ENTRANCE EXAMINATION FOR ADMISSION, MAY 2010.

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 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.

1. What is the mean of the following distribution?

x:	1	2	3	...	n
f_x:	1	2	3	...	n

(A) $\frac{n(n+1)}{2}$ (B) $\frac{n(n+1)(2n+1)}{6}$

(C) 1 (D) $\frac{2n+1}{3}$

2. 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

3. For a positively skewed frequency distribution curve

(A) $\mu_3 > 0$ (B) $\mu_3 < 0$

(C) $\mu_3 = 0$ (D) μ_3 does not exist

4. Suppose X is a continuous random variable with Uniform distribution having mean 1 and variance 4/3. What is $P(X < 0)$?

(A) 0 (B) $\frac{1}{4}$ (C) $\frac{1}{12}$ (D) $\frac{1}{2}$

5. If two independent random variables X and Y have Poisson distribution with parameters 3 and 4 respectively, then $P(X+Y=0)$ is

(A) e^{-3} (B) e^{-4} (C) e^{-7} (D) e^{-12}

6. If $X \sim N(0, 1)$ then X^2 is a

(A) χ^2 variate with n.d.f. (B) χ^2 variate with 1 d.f.

(C) Normal variate (D) Standard normal variate

7. If the sample mean $\overline{X}$ is an estimate of population mean μ, then $\overline{X}$ is

(A) unbiased and efficient (B) unbiased and inefficient

(C) biased and efficient (D) biased and inefficient

8. A lower bound to the variance of an unbiased estimate is obtained by

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

(C) Method of maximum likelihood (D) Method of moments

9. 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

10. The r.v. X has the p.d.f. $f(x) = ae^{-ax}$; $0 < x < \infty$ then the c.d.f. is

(A) $1 - e^{-x/a}$ (B) $1 - e^{x/a}$ (C) $1 - e^{-ax}$ (D) $1 - e^{ax}$

11. The PGF of the discrete random variable N is

$G_N(t) = 1 + (t-1)(0.2t + 0.6)$ then $P(y = 2)$ is equal to

(A) 0.3 (B) 0.2 (C) 0.4 (D) 0.5

12. If X follows Poisson with parameter 5 then the PGF of $y = 2X + 3$ is equal to

(A) $t^2 e^{5(t^2-1)}$ (B) $t^3 e^{5(t^2-1)}$ (C) $\frac{e^{5(t^2-1)}}{t}$ (D) $\frac{e^{-5(t^2-1)}}{t}$

13. If the number of the levels of each factor in factorial experiment is different then the experiment is called as

(A) symmetrical factorial (B) asymmetrical factorial

(C) incomplete (D) simple

14. The ANOVA table for a RBD is given below :

Source of variation	D.F.	S.S.	M.S.S	F ratio
Treatments	2	72	–	X
Blocks	3	–	–	Y
Error	–	12	–	
Total	11	126		

After finding the missing entries the value of F for treatments x and blocks y are respectively

(A) $x = 7,\ y = 18$ (B) $x = 18,\ y = 7$

(C) $x = 12,\ y = 6$ (D) $x = 6,\ y = 12$

15. 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

16. Control chart for the number of defects is

(A) c-chart (B) p-chart

(C) np-chart (D) R-chart

17. The average quality of the product after sampling and 100% inspection of rejected lots is called

(A) AOQL (B) AOQ

(C) RQL (D) LTPD

18. Vital rates are customarily expressed as

(A) percentages (B) per thousand

(C) per million (D) per trillion

19. The empirical relation between the measures of dispersion is

(A) M.D. $= \frac{3}{4}(S.D.)$ (B) M.D. $= \frac{4}{3}(S.D.)$

(C) M.D. $= \frac{4}{5}(S.D.)$ (D) M.D. $= \frac{5}{4}(S.D.)$

20. If $V(X) = \sigma^2$, then $V(Y)$ where $Y = (ax + b)/c$ is

(A) $\frac{a}{c}\sigma^2$ (B) $\frac{a^2}{c}\sigma^2$ (C) $\frac{a^2}{c^2}\sigma^2$ (D) $\frac{a\sigma^2 + b}{c}$

