



ASSOCIATION OF ACCOUNTING TECHNICIANS OF SRI LANKA

AA1 EXAMINATION - JULY 2015

(AA12) QUANTITATIVE METHODS FOR BUSINESS

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

- (1) **Time:** 02 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) **Graph Paper 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.**

26-07-2015

Morning

[9.00 – 11.00]

No. of Pages : 10

No. of Questions : 07

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**SECTION A**

**Objective Test Questions (OTQs)**

Sixteen (16) compulsory questions

(Total 40 marks)

**Question 01**

Select the most correct answer for question No. 1.1 to 1.7. Write the number of the selected answer in your answer booklet with the number assigned to the question.

**1.1** The following notice is displayed in a retail shop:

5% discount on total bill value, if the bill value is between Rs.2,000/- and Rs.4,999/-,  
and 10% discount on total bill value, if the bill value is Rs.5,000/- or above.

Customer **A** has a bill of Rs.2,125/- and customer **B** has a bill of Rs.5,050/-.

The total value of the two bills after deducting discounts is:

- |                 |                 |
|-----------------|-----------------|
| (1) Rs.611.25   | (2) Rs.7,786.25 |
| (3) Rs.6,563.75 | (4) Rs.7,175.00 |
- (03 marks)

1.2 Match each of the financial mathematical terms with correct definition:

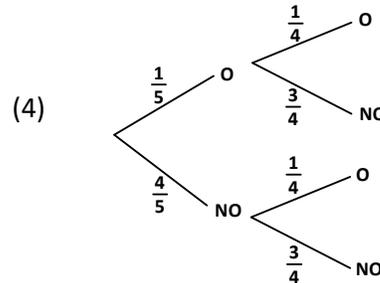
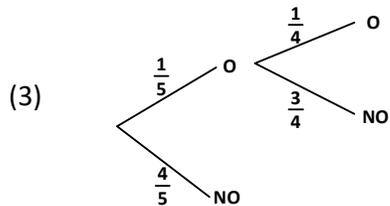
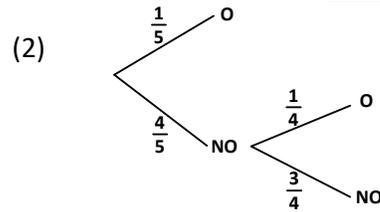
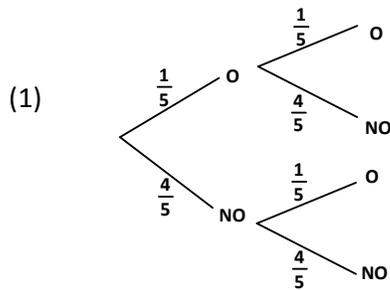
Terms	Definitions
A Annuities	X Periodic payments made in order to satisfy a future obligation.
B Sinking Fund	Y Current value of a future sum of money.
C Present Value of money	Z A sequence of fixed equal payments made over regular time intervals.

- (1)  $A \rightarrow Z$  :  $B \rightarrow X$  :  $C \rightarrow Y$                       (2)  $A \rightarrow Z$  :  $B \rightarrow Y$  :  $C \rightarrow X$   
 (3)  $A \rightarrow Y$  :  $B \rightarrow X$  :  $C \rightarrow Z$                       (4)  $A \rightarrow X$  :  $B \rightarrow Z$  :  $C \rightarrow Y$

(03 marks)

1.3 A bunch of keys has 5 identical (similar looking) keys. Each key is fixed only for one door. A person tries to make at most two attempts to open the lock of one door. He makes the second attempt only if he doesn't succeed in his first attempt. For the second attempt a key is selected at random from the remaining four keys.

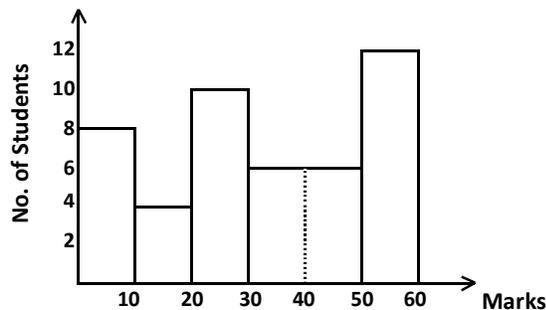
The correct tree diagram to represent the event is:



O - Open  
NO - Not Open

(03 marks)

1.4 Marks scored at an exam by 46 students are represented in the histogram given below:



If this data is represented in a pie chart, the share that represents the marks interval from 30 - 50 in degrees (to the nearest degree) is:

- (1)  $31^{\circ}$                       (2)  $23^{\circ}$                       (3)  $94^{\circ}$                       (4)  $78^{\circ}$

(03 marks)

- 1.5 A project's cash inflows for the next 5 years and the terminal value at the end of year 5 are as follows:

Year	1	2	3	4	5
Cash Inflows (Rs. million)	400	450	480	500	510
Terminal Value (Rs. million)	-	-	-	-	1,600

Assuming a discounting rate of 8% per annum, Present Value (PV) of the project is:

- (1) Rs.1,600 million. (2) Rs.1,852 million.  
 (3) Rs.2,941 million. (4) Rs.3,940 million. (03 marks)

- 1.6 **ABA Insurance PLC** is a globally operated motor bike insurer. When all factors are taken into account, the insurance company estimates that the probability of making an average claim of Rs.5,000/- is 0.1, and that the probability of the motor bike and contents being totally destroyed is 0.005. If that extreme event happens (motor bike being condemned), the company will have to pay Rs.150,000/-. The company charges Rs.1,300/- for the insurance policy. Assume only these two events will occur. Expected profit of issuing a policy is:

- (1) Rs.3,700/-. (2) Rs.75/-. (3) Rs.500/-. (4) Rs.50/-. (03 marks)

- 1.7 Two(02) correct methods of random sampling are:

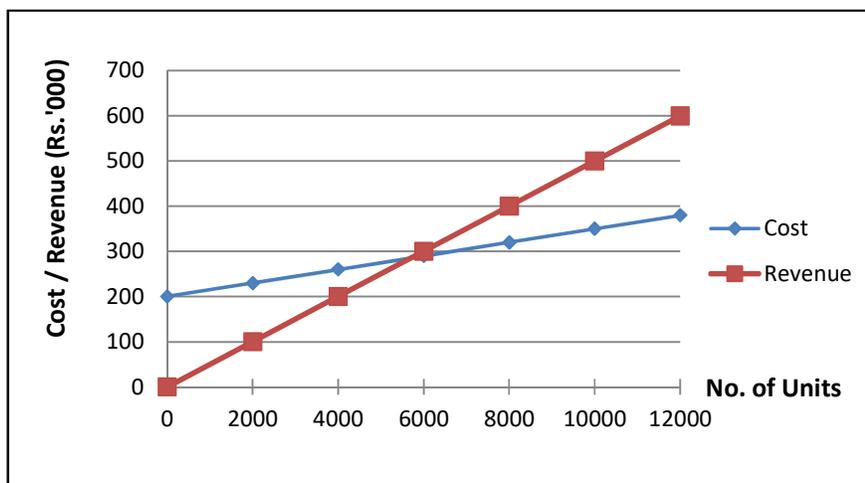
- (1) Systematic and Cluster. (2) Judgment and Systematic.  
 (3) Random and Quota. (4) Convenience and Judgment. (03 marks)

- 1.8 List three(03) factors that can influence the choice of an investment. (03 marks)

Use the graph below to answer question No. 1.9 to 1.13.

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

The total revenue and cost functions of a medium scale furniture manufacturer, **ABC Ltd.** for a month is given below: The variable cost is Rs.15/- per unit.



- 1.9 Cost formula of this product is  $200 + 50P$  where  $P$  is the No. of units produced. (02 marks)
- 1.10 Break-even output falls between 5,000 units and 6,000 units. (02 marks)
- 1.11 When the company sells 10,000 units, profit will be Rs.150,000/-. (02 marks)
- 1.12 Total revenue at the break-even point is equal to fixed cost. (02 marks)
- 1.13 When the fixed cost increases from the given level and other factors remain constant, the break-even output will decrease. (02 marks)

The below table shows details (price and quantity) of three items for base year and current year. Use details provided in the below table to, answer question number **1.14** to **1.16**.

Write short answers for question Nos. **1.14** to **1.16** in your Answer Booklet with the number assigned to the question.

Item	Base Year		Current Year		Y	$q_n p_o$	Z
	Price ( $p_o$ )	Quantity ( $q_o$ )	Price ( $p_n$ )	Quantity ( $q_n$ )			
A	10	12	14	9	120	90	168
B	25	X	27	9	-	225	-
C	16	15	19	14	240	224	285

The Base-weighted Quantity Index (Laspeyres's Quantity Index) for the current year is given as 96.25%. Based on the above information,

- 1.14 What is the formula which gives the values of column Z ? (02 marks)
- 1.15 What is the value of X ? (02 marks)
- 1.16 What is the Base-weighted Price Index (Laspeyres's Price Index) for the current year? (02 marks)

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*End of Section A*

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## SECTION B

Four (04) compulsory questions

(Total 32 marks)

### Question 02

- (a) The monthly profit of a company shows a geometric progression. The sum of profit of first two months is Rs.36 million. The multiplication of the first and third month profit is 9 times the profit of the second month.

