D 123856 (Pages : 15) Name.....

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# CALICUT UNIVERSITY CENTRALIZED ENTRANCE TEST (CU-CET)
## APRIL 2025

M.Sc. STATISTICS

Time : Two Hours Maximum : 300 Marks

*Each question carries 4 marks.*

*1 mark will be deducted for each wrong answer.*

1. Let $A=\{x \in R : x^2 < 3\}$ Which of the following statements is true ?

   (a) A is an open set.
   (b) A is a bounded set.
   (c) A is a closed set.
   (d) A is an uncountable set.

2. Which of the following sequences diverges ?

   (a) $a_n = \frac{1}{n}$.
   (b) $a_n = (-1)^n$.
   (c) $a_n = \frac{n^2}{n+1}$.
   (d) $a_n = \frac{\sin(n)}{n}$.

3. Which test should be used to determine the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n(\log n)^2}$.

   (a) Ratio test.
   (b) Integral test.
   (c) Comparison test.
   (d) Root test.

4. Which of the following functions is not continuous on the interval [0, 1] ?

   (a) $f(x) = x^2$.
   (b) $f(x) = 1/x$.
   (c) $f(x) = \sqrt{x}$.
   (d) $f(x) = \begin{matrix} 1 & \text{if } x = 0 \\ 0 & \text{if } x \neq 0 \end{matrix}$.

5. The Taylor series expansion of $f(x) = \ln(x + 1)$ centered at $x = 0$ is :

   (a) $x - x^2/2 + x^3/3 - \ldots\ldots$

   (b) $x + x^2/2 + x^3/3 + \ldots\ldots$

   (c) $\dfrac{x}{x+1} - \dfrac{x^2}{2(x+1)^2} + \dfrac{x^3}{3(x+1)^3} - \ldots$

   (d) $x - x^2/2 + x^3/3 + \ldots\ldots$

6. Which theorem guarantees the existence of a point $c$ in the interval $(a, b)$ such that $f'(c) = \{f(b) - f(a)\} / \{b - a\}$ ?

   (a) Rolle's theorem.
   (b) Mean value theorem.
   (c) Taylor's theorem.
   (d) Lagrange's theorem.

7. The integral $\int_{-\pi}^{\pi} \sin(x)\cos(x)\,dx$ is equal to :

   (a) 0.
   (b) 1.
   (c) $\pi$.
   (d) 2.

8. Which property is NOT true for diagonal matrices ?

   (a) They are always square matrices.

   (b) All elements outside the main diagonal are zero.

   (c) They are always invertible.

   (d) They can be symmetric matrices.

9. The determinant of the matrix $\begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix}$ is :

   (a) 1.
   (b) 2.
   (c) 3.
   (d) 5.

10. How many solutions does the system of linear equations $2x + y = 4, x - 3y = 2$ have ?

    (a) None.
    (b) One.
    (c) Infinite.
    (d) Two.

11. In a dataset, the mean, median, and mode are all different. What can you infer about the distribution ?

    (a) The distribution is symmetric.

    (b) The distribution is negatively skewed.

    (c) The distribution is positively skewed.

    (d) The distribution is bimodal.

12. If the co-efficient of skewness of a dataset is zero, what can you infer about its shape ?

    (a) The left tail is longer than the right tail.

    (b) The right tail is longer than the left tail.

    (c) The distribution is symmetric.

    (d) The distribution is bimodal.

13. Which of the following statements about the co-efficient of kurtosis is true ?

    (a) It measures the peakedness of a distribution relative to a normal distribution.

    (b) It measures the spread of a distribution relative to its mean.

    (c) It measures the skewness of a distribution.

    (d) It measures the symmetry of a distribution.

14. What type of skewness does a distribution exhibit if its mean is equal to its median ?

    (a) Positive skewness. (b) Negative skewness.

    (c) Symmetrical skewness. (d) No skewness.

15. The range of a dataset is affected by outliers. Which measure of dispersion is more robust to outliers ?

    (a) Quartile deviation. (b) Standard deviation.

    (c) Range. (d) Mean absolute deviation.

16. The co-efficient of variation is used to compare the dispersion of datasets with different units, it is calculated as :

    (a) Standard deviation / Mean.

    (b) Mean / Standard deviation.

    (c) Range / Mean.

    (d) Standard deviation × Mean.

17. Which measure of dispersion divides the dataset into four equal parts ?

    (a) Quartiles. (b) Deciles.

    (c) Percentiles. (d) Interquartile range.

