QUANTITATIVE METHODS FOR BUSINESS

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

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

23-07-2017
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) **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 : 10
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 $2(4x - 5) = 3x$

The value of "x" of the above equation is:

- (1) 2 (2) 5 (3) 10 (4) 3

(03 marks)

1.2 A person has borrowed Rs.140,000/- at an interest rate of 9% compounded annually. Total amount of money that should be repaid by him after 2 years is:

- (1) Rs.152,600/- (2) Rs.165,200/- (3) Rs.166,334/- (4) Rs.306,334/-

(03 marks)

1.3 The price of a motor car of **Brand X** in year 2015 was Rs.22 million and in year 2016 it was Rs.30 million. The value of the price relative for a motor car of **Brand X** in year 2016 considering the year 2015 as the base year would be (*to the nearest integer*):

- (1) 77% (2) 136% (3) 100% (4) 78%
(03 marks)

1.4 Consider the following statements relating to index numbers:

- (a) Index numbers can take negative values.
(b) Index numbers can be less than 100.
(c) The base period is used to calculate the index number.

Out of the above, the correct statements are:

- (1) (a) and (b) only. (2) (b) and (c) only.
(3) (a) and (c) only. (4) All of the above. (03 marks)

1.5 Which one of the following pairs of events is independent?

- (1) Winning two successive prizes in a lottery on two different tickets.
(2) Earning a large income and paying a large amount of income tax.
(3) Being drunk while driving and meeting with an accident.
(4) All of the above.

(03 marks)

1.6 The management committee of a company has identified the Total Cost (TC) function for the last year as $TC = q^2 - 20q + 1,000$.

The Marginal Cost (MC) function of the company for the last year was:

- (1) $MC = 2q + 20$ (2) $MC = 2q^2 - 20q + 1,000$
(3) $MC = 2q - 20$ (4) $MC = 2q^2 - 20q - 1,000$ (03 marks)

1.7 In an audit firm, the average weight of 12 trainees is 52 kilograms. The average weight of these 12 trainees and the manager is 53.5 kilograms.

The weight of the manager is:

- (1) 52.75 kilograms (2) 52 kilograms
(3) 65 kilograms (4) 71.5 kilograms
(03 marks)

Use the following information and the table below to answer question No. 1.11 to 1.13. Write the answers in your answer booklet with the number assigned to the question.

A survey was done with 1,000 families to see whether they had planned to buy a Television (TV) in the last year and whether they have actually purchased a TV during that year. The findings of the survey are tabled below:

Planned to buy a TV	No. of Families Actually Purchased a TV		
	Yes	No	Total
Yes	200	50	250
No	100	650	750
Total	300	700	1,000

- 1.11 Calculate the probability that a family planned to purchase a television. (02 marks)
- 1.12 Calculate the probability that a family actually purchased a television given that they had planned to purchase a television. (02 marks)
- 1.13 Calculate the probability that a family actually purchased a television. (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 At the profit maximization point, Marginal Cost (MC) is equal to Marginal Revenue (MR). (02 marks)
- 1.15 The Internal Rate of Return (IRR) of a project is the rate of interest at which the Net Present Value (NPV) of the project is zero. (02 marks)

End of Section A

SECTION B

Four (04) compulsory questions

(Total 40 marks)

Question 02

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

$$\text{Cost Function } C(x) = 300x + 4,800$$

$$\text{Demand Function } P = -2x + 500$$

Where 'x' is the quantity and P is the price per unit.

You are required to:

- (a) **Identify** the Total Revenue function. (02 marks)
 - (b) **Calculate** the break-even quantity. (03 marks)
 - (c) **Identify** the profit function. (02 marks)
 - (d) **Calculate** the quantity at which the profit is maximized. (03 marks)
- (Total 10 marks)

Question 03

The following table shows the advertising cost incurred by a company and the respective sales income for 8 years:

Advertising Cost (x) (in Rs. millions)	1	3	5	7	9	10	12	14
Sales Income (y) (in Rs. millions)	3	7	10	13	16	21	26	32

The following figures have also been computed:

$$\begin{aligned} \sum x &= 61 & \sum y &= 128 & \sum xy &= 1,279 \\ \sum x^2 &= 605 & \sum y^2 &= 2,724 & & \end{aligned}$$

You are required to:

- (a) **Calculate** the standard deviation of x. (03 marks)
 - (b) (i) **Calculate** the correlation coefficient between x and y. (05 marks)
 - (ii) **Identify** the relationship between Advertising Cost and Sales Income. (02 marks)
- (Total 10 marks)

Question 04

The following table shows the results obtained by five students of an Educational Institute for their examination:

Student	Marks scored for the Aptitude Test (X)	Marks scored for the Practical Training (Y)	X^2	XY
A	60	70	3,600	4,200
B	90	88	8,100	7,920
C	76	69	5,776	5,244
D	97	72	9,409	6,984
E	50	63	2,500	3,150
	$\sum x = 373$	$\sum y = 362$	$\sum x^2 = 29,385$	$\sum xy = 27,498$

You are required to:

- (a) **Identify** the regression line given by $y = a + bx$ using the above information. (07 marks)
- (b) **Compute** the expected marks scored for practical training programme if a student has scored 85 marks for the aptitude test. (03 marks)
- (Total 10 marks)

Question 05

- (a) An amount of Rs.107,180/- was received at the end of the 6th year by lending a sum of Rs.50,000/- for a period of 6 years compounded annually.

Compute the rate of compound interest. (03 marks)

- (b) **Danavi PLC** is planning to enter into the digital printing business. Initial cost of the project is Rs.500,000/-. Expected cash inflows from the project for next five years are as follows:

Year	1	2	3	4	5
Cash inflow (Rs.)	200,000	180,000	150,000	50,000	10,000

The cost of capital (discounting factor) of the company is 11% per annum.

You are required to:

- (i) **Compute** the Net Present Value (NPV) of the project. (06 marks)
- (ii) **State** whether the project could be recommended. (01 mark)
- (Total 10 marks)

End of Section B

SECTION C

One (01) compulsory question

(Total 20 marks)

Question 06

(A) The following simultaneous equations are provided:

$$6x + 2y = 40$$

$$3x + 5y = 40$$

You are required to:

Compute the values of x and y .

(04 marks)

(B) The following table shows the prices and quantity of three items: Shirts, Pants and Frocks for the years 2010 and 2017:

Item	Quantity (in Units)		Price per Unit (Rs.)	
	2010 (q_0)	2017 (q_1)	2010 (p_0)	2017 (p_1)
Shirts	10	15	1,000	1,200
Pants	5	8	2,000	2,500
Frocks	100	120	500	550

You are required to:

Calculate the Quantity Based Weighted Index (Laspeyre's Quantity Index) for the year 2017 considering 2010 as the base year.

(05 marks)

(C) A producer of large scale machines analyzed his daily sales and found that the probability of having no sales is 20%, the probability of having only one unit of sale is 40%, the probability of having two units of sale is 30% and the probability of having three units of sale is 10%.

You are required to:

(a) **Calculate** the expected number of machines sold per day.

(03 marks)

(b) **Calculate** the variance of number of machines sold per day.

(03 marks)

(D) The following table shows the production in a factory in thousands:

Year	2010	2011	2012	2013	2014	2015	2016
Production ('000)	70	74	89	88	84	89	100

You are required to:

Compute the trend in production over the period from year 2010 to 2016 using 3 year moving averages.

(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:

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