

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

ව්‍යාපාර සංඛ්‍යානය I
வணிகப் புள்ளிவிவரவியல் I
Business Statistics I

31 E I

පැය දෙකයි
இரண்டு மணித்தியாலம்
Two hours

Instructions:

- * Answer **all** questions.
- * Write your **Index Number** in the space provided in the answer sheet.
- * Statistical tables will be provided. Use of calculators is **not allowed**.
- * Carefully read and follow the instructions given on the back of the answer sheet.
- * In each of the questions 1 to 50, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct** or **most appropriate** and mark your response on the answer sheet with a cross (X) on the number of the correct option in accordance with the instructions given at the back of the answer sheet.

1. Which of the following statements is true about Statistics?

- (1) Accurate decisions can always be taken by considering the data only.
- (2) Statistics does not support to study the causal relationships.
- (3) Outcomes of statistical studies are not valid for ever.
- (4) Statistics does not facilitate to reduce the complexity of data.
- (5) Sufficient sample always directs to make accurate decisions.

2. Consider the following statements.

- A - Even though collecting primary data can be inconvenient, it has high relevance to the objective of the study.
- B - Adjustments are always needed to be done for using secondary data in any study.
- C - The existence of true zero gives similar interpretation for both types of interval and ratio-scale data.

The true statement/s from the above is/are,

- (1) only A.
- (2) only B.
- (3) only A and B.
- (4) only B and C.
- (5) all A, B and C.

3. Which of the following statements is true?

- (1) The efficiency of the personal interview method completely depends on the respondent's literacy level.
- (2) The response rate and the reliability of the responses under the self-enumeration method are high.
- (3) The telephone interview method can be used to collect data accurately at any situation in national or international level studies.
- (4) When the modern technological facilities are available, the electronic data collection method always provides a representative sample.
- (5) The focus-grouped discussion method provides greater reliable data with the higher response rate.

4. Consider the following statements about data organization and presentation methods.
- A - The original data can be retrieved from the grouped frequency distribution.
- B - When preparing a relative frequency distribution, it is assumed that there are two classes with zero frequencies at both ends.
- C - The selection of most appropriate diagram for data presentation depends on nature of the data and the objective of the study.

The true statement/s from the above is/are,

- (1) only A. (2) only B. (3) only C.
(4) only B and C. (5) all A, B and C.
5. When presenting foreign currency earnings of a country in 2024 for emphasizing the relative importance of top five categories, the most appropriate chart is,
- (1) Lorenze curve. (2) Histogram. (3) Profile chart.
(4) Pictogram. (5) Pie-chart.
6. Which of the following statements is true?
- (1) Class limit can never be equal to the class boundary.
(2) When large amount of discrete data spreads in a small range, the grouped frequency distribution is more appropriate.
(3) When large amount of data spreads in a wide range, ungrouped frequency distribution is more appropriate.
(4) Identity of data can be recognized even after constructing a stem-and-leaf diagram.
(5) Even though the relative frequencies can be presented as whole numbers, it cannot be presented as fractions.

7. Consider the following statements about the measures of central tendency.
- A - In practical applications of mean and mode, the mean is more appropriate for numerical financial data and the mode is more applicable for consumer preferences.
- B - The arithmetic mean is the most appropriate average for changes of growth rates, return rates and indices.
- C - Both median and mode can be directly determined using ogive.

The true statement/s from the above is/are,

- (1) only A. (2) only B. (3) only A and B.
(4) only A and C. (5) all A, B and C.
8. The following table presents the monthly electricity consumption (in kWh) of an urban household over 11 months in 2024.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
Electricity Consumption	310	290	300	315	320	305	300	325	310	315	295

Assuming the median remains unchanged, possible value for the electricity consumption of December in 2024 is,

- (1) 290 (2) 295 (3) 300 (4) 305 (5) 310
9. Which of the following statements is **false**?
- (1) When average production levels are the same, the coefficient of variation helps to identify process with the most consistent output.
- (2) Box-and-whiskers plot condense a data set into five summary measures such as minimum, Q_1 , mean, Q_3 and maximum.
- (3) Karl Person's coefficient of skewness (SK_1) provides a measure of the asymmetry of a distribution by using measures; mean, mode and variance.
- (4) When the coefficient of kurtosis is less than 0.263, the distribution follows the shape of Platykurtosis.
- (5) Bowley's coefficient of skewness can be used for interval and ratio scale data.

10. A company plans to introduce a new satelight service to a particular rural area. A pilot survey was conducted with 50 rural households to measure their internet download speed (in Mbps) before launching the service.

