DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2010

Serial No.

STATISTICS

Code No. 21

A

Time Allowed : Two Hours

Maximum Marks : 300

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC, IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C OR D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE RESPONSE SHEET.
3. You, have to enter your Roll Number on this Test Booklet in the Box provided alongside. *Do NOT* write *anything* else on the Test Booklet.

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4. This Booklet contains 100 items (questions). Each item comprises *four* responses (answers). You will select *one* response which you want to mark on the Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each item.
5. In case you find any discrepancy in this test booklet in any question(s) or the Responses, a written representation explaining the details of such alleged discrepancy, be submitted within three days, indicating the Question No(s) and the Test Booklet Series, in which the discrepancy is alleged. Representation not received within time shall not be entertained at all.
6. You have to mark all your responses ONLY on the separate Response Sheet provided. *See directions in the Response Sheet.*
7. All items carry equal marks. Attempt ALL items. Your total marks will depend only on the number of correct responses marked by you in the Response Sheet.
8. Before you proceed to mark in the Response Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Response Sheet as per instructions sent to you with your Admit Card and Instructions.
9. While writing Centre, Subject and Roll No. on the top of the Response Sheet in appropriate boxes use **"ONLY BALL POINT PEN".**
10. After you have completed filling in all your responses on the Response Sheet and the examination has concluded, you should hand over to the Invigilator only the Response Sheet. You are permitted to take away with you the Test Booklet.

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ROUGH WORK

Objective Multiple Choice Questions

1. If the distribution is moderately symmetrical the relation between mean, median, mode is :

(A) Mode = 3 Median – 2 Mean (B) Mean = 3 Median – Mode

(C) Mode = 3 Mean – 2 Median (D) Mean – Median = 2 (Mean – Mode)

2. A person goes from his house to his college at a speed of 60 km/hour and back from his college to house at a speed of 40 km/hour, then his average speed is :

(A) 50 km/hour (B) 48 km/hour

(C) 48.5 km/hour (D) 48.98 km/hour

3. For the mid-values of class intervals given as :

25, 34, 43, 52, 61, 70.

The first class of the distribution is :

(A) 24.5—25.5 (B) 24—26

(C) 20—30 (D) 20.5—29.5

4. The following frequency distribution :

Classes	**Frequency**
0—15	25
0—10	10
0—5	4

is classified as :

(A) cumulative distribution in less than type

(B) cumulative distribution in more than type

(C) discrete frequency distribution

(D) cumulative frequency distribution

5. The probability of drawing any one diamond card from a pack of playing cards is :

(A) $\frac{1}{52}$ (B) $\frac{1}{13}$

(C) $\frac{4}{13}$ (D) $\frac{1}{4}$

6. In tossing of two perfect dice, the probability of getting 4 as the sum of the numbers on faces is :

(A) $\frac{4}{36}$ (B) $\frac{1}{12}$

(C) $\frac{3}{12}$ (D) $\frac{2}{12}$

7. If A and B are any two events and are not disjoint then :

(A) $P(A \cup B) = P(A) + P(B)$ (B) $P(A \cup B) = P(A) + P(B) + P(A \cap B)$

(C) $P(A \cup B) = P(A) \cdot P(B)$ (D) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

8. A problem of statistics is given to 3 students A, B, C whose chances of solving the problem are $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. Then probability that the problem will be solved is :

(A) $\frac{3}{32}$ (B) $\frac{3}{2}$

(C) $\frac{29}{32}$ (D) $\frac{5}{10}$

9. The probability of the simultaneous occurrence of two events A_1 and A_2 i.e. $P(A_1 \cap A_2)$ is equal to :

(A) $P(A_1) \cdot P(A_1/A_2)$ (B) $P(A_2) \cdot P(A_2/A_1)$

(C) $P(A_1) \cdot P(A_2/A_1)$ (D) All the above

10. An urn contains 5 white and 5 black balls, 4 balls are drawn from the urn, then probability that all 4 balls drawn are black is :

