සියලු ම හිමිකම් ඇවිරිණි /முழுப் பதிப்புரிமையுடையது/All Rights Reserved]

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2026
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2026
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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 at 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*** (×) *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 decipline?

(1) Statistical conclusions have become universally true, due to the development of statistical software.

(2) In statistics, the results are interpreted according to the objectives of the data collecting institution.

(3) Working with individual observations is one of the major steps in a statistical study.

(4) Variation of phenomena provides the basis for the existence of Statistics as a decipline.

(5) Describing the sample based on its summary measures can be considered as statistical inference.

2. Consider the following statements.

A – Variables formed by assigning numerical values to attributes can be considered quantitative data.

B – Measurements of human body temperature can be considered as qualitative data.

C – Social status of people is an example for nominal scale data, whereas their gender is an example of ordinal scale data.

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.

3. Which of the following statements is true?

(1) A good questionnaire should be objective-oriented and should not include complicated, biased, and double-meaning questions.

(2) The reliability of responses in the computer-assisted self-enumeration method is always be higher.

(3) Although deep discussions are made among group members, the response rate is low at the focus-group discussion method.

(4) Sarcastic and humorous responses are not included under the self-enumeration method.

(5) In the direct observation method, electronic equipment or appliances cannot be used.

4. Consider the following statements about data organization and presentation methods.

A – Grouping error can be minimized by increasing the width of classes.

B – The slopes of the 'less-than' and 'or more' cumulative frequency curves are respectively positive and negative.

C – The difference between lower limits and mid values of two consecutive classes are same for a frequency distribution with equal size classes.

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.

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5. When the percentage distributions of a population by ethnic groups from 2021 to 2025 have presented in five pie charts, the most appropriate single chart to present all these data is,
(1) simple bar chart. (2) multiple bar chart. (3) Z-chart.
(4) profile chart. (5) pictogram.

6. The group frequency distribution related to glucose level of Meningitis patients reported recently in a particular zonal education division of Southern province is given below.

Class interval	50 – 59	60 – 69	70 – 79	80 – 89	90 – 99	100 – 109
Frequency	4	c	a	c	5	2
Cumulative frequency	.....	a	b	23	28	.....

The values of 'a' and 'b' are respectively,
(1) 5, 9 (2) 9, 15 (3) 9, 18 (4) 15, 18 (5) 18, 15

7. Consider the following statements about the measures of central tendency.
A – Even though the group frequency distribution is unimodal, the mode cannot be calculated when the size of classes are unequal.
B – For a group of positive distinct observations, the geometric mean lies between the harmonic mean and the arithmetic mean.
C – For any frequency distribution without unusual observations, both mean and mode are identical and representative measures.
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 HR department of a certain company has studied the monthly overtime hours of 20 employees. The calculated mean and variance of overtime hours were respectively 36 and 90.4. The department later discovered that two observed values were incorrect. Two observations 22 hours and 46 hours which should have respectively been 26 hours and 42 hours. After correcting these errors, the mean and variance of overtime hours respectively are,
(1) 36.00, 82.40. (2) 36.00, 90.40. (3) 36.00, 91.25.
(4) 36.40, 82.40. (5) 39.40, 82.40.

9. Which of the following statements is **false**?
(1) Area covered by the histogram of a frequency distribution is equal to the area covered by its frequency polygon.
(2) For any frequency distribution, average of the Q_1 and Q_3 is equal to the median.
(3) The box-and-whisker plot can be used to visually identify the extreme values of a data distribution.
(4) For a moderately skewed distribution, calculated values of S_{k1} and S_{k2} are approximately equal.
(5) When the data are highly concentrated near the mean with extreme values, kurtosis of the distribution is leptokurtic.

10. The number of cyber-crimes reported in particular economic zone within 52 weeks are depicted in following stem-and-leaf plot.

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

The percentile skewness coefficient of the distribution is approximately,
(1) −0.132. (2) 0.072. (3) 0.132. (4) 0.143. (5) 0.168.

11. The 10^{th} and 90^{th} percentiles of intelligence quotient (IQ) marks obtained by candidates for a particular competitive examination were respectively 80.8 and 119.2. If the IQ marks is normally distributed, the quartile deviation of the distribution is,
(1) 10.099. (2) 20.198. (3) 23.600. (4) 38.400. (5) 52.600.

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

(1) Even though the correlation measures the linear relationship between two variables, it does not show the direction of the relationship.

(2) Both interpolative and extrapolative predictions can accurately be done by correlation and regression analysis.

(3) Even though stochastics relationship can be modelled by the regression analysis, causal relationship cannot be modelled by it.

(4) A change of measurement unit of independent variable affects both correlation and regression coefficients.

