

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

M.Sc. (STATISTICS)

COURSE CODE : 375

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 375

Time : 2 Hours

Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the **ANSWER SHEET** using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you -1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

- 10 is the mean of a set of 7 observations and 5 is the mean of another set of 3 observations. The mean of the combined set is
(A) 15 (B) 10 (C) 8.5 (D) 7.5
- The cumulative distribution function of a random variable X is given by

$$F(x) = \begin{cases} 0; & x < 0 \\ x + \frac{1}{2}; & 0 \leq x \leq \frac{1}{2} \\ 1; & x > \frac{1}{2} \end{cases}$$
Then $P[X > 1/4]$ is
(A) 1/4 (B) 1/2 (C) 1 (D) 0
- Which one of the following is not a property of geometric mean?
(A) The geometric mean utilizes all the information available
(B) Geometric mean is greater than the arithmetic mean
(C) If a single value of the variate is zero, then the geometric mean is zero
(D) Negative value of the variate will lead to imaginary value of the geometric mean
- The pdf of a random variable is given by $f(x) = \begin{cases} ax^2(b-x); & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$ Given that the mean is 0.6 the values of a and b are
(A) 1, 12 (B) 12, 1 (C) 1, 10 (D) 10, 1
- If larger units have greater probability of their inclusion in the sample then the sampling scheme known as
(A) selection with replacement
(B) selection with probability proportional to size
(C) selection with constant probability
(D) probability selection
- If $P(\text{reject a lot} | p_0) = \alpha$ and $P(\text{accept a lot} | p_1) = \beta$ in the case of an SPRT for testing $H_0 : p = p_0$ vs $H_1 : p = p_1$ and $L(p)$ is the OC function then
(A) $L(p_0) = 1 - \beta$ (B) $L(p_0) = \alpha$ (C) $L(p_0) = \beta$ (D) $L(p_0) = 1 - \alpha$
- If a random variable X has the probability density function $f(x) = \frac{1}{4}; -2 < X < 2$ and zero elsewhere, then $P(X < 1)$ is
(A) 2/3 (B) 3/4 (C) 1/4 (D) 1/2

8. Which one of the following statements is correct for a statistic $T = \sum_{i=1}^n x_i$, where x_1, x_2, \dots, x_n is a random sample of size n from a Poisson distribution with parameter λ ?
- (A) T is a biased estimator of λ
 (B) T is not sufficient for λ
 (C) T is an efficient estimator of λ
 (D) T is an unbiased estimator for population variance
9. For a binomial distribution with $n = 10$ and $p = 1/2$, the mode of the distribution is at
- (A) $x = 2$ (B) $x = 3$ (C) $x = 4$ (D) $x = 5$
10. In Double sampling inspection plan for attributes, a second sample is taken
- (A) When the first sample does not contain any defective items
 (B) When the first sample contains only one defective item
 (C) Always
 (D) When the number of defectives in the first sample is in between two pre-assigned numbers
11. A valid t-test to assess an observed difference between two independent sample mean values requires that
- (i) both populations are independent
 (ii) the observations arise from normally distributed parent population
 (iii) the variance must be the same for both populations
- (A) (i) and (ii)
 (B) (ii) and (iii)
 (C) (i) and (iii)
 (D) all the three conditions
12. Which of the following is a non-random method of selecting samples from a population?
- (A) Multistage sampling (B) Cluster sampling
 (C) Quota sampling (D) All of the above
13. In the usual notations, two attributes S and T at 2 levels each is said to be positively associated if
- (A) $(ST) > \frac{(S)(T)}{N}$ (B) $(ST) = \frac{(S)(T)}{N}$ (C) $(ST) < \frac{(S)(T)}{N}$ (D) $(ST) = (S)(T)$