(A) $\frac{4}{10}$ (B) $\frac{1}{2}$

(C) $\frac{1}{42}$ (D) $\frac{4}{5}$

11. Suppose 5 men out of 100 and 25 women out of 10000 are colour-blind. A colour-blind person is choosen at random. Assuming male and female are equal in number, the probability of choosen person being male is :

(A) $\frac{1}{20}$ (B) $\frac{1}{2020}$

(C) $\frac{1}{30}$ (D) $\frac{20}{21}$

12. Variance of the mean of a random sample of size n, if variance is denoted by σ^2 is equal to :

(A) $\frac{\sigma^2}{2}$

(B) $\frac{\sigma^2}{n}$

(C) $n\sigma^2$

(D) $\frac{\sigma^2}{\sqrt{n}}$

13. If $P(A) = \frac{1}{3}, P(B) = \frac{1}{4}, P(A \cap B) = \frac{1}{12}$ then $P(A \cup B)$ is equal to :

(A) $\frac{7}{12}$

(B) $\frac{1}{12}$

(C) $\frac{1}{2}$

(D) $\frac{2}{3}$

14. In a binomial distribution, mean is 4 and variance is given as 3, then its mode will be :

(A) 7

(B) 12

(C) 4

(D) 3·3

15. If mean is denoted by μ and variance by σ^2, then in a binomial distribution :

(A) $\mu > \sigma^2$

(B) $\mu = \sigma^2$

(C) $\mu < \sigma^2$

(D) $\mu = \sigma$

16. The distribution for which moment generating function (m.g.f.) does not exist is :

(A) Cauchy's distribution

(B) Gamma distribution

(C) Exponential distribution

(D) Rectangular distribution

17. Gamma variate assumes all values in between the interval :

(A) $-\infty$ to ∞

(B) $-\infty$ to 0

(C) 0 to ∞

(D) 0 to 1

18. If the distribution function of two dimensional random variates X and Y is denoted by F(x, y), then :

(A) $-1 \leq F(x, y) \leq 1$

(B) $0 \leq F(x, y) \leq 1$

(C) $-\infty \leq F(x, y) \leq \infty$

(D) $0 \leq F(x, y) \leq \infty$

19. The Normal distribution is a limiting form of Binomial distribution if :

(A) $n \to \infty, p \to n$ (B) $n \to \infty, p \to 0$

(C) $n \to 0, p \to q$ (D) $n \to \infty$, neither p nor q is small

20. The square of a standard normal variate is a :

(A) Normal variate (B) Chi-square variate

(C) Poisson variate (D) F variate

21. If each observation of a set is divided by 2 then the mean of new values :

(A) Is decreased by 2 (B) Is two times the original mean

(C) Is half of the original mean (D) Remains the same

22. The mean of the squares of first-eleven natural numbers is :

(A) 6 (B) 48

(C) 33 (D) 46

23. In a class 40 students out of 50 passed with mean marks 6.0 and the overall average of class marks is 5.5, then the average marks of failed students is :

(A) 3.5 (B) 2.5

(C) 4.0 (D) 0.5

24. If each values of a series is multiplied by 10, then coefficient of variation will be increased by :

(A) 10 percent (B) 5 percent

(C) 20 percent (D) 0 percent

25. If for a distribution, coefficient of Kurtosis $r_2 < 0$, then the frequency curve is :

(A) Platykurtic (B) Leptokurtic

(C) Mesokurtic (D) None

26. The correct relationship between Arithmetic Mean (AM), Geometric Mean (GM) and Harmonic Mean (HM) is :

(A) AM = GM = HM (B) GM ≥ AM ≥ HM

(C) HM ≥ GM ≥ AM (D) AM ≥ GM ≥ HM

27. The average age of 29 students in a class is 20 years. When the age of the class teacher is included, the average is increased by one year. Then the age of the class teacher is :