21. The empirical relation between mean, median and mode is

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

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

22. If $A \subset B$ then $P(B - A)$ is equal to

(A) $P(B) - P(A)$ (B) $P(B)$ (C) $P(A)$ (D) $P(A \cap B)$

23. A card is drawn at random from a pack of cards, the probability of its being a court card is

(A) 3/13 (B) 1/52 (C) 10/13 (D) 1/2

24. The discrete and continuous distributions possessing the memory less property are

(A) Binomial and Exponential (B) Geometric and Exponential

(C) Poisson and Exponential (D) Hypergeometric and Exponential

25. For which one of the following distribution the mean and variance are equal

(A) Standard Normal (B) Binomial

(C) Poisson (D) Geometric

26. Let $x_1, x_2, \ldots x_n$ be a random sample from a population with unknown mean μ and variance σ^2. Then the unbiased estimator of σ^2 is

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

(C) $\frac{1}{n-1}\sum_i^n (x_i - \bar{x})^2$ (D) $\frac{1}{n}\sum_i^n (x_i - \bar{x})^2$

27. If X follows $N(\mu, \sigma^2)$ then $E(\overline{X}^2)$ with usual notation is

(A) $\frac{\sigma^2}{n}+\mu^2$ (B) $\sigma^2+n\mu^2$ (C) $n(\sigma^2+n\mu^2)$ (D) $n\sigma^2+\mu^2$

28. If T_1 and T_2 be two unbiased estimators of a parameter θ, then the efficiency of T_1 with respect to T_2 is

(A) $V(T_1)+V(T_2)$ (B) $V(T_2)/V(T_1)$

(C) $V(T_1)-V(T_2)$ (D) $V(T_1)/V(T_2)$

29. Which one of the following is not a basic principle of design of experiments?

(A) Randomization (B) Local control

(C) Confounding (D) Replication

30. In an analysis of variance problem for one way classification with three classes and three observations per class, the F-value is 1.5 and the total sum of square is 18. Then the mean square between classes is

(A) 2 (B) 3 (C) 4 (D) 5

31. In the layout of randomized block design with five treatments, each replicated three times, the 15 plots will be grouped into

(A) 5 blocks of 3 plots each (B) 3 blocks of 5 plots each

(C) 15 blocks of 1 plots each (D) 1 blocks of 15 plots each

32. In process control by Shewart's Control-Chart technique, we try to find out

(A) Variations due to random causes

(B) The probability distribution of the process

(C) Variations due to assignable causes

(D) A process with less investment

33. In constructing Control-charts the samples are taken when

(A) the production is over (B) the production is ongoing

(C) the production is about to start (D) the specifications are determined

34. 10 samples (of size 1 each) are taken from a process and Mean chart is constructed. If the two control limits are placed in a distance at 12 units from each other, then the process variance is

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

35. The Maximum Likelihood Estimator of θ in a random sample of size n from $U(0, \theta)$ is

(A) The sample mean (B) The sample median

(C) The largest order statistic (D) The smallest order statistic

36. Let $X_1, X_2, \ldots, X_n$ be a random sample from $B(1, p)$, then a consistent estimator of $p(1-p)$ is

(A) $\overline{X}$ (B) $\overline{X}^2$ (C) $\overline{X}(1-\overline{X})$ (D) $n \cdot \overline{X}$

37. If T_1 is an MVUE of $\gamma(\theta)$; $\theta \in \Theta$ and T_2 is any other unbiased estimator of $\gamma(\theta)$ with efficiency e_θ, the correlation coefficient between T_1 & T_2, say ρ_θ, equals

(A) e_θ (B) e_θ^2 (C) $\frac{1}{\sqrt{e_\theta}}$ (D) $\sqrt{e_\theta}$

38. Every UMP critical region is necessarily

(A) Biased (B) A null set

(C) An infinite set (D) Unbiased

39. Suppose that the probability of being left handed is 0.1. Then the probability that four independently selected individuals are left handed is

(A) 0.001 (B) 0.002 (C) 0.0001 (D) 0.003

40. A hotel has 10 rooms in a row on one floor. The clerk assigns guests to these rooms at random. If the rooms are all empty and two guests arrive, what is the probability that they will be assigned adjoining rooms?

