

ASSOCIATION OF ACCOUNTING TECHNICIANS OF SRI LANKA

AA1 EXAMINATION - JANUARY 2020

(AA12) QUANTITATIVE METHODS FOR BUSINESS

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

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

26-01-2020
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 and Graph Papers 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 $3x + 3 = 2(x + 2)$, the value of x is:

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

(03 marks)

1.2 **Wijaya** invested Rs.25,000/- in a bank account at a simple interest rate of 8% per annum. The total amount of interest on investment at the end of 5th year would be:

- (1) Rs.10,000/- (2) Rs.35,000/- (3) Rs.2,000/- (4) Rs.11,730/-.

(03 marks)

1.3 If the Total Revenue (TR) function of a company is given by $TR = 33q - 4q^2$, the Marginal Revenue (MR) function of the company would be:

- (1) $MR = 33 - 4q$ (2) $MR = 33q - 4q$
 (3) $MR = 33q - 8q$ (4) $MR = 33 - 8q$ (03 marks)

1.4 A company produced 6,000 kg of sugar in the year 2018 and 9,500 kg in 2019. Considering the 2018 as the base year, quantity relative for the year 2019 would be *(to the nearest integer)*:

- (1) 63% (2) 100% (3) 158% (4) 58% (03 marks)

1.5 A Ltd. wants to evaluate a new project with an initial investment of Rs.5,000,000/-. This would generate the annual net cash inflow of Rs.2,500,000/- each for next 3 years. If the cost of capital (discounting factor) of the company is 10%, Net Present Value (NPV) of the project would be:

- (1) Rs.2,500,000/-. (2) Rs.1,215,000/-. (3) Rs.4,000,000/-. (4) Rs.2,458,000/-. (03 marks)

1.6 The prices of four items **P, Q, R** and **S** for the year 2017 and 2019 are given below:

Item	Price per item	
	2017 (Rs.)	2019 (Rs.)
P	220	260
Q	320	360
R	420	450
S	280	300

Based on the above data, considering the year 2017 as the base year, the simple aggregate price index for the year 2019, would be *(to the nearest integer)*:

- (1) 110% (2) 91% (3) 100% (4) 80% (03 marks)

1.7 The data collected on energy consumption of a country over the last 6 years is given below:

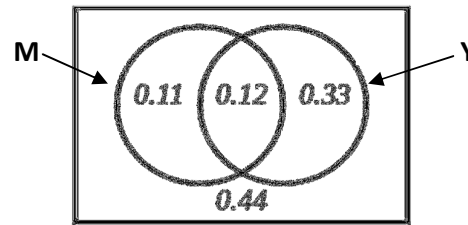
Year (X)	Energy Consumption (E) (in Megawatt)
2013	213
2014	217
2015	218
2016	223
2017	226
2018	227

The trend equation for the average energy consumption is $T = 210 + 3x$.

The estimated energy consumption for the year 2019 would be *(in Megawatt)*:

- (1) 210 (2) 228 (3) 231 (4) 189 (03 marks)

1.8 The following Venn diagram shows the probabilities of two events **M** and **Y**:



Based on the above Venn diagram, $P(M \cup Y)$ is:

- (1) 0.12 (2) 0.44 (3) 0.23 (4) 0.56
(03 marks)

1.9 The following table shows the probability distribution of sales of a company, based on past data:

Sales (x) (Rs.'000)	1,000	1,100	1,250	1,320	1,400
Probability	0.15	0.20	0.30	0.25	0.10

The expected value of sales (Rs.'000) of the company would be:

- (1) Rs.1,075/- (2) Rs.1,215/- (3) Rs.1,125/- (4) Rs.1,225/-
(03 marks)

1.10 A person borrowed Rs.200,000/- at an interest rate of 12% compounded annually. The total amount to be paid for settlement of the loan in full at the end of 3rd year would be:

- (1) Rs.250,880/- (2) Rs.298,560/- (3) Rs.280,986/- (4) Rs.272,000/-
(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 **X Ltd.** is engaged in buying and selling computers. The company sold a computer for Rs.145,000/- to a customer and the policy of the company is kept a profit margin of 25% on purchase price.

Calculate the purchase price of that computer. (02 marks)

1.12 A person invested a sum of Rs.500,000/-. Part of that investment was invested at the simple interest rate of 6% per annum and balance part was invested at the simple interest of 8% per annum. He earned annual interest income of Rs.38,000/- on that investment.