(5) When the correlation coefficient between two variables closes to zero the regression coefficient also closes to zero.

13. Consider the following statements about regression analysis.

A – Magnitude of outlier values affects the regression coefficient.

B – The regression line is shifted to below the line when subtract a constant from the dependent variable.

C – The free-hand method minimizes errors subjectively while ordinary least squares method minimizes errors subjectively as well as mathematically.

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.

14. Which of the following statements is true about spearman's rank correlation coefficient?

(1) Outliers values directly affect to the spearman's rank correlation coefficient.

(2) Rank correlation coefficient is affected by the measurement unit of variables.

(3) Rank correlation coefficient never be negative.

(4) When ranks of two judges are same for all the time, the rank correlation coefficient is zero.

(5) The rank correlation coefficient is approximately zero means that there is a neutral agreement between two judges.

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

A – Mathematical axiomatic approach can be applied for any situation in probability.

B – Probabilities defined correctly using different approaches for certain event in a sample space are consistent with each other.

C – The relative frequency approach cannot be applied to biased coins or weighted dice.

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.

16. If A and B are any two events of a sample space S such that $P(A|B)=P(A|B')$, the true statement is,

(1) $P(B)=P(B')$ (2) $P(A\cap B)=P(A\cap B')$

(3) $P(A)=P(B)$ (4) $P(A\cap B)=P(A)\times[1-P(B')]$

(5) $P(A'\cap B)\times P(B')=P(A\cap B')\times P(B)$

17. Let A and B are two mutually exclusive events, and C is an event independent of both A and B. If $P(A)=\frac{1}{5}$, $P(B)=\frac{2}{5}$ and $P(C)=\frac{1}{2}$, values of $P(A'\cap B'\cap C)$ and $P(A'\cap B')$ respectively are,

(1) $\frac{1}{5}$ and $\frac{2}{5}$ (2) $\frac{1}{5}$ and $\frac{3}{5}$ (3) $\frac{2}{5}$ and $\frac{1}{5}$ (4) $\frac{2}{5}$ and $\frac{3}{5}$ (5) $\frac{3}{5}$ and $\frac{2}{5}$

18. Let D and E are any two events of a sample space S such that $P(D')=p$, $P(E)=\frac{p}{2}+0.1$, $P(D\cap E)=0.1$ and $P(D\cup E)=0.6$. The value of $P(E|D')$ is,

(1) 0.2 (2) 0.4 (3) 0.5 (4) 0.6 (5) 0.8

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19. If X is an any random variable and a and b are two constant terms then, the true statement is,

(1) $E[aX-b]=aE[X]+b$

(2) $[E(X)]^2 \leq E[X^2]$

(3) If $E[X]=0$ then $Var[X]=0$ for all X

(4) If $Var[X]=0$ then $E[X]=0$ for all X

(5) $Var[-X]<0$

20. If the random variable X is Binomially distributed with mean six (6) and variance 3.6, $P(2 \leq X < 5)$ is,

(1) 0.2121 (2) 0.2169 (3) 0.3762

(4) 0.3980 (5) 0.5769

21. Arriving patients to an emerging unit with an average rate of eight per hour, follows a Poisson distribution. The probability that more than two patients arriving during $\frac{1}{2}$ an hour is,

(1) $1-41e^{-8}$ (2) $1-13e^{-4}$ (3) $13e^{-4}$ (4) $\frac{e^{-4}4^2}{2!}$ (5) $\frac{e^{-8}8^2}{2!}$

22. Students' daily travel time to a particular school is Normally distributed with a standard deviation of eight minutes. If 70% of the students travel less than 35 minutes, the minimum travel time of 5% of the students who takes the highest daily travel time (in minutes) is approximately,

(1) 8 (2) 10 (3) 31 (4) 40 (5) 44

23. Consider the following statements about sampling.

A – The target population is the scope of the survey while the sampling population is the population which is covered by the survey.

B – Examining a handful of grains from a container, tasting of different brands of tea, tasting a spoonful of soup from a soup pot are examples for censes in day to day life.

C – Reliable conclusions can be made when the sample which consists of properties; representativeness, adequacy, homogeneity, independency, optimization.

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.

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

(1) In all the random sampling methods, each unit of the population has an equal chance of being selected.

(2) Simple and stratified are fully random sampling methods whereas systematic is a quasi-random sampling method.

(3) Irrespective of selecting the sample randomly or non-randomly, the reliable statistical inferences can be made.

(4) Non sampling errors can be occurred only in samples which are selected based on non random sampling methods.

(5) Choosing an appropriate random sampling method completely depends on objectives of the study.