(A) 50 years (B) 55 years

(C) 49 years (D) 21 years

28. The sum of n observations is 630 and their mean is 42, then the value of n is :

(A) 30 (B) 15

(C) 20 (D) 21

29. Mean deviation is minimum when deviations are taken from :

(A) Mean (B) Median

(C) Mode (D) Zero

30. If in a skewed distribution mean is 30 and mode is 36, then median of the distribution is :

(A) 32 (B) 28

(C) 33 (D) 35

31. Two regression coefficients are :

(A) Independent of change of origin but not of scale

(B) Dependent of change of origin but not of scale

(C) Independent of change of origin and scale

(D) Dependent of change of origin and scale

32. Both the regression lines of X on Y and Y on X are :

(A) Always parallel to each other (B) Intersect each other

(C) Never intersect (D) Always perpendicular

33. If one of the regression coefficient is greater than 1 the other must be :

(A) equal to 1 (B) greater than 1

(C) less than 1 (D) less than or equal to 1

34. If the two variables are uncorrected, then the two lines of regression are :

(A) perpendicular (B) coincides

(C) parallel (D) does not intersect

35. The two lines of regressions are given as X + 2Y – 5 = 0 and 2X + 3Y = 8. Then the mean values of X and Y respectively are :

(A) 2, 1 (B) 2, 5

(C) 2, 3 (D) 1, 2

36. Two lines of regression intersect at the point :

(A) (X, Y) (B) $(\overline{X}, \overline{Y})$

(C) (0, 0) (D) (1, 1)

37. If a constant 20 is subtracted from each of the values of X and Y, the regression coefficient will be :

(A) reduced by 20

(B) $\frac{1}{20}$ th of the original value

(C) increased by 20

(D) not changed

38. The value of correlation ratio varies from :

(A) –1 to 1

(B) –1 to 0

(C) 0 to 1

(D) 0 to $\frac{1}{2}$

39. If the regression line of Y on X is Y = aX + b and X on Y is X = cY + d, the correlation coefficient between X and Y is :

(A) $\sqrt{a/c}$

(B) $\sqrt{a/d}$

(C) $\sqrt{ac}$

(D) $\sqrt{bd}$

40. If the sum of squares of differences between ten ranks of two series is 33, then the rank correlation coefficient is :

(A) .303

(B) .80

(C) .33

(D) .66

41. $H_0 : \mu_1 = \mu_2$ for samples of sizes 8 and 10 from normal populations (variance unknown) would be tested using :

(A) Student's t

(B) χ^2 test

(C) Fisher's Z

(D) S.N.V.Z. test

42. Students 't' distribution was discovered by :

(A) Fisher

(B) W.S. Gosset

(C) Karl Pearson

(D) Laplace

43. The relation between χ^2 with n d.f. is :

(A) 2 mean = variance

(B) mean = 2 variance

(C) mean = variance

(D) $\text{mean}^2 = \sqrt{\text{variance}}$

44. If n the sample size is larger than 30, the Student's t-distribution tends to :

(A) F-distribution

(B) Cauchy distribution

(C) Chi-square

(D) Normal

45. The range of F-variate is :

(A) $-\infty$ to ∞
(B) 0 to 1
(C) 0 to ∞
(D) $-\infty$ to 0

46. F-distribution curve is :

(A) Positively skewed
(B) Negatively skewed
(C) Symmetrical
(D) May be of any shape

47. Mode of the Chi-square distribution with n d.f. lies at the point :

(A) $\chi^2 = n - 2$
(B) $\chi^2 = n - 1$
(C) $\chi^2 = n$
(D) $\chi^2 = n^2 - 1$

48. If the sample size n = 2, the Students t-distribution reduces to :

(A) Normal distribution
(B) F-distribution
(C) Cauchy distribution
(D) Gamma distribution