(A) 2/5 (B) 3/5 (C) 4/5 (D) 1/5

41. Which one of the following is not a property of variance?

(A) Adding a constant value to a r.v. X does not affect the original population variance of X

(B) Multiplying a r.v. X by a constant value multiples the variance of X by a factor equal to the square of the constant

(C) Variance of a sum of random variables is always equal to the sum of the variance of individual random variables

(D) Variance is always non-negative

42. The probability of observing a more extreme value of the test statistic than the value observed, when the null hypothesis is true, is

(A) statistic (B) parameter

(C) p-value (D) level of significance

43. An error rate set by the investigator measured in terms of the probability of incorrectly rejecting the null hypothesis when the null hypothesis is true is

(A) p-value (B) critical region

(C) level of significance (D) type II error

44. The probability of correctly rejecting the null hypothesis when the alternative hypothesis is true is called

(A) Level of significance (B) Type I error

(C) Power (D) Statistic

45. If X follows an F distribution with (2, 4) degrees of freedom, then $\frac{1}{X}$ follows

(A) An F distribution with (4, 2) degrees of freedom

(B) An F distribution with (2, 4) degrees of freedom

(C) A Student's t-distribution with 6 degrees of freedom

(D) A Chi-square distribution with 2 degrees of freedom

46. Which one of the following is a relative measure of dispersion?

(A) standard deviation (B) variance

(C) coefficient of variation (D) all of the above

47. The first cattle census on all India basis was conducted from

(A) December 1920 to April 1921 (B) December 1919 to April 1920

(C) December 1918 to April 1919 (D) December 1948 to April 1949

48. Which one of the following statements is not a true statement?

(A) The correlation coefficient is the geometric mean of the two regression coefficients

(B) The square of the correlation coefficient is always less than equal to 1

(C) The correlation coefficient will be between the two regression coefficients

(D) Both regression coefficients should be > 1 or < 1

49. The mean of a random samples of 16 observations for $N(\mu, \sigma^2 = 4)$ distribution is 25. The 95% confidence interval for μ is approximately

(A) (24, 26) (B) (24.5, 25.5)

(C) (21, 29) (D) (23, 27)

50. If (20, 30) is a 90% Confidence Interval (C.I.) for a parameter θ then which one of the following is a correct statement about the confidence interval

(A) With probability 90% θ will be in the interval (20, 30)

(B) θ will be in the middle of the confidence interval with a longer probability (> 90%) than towards the end of C.I.

(C) (20, 30) is a C.I. randomly selected from a collection of intervals 90% of which contain θ

(D) All other intervals will contain θ with probability less than 90%

51. X is 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

52. 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

53. 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

54. 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

55. 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) $(r-1)(c-1)$

56. The aggregate index formula using base period quantities is called

(A) Laspeyre's index (B) Fisher's index

(C) Bowley's index (D) Paasche's index

57. The father of Indian statistical movement

(A) C.R. Roa (B) P.C. Mahalanobis

(C) P.V. Sukhatme (D) P.K. Sen

58. Fisher's ideal index formula satisfies

(A) Circular test (B) Time reversal test

(C) Factor reversal test (D) Both (B) and (C)