25. In simple random sampling without replacement, if the population proportion (P) is known, the standard error of the sampling distribution of the sample proportion is,

(1) $\sqrt{\frac{P(1-P)}{n-1}\left(\frac{N-n}{N}\right)}$ (2) $\sqrt{\frac{P(1-P)}{n}\left(\frac{N-n}{N}\right)}$

(3) $\sqrt{\frac{P(1-P)}{n}}$ (4) $\sqrt{\frac{P(1-P)}{n-1}\left(\frac{N-n}{N-1}\right)}$

(5) $\sqrt{\frac{P(1-P)}{n}\left(\frac{N-n}{N-1}\right)}$

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

(1) Purposive sampling produces unbiased results, since the selection of sampling units depends on subjective judgment.

(2) Although quota sampling ensures subgroup representation, the selections bias can be occurred due to non-random selections within quotas.

(3) Since decisions are made on the knowledge and experience of the investigator, results from judgment sampling can be generalizable to the entire population.

(4) Non-random sampling methods also provide the same level of precision as random sampling methods.

(5) The purposive sampling method is often used in studies involving sensitive or hard-to-reach groups, such as drug users or migrant populations.

27. Consider the following statements about the sampling distributions.

A – Although the variance of the *t*-distribution is greater than the normal distribution, the *t*-distribution is platykurtic.

B – When the sample size adequately increases, the sampling distribution of the sample means tends to follow a t-distribution.

C – When a random sample $X_1, X_2, ..., X_n$ is taken from a normal population with mean μ and variance σ^2, the sampling distribution of $\frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$ is also normal with mean μ and variance 1.

The **false** 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.

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

(1) Sample proportion (p) is a consistent estimator for the population proportion (π) but not sufficient estimator.

(2) If an estimator is unbiased for the population parameter, its variance also should necessarily be minimum.

(3) Among the unbiased estimators, the estimator with maximum variance is the most efficient estimator for the population parameter.

(4) If two samples with size n_1 and n_2 are taken independently from two populations such that $X_1 \sim N(\mu_1, \sigma_1^2)$ and $X_2 \sim N(\mu_2, \sigma_2^2)$, then $\bar{X}_1 - \bar{X}_2 - N(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} - \frac{\sigma_2^2}{n_2})$.

(5) The pooled variance estimator $\left(S_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}\right)$ is always less than the maximum variance value of two samples considered.

29. Two independent samples with size n_1 and n_2 ($n_1 + n_2 < 30$) are taken randomly from two normal populations with unknown variances (variances are assumed to be equal). The 99% confidence interval for the differences of two population means ($\mu_1 - \mu_2$) is,

(1) $\bar{X}_1 - \bar{X}_2 \pm t_{0.005, n_1+n_2-2} \times S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

(2) $\bar{X}_1 - \bar{X}_2 \pm t_{0.05, n_1+n_2-2} \times \sqrt{S_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$

(3) $\bar{X}_1 - \bar{X}_2 \pm t_{0.05, n_1+n_2-2} \times S_p \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

(4) $\bar{X}_1 - \bar{X}_2 \pm t_{0.005, n_1+n_2-2} \times \sqrt{S_p\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$

(5) $\bar{X}_1 - \bar{X}_2 \pm t_{0.005, n_1+n_2-2} \times S_p \sqrt{\frac{s_1^2 + s_2^2}{n_1+n_2-2}}$

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30. Consider the following statements about confidence intervals.

A – A 90% confidence interval means that approximately 90 out of 900 repeatedly constructed intervals contain the true population parameter.

B – The confidence coefficient ranges between -1 and 1, whereas the confidence level is expressed as a percentage value.

C – When the sample is taken from a large population, the width of the confidence interval for the parameter μ is increased.

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.

31. Cyclone Ditwah caused for severe flooding in Western province and random sample of 36 households was taken to estimate the mean duration (in hours) of electricity interruption. The sample mean was 18 hours 30 minutes and the sample standard deviation was 2 hours. The 98% confidence interval for the true mean duration of electricity interruption approximately is,

(1) (16.95, 20.05) (2) (17.52, 19.08) (3) (17.72, 19.28) (4) (17.81, 19.19) (5) (18.37, 18.63)

32. A survey conducted in a particular district has used a random sample of 225 women to estimate the mean age at the first marriage. The sample mean is 27 years and 3 months and population standard deviation is 4 years and 6 months. At a 95% confidence level, the probable error approximately is,

(1) 0.039 (2) 0.492 (3) 0.588 (4) 0.601 (5) 2.646

33. A health survey aims to estimate the mean daily sugar consumption per person. A preliminary study indicates that $\sigma=12$ grams. At a 90% confidence level and a margin of error of 0.8 grams, the sample size is approximately 271. Keeping other factors fixed, this sample size can be decreased by,

(1) only increasing the confidence level. (2) only increasing the confidence coefficient.
(3) only decreasing the margin of error. (4) only increasing the margin of error.
(5) only decreasing the level of significance.