1	7	8	8	9															
2	0	1	2	3	3	4	4	5	5	6	6	6	7	8	8	9	9		
3	0	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9		
4	0	0	1	1	2	3	4	5											
5	0	2	4	5															

If the company wants to offer an advanced plan to 32% households with the fastest downloading speed, the minimum download speed limit (in Mbps) to be considered for the above plan is,

- (1) 16 (2) 26 (3) 32 (4) 34 (5) 37

11. The mean of a certain data set was 16 and $\sum_{i=1}^{10} x_i^2 = 2920$. If the second quartile of the distribution was 19, then the coefficient of skewness (SK_2) and coefficient of variation are,

- (1) -1.5 and 37.5 (2) -1.5 and 2.25 (3) -0.5 and 37.5
(4) -0.5 and 225 (5) 0.5 and 31.6

12. Which of the following statements is true about correlation and regression?

- (1) The product-moment correlation coefficient is free from impact of extreme values in the data.
(2) When there is a perfect linear relationship between X and Y , error sum-of-squares is equal to the total variation of the dependent variable.
(3) Although the linear relationship can be identified, the non linear relationship cannot be identified by a scatter plot.
(4) When the first judge gives ranks from 1 to 7 and the second judge gives the reverse order of the first judge's ranks, the spearman correlation coefficient is perfect negative.
(5) There is a relationship between coefficient of determination and sign of the regression coefficient.

13. Consider the following statements about the ordinary least squares method for estimating a simple regression line.

- A - The summation of the differences between observed and estimated values is greater than one.
B - If the regression coefficient closes to zero, then there is no relationship between X and Y .
C - The least square method minimizes the sum of squares of vertical distance between each of the observed and estimated values.

The true statement/s from the above is/are,

- (1) only A. (2) only B. (3) only C.
(4) only A and C. (5) all A, B and C.

14. Three judges; A , B and C rank four students in a competition. The ranks of judge A are 1, 2, 3 and 4 respectively. The differences between each pair of ranks given by judges A and B are ± 2 and the differences between each pair of ranks given by judges B and C are ± 1 . Then the value of rank correlation coefficient between A and C is,

- (1) $r_k = -1$ (2) $r_k = -0.6$ (3) $r_k = 0$ (4) $r_k = 0.6$ (5) $r_k = 1$

15. Consider the following statements about the approaches to probability.

- A - A weather forecast done by using a statistical model is an example for the subjective approach.
B - Under the relative frequency approach, the reliability of probability estimation is increased when increasing the number of trials.
C - According to the mathematical axiomatic approach, the probability of the sample space is between 0 and 1.

The **false** statement/s from the above is/are,

- (1) only A. (2) only B. (3) only A and B.
(4) only A and C. (5) all A, B and C.

16. In a certain competition, a contestant is required to answer three questions out of five. As a part of the competition rules, the first question is compulsory. According to the rules of the competition, the number of different ways for contestant can select the remaining questions to complete the competition is,
- (1) 4 (2) 6 (3) 10 (4) 12 (5) 60
17. A_1, A_2, A_3, A_4 and A_5 are five mutually exclusive and exhaustive events in the sample space S . If $P(A_2) = \frac{1}{3}$, $P(A_2 \cup A_3) = \frac{2}{3}$, $P(A_2 \cup A_4) = \frac{1}{2}$ and $P(A_5) = 2P(A_1)$, then the value of $P(A_5)$ is,
- (1) $\frac{1}{18}$ (2) $\frac{1}{12}$ (3) $\frac{1}{9}$ (4) $\frac{1}{6}$ (5) $\frac{1}{3}$
18. The probability of a plane crashes due to engine failure is 0.002 while due to pilot's error is 0.003. When these events are independent, the probability that a crash occurs is,
- (1) 6×10^{-6} (2) 4.994×10^{-3} (3) 5×10^{-3} (4) 5.006×10^{-3} (5) 6×10^{-3}
19. A production cost of a certain item is Rs. 800. There is a 0.2 probability to sell the item for its selling price Rs. 1500. However, there are 0.3 and 0.5 probabilities respectively to sell the item by giving Rs. 200 and Rs. 300 discounts to the selling price. Then the expected profit is,
- (1) Rs. 490.00 (2) Rs. 510.00 (3) Rs. 700.00 (4) Rs. 1290.00 (5) Rs. 1500.00
20. There is a 0.65 probability that a student in a randomly selected class solves given statistics questions. Using a Binomial Distribution with the given information, the statement that can be analysed is,
- (1) the average mark obtained by students more than three.
 (2) the time taken by each student to solve questions.
 (3) the median mark of the students in this sample.
 (4) the speed of students in solving questions.
 (5) the number of students who did not solve questions.
21. The number of social media messages received by a person follows a Poission distribution with mean two per 20 minutes. The probability that exactly three messages received given that at least one message has been received in an hour is,
- (1) $\frac{892}{10\,000}$ (2) $\frac{892}{9\,975}$ (3) $\frac{149}{892}$ (4) $\frac{1804}{10\,000}$ (5) $\frac{1804}{8\,647}$
22. A group of 1200 people in a certain area lost their homes due to war. It is estimated that 0.75 probability of receiving meal for them daily. If the probability that at least 650 person receive meal tomorrow can be approximately calculated, the correct probability statement is,
- (1) $P(X \geq 650) \approx \text{Poisson}(900)$ (2) $P(X \geq 650) \approx \text{Poisson}(225)$
 (3) $P(X \geq 650) \approx N(900, 225)$ (4) $P(X \geq 649.5) \approx N(900, 15)$
 (5) $P(X \geq 649.5) \approx N(900, 225)$
23. Consider the following statements about sampling.
- A - A census is preferred in every situation when cost and time are not constraints.
 B - A sample survey facilitates for deeper investigations than a census, even though enumerators are less experienced and not trained.
 C - While sampling error occurs in sample surveys, non-sampling errors can be occurred in both censuses and sample surveys.
- The true statement/s from the above is/are,
- (1) only A. (2) only B. (3) only C.
 (4) only B and C. (5) all A, B and C.

