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ROLL No. [| | | | |]

QN. BOOKLET No. **009**

TEST FOR POST GRADUATE PROGRAMMES

STATISTICS

Time: 2 Hours

Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Question Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil your OMR Sheet. Read carefully all the instructions given on the OMR Sheet.
2. Write your Roll Number in the space provided on the top of **this page.**
3. Also write your Roll Number, Test Code, Test Centre Code, Test Centre Name, Test Subject and the date and time of the examination in the columns provided for the same on the **Answer Sheet.** Darken the appropriate bubbles with HB pencil.
4. The paper consists of 150 objective type questions. All questions carry equal marks.
5. Each Question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by **HB pencil** corresponding to the correct response as indicated in the example shown on the Answer Sheet. Also write the alphabet of your response with ball pen in the starred column against attempted questions and put an '×' mark by ball pen in the starred column against unattempted questions as given in the example in the OMR Sheet.
6. Each correct answer carries 3 marks and each wrong answer carries 1 minus mark.
7. Please do your rough work only on the space provided for it at the end of this question booklet.
8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However Question Booklet may be retained with the Candidate.
9. Every precaution has been taken to avoid errors in the Question Booklet. In the event of such unforeseen happenings, suitable remedial measures will be taken at the time of evaluation.
10. Please feel comfortable and relaxed. You can do better in this test in a tension-free disposition.

WISH YOU A SUCCESSFUL PERFORMANCE

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STATISTICS

1. The mean of the following distribution is

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

(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 $\frac{4}{3}$. Then $P(X < 0)$ is

(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 follows $N(0,1)$ then X^2 is a

(A) Chi square variate with n $d.f$
(B) Chi square variate with 1 $d.f$
(C) normal variate
(D) standard normal variate

7. A lower bound for the variance of an unbiased estimate is obtained by

(A) Rao-Blackwell theorem
(B) Rao-Cramer inequality
(C) analysis of variance
(D) method of moments

8. If $P(A)=0.3$, $P(B)=0.4$ and $P(A\cap B)=0$ then $P(A\cup B')$ is equal to

(A) 0.7
(B) 0.6
(C) 0.8
(D) 0.9

9. 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) $1-e^{ax}$

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

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

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

(A) symmetrical factorial
(B) asymmetrical factorial
(C) incomplete
(D) simple

12. 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		

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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) $x=6, y=12$

13. 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

14. If $z_1=2+i,\ z_2=3-2i$ then the complex conjugate of z_1z_2 is

(A) $8+i$
(B) $8-i$
(C) $7+i$
(D) $7-i$

15. In a moderately asymmetrical distribution, 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) $M.D.=\frac{5}{4}(S.D.)$

16. If $V(X)=\sigma^2$, then $V(Y)$ where $Y=\frac{(ax+b)}{c}$ is

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

17. 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

18. 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

19. The interval estimate of a population mean with large sample size and known standard deviation is given by

(A) $\bar{x} \pm z_{\alpha/2} \sigma_{\bar{x}}$
(B) $\bar{x} \pm z_{\alpha/2} s_{\bar{x}}$
(C) $\bar{x} \pm t_{\alpha/2} \sigma_{\bar{x}}$
(D) $\bar{x} \pm t_{\alpha/2} s_{\bar{x}}$

20. Distance between the points represented by $2+2i$ and $3+3i$ is

(A) 2
(B) $\sqrt{2}$
(C) 1
(D) $4\sqrt{2}$

21. If the correlation coefficient between X and Y is 0.3 then the correlation between $U = 2X + 3$ and $V = 3Y - 4$ is

(A) 1.8
(B) $\frac{0.3}{6}$
(C) 0.3
(D) $\frac{2}{0.9}$

22. The following data are generated by the relation $Y = X^2$

X:	−8	−6	−4	−2	0	2	4	6	8
Y:	64	36	16	4	0	4	16	36	64

The correlation coefficient between X and Y will be

(A) 0
(B) +1
(C) −1
(D) $(0.5)^2$

23. The standard error of the mean of a random sample of 16 observations from $N(\mu, \sigma^2 = 4)$ distribution is

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

24. The value of $\lim_{x \to 0} \frac{e^{x/a} - e^{-x/b}}{\sin x}$ is

(A) $\frac{(a+b)}{ab}$ (B) $\frac{ab}{(a+b)}$
(C) $\frac{(a-b)}{ab}$ (D) $\frac{ab}{(a-b)}$