34. Consider the following statements about the hypotheses tests.

A – Sample evidences are used in statistical testings to test a claim about a population parameter.

B – When decisions are made based on total population data, statistical hypotheses tests are unnecessary.

C – It ensure that a decision made about a population parameter will always be correct by statistical hypotheses tests.

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.

35. A researcher wants to determine whether the proportion of customers who prefer online purchasing is different from the population proportion π_0. It is given that $\hat{p}=0.42$, $SE(\hat{p})=0.05$ and the p-value of the test is 0.1096. The value of π_0 approximately is,

(1) 0.30 (2) 0.34 (3) 0.36 (4) 0.41 (5) 0.50

36. Two independent random samples with equal sizes employees were selected from two companies ***A*** and ***B*** and compare the average number of overtime hours per week. Statistics of the corresponding data are given as $\bar{x}_A=8, \bar{x}_B=6$ and $s_p^2=4$. If populations are normally distributed with equal variances and value of the test statistic is 2, the degrees of freedom of the corresponding distribution is,

(1) 2 (2) 7 (3) 14 (4) 15 (5) 16

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

(1) The decision of a hypotheses test is made by comparing the calculated test statistic with its p-value.

(2) If the sample information does not provide sufficient evidence to reject the null hypothesis, it confirms that the null hypothesis is true.

(3) In increasing the level of significance, possibilities of rejecting the null hypothesis tends to be low.

(4) It is more likely to do not reject the null hypothesis when the p-value of a test approaches to zero.

(5) When the sample size is large, the level of significance of a hypotheses test tends to be large.

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38. A company examined whether consumers' preferences is statistically depended with their gender for soft drink brands using the chi-square test for independency. The total number of consumers surveyed was 84, and the test statistic (χ^2) was 24. The value of the contingency coefficient between two variables approximately is,

(1) 0.22 (2) 0.28 (3) 0.40 (4) 0.47 (5) 0.63

39. Consider the following statements about ANOVA.

A – When the variation between groups is large compared to the variation within the group, the rejecting possibility of null hypothesis is high.

B – In ANOVA, rejecting the null hypothesis implies that all the population means are different from each other.

C – ANOVA can be applied without concerning about the distributions of the dependent variable in each population.

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.

40. Consider the following statements about time series analysis.

A – Increasing the daily electricity demand increases during evening hours represents the daily seasonal variations.

B – Increasing the sales in a super market due to the special promotion strategy represents the seasonal variations

C – Irregular variations are represented in the fluctuations in all share price index due to unexpected global crises.

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

(1) only A. (2) only C. (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 time series analysis?

(1) In an additive time series model, the components are mutually exclusive but not collectively exhaustive.
(2) Both seasonal and cyclical variations can be estimated by using data that measured by annually.
(3) The additive model is appropriate when seasonal fluctuations increase proportionately with the trend of the time series.
(4) Observed present value of the time series variable correlates with only immediate four past values.
(5) The additive model is appropriate when components do not interact with each other.

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

A – By representing actual values as a percentage of corresponding moving averages, indicates that trend and cyclical variations are removed.

B – Even though a de-seasonalized time series consists of cyclical variations and irregular variations, it does not include the long-term trend.

C – In the ratio-to-trend method, estimated trend values are divided by actual values to compute seasonal indices.

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.

43. The annual sales trend equation for a particular product is given as $\hat{T} = 2040 + 32t$ (t = one year) with origin at 1st July 2023. The equation that gives quarterly trend values considering the mid-date of the second quarter of 2025 as the origin is,

(1) $\hat{T} = \frac{2040}{4} + \frac{32}{16}t$ (2) $\hat{T} = \frac{2040}{16} + \frac{32}{16}(t+7.5)$

(3) $\hat{T} = \frac{2040}{4} + \frac{32}{16}(t+7)$ (4) $\hat{T} = \frac{2040}{4} + \frac{32}{4}(t+7.5)$

(5) $\hat{T} = \frac{2040}{4} + \frac{32}{16}(t+7.5)$

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44. Consider the following statements about statistical quality control.

A – When goods and services meet predetermined standards and specifications, it ensures that the product or service is in the required quality level.

B – Random causes, such as changes in temperature, humidity, or wind speed, affects the process variation but not to the quality of a product.

C – Quality variations are occurred only by human errors. However, quality is maintained by a quality controller.

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.

45. Which of the following statements is true about statistical quality control?

(1) The decision regarding the quality of a product completely depends on the R-chart.
(2) When only the acceptance number is increased, the OC-curve shifts to the left.
(3) Negative values can be observed for control limits in both the $\bar{X}$-chart and the R-chart.
(4) The distance from central line to upper control limit and to lower control limit are always equal in a $\bar{X}$-chart.
(5) In acceptance sampling, the Binomial distribution can be approximated by the Poisson distribution when both the n and p are large.