24. Which of the following statements is true about the random sampling?

- (1) When selecting farmers for a study on fertilizer use, the clusters with the most active and successful farmers provides a representative sample.
- (2) Systematic sampling always gives unbiased results, even though the sampling frame has a cyclical pattern.
- (3) It is required to have an equal number of households from each district under stratified random sampling to estimate National Poverty Head Count Index in Sri Lanka.
- (4) When intra-cluster correlation is low, the cluster sampling is more appropriate for selecting a sample.
- (5) Even though there is a higher non response rate, the standard error of a statistic is always low for a randomly selected sample.

25. In simple random sampling (size n) without replacement, if the population variance (σ^2) is known for a population with size N , the variance of the sampling distribution of the sample means is,

- (1) $\frac{\sigma^2}{n}$ (2) $\frac{\sigma^2}{n-1}$ (3) $\frac{\sigma^2}{n} \left(\frac{N-n}{N-1} \right)$ (4) $\frac{\sigma^2}{n} \left(\frac{N-1}{N-n} \right)$ (5) $\frac{\sigma^2}{n-1} \left(\frac{N-n}{N} \right)$

26. Which of the following statements is true about non-random sampling?

- (1) Convenient sampling can be used to identify consumer preferences in marketing surveys within a short period.
- (2) Even though the non-random sampling gives a biased sample, the results can be generalized for the population using a statistical analysis.
- (3) Quota sampling does not ensure that each subgroup of the population is represented in the sample.
- (4) In purposive sampling, since the investigator select sampling units to the survey by himself, the bias will be eliminated.
- (5) The sampling error can be calculated in Judgment sampling since it is based on the knowledge and experience of the field investigator.

27. Consider the following statements about the sampling distributions.

- A - The t-distribution closes to the normal distribution when the degrees of freedom increases.
 B - The central limit theorem can be applied in making inferences for large samples from known populations only.
 C - When the population variance is unknown, the sampling distribution of the sample means is assumed to be normal, regardless of the sample size.

The **false** statement/s from the above is/are,

- (1) only A. (2) only B. (3) only A and B.
 (4) only B and C. (5) all A, B and C.

28. Which of the following statements is true regarding point estimators?

- (1) $S^2 = \frac{\sum (x_i - \bar{X})^2}{n}$ is an unbiased estimator for the population variance.
- (2) When the bias of an estimator is approaching to zero the expected value of the point estimator closes to the population parameter.
- (3) When sample size n increases, the estimator $T = \sum_{i=1}^n \frac{x_i}{n-1}$ for population parameter μ satisfies consistency but not sufficiency.
- (4) Even though both P_1 and P_2 are estimators for π_1 and π_2 , $P_1 - P_2$ cannot be considered as an estimator for $\pi_1 - \pi_2$.
- (5) Sample Median (X_{median}) can be considered as unbiased estimator for the median of any population distribution.

29. A sample with size n is taken from a population with known variance σ^2 . The 98% confidence interval for the population mean μ is,

$$(1) \quad \bar{X} \pm Z_{0.01} \sqrt{\frac{\sigma^2}{n}} \quad (2) \quad \bar{X} \pm t_{0.01, n-1} \sqrt{\frac{\sigma^2}{n}} \quad (3) \quad \bar{X} \pm Z_{0.02} \frac{\sigma}{\sqrt{n}}$$

$$(4) \quad \bar{X} \pm t_{0.02, n-1} \sqrt{\frac{\sigma}{n}} \quad (5) \quad \bar{X} \pm t_{0.025, n-1} \frac{\sigma^2}{\sqrt{n}}$$

30. Consider the following statements.

- A - Confidence interval implies the range in which the sample statistic will fall at a given level of confidence.
 B - When the level of confidence decreases, the gap between confidence limits also decreases.
 C - If X_1 and X_2 are two independent variables with known population variances and

$$X_1 \sim N\left(\mu_1, \frac{\sigma_1^2}{n_1}\right) \text{ and } X_2 \sim N\left(\mu_2, \frac{\sigma_2^2}{n_2}\right), \text{ then } X_1 - X_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2 + \sigma_2^2}{n_1 + n_2 - 2}\right).$$

The true statement/s from the above is/are,

- (1) only A. (2) only B. (3) only A and B.
 (4) only B and C. (5) all A, B and C.