25. The weights used in a quantity index are

(A) percentage of total quantity (B) average of quantities
(C) prices (D) None of these

26. Symbolically, $P_{0n} \times P_{n0} = 1$ stands for

(A) circular test (B) factor reversal test
(C) time reversal test (D) None of these

27. If $u = y \sin x$ then $\frac{\partial^2 u}{\partial x \partial y}$ is equal to

(A) $\cos x$ (B) $\cos y$
(C) $\sin x$ (D) 0

28. 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

29. The quantity $(1-\beta)$, where β is the probability of type II error, is called

(A) Level of the Test (B) Power of the Test
(C) Size of the Test (D) Type-I Error

30. 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 car thefts that the police can expect per day is

(A) 1.43 (B) 1.45
(C) 2.13 (D) 2.12

31. The value of $\lim_{x \to 0} \frac{\sin x}{x}$ is

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

32. If f and g are real functions defined by $f(x) = x+2$ and $g(x) = 2x^2+5$, then $f \circ g$ is equal to

(A) $2x^2+7$
(B) $2x^2+5$
(C) $2(x+2)^2+5$
(D) $2x+5$

33. 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) $\frac{x^2}{y}$

34. The sequence $\{s_n\}$ of real numbers, is said to be non-decreasing if

(A) $s_n < s_{n+1}, \forall n$
(B) $s_n \le s_{n+1}, \forall n$
(C) $s_n > s_{n+1}, \forall n$
(D) $s_n \ge s_{n+1}, \forall n$

35. If $x^3 + Ax^2 + Bx + 6$ has $(x-2)$ as a factor and leaves as remainder 3 when divided by $(x-3)$, then the values of A and B respectively, are

(A) 1,3
(B) 3,1
(C) −3,−1
(D) −1,−3

36. If $x \log_{10} 4 = 2\log_{10}(1-2^x)$, then x is equal to

(A) 0
(B) 1
(C) −1
(D) $\frac{1}{2}$

37. $\int_0^{\frac{\pi}{2}} \sin^5 x \cos x \, dx$ is equal to

(A) $\frac{1}{3}$ (B) $\frac{1}{6}$

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

38. If the sum of the roots of $ax^2 + bx + c = 0$ be equal to the sum of their squares, then

(A) $2ac = ab + b^2$ (B) $2ab = bc + c^2$

(C) $2bc = ac + c^2$ (D) $2ac = ab + c^2$

39. If A and B are square matrices of the same order then, which one of the following is true?

(A) $\det AB = \det A$ (B) $\det AB = \det B$

(C) $\det AB = \det A . \det B$ (D) $\det AB = \det A + \det B$

40. If A has an inverse then which one the following is true?

(A) $\det A = \frac{1}{\det A}$ (B) $\det A^{-1} = \frac{1}{\det A}$

(C) $\det A^{-1} = \det A$ (D) $\det A^{-1} = \frac{1}{\det A^{-1}}$

41. Suppose A is orthogonal then $\det(A)$ is equal to

(A) 1 (B) -1

(C) 0 (D) ± 1

42. 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) -6,7

(C) -6,11 (D) 11,6

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

(A) $\frac{2}{3}$ (B) $\frac{5}{3}$

(C) $\frac{3}{2}$ (D) $\frac{3}{5}$

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

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

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

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

(A) $\left(2-\sqrt{-7},\frac{8}{3}\right)$ (B) $\left(2-\sqrt{-7},\frac{7}{3}\right)$

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

46. 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) $c=\frac{1}{2}$

47. 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}

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48. A bag contains 3 white, 1 black and 3 red balls. Two balls are drawn from the well shuffled bag. The probability of both the balls being black is:

(A) one
(B) Zero
(C). $\frac{1}{7}$
(D) None of these

49. If X and Y are two random variables the covariance between the variables $aX+b$ and $cY+b$ in terms of $\text{cov}(X,Y)$ is $\text{cov}(aX+b, cY+d))$ is equal to