Calculate the amount invested at the rate of 8% per annum. (02 marks)

1.13 State two(02) reasons for use of sampling. (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 If the correlation coefficient between two variables is -1, there is a weak negative relationship. (02 marks)

1.15 At the break-even point, the total revenue is equal to the total cost. (02 marks)
(Total 40 marks)

End of Section A

SECTION B

Four (04) compulsory questions

(Total 40 marks)

Question 02

- (a) **Mahesh** invested Rs.750,000/- in a special savings account of a bank at an annual interest rate of 12% compounded quarterly.

You are required to:

Calculate the following in his account at the end of 2nd year:

- (i) The total amount in his account. (04 marks)
- (ii) Total interest earned. (02 marks)
- (b) **Saman** borrowed Rs.500,000/- at an interest rate of 14% compounded annually. This loan should be repaid in 5 equal annual installments at the end of the every year.

You are required to:

Compute the value of an installment to be paid per annum on the loan. (04 marks)
(Total 10 marks)

Question 03

- (a) The accountant of **Aba Ltd.** has identified the following Total Revenue (TR) function and Total Cost (TC) function with reference to a newly developed product:

$$TR = 74x + 2x^2$$

$$TC = 3x^2 - 86x + 250$$

Where x is the number of units.

You are required to:

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

- (b) A company produces and sells Product **B**. Its variable cost is Rs.75/- per unit and fixed cost is Rs.250,125/-. Total Revenue (TR) function is $650x$ (where x is the number of units produced).

You are required to:

- (i) **Identify** the Total Cost (TC) function and profit function. (03 marks)
- (ii) **Calculate** the break-even quantity. (03 marks)

(Total 10 marks)

Question 04

The monthly salary of 50 employees of **Sanji Ltd.** is given in the following table:

Monthly salary (Rs.'000)	10 -19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
No. of employees	6	20	8	6	6	4

You are required to:

Calculate the following of the monthly salary:

- (a) Mean. (03 marks)
 - (b) Standard deviation. (04 marks)
 - (c) Coefficient of variation. (03 marks)
- (Total 10 marks)

Question 05

The following table shows number of vehicles manufactured and total production cost of a vehicle manufacturing company for 6 months:

No. of Vehicle manufactured (x)	42	51	32	60	48	72
Total Production Cost (y) (Rs. in millions)	56	68	43	76	66	94

You are required to:

- (a) **Draw** a scatter diagram using the above data in a graph paper. (03 marks)
 - (b) **Identify** the least square regression line given by $y = a + bx$ to determine the linear relationship between the above two variables. (05 marks)
 - (c) **Calculate** the expected production cost if the number of vehicle manufactured is 55. (02 marks)
- (Total 10 marks)

————— *End of Section B* —————

SECTION C

One (01) compulsory question

(Total 20 marks)

Question 06

(A) The following simultaneous equations are given:

$$3x + 5y = 36$$

$$2x + 6y = 32$$

You are required to:

Calculate the value of x and y .

(03 marks)

- (B) The following table presents the quarterly sales, 4-quarter moving average and centered moving average figures relating to the sales of product A. 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
2017	1	1	300			
	2	2	225			
				262.5		
	3	3	275		-- (d) --	1.02
				-- (a) --		
	4	4	250		278.125	-- (f) --
			281.25			
2018	1	5	350		284.375	1.23
				287.5		
	2	6	250		290.625	0.86
				-- (b) --		
	3	7	300		-- (e) --	1.00
				306.25		
	4	8	275		309.375	0.89
			312.5			
2019	1	9	400		318.75	1.255
				-- (c) --		
	2	10	275		328.125	-- (g) --
				331.25		
	3	11	350			
	4	12	300			

You are required to:

Calculate the respective values for (a) to (g) of the above table. (07 marks)

- (C) A bag contains 5 red marbles and 3 black marbles all of the same size. In each draw, a marble is drawn at random from the bag and replaced.

You are required to:

- (a) **Draw** a tree diagram showing the results of drawing two marbles, one after the other. (04 marks)
- (b) **Calculate** the probability that:
- (i) Both marbles drawn are of the same colour. (02 marks)
- (ii) At least one red marble. (02 marks)
- (iii) At least one black marble. (02 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:

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