31. A random sample of 25 wild elephants hit by Northern trains obtained a mean age of 15 years 3 months and a variance of 2 years 3 months. Assuming that the ages of elephants have a normal distribution, the 95% confidence interval to estimate the population mean age of wild elephants hit by trains is approximately,

- (1) (14.30, 16.20) (2) (14.32, 16.18) (3) (14.37, 16.23)
 (4) (14.63, 15.87) (5) (14.74, 15.76)

32. It is estimated that $p\%$ of the vegetables and fruits transported by lorries from Dambulla to Peliyagoda are subject to damage during transportation. To study this, a random sample of 210 lorries were examined. The 90% confidence interval for the proportion of damaged vegetables and fruits was found to be (0.277, 0.383). Then, the p is,

- (1) 15% (2) 33% (3) 35% (4) 66% (5) 77%

33. The Department of Police reports that approximately 40% of fatal damages by road accidents could be prevented if passengers wear seat belts. If the margin of error of 95% confidence interval for π is $\sqrt{1.96 \times 10^{-3}}$, the size of the sample approximately is,

- (1) 21 (2) 47 (3) 240 (4) 471 (5) 1307

34. Consider the following statements about the hypotheses tests.

- A - Hypotheses tests determine whether observed differences are statistically significant at given level of significance.
 B - Increasing the sample size causes to decrease the power of a hypothesis test.
 C - Hypotheses Tests can be used only, when the sizes of samples are large.

The true statement/s from the above is/are,

- (1) only A. (2) only B. (3) only C.
 (4) only A and C. (5) all A, B and C.

35. For testing $H_0: \mu = \mu_0$ versus $H_1: \mu > \mu_0$, a random sample of size $n=36$ is selected. It is reported that $\bar{x}=3.46$ and $s=0.72$. If the p -value for the test is 0.1841, the value of μ_0 is approximately,

- (1) 3.26 (2) 3.35 (3) 3.43 (4) 3.57 (5) 3.66

36. Random samples of 200 bolts manufactured by each machine A and B, 15 and 7 bolts were respectively defective. If the standard error in sampling distribution of the difference of two sample proportions is 0.0228, the corresponding p -value for testing the hypothesis $H_1: \pi_A \neq \pi_B$ is approximately,

- (1) 0.0802 (2) 0.2299 (3) 0.4599 (4) 0.5401 (5) 0.9198

37. Which of the following statements is true about statistical tests?

- (1) The alternative hypothesis is always a simple hypothesis.
- (2) Chi-square test can be used to test the association between any type of two variables.
- (3) The critical value is the cutoff point that indicates whether to reject the null hypothesis based on the significance level.
- (4) When only the population variance is known the Z-test is used to test a hypothesis about the population mean.
- (5) One way ANOVA can be used for only testing a hypothesis about three population means.

38. Consider the following statements.

- A - The coefficient of contingency can be taken any value between -1 to +1.
- B - When testing the claim that the proportion of students who have a part-time job is at most 0.82, the alternative hypothesis would be $p > 0.82$.
- C - In a chi-square goodness of fit test, there is a high possibility to do not reject null hypothesis whenever each of the observed frequencies are approximately equal to their corresponding expected values.

The true statement/s from the above is/are,

- (1) only A.
- (2) only C.
- (3) only A and B.
- (4) only B and C.
- (5) all A, B and C.

39. A soft drink company tested effectiveness of three advertising strategies using ANOVA. Accordingly, the results were $SSE = 129.6$, $SST = 828.6$ and $MSE = 5.4$. If an equal number of outlets are used to apply each of these strategies, the total number of outlets (n) used in the study is,

- (1) 24
- (2) 26
- (3) 27
- (4) 30
- (5) 33

40. Consider the following statements about the time series analysis.

- A - The variation in crude oil prices due to the Gaza War is an example of irregular variation.
- B - The variation of hydroelectric power generation of a country is an example of cyclical movements.
- C - The long term trend is depicted by the reported number of dengue patients in the Colombo district during last 20 years.

The true statement/s from the above is/are,

- (1) only A.
- (2) only B.
- (3) only A and B.
- (4) only A and C.
- (5) all A, B and C.

41. Which of the following statements is true about the time series analysis?

- (1) The number of students eligible for university entrance by district in 2024 is an example for time series data.
- (2) The multiplicative model is more appropriate when components of a time series operate independently each other.
- (3) In a series of textiles sales during last 15 years, cyclical movements can be observed in every three-year period.
- (4) The order of the moving average method indicates the number of periods considered for smoothing long term movements.
- (5) Seasonal and irregular movements can be removed by taking moving averages of a time series with monthly data.

42. Consider the following statements about the estimation of seasonal indices and trend.

- A - When only the base period is changed, the trend line will be shifted parallelly.
- B - The average percentage method is more appropriate for estimating seasonal movements when a clear trend exists in the time series.
- C - Quarterly seasonal indices can be obtained by taking the average of yearly percentage values of the $\hat{S}_t$.