(A) $\text{cov}(X,Y)$
(B) $abcd * \text{cov}(X,Y)$
(C) $ac\ \text{cov}(X,Y)+bd$
(D) $ac\ \text{cov}(X,Y)$

50. A family of parametric distributions, for which the mean and variance does not exist, is

(A) F distribution
(B) Cauchy distribution
(C) negative binomial distribution
(D) Pareto distribution

51. The relation between $A.M.$, $G.M.$, and $H.M.$ is

(A) $G.M. = \sqrt{A.M. * H.M.}$
(B) $A.M. \geq G.M. \geq H.M.$
(C) both (A) and (B)
(D) None of these

52. In an entrance examination in Maths and Statistics, out of 120 students appeared for the examination, 65 passed in Maths, 75 passed in statistics and 35 passed in both the tests. A student is selected at random. What is the probability that the student has failed in both the tests?

(A) $\frac{1}{8}$
(B) $\frac{7}{8}$
(C) $\frac{1}{120}$
(D) $\frac{7}{120}$

53. Variables that are not being controlled by the researcher in the experiment but can have effect on the outcome of the treatment being studied is known as

(A) response variable
(B) random variable
(C) concomitant variable
(D) attribute

54. An experiment designed in such a way that two or more treatments are explored simultaneously using homogeneous experimental units is known as

(A) randomized block design
(B) Latin square design
(C) repeated measure design
(D) factorial design

55. A control chart that displays the number of non-confofmances per item or unit is known as

(A) p-chart
(B) c-chart
(C) $\overline{X}$-chart
(D) R-chart

56. The probability that the consumer will accept a bad (non-conforming) lot based on sample evidence is called as

(A) consumer's risk
(B) producer's risk
(C) owner's risk
(D) seller's risk

57. In quality control, a graph of the probability of acceptance for various values of non-conforming percent is known as

(A) ASN Curve
(B) OC Curve
(C) Lorenz Curve
(D) Power curve

58. A problem that arises in regression analysis when the data occur over time and the error terms are correlated is called as

(A) Partial Correlation
(B) Multiple Correlation
(C) Auto Correlation
(D) Spurious Correlation

59. A theorem stating that atleast $\left(1-\frac{1}{k^2}\right)$ values will fall within $\pm k$ standard deviations of the mean regardless of the shape of the distribution is

(A) Bayes' theorem
(B) Chebychev's theorem
(C) Central Limit Theorem
(D) Schwarz inequality

60. 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) Yules' coefficient
(C) co-efficient of determination
(D) co-efficient of variation

61. A two way table that contains the frequencies of responses to two questions relating to 2 attributes is called as

(A) bivariate frequency table
(B) contingency table
(C) ANOVA table
(D) ANOCOVA table

62. A theorem that states that regardless of the shape of a population, the distributions of sample means is normal if sample size are large is

(A) Central Limit Theorem
(B) Bayes' theorem
(C) Chebychev's theorem
(D) Markov theorem

63. A type of weighted arithmetic mean price index in which the base year quantity values are used as weights is

(A) Fisher's Price index
(B) Paasche's Price index
(C) Laspeyre's Price index
(D) Consumer Price index

64. The National Sample Survey Organization (NSSO) comes under

(A) Ministry of Planning
(B) Reserve Bank of India
(C) Ministry of Statistics
(D) Indian Statistical Institute

65. Population census in India was first started in the year

(A) 1881
(B) 1880
(C) 1885
(D) 1890

66. The year in which the last census was conducted in India is

(A) 2000
(B) 1998
(C) 1991
(D) 2001

67. The number of live births and deaths of children under one year of age in a city, in the year 1983 were reported as given below.
No. of births = 4700
No. of deaths = 94
Then the infant mortality rate is equal to

(A) 20 per thousand
(B) 20 per hundred
(C) 25 per thousand
(D) 25 per hundred

68. If D is the number of deaths in a year and T is the Annual mean population, then the formula for Crude Death Rate is

(A) $T/D * 1000$ (B) $D/T * 1000$

(C) $T/D * 100$ (D) $D/T * 100$

69. A table that exhibits the numbers living and dying at each age, on the basis of the experience of a cohort is known as

(A) fertility table (B) life table
(C) frequency table (D) contingency table

70. A non parametric test used for testing the identical nature of two populations is

(A) Kruskal Wallis test (B) Friedman test
(C) Wald-Wolfowitz Run test (D) Mann-Whitney U test

71. One or more observations that are so extreme in value relative to the other data in the sample are called as

(A) Order Statistics (B) Range
(C) Outliers (D) None of the above

72. In a group of 24 actuaries, 20 have worked for life office A and 12 have worked for life office B. Every one in the group has worked for atleast one of the two companies. What is the probability that an actuary picked at random has worked for life office A given that they have worked for life office B?