18. What percentage of the data lies within one standard deviation of the mean in a normal distribution ?

    (a) 34 %. (b) 50 %.

    (c) 68 %. (d) 95 %.

19. The geometric mean is appropriate for averaging :

    (a) Rates of change. (b) Ratios.

    (c) Ordinal data. (d) Nominal data.

20. In a positively skewed distribution, which measure of central tendency is typically the largest ?

    (a) Mean. (b) Median.

    (c) Mode. (d) Geometric mean.

21. Which correlation co-efficient is more robust against outliers and non-linear relationships ?

    (a) Karl Pearson correlation co-efficient.

    (b) Spearman correlation co-efficient.

    (c) Partial correlation co-efficient.

    (d) Multiple correlation co-efficient.

22. A dataset shows a scatterplot with a non-linear pattern. Which technique would be most appropriate for modeling this relationship ?

(a) Least squares regression.

(b) Spearman correlation co-efficient.

(c) Principle of least squares.

(d) Multiple regression analysis.

23. What does the co-efficient of determination (R-squared) measure in the context of linear regression ?

(a) The strength of the relationship between independent and dependent variables.

(b) The accuracy of the regression predictions.

(c) The proportion of variation in the dependent variable explained by the independent variable.

(d) The significance of the regression co-efficients.

24. A time series data exhibits a seasonal pattern with fluctuations around the trend. Which component represents these fluctuations ?

(a) Trend. (b) Seasonal variation.

(c) Cyclical variation. (d) Residuals.

25. What is the primary purpose of using index numbers in economics?

(a) To analyze time series data.

(b) To measure the central tendency of a dataset.

(c) To compare changes in variables over time or between different groups.

(d) To estimate the correlation co-efficient between variables.

26. An economist wants to calculate a price index to measure inflation. Which type of index number would be most suitable for this purpose ?

(a) Weighted index numbers. (b) Unweighted index numbers.

(c) Fisher's ideal index numbers. (d) Laspeyres index numbers.

27. In index number theory, what does the Laspeyres index measure ?

(a) The weighted average of price changes using base-period quantities.

(b) The weighted average of price changes using current-period quantities.

(c) The unweighted average of price changes using base-period quantities.

(d) The unweighted average of price changes using current-period quantities.

28. In a multiple regression analysis involving three predictor variables, what does the co-efficient of determination (R-squared) value of 0.85 indicate ?

(a) 85 % of the variation in the dependent variable is explained by the three predictor variables.

(b) The model has a good fit because R-squared is close to 1.

(c) There is a strong linear relationship between the predictor variables.

(d) The model is overfitting the data.

29. What is the relationship between the Karl Pearson correlation co-efficient and the Spearman correlation co-efficient for linear relationships ?

(a) They are equal

(b) The Karl Pearson correlation co-efficient is always higher

(c) The Spearman correlation co-efficient is always higher.

(d) There is no relationship between them.

30. A researcher wants to assess the relationship between income, education level, and job satisfaction using statistical analysis. Which technique would be most appropriate ?

(a) Simple linear regression.

(b) Multiple regression analysis.

(c) Spearman correlation co-efficient.

(d) Principle of least squares.

31. In a standard deck of 52 cards, what is the sample space of drawing two cards successively without replacement ?

(a) {red, black}.

(b) {heart, diamond, spade, club}.

(c) {face cards, number cards}.

(d) {red heart, red diamond, black spade, black club}.

32. If P (A) = 0.3, P (B) = 0.4, and $P(A \cap B) = 0.1$, what is $P(A \cup B)$ ?

(a) 0.2. (b) 0.3.

(c) 0.4. (d) 0.6.

33. What is the probability of drawing a red card or a face card from a standard deck of 52 cards ?

(a) 1/13. (b) 1/4.

(c) 1/2. (d) 3/4.

34. If P (A | B) = 0.6 and P (B) = 0.3, what is P (A and B) ?

(a) 0.18. (b) 0.20.

(c) 0.30. (d) 0.36.

35. In a bag, there are 5 red balls and 3 blue balls. If two balls are drawn without replacement, what is the probability of getting a red ball followed by a blue ball ?

(a) 5/16. (b) 15/56.

(c) 5/24. (d) 3/10.

36. What role does Bayes' theorem play in probability theory ?

(a) It calculates the probability of an event given prior knowledge and evidence.

(b) It determines the probability of independent events occurring simultaneously.

(c) It quantifies the distribution of discrete random variables.

(d) It measures the likelihood of events in a joint probability distribution.