The true statement/s from the above is/are,

- (1) only A.
- (2) only A and B.
- (3) only A and C.
- (4) only B and C.
- (5) all A, B and C.

43. The not adjusted quarterly seasonal indices for the number of laptops sold by a certain company during 2020-2024 were given as 89, 102, 96 and 123 respectively. The company has forecasted that 1386 laptops will be sold in the fourth quarter in 2025. If there is no seasonal effect, the number of laptops that will be sold in the fourth quarter is,
 (1) 1 050 (2) 1 155 (3) 1 254 (4) 1 663 (5) 1 830
44. Consider the following statements about statistical quality control.
 A - A process operating within the control limits implies absence of random variations.
 B - A control chart showing a sequence of all points near the center line ensures that the process is statistically controlled.
 C - When sample size increases the Operating Characteristic (OC) curve becomes steeper.
 The true statement/s from the above is/are,
 (1) only A. (2) only B. (3) only C.
 (4) only B and C. (5) all A, B and C.
45. Which of the following statements is true about acceptance sampling plans?
 (1) Acceptable Quality Level (AQL) is the minimum defective percentage of items that can be considered acceptable in a lot.
 (2) Acceptance sampling plan helps in decision-making about large lots under cost and time constraints.
 (3) Increasing the acceptance number while keeping the sample size constant will decrease the probability of accepting a bad lot.
 (4) Sampling plans are designed to remove both producers' and consumers' risk simultaneously.
 (5) Acceptance sampling should be applied at every stage of production process to ensure process stability.
46. In an Aircraft assembly line, a quality inspector monitors the average weight of aircraft tyres to ensure their consistency. The grand mean weight ($\bar{X}$) is 8.40 kilograms (in thousand) and the average of weights ranges ($\bar{R}$) of samples is 0.92 kilograms (in thousand). If samples of size five aircraft tyres are monitored regularly, the mean which indicates the out-of-control is,
 (1) 7.88 (2) 8.00 (3) 8.40 (4) 8.93 (5) 9.10
47. Due to new tariffs imposed on exported goods, a garment supplier considered the proportion of defective items in each shipment to avoid the number of defective items. Previous data shows an average defect rate of 2% with each shipment containing 100 items. The value of the upper control limit to be accepted the shipment is,
 (1) 0.014 (2) 0.034 (3) 0.042 (4) 0.048 (5) 0.062
48. Which of the following statements is true about the index numbers?
 (1) The base year of the newly introduced National Consumer Price Index (NCPI) is 2021.
 (2) The Laspeyres' price index is always an up-to-date index in capturing price changes of busfare.
 (3) All price indices are constructed based on primary data collected from consumers.
 (4) The base year of an index should always be the first year of any data series.
 (5) As a key economic indicator, the Colombo Consumer Price Index (CCPI) is calculated by the Central Bank of Sri Lanka.
49. In 2025 the average price of a commodity decreased by 25% of its 2019 price but increased by 50% of its 2013 price. When considering 2013 as the base year, the price relative for the year 2025 is approximately,
 (1) 50 (2) 67 (3) 75 (4) 150 (5) 200
50. Consider the following statements about properties of index numbers.
 A - The Fisher Ideal Index is the Geometric mean of the Laspeyres' and Paasche's indices and satisfies both the time reversal and factor reversal tests.
 B - The Laspeyres' index can be calculated at a lower cost since it uses the base-period quantities.
 C - The Marshall-Edgeworth index satisfies the time reversal test but does not satisfy the factor reversal test.
 The true statement/s from the above is/are,
 (1) only A. (2) only B. (3) only A and C.
 (4) only B and C. (5) all A, B and C.

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரīட்சைத் திணைக்களம் இலங்கைப் பரīட்சைத் திணைக்களம் இலங்கைப் பரīட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

ව්‍යාපාර සංඛ්‍යානයි II
வணிகப் புள்ளிவிவரவியல் II
Business Statistics II

31 E II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීමේ කාලය - මිනිත්තු 10 යි
மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Instructions:

- * Answer **five** questions selecting at least **two** questions from each part.
- * Statistical tables and graph papers will be provided. Use of calculators is **not allowed**.

Part I

- State **four** practical situations in which statistics is useful in making accurate business decisions. (02 marks)
 - Describe the required data, and their sources to obtain statistical measures in **two** of the situations you stated in (i) above. (02 marks)
 - Explain the difference between a pre-test and a pilot survey. (02 marks)
 - Provide an example for each of the adjustments; accuracy, completeness, relevancy and consistency on editing data before conducting a statistical analysis. (04 marks)
 - Discuss **three** necessities of selecting the most appropriate technique for data presentation. (03 marks)
 - Monthly household electricity consumption (approximately in million kWh) of a certain district for the year 2023 and its moving annual totals are given in the following table.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Electricity Consumption	12.0	11.5	13.0	14.0	13.5	14.5	15.0	15.5	14.8	15.2	16.0	17.0
Moving Annual Total	160.8	161.1	162.3	163.8	164.5	165.8	166.8	167.8	168.8	169.8	170.8	172.0

- Construct the Z-chart and comment on the monthly household electricity consumption of this district. (06 marks)
 - State **two** uses of the information obtained from the chart for the relevant service providing authorities. (01 mark)
- Following table provides selected summary measures of travel time in minutes (**P**) and number of passengers (**Q**) of randomly selected 10 buses of a particular route.