14. Factor reversal test is satisfied by
 (A) Simple aggregate index (B) Paasche's index
 (C) Laspeyre's index (D) Fisher's index
15. A player plays a game by throwing a fair dice and he gets X_i rupees if the die shows i points. The values of X_i are $X_1 = 0$, $X_2 = 20$, $X_3 = 0$, $X_4 = 40$, $X_5 = 0$, $X_6 = -30$. What is the expected gain if he plays the game once?
 (A) 2 (B) 2.5 (C) 0.25 (D) 5
16. Let X_1, X_2, \dots, X_n be a random sample from $B(1, p)$, then a consistent estimator of $p(1-p)$ is
 (A) \bar{X} (B) \bar{X}^2 (C) $\bar{X}(1-\bar{X})$ (D) $n\bar{X}$
17. If A and B are two independent events such that $P(\bar{A}) = 0.7$, $P(\bar{B}) = k$ and $P(A \cup B) = 0.8$, then the value of k is
 (A) $5/7$ (B) $2/7$ (C) 1 (D) 0
18. A random variable Y has the following distribution
- | | | | | |
|--------------|------|------|-----|-----|
| $Y :$ | -1 | 0 | 1 | 2 |
| $P(Y = y) :$ | $3k$ | $2k$ | 0.4 | 0.1 |
- The value of the constant k is
 (A) 0.10 (B) 0.15 (C) 0.20 (D) 0.01
19. 'A' can hit a target 2 times in 5 shots; 'B', 1 time in 5 shots; 'C', 2 times in 4 shots. They fire a volley. The probability that all three hit the target is
 (A) $\frac{2}{5}$ (B) $\frac{1}{5}$ (C) $\frac{1}{2}$ (D) $\frac{1}{81}$
20. Which one of the following is not a linear contrast among three treatments?
 (A) $T_1 + 2T_2 - T_3$ (B) $T_1 - T_3$
 (C) $T_1 - 2T_2 + T_3$ (D) $-T_1 + 2T_2 - T_3$
21. The Central limit theorems tells that the sampling distribution of a statistic is approximately normal. Which of the following conditions are necessary for the theorem to be valid?
 (A) Sample size has to be large
 (B) Population from which the samples are drawn is normal
 (C) Population variance has to be small
 (D) Population from which the samples are drawn in symmetric

22. Let $X_1 \sim N(\mu = 2, \sigma^2 = 1)$ and $X_2 \sim N(\mu = 3, \sigma^2 = 2)$ and X_1 and X_2 are independent. Then the distribution of $2X_1 + 3X_2$ is
 (A) $N(12, 15)$ (B) $N(15, 12)$ (C) $N(22, 13)$ (D) $N(13, 22)$
23. The process of reducing the experimental error by dividing the relatively heterogeneous experimental area into homogeneous blocks is known as
 (A) randomization (B) replication
 (C) local control (D) experimental error
24. If the coefficient of correlation between two variables is -0.4 , then the coefficient of determination is
 (A) 0.84 (B) 0.6 (C) 0.16 (D) -0.6
25. Let X follow uniform distribution over the interval $(2, 4)$. Then the mean and variance of X are
 (A) $3, 1/3$ (B) $2/3, 4$ (C) $1/3, 6$ (D) $1/3, 2$
26. If the two lines of regression are obtained as $2x + 3y = 6$ and $2x + 4y = 2$, then the arithmetic mean of x and y is
 (A) $9, -4$ (B) $-9, 4$ (C) $4, 9$ (D) $-4, 9$
27. If the regression coefficients of x on y and y on x are respectively -1 and -0.25 , the correlation coefficient between x and y is
 (A) 0.5 (B) -0.5 (C) 0 (D) -1
28. A non parametric alternative to the analysis of variance test for data arising from a Randomized block design is
 (A) Kruskal Wallis test (B) Run test
 (C) Median test (D) Friedman test
29. The proportion of variability of the dependent variable accounted for or explained by the independent variable in a regression model is
 (A) Co-efficient of association (B) Yule's coefficient
 (C) Co-efficient of determination (D) Co-efficient of variation
30. For a bivariate set of 5 observations, if the sum of squares of difference in ranks is obtained as 24, then the value of rank correlation is
 (A) 0.2 (B) -0.4 (C) 0.40 (D) -0.2

31. A family of parametric distributions, for which the mean and variance does not exist, is
 (A) Polya's distribution (B) Cauchy distribution
 (C) Negative binomial distribution (D) Pareto distribution
32. A Statistical diagram that utilizes the upper and lower quartiles along with the median and the two most extreme values is known as
 (A) Scatter diagram (B) Lorenz Curve
 (C) Box Plot (D) Pareto Chart
33. Errors such as unclear definitions, defective questionnaires and poorly conceived concepts are classified as
 (A) Sampling error (B) Conceptual error
 (C) Controlled error (D) Non-Sampling error
34. The coefficient of correlation is independent of
 (A) change of scale only
 (B) change of origin only
 (C) both change of scale and origin
 (D) neither change of scale nor change of origin
35. For a positively skewed frequency distribution curve, the third central moment
 (A) is greater than zero (B) is equal to zero
 (C) is less than zero (D) does not exist
36. If two independent random variables X and Y have Poisson distribution with parameter 3 and 4 respectively, then $P(X + Y = 0)$ is
 (A) e^{-3} (B) e^{-4} (C) e^{-7} (D) e^{-12}
37. A lower bound to the variance of an unbiased estimator is obtained by
 (A) Rao Blackwell theorem (B) Rao-Cramer inequality
 (C) Method of maximum likelihood (D) Method of moments
38. If $P(A) = 0.3$, $P(B) = 0.4$ and $P(A \cap B) = 0$ then $P(A \cup B^c)$ is equal to
 (A) 0.7 (B) 0.6 (C) 0.8 (D) 0.9
39. The r.v. X has the p.d.f. $f(x) = ae^{-ax}$, $0 < x < \infty$ then the c.d.f. is
 (A) $1 - e^{-\frac{x}{a}}$ (B) $1 - e^{\frac{x}{a}}$ (C) $1 - e^{-ax}$ (D) $1 - e^{ax}$