59. If $P(A) = 1/3$, $P(B) = 1/2$ and $P(A \mid B) = 1/4$ then $P(B \mid A^c)$ is equal to

(A) 7/16 (B) 6/16 (C) 9/16 (D) 3/16

60. The PGF of a random variable X where $P(X=0)=0.5$, $P(X=1)=0.3$ and $P(X=3)=0.2$ is

(A) $0.3t+0.2t^3$ (B) $0.5+0.3t$

(C) $0.5+0.3t+0.2t^3$ (D) $0.2t^3$

61. Let $f(x)=\dfrac{|x|}{x}$; $x\neq 0$, $f(0)=0$, then,

(A) f is continuous at all x

(B) the right and left limits of f do not exits at $x=0$

(C) f has a discontinuity of the first kind at $x=0$

(D) f has a discontinuity of the second kind at $x=0$

62. A is a real n-rowed square matrix and n is an odd number. Which one of the following statement is definitely true?

(A) All the eigen values of A are real (B) A has at least one real eigen value

(C) All the eigen values of A are complex (D) None of the above

63. For the sequence 1, 0, 2, 1, 0, 2, 1, 0, 2, 1, ... the limit superior (L) and limit inferior (l) are

(A) $L=1, l=2$ (B) $L=0, l=2$ (C) $L=2, l=0$ (D) $L=2, l=2$

64. If $2x^3-6x^2+13x-10$ is divided by $x+1$, the remainder is

(A) 30 (B) –30 (C) 31 (D) –31

65. The equation $3x^3-4x^2+x+88=0$ has one of its roots $2+\sqrt{7}$. The other two roots are

(A) $(2-\sqrt{-7}, 8/3)$ (B) $(2-\sqrt{-7}, 7/3)$

(C) $(2-\sqrt{7}, -8/3)$ (D) $(2-\sqrt{-7}, \frac{1}{2})$

66. If $x+y>4$ and $x<3$, then $y>1$ is true. Under which condition is this statement true?

(A) Always (B) Only if $x<0$ (C) Only if $x>0$ (D) never

67. If $x+y+z=8$ and $x^2+y^2+z^2=50$ then what is the value of $xy+yz+zx$?

(A) 14 (B) 10 (C) 7 (D) $7\sqrt{2}$

68. The operation '*' applied to a number gives, as its result, 10 subtracted from twice that number. What is *(*(*9))?

(A) –11 (B) 2 (C) 0 (D) –2

69. 20% of a larger number is 2.3 less than 30% of a smaller number. The larger number also exceeds the smaller number by 10. What is the value of the larger number?

(A) 67 (B) 33 (C) 53 (D) 47

70. Suppose A is orthogonal then det (A) is equal to

(A) 1 (B) –1 (C) 0 (D) ± 1

71. A complex matrix A is said to be unitary matrix if

(A) $AA^T = A^T A$ (B) $AA^T = A^T A = I$

(C) $AA^H = A^H A$ (D) $AA^H = A^H A = I$

72. If $A = \begin{bmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{bmatrix}$ then $|A|$ is equal to

(A) $(a-b)(b-c)(c-a)$ (B) $(a-b)(b+c)(c-a)$

(C) $(a-b)(b-c)(c+a)$ (D) $(a-b)(b-c)(c-a)(a+b+c)$

73. If $A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1+a & 1 & 1 \\ 1 & 1 & 1+b & 1 \\ 1 & 1 & 1 & 1+c \end{bmatrix}$ then $|A|$ is equal to

(A) $(1+a)(1+b)(1+c)$ (B) abc

(C) $1+abc$ (D) $(1+a)(1+bc)$

74. The solution of $\begin{aligned} 2x+y-z &= 3 \\ x+y+z &= 1 \\ x-2y-3z &= 4 \end{aligned}$ is

(A) (0, 1, 2) (B) (2, 1, 0)

(C) (2, –1, 0) (D) (–2, 1, 0)

75. If $M = \begin{pmatrix} 3 & 4 & 0 & 0 & 0 \\ 2 & 5 & 0 & 0 & 0 \\ 0 & 9 & 2 & 0 & 0 \\ 0 & 5 & 0 & 6 & 7 \\ 0 & 0 & 4 & 3 & 4 \end{pmatrix}$, then $|M|$ is

(A) 42 (B) 40 (C) 60 (D) 64

76. The slope of the tangent line to the curve $x^2 + 2xy - 3y^2 = 9$ at the point (3, 2) is

(A) 2/3 (B) 5/3 (C) 3/2 (D) 3/5

77. The maximum of $f(x) = \frac{x}{2} - \sin x$ in $[0, 2\pi]$ is

(A) $\frac{\pi}{6} - \frac{\sqrt{3}}{2}$ (B) $\frac{\pi}{6} + \frac{\sqrt{32}}{}$

(C) $\frac{5\pi}{6} + \frac{\sqrt{3}}{2}$ (D) $\frac{5\pi}{6} - \frac{3}{2}$

78. $\int \left(\frac{\sec x}{1+\tan x}\right)^2 dx =$

(A) $\frac{1}{1+\tan x}$ (B) $-\frac{1}{1+\tan x}$ (C) $\frac{\sec x}{\tan x}$ (D) $\frac{\sec x}{1+\tan x}$

79. $\int_0^{\frac{\pi}{2}} \sqrt{\sin x + 1} \cos x \, dx =$

(A) $2\sqrt{2}$ (B) $2\sqrt{2} - 1$ (C) $\frac{2}{3}(2\sqrt{2} - 1)$ (D) $\sqrt{2}$