**Calculate** the total profit for a period of 8 months. (03 marks)

- (b) A small scale garment manufacturer forecasts his profits against the number of employees and the data is given below:

<b>No. of employees</b>	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70
<b>Profit (Rs. million)</b>	8	12	8	16	13	7

**Draw** a histogram for the above data and **identify** the mode value using the histogram.

(05 marks)

(Total 08 marks)

### Question 03

- (a) The production cost function(C) of a manufacturing firm is given by,  $C = \frac{1}{3}p^3 - 5p^2 + 16p + 100$  ; where  $p$  is the number of units produced.

**Calculate** the number of units at which the production cost becomes lowest. (03 marks)

- (b) The average number of motor cars entered in a highway and the number of accidents are summarized and tabulated below:

<b>No. of motor cars</b>	41 - 45	46 - 50	51 - 55	56 - 60	61 - 65	66 - 70	71 - 75
<b>No. of accidents</b>	1	2	3	6	8	3	2

**Compute** the mean and the standard deviation of number of accidents in the highway.

(05 marks)

(Total 08 marks)

### Question 04

- (a) Products manufactured in a factory are packed by 3 production lines  $P_1$ ,  $P_2$  and  $P_3$ . According to the past statistics, 2% of products packed from  $P_1$ , 3% of the products packed from  $P_2$  and 5% of the products packed from  $P_3$  are not packed properly. Products are fed to the production line at the ratio of 30% : 33% : 37% respectively.

**Calculate** the probability that a packed product chosen at random is **not packed** properly.

(04 marks)

- (b) The length of a certain type of steel cables produced by a company is approximated by a normal distribution model with a mean of 5 cm and a standard deviation of 0.02 cm. Rejected steel cables are the steel cables with length less than 4.96cm.

If a steel cable is chosen at random,

- (i) **Calculate** the probability that the length of steel cable is between 4.98 cm and 5.02 cm.

- (ii) **Identify** the percentage of steel cables produced are rejected.

(04 marks)

(Total 08 marks)

### Question 05

Ice cream corn manufacturing machine has a maximum useful life of 16 years. The output per hour (No. of cones) will change with the life of the machine. The following table shows the details to assess the correlation coefficient between the two variables. **A**, **B** and **C** columns provide some of the intermediate values computed to calculate the correlation coefficient.

Life of Machine (x)	Output per hour (y)	A	B	C
2	50	100	4	2,500
4	60	240	---	3,600
6	55	---	36	3,025
12	45	540	144	---
14	40	560	196	1,600
16	35	560	---	1,225
$\Sigma x = 54$	$\Sigma y = 285$	$\Sigma xy = 2,330$	---	---

**Recognize** the missing data in columns **A**, **B** and **C** and **calculate** the correlation coefficient for the above data set. (08 marks)

End of Section B

### SECTION C

Two (02) compulsory questions

(Total 28 marks)

### Question 06

- (a) List the four(04) components of variation in time series. (02 marks)
- (b) The quarterly share prices of a company over the past four years are given below:

Year	Quarter		Share Price (Rs.)
2012	1	1	88
	2	2	69
	3	3	75
	4	4	105
2013	1	5	45
	2	6	75
	3	7	65
	4	8	98
2014	1	9	56
	2	10	91
	3	11	66
	4	12	99
2015	1	13	75
	2	14	96
	3	15	78
	4	16	110

**Compute** the following:

- (i) Moving total values.
- (ii) Centered moving total values.
- (iii) Quarterly Centered moving average.
- (iv) Trend values.

(12 marks)

(Total 14 marks)

### Question 07

**Green Fruits (Pvt) Ltd.** is a leading Fruit Juice Manufacturer and is in the business of selling bottled fruit juice through retail stores. The company is considering following two proposals for the development of the business:

**Proposal 1: Purchase of a new machine to expand the existing capacity of Fruit Juice Manufacturing**

The new machine will cost Rs.100 million and the expected life of the machine is 5 years.

The expected cash inflows from the investment is as follows:

Year	1	2	3	4	5
Cash inflows (Rs. million)	20	30	35	35	30

**Proposal 2: Purchase of a Label printing machine**

At the moment **Green Fruits (Pvt) Ltd.** purchases labels from an outside label supplier. The new machine will cost Rs.115 million and the expected life of the machine is 7 years. At the end of the 7<sup>th</sup> year the machine could be sold for Rs.20 million.

The expected cash inflows from the investment is as follows:

Year	1	2	3	4	5	6	7
Cash inflows (Rs. million)	10	15	20	25	25	25	20

The discounting rate of the company is 8%.

- (a) **Compute** the Net Present Value (NPV) of the two machines.
- (b) **State** with reasons whether the company should go ahead with the proposal 1 to expand the existing production capacity.
- (c) **State** with reasons whether the company should go ahead with the proposal 2.

(14 marks)

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End of Section C

## ACTION VERB CHECK LIST

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

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

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

$$S = a \frac{\{r^n - 1\}}{\{r - 1\}} \quad r \neq 1$$

### 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 $\sigma$ :

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):

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

### 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:

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