40. X is a random variable taking values 1 and 2 with probabilities p and q , $p+q=1$. To test $H: p=0.2$, a single observation is made on X (say x). A test rejects H if $x=1$. What is the size of the test?
 (A) 0.8 (B) less than 0.2 (C) greater than 0.2 (D) 0.2
41. If T is an unbiased estimator of θ , then
 (A) T has no error
 (B) the error in T will tend to 0 as the sample size tends to ∞
 (C) The average error is zero
 (D) T has both the errors
42. Control charts are used to
 (A) Identify the presence of chance causes
 (B) Identify the trend of the process
 (C) Identify the behaviour of the process
 (D) Identify the tool consumption rate
43. X takes the value 0,1,2,3 with respective probabilities 0.1, 0.3, 0.5, 0.1. What is the mean of $Y = X^2 + 2X$?
 (A) 20 (B) 16 (C) 15.1 (D) 6.4
44. In a normal distribution 30% of items are above 42 and 30% of the items are below 28. What is the mean of the distribution?
 (A) cannot be found since the variance is not given
 (B) 21
 (C) 35
 (D) 7
45. If data in a two-way classification are displayed in r rows and c columns, then the degrees of freedom for the error sum of squares is
 (A) $r-1$ (B) $c-1$ (C) $r(c-1)$ (D) $(r-1)(c-1)$
46. Decomposing a time series refers to breaking down past data into a components of
 (A) constant and variation
 (B) trend, cycle and random variations
 (C) tactical and operational variations
 (D) long term, short term and medium term variations

47. The power of a statistical test depends upon
- (i) sample size
 - (ii) level of significance
 - (iii) variance of sampled population
 - (iv) the difference between the value specified by the null and the alternative hypothesis
- (A) (i) and (ii) (B) (ii) and (iii) (C) (i) and (iv) (D) all the four
48. If the events are mutually exclusive, then
- (A) their probabilities sum to zero
 - (B) their probabilities sum to one
 - (C) both events cannot occur at the same time
 - (D) both of them contain every possible outcome of an experiment
49. What is the probability that a value chosen at random from a population is larger than the median of the population?
- (A) 0.25 (B) 0.50 (C) 0.75 (D) 1
50. If the population proportion is 0.5 and the standard error of sample proportion is 0.01, then the required sample size is
- (A) 250 (B) 2500 (C) 3000 (D) 3500
51. The police chief of a city knows that the probabilities for 0, 1, 2, 3, 4 or 5 car thefts on any given day are 0.21, 0.37, 0.25, 0.13, 0.03 and 0.01. The number of cars thefts that the police can expect per day is
- (A) 1.43 (B) 1.45 (C) 2.13 (D) 2.12
52. Producer's risk is the
- (A) Probability of rejecting a good lot
 - (B) Probability of accepting a good lot
 - (C) Probability of rejecting a bad lot
 - (D) Probability of accepting a bad lot
53. In a Double Sampling Inspection Plan for attributes, the number of plan parameters is
- (A) 2 (B) 3 (C) 4 (D) 11