49. If X_1 and X_2 are two independent χ^2-variate then which of the following has also χ^2-distribution ?

(A) $\frac{X_1}{X_1 + X_2}$
(B) $\frac{X_1}{X_2}$
(C) $\frac{X_2}{X_1}$
(D) $X_1 + X_2$

50. The distribution of χ^2_1 is equivalent to the distribution :

(A) $F_{1, \infty}$
(B) $F_{1, 0}$
(C) $F_{\infty, 1}$
(D) $F_{1, 1}$

51. If an estimator T_n of population parameter θ converges in probability to θ as n tends ∞ is said to be :

(A) unbiased
(B) consistent
(C) efficient
(D) sufficient

52. An estimator $\hat{\theta}$ is said to be unbiased estimator of θ if :

(A) $E(\hat{\theta}) = \theta$
(B) $\hat{\theta} = E(\theta)$
(C) $[E(\hat{\theta})]^2 = \theta$
(D) $E(\hat{\theta}) = \theta^2$

53. Mean square error of an estimator T_n of θ is expressed as :

(A) bias + var (T_n)

(B) bias – var (T_n)

(C) $bias^2$ + var (T_n)

(D) [bias + var $T_n]^2$

54. If $\hat{\theta}_1$ and $\hat{\theta}_2$ are two unbiased estimator of the parameter θ, then $\hat{\theta}_1$ is said to be minimum variance unbiased estimator of θ if :

(A) $V(\hat{\theta}_1) \geq V(\hat{\theta}_2)$

(B) $V(\hat{\theta}_1) \leq V(\hat{\theta}_2)$

(C) $V(\hat{\theta}_1) = V(\hat{\theta}_2)$

(D) $V(\hat{\theta}_1) \geq [V(\hat{\theta}_2)]^2$

55. If T_1 and T_2 two minimum variance unbiased estimator of θ, then :

(A) $T_1 = T_2$

(B) $T_1 \neq T_2$

(C) $T_1 > T_2$

(D) $T_1 < T_2$

56. Let $X_1, X_2, ..., X_n$ be a random sample from Bernoulli population with parameter p, $0 < p < 1$, then sufficient statistics for this family of distributions is :

(A) $\sum_{i=1}^{n} X_i$

(B) $\sum_{i=1}^{n} X_i^2$

(C) $\prod_{i=1}^{n} X_i$

(D) $\frac{1}{2}\sum_{i=1}^{n} X_i$

57. Let $X_1, X_2, X_3 ...., X_n$ be a random sample from $N(\mu, \sigma^2)$. Then sufficient estimator for σ^2 is :

(A) $\sum_{i=1}^{n} X_i$

(B) $\sum_{i=1}^{n} X_i^2$

(C) $\frac{1}{n}\sum_{i=1}^{n} X_i$

(D) $[\Sigma X_i]^2$

58. For random sampling from $N(\mu, \sigma^2)$ the maximum likelihood estimator for μ when σ^2 is known is :

(A) $\sum_{i=1}^{n} X_i$

(B) $\frac{1}{n}\sum_{i=1}^{n} X_i$

(C) $\sum_{i=1}^{n} X_i^2$

(D) $\frac{1}{n}\sum_{i=1}^{n} X_i^2$

59. If sample mean is $\bar{x}$ and population mean is μ. Then the most-efficient estimator of μ is :

(A) $\frac{1}{n}\sum_{i=1}^{n} X_i$

(B) $\sum_{i=1}^{n} X_i$

(C) $\frac{1}{n}\sum_{i=1}^{n} (X_i + 1)$

(D) $\sum_{i=1}^{n} X_i^2$

60. Cramer-Rao inequality gives :

(A) Upper bound to the variance of an unbiased estimate of $\psi(\theta)$

(B) Lower bound to the variance of an unbiased estimate of $\psi(\theta)$

(C) Lower bound to the mean of an unbiased estimate of $\psi(\theta)$

(D) None of the above

61. The method of moments for estimating the parameters was discovered and studied by :

(A) R.A. Fisher

(B) J. Neyman

(C) Laplace

(D) Karl Pearson

62. A random sample $x_1, x_2 .... x_n$ is taken from a normal population with mean zero and variance σ^2 then M.V.U. Estimator of σ^2 is :