37. If the joint probability distribution of two continuous random variables X and Y is given by $f(x, y) = kxy$ for $0 \leq x \leq 1$ and $0 \leq y \leq 2$, what is the value of $k$ ?

(a) 1.

(b) 2.

(c) 3.

(d) 4.

38. What is the probability of rolling a number less than or equal to 4 on a fair six-sided die ?

(a) 1/6.

(b) 2/3.

(c) 3/6.

(d) 4/6.

39. If X and Y are independent random variables with probability density functions $f(x)$ and $g(y)$ respectively, what is the joint probability distribution of X and Y ?

(a) $f(x) * g(y)$.

(b) $f(x) + g(y)$.

(c) $f(x) / g(y)$.

(d) $f(x) - g(y)$.

40. What is the formula for the marginal probability distribution function of Y in terms of the joint probability distribution function $f(x, y)$ ?

(a) $\int f(x, y)\, dx$.

(b) $\int f(x, y)\, dy$.

(c) $\int f(x, y)\, dx\, dy$.

(d) $\int f(x, y)\, dx + \int f(x, y)\, dy$.

41. Which of the following distributions is characterized by a symmetric, bell-shaped curve and is often used to model natural phenomena such as height, weight, and test scores ?

(a) Uniform distribution.

(b) Exponential distribution.

(c) Normal distribution.

(d) Beta distribution.

42. The moment generating function (MGF) of a random variable X is given by M $(t) = e^{\wedge}(3t + t^{\wedge}2)$. What is the third moment of X ?

(a) 3. (b) 9.

(c) 15. (d) 21.

43. A random variable X follows a hypergeometric distribution with parameters N = 10, K = 4, and $n = 3$. What is the probability that exactly 2 successes occur in the sample ?

(a) 0.206. (b) 0.363.

(c) 0.500. (d) 0.667.

44. The distribution of the sum of squares of $n$ independent standard normal random variables follows which sampling distribution ?

(a) Chi-square distribution. (b) Student's $t$-distribution.

(c) F-distribution. (d) Normal distribution.

45. In a Poisson distribution, if $\lambda$ is the average rate of occurrence over a fixed interval of time or space, then the variance of the distribution is equal to :

(a) $\lambda$. (b) $2\lambda$.

(c) $\lambda^{\wedge}2$. (d) $\sqrt{\lambda}$.

46. Which of the following distributions is often used to model the time until an event occurs, given a constant rate of occurrence ?

(a) Normal distribution. (b) Gamma distribution.

(c) Binomial distribution. (d) Lognormal distribution.

47. The sampling distribution of the sample mean, when the sample size is large, is approximately :

(a) Normal with mean 0 and standard deviation 1.

(b) Chi-square with $n$ degrees of freedom.

(c) Student's $t$ with $n$ degrees of freedom.

(d) Normal with mean $\mu$ and standard deviation $\sigma / \sqrt{n}$.

48. Which distribution is used to model the number of successes in a sequence of independent trials with more than two possible outcomes on each trial ?

(a) Binomial distribution.
(b) Multinomial distribution.
(c) Poisson distribution.
(d) Hypergeometric distribution.

49. Which of the following statements regarding the moment generating function (MGF) is true ?

(a) The MGF is always defined for all random variables.
(b) The MGF uniquely determines the probability distribution of a random variable.
(c) The MGF is primarily used for discrete distributions.
(d) The MGF is equivalent to the probability generating function.

50. Which distribution is commonly used to model the joint distribution of two correlated random variables with normal marginal distributions ?

(a) Multinomial distribution.
(b) Bivariate normal distribution.
(c) Poisson distribution.
(d) Exponential distribution.

51. Which property of an estimator ensures that the estimator, on average, provides estimates that are close to the true parameter value ?

(a) Consistency.
(b) Unbiasedness.
(c) Efficiency.
(d) Sufficiency.

52. The Cramer-Rao lower bound establishes a limit on the variance of an unbiased estimator based on :

(a) The sample size.
(b) The parameter being estimated.
(c) The information provided by the sample.
(d) The population distribution.

53. According to the Neymann factorization theorem, a statistic T is sufficient for a parameter $\theta$ if and only if :

(a) The likelihood function is maximized.
(b) The joint distribution of the sample can be factorized into two functions.
(c) The estimator is unbiased.
(d) The estimator is consistent.

54. Which method of estimation involves equating sample moments to population moments ?

(a) Method of moments.

(b) Method of maximum likelihood estimation.