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$

(C) $\frac{4}{9}$ (D) $\frac{2}{9}$

73. Let X follows the Uniform distribution over the interval $(-1, 4)$. Then the distribution function of X is

(A) $\frac{(x-1)}{5}$ (B) $\frac{(x-1)^2}{5}$

(C) $\frac{(x+1)}{5}$ (D) $\frac{(x+1)^2}{5}$

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74. The $p.g.f.$ of a $r.v.$ X where $P[X=0]=0.5$, $P[X=1]=0.3$ and $P[X=3]=0.2$ is

(A) $0.5+0.3t+0.2t^3$
(B) $0.5t^3+0.2t^2+0.3t$
(C) $0.5+0.3t^2+0.2t^3$
(D) $0.2t^3$

75. The $m.g.f.$ of a $r.v$ is given by $M_X(t)=\left(1-\frac{t}{5}\right)^{-1}$; $t<5$, then the mean and variance of X are

(A) $\frac{1}{5},\frac{1}{25}$
(B) $\frac{1}{25},\frac{1}{5}$
(C) $\frac{2}{5},\frac{3}{25}$
(D) $\frac{3}{25},\frac{2}{5}$

76. If $M_X(t)$ and $G_X(t)$ are the $m.g.f.$ and pgf of a $r.v$ X, then which one of the following relation is correct?

(A) $M_X(t)=G_X(e^{2t})$
(B) $M_X(t)=G_X(e^{-2t})$
(C) $M_X(t)=G_X(e^{t})$
(D) $M_X(t)=\log G_X(t)$

77. $(X_1,X_2,....,X_{15})$ is a sample of size 15 from a Normal population with mean 2 and variance 1, then the distribution of $14s^2$, where s^2 is the sample variance, follows

(A) F distribution with (14, 2) $d.f$
(B) χ^2 distribution with 14 $d.f$
(C) t distribution with 14 $d.f$
(D) Normal distribution

78. Independent random samples of size n_1 and n_2 are taken from the normal population $N(\mu_1,\sigma_1^2)$ and $N(\mu_2,\sigma_2^2)$ respectively. Then the sampling distribution of $\overline{X_1}-\overline{X_2}$ is

(A) $N(\mu_1-\mu_2,\sigma_1^2/n_1+\sigma_2^2/n_2)$
(B) $N(\mu_1+\mu_2,\sigma_1^2/n_1+\sigma_2^2/n_2)$
(C) $N(\mu_1-\mu_2,\sigma_1^2/n_1-\sigma_2^2/n_2)$
(D) $N(\mu_1+\mu_2,\sigma_1^2/n_1-\sigma_2^2/n_2)$

79. If $P(\overline{A}B)=P(A\overline{B})$, then

(A) $P(A)>P(B)$
(B) $P(A)<P(B)$
(C) $P(A)=P(B)$
(D) $P(A).P(B)=\frac{1}{4}$

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80. For a continuous *r.v.* X, the point probability is