(A) $\frac{1}{n}\sum X_i^2$

(B) $\sum X_i^2$

(C) $\frac{1}{n}\sqrt{X_i}$

(D) $\frac{1}{n-1}\sum X_i$

63. Minimum Chi-square estimators are not necessarily :

(A) efficient

(B) consistent

(C) unbiased

(D) none

64. Bias of an estimator will be :

(A) positive

(B) negative

(C) either positive or negative

(D) always zero

65. If the expected value of an estimator $\hat{\theta}$ is not equal to its parametric value θ, it is said to be :

(A) unbiased estimator

(B) biased estimator

(C) consistent estimator

(D) sufficient estimator

66. Factorisation theorem for sufficiency is known as :

(A) Rao-Blackwell theorem (B) Cramer-Rao theorem

(C) Chapman-Robins theorem (D) Fisher-Neyman theorem

67. If $\hat{\theta}_n$ is an unbiased estimator of θ with variance σ_n^2 and $\hat{\theta}_n \to \theta, \sigma_n \to 0$ as $n \to \infty$ then estimator $\hat{\theta}_n$ is said to be :

(A) efficient (B) sufficient

(C) consistent (D) none

68. For a sample from a normal population $N(\mu, \sigma^2)$ where σ^2 is known, sample mean is :

(A) unbiased and consistent estimate of μ

(B) unbiased but not consistent estimate of μ

(C) consistent but biased estimate of μ

(D) not an estimate of μ

69. Let X_1, X_2 and X_3 is a random sample of size 3 from a population with mean μ and variance σ^2. Then $T = X_1 + X_2 - X_3$ is :

(A) unbiased estimate of μ (B) biased estimate of μ

(C) not an estimate of μ (D) unbiased estimate of σ^2

70. The denominator in the Cramer-Rao inequality is known as :

(A) Lower bound of the variance (B) Fisher information

(C) Upper bound of variance (D) None

71. Let $x_1, x_2, \ldots, x_n$ is a random sample from a Normal population N(μ, 1), then $\frac{1}{n}\sum x_i^2$ is an unbiased estimate of :

(A) μ^2 (B) $\mu^2 - 1$

(C) $\mu^2 + 1$ (D) $\frac{\mu^2}{n}$

72. The maximum likelihood estimators are generally :

(A) consistent and invariant (B) invariant and unbiased

(C) unbiased and consistent (D) unbiased and inconsistent

73. A random sample of size 5 say x_1, x_2, x_3, x_4, x_5 is drawn from a normal population with unknown mean μ. Then $T = \frac{x_1 + x_2 + x_3 + x_4 + x_5}{5}$ is an :

(A) unbiased estimate of μ + 5 (B) unbiased estimate of μ

(C) biased estimate of μ (D) unbiased estimate of $\frac{\mu}{5}$

74. Rao-Blackwell theorem enable us to obtain minimum variance unbiased estimators through :

(A) sufficient statistics (B) efficient statistics

(C) consistent statistics (D) none

75. For random sampling from normal population $N(\mu, \sigma^2)$, the maximum likelihood estimator for σ^2 when μ is known is :

(A) $\frac{1}{n-1}\sum_{i=1}^{n}(x_i-\mu)^2$ (B) $\frac{1}{n}\sum_{i=1}^{n}(x_i-\mu)^2$

(C) $\frac{1}{n}\sum_{i=1}^{n}(x_i-\overline{x})^2$ (D) $\frac{1}{n-1}\sum x_i^2$