54. Type-I error is the event of
- Rejecting the null hypothesis when it is not true
 - Rejecting the null hypothesis when it is true
 - Accepting the null hypothesis when it is not true
 - Accepting the null hypothesis when it is true
55. In the Wald-Wolfowitz Run Test, the hypothesis tested is
- The equality of means of the two populations
 - The equality of variances of the two populations
 - The equality of medians of the two populations
 - The equality of densities of the two populations
56. A population will be called stationary if
- it is of constant size over time
 - it is of constant age over time
 - it is of constant size, age and/or sex composition over time
 - it is of constant sex composition over time.
57. The weights used in a quantity index are
- percentage of total quantity
 - average of quantities
 - prices
 - none of these
58. Symbolically $P_{0n} \times P_{n0} = 1$ stands for
- circular test
 - factor reversal test
 - time reversal test
 - none of these
59. The test statistic used for testing the $H_0: \rho = 0$ against $H_1: \rho > 0$, ρ being the population correlation coefficient is $t = \frac{r}{\sqrt{1-r^2}} \sqrt{n-2}$, r being the sample correlation coefficient, The hypothesis is rejected if
- r is positive and $t \geq t_{\alpha, n-2}$
 - r is negative and $t \geq t_{\alpha, n-2}$
 - r is positive and $t = t_{\alpha, n-1}$
 - r is negative and $t = t_{\alpha, n}$
60. Crude rate of natural increase, vital index, net reproduction rate are some of the measures of
- Population growth
 - Infant mortality
 - Fertility rate
 - Mortality

61. The values of t for which $\begin{vmatrix} t-2 & 3 \\ 4 & t-1 \end{vmatrix} = 0$ are

- (A) 4, 0 (B) 6, 2 (C) -5, 2 (D) 5, -2

62. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$ then A^{-1} is equal to

(A) $\begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$

(B) $\begin{bmatrix} 1/a & 0 & 0 \\ 0 & 1/b & 0 \\ 0 & 0 & 1/c \end{bmatrix}$

(C) $\begin{bmatrix} -a & 0 & 0 \\ 0 & -b & 0 \\ 0 & 0 & -c \end{bmatrix}$

(D) $\begin{bmatrix} bc & 0 & 0 \\ 0 & ca & 0 \\ 0 & 0 & ab \end{bmatrix}$

63. If $M = \begin{bmatrix} 1 & 1 & 0 \\ -1 & 1 & 2 \\ 2 & 2 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ then the rank of M is equal to

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

64. The sequence $a_n = \frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{2n}$ is convergent and its limit lies between

- (A) 0 and 1 (B) $1/4$ and 1 (C) 0 and $1/2$ (D) $1/2$ and 1

65. If one root of the equation $x^2 + px + q = 0$ is $3 - i\sqrt{2}$, then the value of p and q are

- (A) -6, 11 (B) 6, 11 (C) -6, 7 (D) -6, 14

66. If $f(x) = \begin{cases} x, & x \leq 1 \\ ax, & 1 < x < 2 \\ x^2 + bx + 4, & x \geq 2 \end{cases}$ and $f(x)$ is differentiable everywhere then the value of a and b is

- (A) $a = 1, b = -2$ (B) $a = 3, b = -4$ (C) $a = 2, b = -3$ (D) $a = 1, b = -3$

67. A square matrix is said to be idempotent if

- (A) $A^{1/2} = A$ (B) $A^2 = A$ (C) $A^{1/3} = A$ (D) $A^3 = A$

68. The value of the integral $\int_0^{\infty} \frac{x^3}{(1-x)^7} dx$ is
 (A) $\frac{1}{60}$ (B) 60 (C) $\frac{1}{30}$ (D) 30
69. If the matrix $\begin{bmatrix} -1 & 3 & 2 \\ 1 & k & -3 \\ 1 & 4 & 5 \end{bmatrix}$ has an inverse then the value of k is
 (A) k is any real number (B) $k = -4$
 (C) $k \neq -4$ (D) $k = 4$
70. If $a * b = a + b - ab$. What is the value of $3 * (4 * 5)$
 (A) 25 (B) 15 (C) 10 (D) 5
71. $\lim_{t \rightarrow 0} \frac{1 - e^{-t}}{t}$ is
 (A) 1 (B) 0 (C) -1 (D) not defined
72. If one root of the equation $x^2 - ax + 1 = 0$ is α , then the other root is
 (A) $\frac{1}{\alpha}$ (B) $-\frac{1}{\alpha}$ (C) $1 - \alpha$ (D) $1 + \alpha$
73. If B is an infinite subset of a countable set A , then B is
 (A) uncountable (B) countable (C) open (D) closed
74. The matrix $\begin{pmatrix} 1 & -1 & 4 \\ 2 & -1 & 5 \\ 2 & -2 & 8 \end{pmatrix}$
 (A) singular with rank 2 (B) non-singular with rank 3
 (C) singular with rank 1 (D) non-singular with rank 2
75. The value of $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ is
 (A) 1 (B) 0 (C) $1/2$ (D) 2
76. The sequence $\{s_n\}$ of real numbers, is said to be non-decreasing if
 (A) $s_n < s_{n+1} \forall n$ (B) $s_n \leq s_{n+1} \forall n$
 (C) $s_n > s_{n+1} \forall n$ (D) $s_n \geq s_{n+1} \forall n$