	Mean	Median	Mode	Quartile Deviation	Standard Deviation	Minimum Value	Maximum Value
P	102.4	89.5	87	3.25	25.7	86	160
Q	49.3	48.5	47	2.75	5.7	42	60

State the most appropriate measure of central tendency and measure of dispersion to explain the distribution of each variable with reasons. (04 marks)

[see page two]

- (b) (i) Define the geometric mean and write down **two** practical uses of it. (02 marks)
- (ii) The Gross Domestic Product (GDP) growth rates of an Asian country for consecutive five years are shown in the following table.

Year	2020	2021	2022	2023	2024
GDP Growth Rate	2.24	8.45	2.95	5.25	5.00

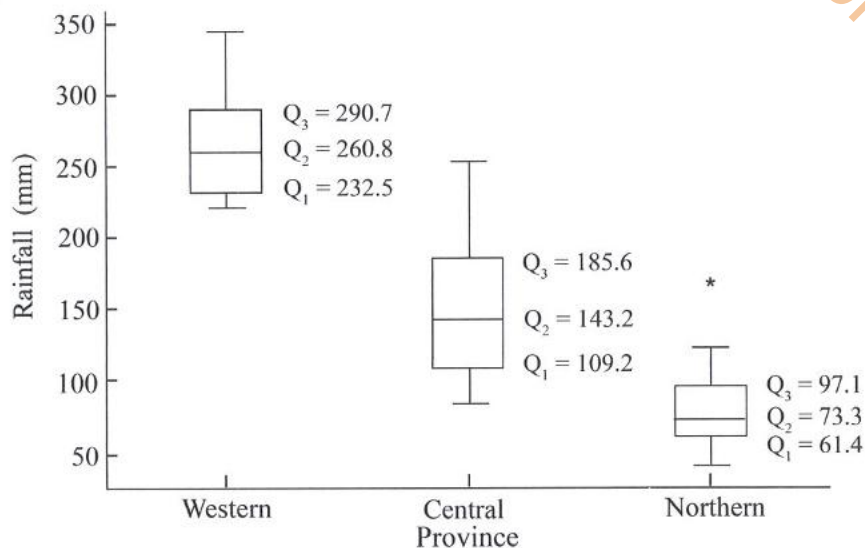
Calculate the appropriate average for GDP growth rate of this country, and comment on it. (02 marks)

- (c) Urban (u) and rural (r) daily water consumption (in litres) distributions of a household in Sri Lanka are shown in the table below.

Water Consumption	f_u (Urban)	f_r (Rural)
1 - 50	3	7
51 - 100	5	10
101 - 150	12	6
151 - 200	9	5
201 - 250	1	2
	30	30

$$\sum_{u=1}^5 f_u x_u = 3765, \sum_{r=1}^5 f_r x_r = 3015, \sum_{u=1}^5 f_u (x_u - \bar{x}_u)^2 = 75000, \sum_{r=1}^5 f_r (x_r - \bar{x}_r)^2 = 108750$$

- (i) Calculate the mean, median, mode, variance and Karl Pearson's coefficient of skewness for the urban and rural water consumption distributions. (07 marks)
- (ii) Comment on the shapes of the urban and rural water consumption (in litres) distributions. (02 marks)
- (d) Box-and-Whiskers plots related to monthly rainfall (approximately in mm) distributions of three provinces; Western, Central and Northern in Sri Lanka for a certain year are given as follows.



- (i) If percentile coefficient of kurtosis for Western and Northern are 0.187 and 0.174 respectively, calculate percentile coefficient of kurtosis for Central province (Consider $P_{10} = 117.1$ and $P_{90} = 251.7$). (01 mark)
- (ii) Comment on kurtosis coefficient of each distribution by comparing kurtosis coefficient of the normal distribution. (02 marks)

3. (a) The following table shows the unemployment rates in Sri Lanka from 2016 to 2024.

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024
Unemployment Rate	4.4	4.2	4.4	4.8	5.5	5.1	4.7	4.7	4.4

- (i) Draw a time series plot for the given data and comment on the variation of the unemployment rate during this time span. (02 marks)
- (ii) Estimate the trend value of unemployment rate for the year 2025 by using least square method. (03 marks)
- (b) The estimated least squares trend equation for the data on hotel room bookings in a certain area from 2020 to 2024 is $\hat{T} = 32800 + 1648t$ (Origin = 2022 and time unit = 1 year). The quarterly values of the product of seasonal and irregular components estimated ($\hat{S}$) under the ratio to moving average method based on the above data are given in the table below.