46. A quality controller uses an np-chart to monitor the number of defective items produced in each sample. He inspects n items every day. Based on data collected over one month, the process average fraction defective is estimated as $\bar{p} = 0.10$. If the 3-sigma upper control limit (UCL) and lower control limit (LCL) of the chart are 16.2 and 0 respectively, the sample size (n) used for each sample is,

(1) 9 (2) 54 (3) 81 (4) 162 (5) 270

47. A manufacturing plant receives a large shipment of airbags from a supplier. The quality control department uses an acceptance sampling plan with a sample size of $n = 80$ and the acceptance number of $c = 2$. The acceptance quality level (AQL) and lot tolerance percent defectives (LTPD) of the sampling plan are respectively 0.01 and 0.05. The consumer risk and producer risk in the sampling plan respectively are,

(1) 0.092, 0.191 (2) 0.238, 0.047 (3) 0.238, 0.953 (4) 0.762, 0.047 (5) 0.762, 0.953

48. Which of the following statements is true about the index numbers?

(1) Price indices measure changes in the monetary value of all goods or services over the time.
(2) An index number usually compares the changes in prices or quantities of future period with a selected base period.
(3) Index numbers always give accurate and precise measurements of economic changes.
(4) When calculating the price indices the quantities of selected items are not considered.
(5) The accuracy of index numbers depends on the selection of items, weights and base period.

49. Considering 2015 as the base year, the price indices of selected basket of goods from 2021 to 2025 are given in the table below.

Year	2021	2022	2023	2024	2025
Price Index	116	108	120	150	132

Taking the base year as 2023, the calculated approximate new price indices for 2021 and 2025 are respectively,

(1) 75.76, 86.21 (2) 90.91, 103.45 (3) 96.67, 110.00
(4) 110.00, 103.45 (5) 116.00, 132.00

50. Consider the following statements about properties of index numbers.

A – The Marshall–Edgeworth index is a compromise between Laspeyres and Paasche indices in terms of weightings.

B – Laspeyres's price index reflects current consumption patterns, whereas Paasche's price index is based on base-period consumption patterns.

C – The use of weights from a typical period with abnormal events is important in the construction of Fisher's ideal index.

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.

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

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2026
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2026
General Certificate of Education (Adv. Level) Examination, 2026

ව්‍යාපාර සංඛ්‍යානය வணிகப் புள்ளிவிவரவியல் **Business Statistics**	II II II	31 E II

පැය තුනයි மூன்று மணித்தியாலம் ***Three hours***	අමතර කියවීම් 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

1. (a) (i) Mention **four** situations that the misuse of Statistics may lead to inaccurate decisions and adversely affect the success of a business. (02 *marks*)

(ii) State **one demerit** of each primary data collection method; direct observation, self-enumeration, personal interview and suggest solutions to overcome those demerits. (03 *marks*)

(b) (i) State **a merit** and **a demerit** for each of dichotomous, multiple choice and free answerable questions of a questionnaire. (03 *marks*)

(ii) A team appointed to provide recommendations for preventing the spread of dengue in high-risk areas has identified several key factors that require immediate control. Select and mention the appropriate choice related to each factor as in the table below.

Factor	Nominal/Ordinal/Interval/Ratio	Qualitative/Quantitative
Population density		
Living condition		
Temperature of the area		
Waste management method		

(02 *marks*)

(c) Discuss **four** properties of a table which can be used to present data meaningfully. (02 *marks*)

(d) The distributions of land area by population distribution of a particular municipal council area of the Western province in 2015 and 2025 are given in the following table.

Population (%)	10	10	10	10	10	10	10	10	10	10
Land area in 2015 (km²)	6.0	7.5	9.0	10.5	12.0	13.5	16.5	18.0	21.0	36.0
Land area in 2025 (km²)	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	18.0	54.0

(i) Construct Lorenz curves for land area distributions in year 2015 and 2025 on a same chart. (06 *marks*)

(ii) Comment on the land area distributions in year 2015 and 2025 by highlighting the key features. (02 *marks*)

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2. (a) The recorded daily vessel counts of maritime traffic through a strategic strait for the seven days before and seven days after the commencement of hostilities between two conflicting parties are given in the following table.

Day	1	2	3	4	5	6	7
Before	2 300	2 400	2 500	2 500	2 250	2 800	2 750
After	100	200	300	0	0	8 500	8 400

A student claims that there is no difference in average maritime traffic through the strategic strait before and after the commencement of hostilities based on the calculated means about maritime traffic.