(c) Bayesian estimation.

(d) Least squares estimation.

55. What does a confidence interval represent in interval estimation ?

(a) The range of possible parameter values.

(b) The probability that the parameter lies within the interval.

(c) The level of significance of the test.

(d) The precision of the estimator.

56. Type I error in hypothesis testing refers to :

(a) Rejecting the null hypothesis when it is true.

(b) Failing to reject the null hypothesis when it is false.

(c) Rejecting the alternative hypothesis when it is true.

(d) Failing to reject the alternative hypothesis when it is false.

57. The power of a hypothesis test is influenced by :

(a) The level of significance.

(b) The sample size.

(c) The variability of the data.

(d) The null hypothesis.

58. The critical region of a hypothesis test consists of :

(a) All possible outcomes of the sample.

(b) Outcomes that lead to acceptance of the null hypothesis.

(c) Outcomes that lead to rejection of the null hypothesis.

(d) Outcomes that lead to rejection of the alternative hypothesis.

59. Which distribution is commonly used in hypothesis testing for comparing means of two independent samples ?

(a) Normal distribution.
(b) Student's *t*-distribution.
(c) Chi-square distribution.
(d) F-distribution.

60. The Kolmogorov-Smirnov test is used for :

(a) Testing normality of data.
(b) Comparing means of two independent samples.
(c) Testing the equality of variances in two samples.
(d) Testing the goodness of fit of a sample distribution to a theoretical distribution.

61. Which of the following is an example of a non-sampling error in statistical sampling ?

(a) Sampling bias.
(b) Measurement error.
(c) Nonresponse bias.
(d) Variability due to chance.

62. In simple random sampling, each member of the population has :

(a) An equal probability of selection.
(b) No chance of being selected.
(c) A probability of selection proportional to its size.
(d) A predetermined probability of selection.

63. What is the purpose of stratified random sampling ?

(a) To ensure that every member of the population has an equal chance of selection.
(b) To reduce sampling variability.
(c) To ensure representation from different subgroups within the population.
(d) To select every kth element from the population.

64. The standard error of the population mean is a measure of :

(a) Sampling variability.
(b) Sampling bias.
(c) Sampling efficiency.
(d) Sampling precision.

65. Which experimental design involves multiple independent variables and their interactions ?

(a) One-way ANOVA.

(b) Two-way ANOVA.

(c) Latin square design.

(d) Completely randomized design.

66. What is the formula to calculate the crude birth rate ?

(a) (Number of births / Total population) × 100.

(b) (Number of births / Number of women of childbearing age) × 1,000.

(c) (Number of births / Total population) × 1,000.

(d) (Number of births / Total population) × 10,000.

67. Age-specific death rates are calculated by dividing the number of deaths in a specific age group by :

(a) The total population.

(b) The number of deaths in all age groups.

(c) The number of births in all age groups.

(d) The population in that specific age group.

68. Which agency in India is responsible for conducting the National Sample Survey ?

(a) Registrar General and Census Commissioner of India.

(b) Ministry of Statistics and Programme Implementation.

(c) Central Statistical Office.

(d) Ministry of Home Affairs.

69. What does the agricultural census primarily focus on ?

(a) Yield of crops.

(b) Landholding patterns.

(c) Livestock population.

(d) Agricultural machinery.

70. The measurement of the total value of goods and services produced within a country's borders in a specific time period is known as :

(a) Gross Domestic Product (GDP).

(b) Gross National Product (GNP).

(c) Net National Product (NNP).

(d) National Income.

71. In statistical quality control, what does an "R-chart" primarily monitor ?

(a) Individual measurements of a process.

(b) Mean of a sample taken from the process.

(c) Range of measurements in a process.

(d) Variability within a sample from the process.

72. Which type of control chart is used to monitor the proportion of defective items in a sample ?

(a) X-bar chart. (b) R-chart.

(c) P-chart. (d) S-chart.

73. Acceptance sampling plans are often based on which statistical distribution ?

(a) Normal distribution. (b) Poisson distribution.

(c) Binomial distribution. (d) Exponential distribution.

74. The transportation problem deals with optimizing the :

(a) Allocation of resources to different tasks.

(b) Routing of vehicles between various locations.

(c) Assignment of workers to different shifts.

(d) Distribution of goods from multiple suppliers to multiple destinations.

75. Which method is commonly used to solve assignment problems in Operations Research ?

(a) Graphical method.

(b) Simplex method.

(c) Hungarian method.

(d) Genetic algorithm.