Year	Quarter			
	I	II	III	IV
2020	-	-	110.2	117.8
2021	89.0	78.0	111.8	121.2
2022	91.5	76.0	110.0	118.0
2023	90.5	82.0	108.0	123.0
2024	89.0	84.0	-	-
Total	360	320	440	480

- (i) Calculate seasonal indices for quarters II and IV, and comment on it. (02 marks)
- (ii) Forecast the number of hotel room bookings for quarter II of the year 2025, assuming a multiplicative model with no cyclical variation. (03 marks)
- (c) (i) What is the aim of constructing an index number? (01 mark)
- (ii) State **four** problems arisen in constructing an index number. (02 marks)
- (iii) Describe how can be overcome the **two** limitations of the simple aggregate quantity index. (02 marks)
- (d) (i) Define the typical period index and explain its relationship to the Marshall-Edgeworth index. (02 marks)
- (ii) A consumer buys four consumer goods **A**, **B**, **C** and **D**. Prices (Rs.) of these goods in 2018 and 2022 as well as averages of quantities (units) bought for the period from 2018 to 2022 are given in the table below.

Consumer Good	Average Quantity (2018 - 2022)	Price in 2018	Price in 2022
A	8	80	100
B	16	60	50
C	25	120	160
D	5	40	80

Compute the typical period price index for 2022 relative to 2018 and comment on it. (03 marks)

4. (a) Explain the difference between simple and multiple linear regressions. (02 marks)

- (b) A researcher wants to identify the impact of digital screen time usage on the mental well-being of youngsters. He randomly selected 10 youngsters and computed their mental well-being scores out of 100 (Y). He also recorded how many hours they spent on digital screens per week (X). The data are given in the table below.

Youngster	1	2	3	4	5	6	7	8	9	10
X	30	40	25	35	20	40	45	55	60	50
Y	67	65	70	64	65	55	64	50	55	45

$$\sum X = 400, \sum Y = 600, \sum XY = 23280, \sum X^2 = 17500, \sum Y^2 = 36606$$

- (i) Estimate the least squares regression line of mental well-being scores on weekly digital screen time and interpret the coefficients. (04 marks)
- (ii) Explain whether the weekly digital screen time alone is enough to describe the mental well-being scores. (02 marks)
- (iii) What is your suggestion to better explain the mental well-being scores in regression analysis? (01 mark)
- (iv) If a youngster spends 48 hours per week on digital screen time, what would be his expected mental well-being scores? (01 mark)
- (c) (i) Explain the difference between process control and product control. (01 mark)
- (ii) The railway customer service unit recorded the number of complaints regarding late arrivals of trains over 10 consecutive weeks as follows.

Week	1	2	3	4	5	6	7	8	9	10
Number of Complaints	60	72	62	86	82	75	83	94	94	102

Construct the C -chart for the number of complaints and give your comments. (03 marks)

- (d) (i) State **two** uses of Operating Characteristic (OC) curve in statistical quality control. (02 marks)
- (ii) A company intends to design an acceptance sampling plan for the procurement of raw materials. The producer's risk for the plan should be less than 10% at an Acceptance Quality Level (AQL) of 1%, while the consumer's risk should be less than 15% at a Rejectable Quality Level (RQL) of 5%. Two sampling plans have been proposed for the above procurement as follows.

Plan A: $n=50$ and $c=1$

Plan B: $n=100$ and $c=2$

Determine the appropriate plan that meets this company's requirements. (04 marks)

Part II

5. (a) Write down **two** conditions of the relative frequency approaches to probability. (02 marks)
- (b) A survey has been done whether the group of employees have technical training and whether they have promoted. The probability table which made based on the results of the survey is given below.

Events	Promoted (B)	Not Promoted (B')
With Technical Training (A)	0.25	0.15
Without Technical Training (A')	0.05	p

- (i) Find the value of ' p '. (01 mark)
- (ii) What is the probability that an employee has technical training, given that he was promoted? (02 marks)
- (iii) Are the technical training (A) and promotion (B) independent? Verify your answer. (02 marks)
- (iv) What is the probability that an employee has technical training or a promotion? (02 marks)
- (c) According to Nadeesha's experience, if her Scooty bike starts, she has an 80% chance of getting to work on-time. However, if her bike doesn't start, the chance of getting to work on-time is 55%. If Nadeesha's bike has 70% of chance to start, what is the probability that,
- (i) her bike starts and she gets to work on-time. (02 marks)
- (ii) she gets to work late. (03 marks)
- (iii) her bike starts, given that she has got to work on-time. (03 marks)
- (d) A and B are two collectively exhaustive and mutually exclusive events in the sample space S . If it is given that, $P(A) = 12p^2 + p - 1$ and $P(B) = 1 - 2p$, find the value of p and hence, calculate the probability of A . (03 marks)

6. (a) The probability distribution for customer service time at a bakery is given below.