(i) Explain whether you agree or disagree with the student's claim by giving a reason. (02 *marks*)

(ii) Mention the most appropriate measure of variation that can be applied to describe the variability of the above two distributions separately with reasons. (02 *marks*)

(b) (i) Define the harmonic mean and state **two** of its uses. (02 *marks*)

(ii) A land seller is planning to sell a newly developed land. This land is separated to four plots as ***A***, ***B***, ***C*** and ***D*** based on the accessibility of infrastructure facilities. Price per perch of each plot is shown in the following table.

Plot	*A*	*B*	*C*	*D*
Size of a plot (in perches)	6	10	12	12
Price per perch (in Rs. million)	3.0	2.5	2.0	1.5

Calculate average price per perch of this land by using the most appropriate measure and comment on it. (02 *marks*)

(c) The given cut-off marks of two subject streams ***A*** and ***B*** for 12 universities from a particular district are given in the table below.

Subject stream *A* (x_A)	2.35	2.19	2.15	2.05	1.89	1.97	1.92	1.95	1.89	1.87	1.88	1.89
Subject stream *B* (x_B)	1.90	1.88	1.77	1.21	1.56	1.20	1.22	1.34	1.22	1.66	1.54	1.50

$\sum_{i=1}^{12} x_{A_i}^2 = 48.26 \quad \sum_{i=1}^{12} x_{B_i}^2 = 27.76$

(i) Calculate the means, medians, variances and Karl Pearson's coefficients of skewness for the cut-off marks distributions of two subject streams ***A*** and ***B***. (08 *marks*)

(ii) Comment on the shapes of the cut-off marks distributions. (02 *marks*)

(d) A meteorological researcher investigates whether El Niño affects a certain island using standardized sea surface temperature. According to the previous researches, z-score above the value 2 indicates a significant impact of El Niño. If the mean temperature, the standard deviation and current temperature of the sea around this island are respectively 28 °C, 0.8 °C and 30 °C, determine the El Niño impact and comment on it. (02 *marks*)

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3. (a) (i) Briefly explain why it is required to make adjustments to observed time series data before analyzing. (02 *marks*)

(ii) Describe **two** advantages of ordinary least squares method compared to the semi-average method in estimating the trend. (02 *marks*)

(b) An airline operating in a particular country recorded the time series data of quarterly number of air ticket bookings (in thousands) from 2022 to 2025. The management believes that the series contains trend and seasonal variations, while cyclical variation is negligible. The following table presents the actual air ticket bookings together with the corresponding trend values (shown within brackets) obtained using the ordinary least squares method.

Year	Quarter			
	Q1	Q2	Q3	Q4
2022	88 (95)	102 (101)	137 (107)	126 (113)
2023	105 (119)	118 (125)	148 (131)	144 (137)
2024	126 (143)	134 (149)	169 (155)	162 (161)
2025	149 (167)	162 (173)	182 (179)	188 (185)

(i) Assuming an additive model, estimate the seasonal indices for each quarter and comment on them. (05 *marks*)

(ii) Forecast the number of air ticket bookings for the second quarter of 2026. (01 *mark*)

(c) (i) Explain **four** uses of index numbers in making decisions for the success of a business. (02 *marks*)

(ii) Mention **four** properties of index numbers and explain briefly why they are important. (03 *marks*)

(d) During the economic crisis, households altered their consumption patterns due to substantial increases in the prices of imported goods and fuel. For studying this impact, the data related to selected commodities in the base year 2021 and the current year 2024 are given in the table below.

Item	2021		2024	
	Price of a unit (Rs.)	Quantity	Price of a unit (Rs.)	Quantity
Wheat flour (in kg)	100	30	320	10
Petrol (in l)	200	20	450	8
Milk powder (in kg)	500	8	1 200	2
Palm oil (in l)	80	10	100	40

(i) Calculate the Laspeyres' price index and Paasche's price index. (04 *marks*)

(ii) Discuss which of the above price indices is favourble to the trade union and is favourble to employers.
(**Note:** A trade union demand for higher wages but employers do not agree with them.) (01 *mark*)

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4. (a) Define the correlation between two variables and discuss the main properties of Spearman's rank correlation coefficient. (03 *marks*)

(b) A particular bank wants to examine the effect of interest rates (X) on amount of fixed deposit saving (Y_1) and amount of personal loans (Y_2) in the economic crisis period. The bank collected the following data over the past 10 months period.