80. $\int \frac{\ln x}{x^2} dx =$

(A) $-\frac{1}{x}$ (B) $-\frac{1}{x}(\ln x + 1)$

(C) $-(\ln x + 1)$ (D) $\frac{1}{x}(\ln x + 1)$

81. What is the value of c so that $y(x) = c(1-x^2)$ satisfies the given initial condition $y(0) = 1$?

(A) $c = 0$ (B) $c = -1$ (C) $c = 1$ (D) $c = \frac{1}{2}$

82. If $f(x) = x^n$, where n is a positive integer then the value of $\sum_{r=0}^{n} \frac{f^{(r)}(1)}{r!}$ is

(A) 0 (B) -1 (C) 2^n (D) 2^{n-1}

83. The value of $\int e^{\sqrt{x}}\, dx$ is

(A) $2e^{\sqrt{x}}\left(\sqrt{x}+1\right)+c$ (B) $2e^{\sqrt{x}}\left(\sqrt{x}-1\right)+c$

(C) $e^{\sqrt{x}}\left(\sqrt{x}+1\right)+c$ (D) $e^{\sqrt{x}}\left(\sqrt{x}-1\right)+c$

84. What is the value of $\int_{1/e}^{e} |\log x|\, dx$?

(A) $1-1/e$ (B) $2(1-1/e)$

(C) $1/e-1$ (D) $2(1/e-1)$

85. The derivative of every odd function is

(A) odd function (B) even function

(C) implicit function (D) composite function

86. If $\frac{x+1}{(x-a)(x-3)} = \frac{2}{(x-a)} + \frac{b}{(x-3)}$, then the value of (a, b)

(A) $(7, -1)$ (B) $(-4, 1)$ (C) $(4, 1)$ (D) $(-4, -1)$

87. If the expansion of $\left(x - \frac{1}{x^2}\right)^{2n}$ contains a term independent of x, then n is a multiple of

(A) 5 (B) 2

(C) 3 (D) 6

88. 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

89. If A is a square matrix of order n with $|A| = 0$, then the rank of the matrix A is

(A) Less than n (B) Equal to n

(C) More than n (D) Unity

90. The system of linear equations $2x - 4y = 7$; $3x - 6y = 5$, is having

(A) Unique solution (B) Infinite number of solution

(C) No solution (D) Inconsistency

91. The vector $(\pi, 2, 5\pi)$ belongs to the Vector Space

(A) R^2 (B) R (C) R^3 (D) C

92. Find x and y if $(4, y) = x(2, 3)$

(A) $x = 1,\ y = 1$ (B) $x = 2,\ y = 6$

(C) $x = 3,\ y = 1$ (D) $x = 1,\ y = 6$

93. When n is even, $\binom{n}{r}$ is greatest when

(A) $r = \frac{n}{2} + 1$ (B) $r = \frac{n}{2}$

(C) $r = \frac{n-1}{2}$ (D) $r = \frac{n+1}{2}$

94. The value of $\log_5 5 . \log_4 9 . \log_3 2$ is

(A) 2 (B) 1 (C) 5 (D) 4

95. $P = \{1, 1.1, 1.3, 1.5, 1.7, 1.9, 2\}$ is a partition of the interval

(A) (1, 2) (B) [0, 1]

(C) [1, 2] (D) (0, 1)

96. If a,b and c are in Arithmetic Progression (A.P) as well as in Geometric Progression (G.P), then

(A) $a = b$ (B) $a = b = c$

(C) $\frac{a}{b} = \frac{c}{d}$ (D) $b = c$

97. The series $\sum_{n=1}^{\infty} \frac{1}{n}$

(A) Converges to 0 (B) Converges to 1

(C) Diverges (D) Converges to $\frac{1}{2}$

98. 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) $s_n \geq s_{n+1} \forall_n$

99. The value of $\int_0^1 x(1-x)^4 \, dx$ is

(A) 1/12 (B) 1/30

(C) 1/24 (D) 1/20

100. If $\frac{1-i}{1+i}$ is a root of the equation $ax^2 + bx + 1 = 0$ when (a, b) are real then (a, b) is

(A) (1, 1) (B) (1, –1)

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