77. If A and B are two row vectors of the same order, then which one of the following is true?
- (A) $A'B$ does not exist (B) AB' is a scalar quantity
(C) $A'B = AB'$ (D) AB will exist
78. If x is a number satisfying $2 < x < 3$ and y is such that $7 < y < 8$, which of the following expressions will have the largest value?
- (A) x^2y (B) xy^2 (C) $5xy$ (D) x^2/y
79. If $x \log_{10} 4 = 2 \log_{10} (1 - 2^x)$, then x is equal to
- (A) 0 (B) 1 (C) -1 (D) $1/2$
80. The matrix $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ is
- (A) singular (B) orthogonal
(C) skew symmetric (D) negative semi definite
81. If $f(x)$ is real valued function defined on $[0, \infty]$ such that $f(0) = 0$ and $f''(x) > 0$, for all x then the function $h(x) = \frac{f(x)}{x}$ is
- (A) increasing in $[0, \infty]$
(B) decreasing in $[0, 1]$
(C) increasing in $[0, 1]$ and decreasing in $[1, \infty]$
(D) decreasing in $[0, 1]$ and increasing in $[1, \infty]$
82. $\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{3n+k}$ is
- (A) $\log \frac{4}{3}$ (B) $\log \frac{3}{4}$ (C) $\log \frac{3}{2}$ (D) $\log \frac{5}{4}$
83. Let P and Q be square matrix such that $PQ = I$, the identity matrix. Then zero is an eigen
- (A) P but not of Q (B) Q but not of P
(C) Both P and Q (D) neither P nor Q

84. $\frac{d}{dx} \int_{\sin^2 x}^{2\sin x} e^{t^2} dt$ at $x = \pi$ is
 (A) 1 (B) -1 (C) 2 (D) -2
85. If the characteristic equation of a matrix M be $\lambda^2 - \lambda - 1 = 0$, then
 (A) M^{-1} does not exist
 (B) M^{-1} exist but cannot be determined form of data
 (C) $M^{-1} = M + 1$
 (D) $M^{-1} = M - 1$
86. Which of the following is not an integer in C++?
 (A) char (B) long (C) short (D) integer
87. Which of the following is the correct size of a decimal data type in C++?
 (A) 8 bytes (B) 4 bytes (C) 16 bytes (D) 10 bytes
88. A function call mechanism in C++ that passes arguments to a function by passing a copy of the values of the arguments is
 (A) call by name (B) call by value
 (C) call by reference (D) call by value result
89. The operator that cannot be overloaded in C++ is
 (A) ++ (B) () (C) :: (D) ~
90. Which of the following statement is correct?
 (A) information is never lost during narrowing conversions
 (B) the C Integer () function can be used to correct
 (C) widening conversions take place automatically
 (D) assigning an integer to an object type is known as Un boxing
91. What does stderr represents in C?
 (A) standard error (B) standard error types
 (C) standard error streams (D) standard error definitions

92. If the two strings are identical, then `strcmp()` function returns
 (A) -1 (B) 1 (C) 0 (D) yes
93. What will happen in a C program, if a value is assigned to an array element whose subscript exceeds the size of the array?
 (A) the element will be set to '0'
 (B) the compiler would report an error
 (C) the program may crash if some important data gets overwritten
 (D) the array size would appropriately grow
94. The purpose of structure, union and enumeration in C is to
 (A) define new values (B) define new data types
 (C) define new pointers (D) define new structures
95. Which of the following data types cannot be used in the condition of switch - case statement?
 (A) character (B) integer (C) float (D) enum
96. In order to find and select particular cells, the short cut key to be used in MS- Excel is
 (A) Ctrl + W (B) Ctrl + F
 (C) Alt + Shift + F (D) Ctrl + Shift + T
97. The statistical function used to compute the *p*-value for Student's *t*-distribution in MS-Excel is
 (A) `TINV()` (B) `TDIST` (C) `TTEST` (D) `CHIDIST`
98. What is the shortcut button used to close a excel MS-Excel worksheet?
 (A) Ctrl +X (B) Ctrl + W (C) Alt + F4 (D) Ctrl + F4
99. From which Excel ribbon, header and footer for an Excel document can be placed?
 (A) Page Layout (B) View (C) Insert (D) Data
100. Which of the following function is more appropriate for reading in a multi-word string?
 (A) `printf()` (B) `scanf()` (C) `gets()` (D) `return`