Customer Service Time (in minutes)	1	2	3	4	5
Probability	0.2	0.25	0.25	0.2	0.1

- (i) What is the probability that the service time for a certain customer is more than three minutes? (01 mark)
- (ii) Find the probability that the service time not more than four minutes, given that it is more than one minute. (02 marks)
- (iii) What is the expected value of this service time distribution? (02 marks)
- (iv) If 50 customers were served at the bakery in a particular evening, how many of these customers would you expect to take more than three minutes to be served? (02 marks)
- (b) In an election, the probability that a randomly chosen voter supports candidate A is 0.6. If a random sample of 10 voters is selected,
- (i) find the probability that more than 50% of voters support to candidate A . (02 marks)
- (ii) To run the election campaign, candidate B decided to make the telephone calls for voter. The probability that a telephone busy is 0.2. If 15 calls are made separately, what is the probability that at least two telephone calls are busy? (02 marks)

- (c) (i) State **two** characteristics of a random variable which follows the Poisson distribution. (02 marks)
- (ii) If power failures occur at an average rate of three times per week in a town, define the relevant random variable which follows the Poisson distribution. (01 mark)
- (iii) Based on above information, find the probability that there will be at most five power failures in two weeks. (02 marks)
- (d) (i) Write down the relationship between normal and standard normal distributions and state why this relationship is useful in statistics. (02 marks)
- (ii) Metal spoons are made with a mean weight of 85 grams and a standard deviation of five grams. Metal spoons are sold at different prices accordingly to their weights as shown in the table below.

Weight (Grams)	≤ 70	70 - 82	82 - 92	> 92
Price (Rs.)	140	160	180	200

Assuming weights of metal spoons are distributed normally, find the probability that the price of a spoon selected randomly is Rs. 200.00. (02 marks)

7. (a) For each of the following situations, state the most appropriate random sampling method to select a representative sample and write down **two** advantages of each selected sampling method.
- (i) The Department of Health needs to estimate the number of households that are prevalent of dengue fever in Colombo Municipal Council area.
- (ii) A mobile data service provider wishes to investigate consumers' time preference for internet usage by selecting subscribers from its customer database.
- (iii) A certain government department plans to analyze the sources of income distribution by selecting households from income groups; low, middle, and high. (06 marks)
- (b) (i) Describe the procedure for selecting a linear systematic sample and state its **two** disadvantages. (02 marks)
- (ii) Explain solutions for the above disadvantages of linear systematic sampling. (02 marks)
- (c) Assume X_1, X_2, X_3 and X_4 be a random sample from a population with mean θ and variance θ^2 . Consider $T_1 = \frac{X_1 + X_2 + X_3 + X_4}{4}$ and $T_2 = \frac{X_1 + X_2 + X_3 + 2X_4}{5}$ as two estimators of θ .
- (i) Determine whether the above estimators are unbiased for θ . (02 marks)
- (ii) Calculate variance of each estimator. (02 marks)
- (iii) Determine which estimator is the most efficient and calculate its relative efficiency. (02 marks)
- (d) A tea processing factory in Nuwara Eliya wants to monitor the caffeine content (in milligrams) of its packaged tea bags. A random sample of 60 tea bags was tested and the mean and the standard error of caffeine content were 45 milligrams and three milligrams respectively.
- (i) Construct a 95% confidence interval for the mean caffeine content for all tea bags produced by the factory by stating relevant assumptions. (03 marks)
- (ii) Interpret this confidence interval. (01 mark)

8. (a) (i) What is meant by 'statistical hypotheses tests' and state **two** examples for its usages? (02 marks)
- (ii) Describe the difference between chi-square test for goodness of fit and chi-square test for independency. (02 marks)
- (b) The management of the railway department of a certain country has implemented a new plan to improve its on-time train operations (Arrivals and Departures) with the purpose of increasing number of commuters. Prior to the new plan operation, the data exhibited that 64% of the train operations were on-time. If a random sample of 144 train operations under the new plan reveals that 108 were on-time,
- (i) test whether the train on-time operations has increased at 5% level of significance. (04 marks)
- (ii) state the required assumptions to apply the statistical test in above part (i). (01 mark)
- (c) The administrative department of a particular super market network is planning to expand the number of automated cashier counters of the network. A sample survey was conducted to study about the time spent on payments by the customers at the cashier counter (*A*) and at the automated cashier counter (*B*). The summarized results are as follows:

Cashier counter	<i>n</i>	$\bar{x}$ (in minutes)	<i>s</i> (in minutes)
<i>A</i>	100	4.1	2.0
<i>B</i>	100	3.4	1.5

Test whether the mean time spent on payments are different at 2% significant level and comment on it. (04 marks)

- (d) A large scale company concerns about employees absenteeism, which affects its operating cost. To investigate patterns in absenteeism, the human resources department of the company has recorded employees' absenteeism data on weekdays over several months and are given as follows:

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Number of absentees	30	62	71	67	70

- (i) Formulate the appropriate hypotheses to test whether employees' absenteeism are uniformly distributed. (02 marks)
- (ii) Calculate the appropriate test statistic for the above hypothesis testing. (04 marks)
- (iii) Draw your conclusion at 5% level of significance. (01 mark)

Department Of Examinations , Sri Lanka