76. In sampling from a normal population $N(\mu, \sigma^2)$, the most-efficient estimator of the population mean μ is :

(A) sample mean (B) sample median

(C) mode (D) $\sum_{i=1}^{n} x_i$

77. The theory of testing parametric statistical hypothesis was originally set forth by :

(A) R.A. Fisher (B) J. Neyman

(C) A. Wald (D) E.L. Lehman

78. In testing hypothesis, power of a test is related to :

(A) type I error (B) type II error

(C) type I and II errors both (D) none of these

79. The level of significance may be defined as the probability of :

(A) type I error (B) type II error

(C) no error (D) critical region

80. The degrees of freedom in a test is related to :

(A) No. of observation in a set

(B) Hypothesis under test

(C) No. of independent observations in a set

(D) None of these

81. The ordinary run test is used for :

(A) test for randomness
(B) test for location
(C) test for scale
(D) test for association

82. Neyman-Pearson lemma provides :

(A) a consistent test
(B) a most-powerful test
(C) minimax test
(D) Bayes test

83. A test is said to be unbiased if :

(A) the power of the test is always greater than its size α
(B) the power of the test is always less than its size α
(C) power of the test is equal to its size α
(D) none of these

84. To test $H_0 : \mu = \mu_0$ Vs $H_1 : \mu > \mu_0$ when the population S.D. is known, the appropriate test is :

(A) t-test
(B) Z-test
(C) Chi-square test
(D) none of these

85. In the test of hypothesis $H_0 : \mu = \mu_0$ Vs $H_1 : \mu > \mu_0$ is said to be :

(A) one sided left tailed test
(B) one sided right tailed test
(C) two sided test
(D) none of these

86. Paired t-test is applicable when the observations in the two samples are :

(A) paired
(B) correlated
(C) equal in numbers
(D) all of these

87. The degrees of freedom for paired t-test based on n pairs of observations is :

(A) $2(n - 1)$
(B) $n - 1$
(C) $2n - 1$
(D) $n - 2$

88. Degrees of freedom for χ^2-test in case of (2×2) contingency table is :

(A) 3
(B) 4
(C) 2
(D) 1

89. Equality of several normal population means can be tested by :

(A) χ^2-test
(B) t-test
(C) Normal test
(D) F-test

90. In design of experiments for analysis of variance we use :

(A) F-test
(B) χ^2-test
(C) Z-test
(D) t-test

91. The value of statistics F will be :
(A) positive (B) negative
(C) may be positive or negative (D) none of these

92. Relative efficiency in Non-parametric tests is the ratio of :
(A) size of two tests (B) power of two tests
(C) size of samples (D) all of these

93. The concept of asymptotic relative efficiency was given by :
(A) E.J.G. Pitman (B) A.M. Mood
(C) F. Wilcoxon (D) None of these

94. Kolmogorov-Smirnov test is based on the theorem given by :
(A) N.V. Smirnov (B) A.N. Kolmogorov
(C) Kolmogorov-Smirnov (D) Glivenko-Cantelli

95. Kolmogorov-Smirnov test is a :
(A) left sided test (B) right sided test
(C) two sided test (D) all of these

96. The distribution of non-parametric sign test is :
(A) binomial (B) Poisson
(C) normal (D) none of these

97. For non-parametric sign-test we consider the difference of observed values from the median values in terms of :
(A) magnitude only (B) sign's only
(C) sign and magnitude both (D) none of these

98. The non-parametric analogous to parametric F-test is :
(A) Wilcoxon-Mann-Whitney test (B) Wald-Wolfowitz test
(C) Kolmogorov-Smirnov test (D) Mood test

99. An alternative to the paired t-test in non-parametrics is :
(A) Mood test (B) Kolmogorov-Smirnov test
(C) Wilcoxon-Signed rank test (D) Sukhatme test

100. The number of possible sample of size n out of N population without replacement is :
(A) ${}^{N}e_{n}$ (B) n !
(C) n^2 (D) (N – n)

ROUGH WORK