Month	1	2	3	4	5	6	7	8	9	10
X **(%)**	3	4	5	6	7	9	10	11	12	13
Y_1 **(in Rs. million)**	220	230	240	270	290	320	320	350	370	390

$\sum_{i=1}^{10} X_i = 80 \quad \sum_{i=1}^{10} Y_{1i} = 3000 \quad \sum_{i=1}^{10} X_i^2 = 750 \quad \sum_{i=1}^{10} X_i Y_{1i} = 25\,870$

(i) Estimate the ordinary least squares linear regression equation of fixed deposit savings on interest rate and interpret the coefficients. (03 *marks*)

(ii) The bank has estimated the regression equation of personal loan amount (in Rs. million) on interest rate as $\hat{Y}_2 = 404 - 13X$ ($R^2 = 0.88$). Hence, determine the interest rate at which the expected amount of personal loans equals to the expected amount of fixed deposit savings. (02 *marks*)

(iii) If a certain branch reports that its expected fixed deposit savings amount is Rs. 351 million, estimate the corresponding amount of personal loan. (02 *marks*)

(c) (i) Describe the roles of the mean control chart and the range control chart in process control. (02 *marks*)

(ii) In order to test the net weight (in grams) of a packet of milk powder packed by a machine, five samples, each consisting of five packets, were randomly drawn at different time points during the production process. The observed data are given in table below.

Sample	**Time**				
	At 10.30	**At 11.30**	**At 12.30**	**At 13.30**	**At 14.30**
1	394	395	397	400	399
2	403	405	402	404	406
3	396	397	398	396	403
4	396	400	401	397	401
5	399	402	407	400	402

Construct the $\bar{X}$-chart and R-chart for the above data and comment whether the process is statistically under control or not. (06 *marks*)

(d) Explain the difference between acceptable quality level (AQL) and lot tolerance percent defectives (LTPD). (02 *marks*)

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Part II

5. (a) (i) Define the classical approach to probability. (02 *marks*)

(ii) Mention **two** advantages and **two** limitations of the classical approach to probability. (02 *marks*)

(iii) Discuss the statement "In classical approach, probability of an event is determined mainly from past observations and experiments" (01 *mark*)

(b) In a job market survey, considered the three types of skills; computer skill (C), English Language skill (E) and presentation skill (P). It is revealed that out of total candidates, the 70% has computer skills, 30% has both computer and English Language skills, 42% has both computer and presentation skill, 30% has both English Language and presentation skills. It also revealed that 20% of candidates has all three skills. Furthermore, having computer skills to a candidate is independent from having presentation skills and it is given that $P(C \mid E) = \frac{2}{3}$. If a candidate is selected at random then calculate the probability of having

(i) exactly one skill. (02 *marks*)

(ii) exactly two skills. (02 *marks*)

(iii) none of the three skills. (02 *marks*)

(c) State whether the statement "When two events are mutually exclusive, they may or may not be independent." is true or false, and verify your answer with an explanation. (02 *marks*)

(d) There is a tendency to increase gold price during globle conflicts and economists have studied the relationship between war news and gold price fluctuations. When there is war really risen, the price of gold increases by 85%. Though there is no war really risen, the price of gold increases by 25% due to market panic. According to the study the probability that the war really rise is 0.3.

(i) Explain whether there is a relationship between gold price fluctuations and war news. (02 *marks*)

(ii) What is the probability that the price of the gold would increase? (02 *marks*)

(iii) What is the probability that the war has really been risen given that the gold price has not increased? (03 *marks*)

6. (a) A certain taxi service company receives customer complaints (X) per day according to the following distribution:

Number of complaints (x)	0	1	2	3	4
P ($X = x$)	0.20	0.25	0.25	0.15	0.15

(i) Verify that this is a valid probability distribution. (01 *mark*)

(ii) Calculate the probability that at least two complaints are received per day. (01 *mark*)

(iii) Calculate the expected number of complaints per day. (01 *mark*)

(iv) If $4Y = 3X + 1$, obtain the mean and the variance of Y. (03 *marks*)

(b) A machine that packs washing liquid filled bottles has a 2% probability of damaging during the packaging process. A shipment contains 50 bottles packed independently. Let X represent the number of damaged bottles in the shipment.

(i) State the distribution of X with its parameters. (01 *mark*)

(ii) Calculate the probability that at least one bottle is damaged. (01 *mark*)

(iii) Calculate the probability that at most two bottles are damaged. (01 *mark*)

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(c) An average of six customers arrives at a supermarket per every 10 minutes.
(i) Calculate the probability that more than 14 customers arrive in 10 minutes. (01 *mark*)
(ii) Calculate the probability that fewer than three customers arrive in five minutes. (01 *mark*)
(iii) If one cashier can handle eight customers in 10 minutes, assess whether one cashier is sufficient or not.
(**Note:** exceeding 12% chance of handling more than eight customers implies that one cashier is not sufficient.) (03 *marks*)

(d) The time taken for buses to travel between two cities follows a normal distribution with mean 45 minutes and standard deviation five minutes.
(i) Calculate the probability that a journey takes more than 55 minutes. (01 *mark*)
(ii) Calculate the probability that a journey takes between 40 and 53 minutes. (02 *marks*)
(iii) If the fastest 10% of journeys are considered 'express trips,' calculate the maximum travel time for an express trip. (02 *marks*)
(iv) Give **two** suggestions to reduce the mean travel time of busses between two cities. (01 *mark*)

7. (a) Briefly describe the significance of the following **four** main steps in a sample survey plan.
(i) Identifying the objectives
(ii) Selecting the sampling frame
(iii) Determining the sample size
(iv) Choosing the sampling method (06 *marks*)

(b) (i) Mention **two** requirements to be considered for applying the stratified random sampling method. (01 *mark*)
(ii) Describe the main steps of selecting a stratified random sample. (02 *marks*)
(iii) Explain under which circumstance systematic sampling is similar to stratified random sampling. (01 *mark*)

(c) Assume that the number of new malaria cases (y_i) recorded from the five (N=5) medical officer of health (MOH) offices in a particular assistant government agent (AGA) division are 3, 5, 2, 6, and 4.
(i) Write down the sample means of all the samples with size two that can be taken without replacement. (02 *marks*)
(ii) All the sample means of size two taken from the above population with replacement are given below.

3.0	4.0	2.5	4.5	3.5	4.0	5.0	3.5	5.5	4.5	2.5	3.5	2.0
4.0	3.0	4.5	5.5	4.0	6.0	5.0	3.5	4.5	3.0	5.0	4.0	

Calculate the expected number of malaria cases in the sampling distributions of means obtained from samples with and without replacement separately. (02 *marks*)
(iii) Show that both the expected values of $\bar{Y}$ are unbiased estimators for the population mean μ. (02 *marks*)

(d) A demographer wants to estimate the confidence limits for the true difference of the proportion of youth who are unmarried in urban (U) and rural (R) areas of a particular district. In a recent survey, 150 out of 250 youth in urban areas and 96 out of 200 youth in rural areas were reported as unmarried (Consider $\frac{P_U(1-P_U)}{n_U} = 0.00096$ and $\frac{P_R(1-P_R)}{n_R} = 0.00125$).
(i) Construct a 90% confidence interval for the true difference of the proportion of youth who are unmarried in urban and rural areas ($\pi_U - \pi_R$) by stating the assumptions. (03 *marks*)
(ii) Interpret this confidence interval. (01 *mark*)

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8. (a) Define the type I and type II errors in a hypothesis testing and provide **one** suggestion to reduce both the errors. (02 *marks*)

(b) A research team of a leading automobile manufacturing company wants to determine whether a newly developed engine satisfies the environmental requirement that the mean carbon emission level be less than 20 ppm. The statistics; $\bar{x} = 17.01$ ppm and $s = 3.00$ ppm were obtained by the research team from a random sample of 10 engines. Assume that carbon emission is normally distributed with standard deviation 2.99 ppm and test whether the new engine meets the environmental requirement standard at 1% level of significance by using p-value approach. (05 *marks*)

(c) In a proposal to reduce corruption, eliminate long queues, and optimize state resources, a particular government recently introduced digitized, web-based appointment and processing systems at major public offices. However, citizens frequently complain about web crashes, and processing delays and many of them still believe traditional counter services. Therefore, a policy research team decides to investigate whether the new digital system has actually succeeded in reducing the average time, a citizen spends to get a passport processed. The research team has obtained following statistics from samples of two distinct application streams.

Stream	n	$\bar{x}$ **(in hours)**	s^2 **(in hours)**
Digital service	40	4.2	1.6
Counter service	50	5.1	2.5

(i) Stating assumptions, test whether the mean processing time of digital service is significantly less than the processing time of traditional counter service at 5% level of significance. (04 *marks*)

(ii) Comment on the results. (01 *mark*)

(d) A battery manufacturing company produces four different brands (***A***, ***B***, ***C*** and ***D***) of lithium batteries for electric vehicles (EVs). An experiment was carried out to determine whether the mean charged time of the batteries differs among the brands. Eight batteries are randomly selected from each brand and tested until the charged time ends. The following incomplete one-way ANOVA table was obtained at the experiment:

Source of variation	**Sum of squares**	**Degrees of freedom**	**Mean squares**	**F**
Between brands	.....	.....	100	.....
Within brand	560	.....	.....	
Total	.....			

(i) Complete the ANOVA table. (03 *marks*)

(ii) Formulate the appropriate hypotheses to test the above situations and state the decision rule for conducting the test at the 1% level of significance. (02 *marks*)

(iii) Based on the results, give your conclusions. (01 *mark*)

(iv) Provide the assumptions that you made for this test. (02 *marks*)

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