(A) less than 1 (B) $\frac{1}{2}$

(C) 0 (D) $\frac{1}{3}$

81. A random variable X has *p.d.f.* $f(x) = cxe^{-\frac{x^2}{8}}; 0 \leq x < \infty$. Then the value of c is

(A) $\frac{1}{3}$ (B) $\frac{1}{4}$

(C) $\frac{1}{5}$ (D) $\frac{1}{8}$

82. The *cdf* of a *r.v* X is given by

$$F(x) = 0; x \leq 0$$
$$= x; 0 \leq x \leq 1$$
$$= 1; x > 1$$

then $P(1/2 \leq x \leq 2)$ is equal to

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{1}{4}$ (D) $\frac{1}{8}$

83. The *pdf* of X is given by

$$f(x) = 2x;\ 0 < x < 1;$$
$$= 0\ ;\ \text{otherwise}$$

then the *cdf* of $Y = \sqrt{X}$ is

(A) $y^4; 0 \leq y < 1$ (B) $y^3; 0 \leq y < 1$

(C) $2y^4; 0 \leq y < 1$ (D) $2y^3; 0 \leq y < 1$

84. Which one of the following statements is true?

(i) Marginal distributions determine conditional distribution uniquely
(ii) Marginal distribution will determine the joint distribution uniquely
(iii) Marginal distribution does not determine the joint distribution uniquely
(iv) Marginal distribution does not determine the conditional distribution uniquely

(A) (iii) (B) (i)

(C) (ii) (D) (iv)

85. Let X follow the Beta distribution, $B(2, \frac{1}{2})$ and $Y = X^2$. Then $E(Y)$ is equal to

(A) $\frac{3}{4}$ (B) $\frac{3}{5}$

(C) $\frac{3}{7}$ (D) $\frac{3}{2}$

86. A continuous *r.v.* X has the *p.d.f.* $f(x) = a + bx;\ 0 \le x \le 1$. If the mean of the distribution is $\frac{1}{2}$, then the variance of X is equal to

(A) $\frac{1}{11}$ (B) $\frac{1}{12}$

(C) $\frac{2}{11}$ (D) $\frac{5}{12}$

87. Let X follows Poisson with mean λ. If $2\ P(X=0)+P(X=2)=2\ P(X=1)$ then $E(X)$ is equal to

(A) 2 (B) 1

(C) 3 (D) 4

88. Let X and Y are two independent Poisson variables with mean 2 and 4 respectively. Then the conditional distribution of X given $X+Y=5$ is

(A) Binomial $\left[5, \frac{1}{3}\right]$ (B) Binomial $\left[5, \frac{1}{4}\right]$

(C) Binomial $\left[5, \frac{1}{6}\right]$ (D) Binomial $\left[5, \frac{3}{4}\right]$

89. A batsman has a certain average of runs for 16 innings. In the 17^{th} innings, he makes a score of 85 runs, thereby increasing his average by 3. Then the average after the 17^{th} innings is

(A) 37 (B) 36

(C) 35 (D) 34

90. In a mixture of 35 litres, the ratio of milk and water is 4:1. If one litre of water is added to the mixture then what will be the new ratio of milk and water?

(A) 7 : 3
(B) 7 : 4
(C) 7 : 2
(D) 7 : 1

91. A committee of 3 members is to be selected out of 3 men and 2 women. What is the probability that the committee has atleast one woman?

(A) $\frac{1}{10}$
(B) $\frac{9}{20}$
(C) $\frac{1}{20}$
(D) $\frac{9}{10}$

92. If $A+B=180^\circ$, then the value of $\sin^2 A-\sin^2 B$ is equal to

(A) -1
(B) 0
(C) 1
(D) $\sqrt{2}$

93. If $x+\frac{1}{x}=4$, then the value of $x^4+\frac{1}{x^4}$ is equal to

(A) 109
(B) 125
(C) 112
(D) 194

94. The eigen values of the matrix $A=\begin{bmatrix}3 & 0\\0 & -2\end{bmatrix}$ are

(A) $(3,-2)$
(B) $(-3,2)$
(C) $(-3,-2)$
(D) $\left(\frac{1}{3},-\frac{1}{2}\right)$

95. The value of the integral $\int_{-1}^{1}|x|\,dx$ is

(A) 0
(B) 1
(C) 2
(D) ∞

96. In stratified random sampling under optimum allocation the stratum sample size n_h is proportional to

(A) N_h (B) S_h

(C) $\sum_h N_h S_h$ (D) $N_h S_h$

97. Let X_i be *i.i.d.* $N(0,1)$, $i = 1,2,....,5$ and $Y = \frac{3(X_1^2 + X_2^2)}{2(X_3^2 + X_4^2 + X_5^2)}$. Then the distribution of Y is

(A) Beta (B) Chi-square

(C) F (D) Gamma

98. The rank of the matrix $A = \begin{bmatrix} 2 & 1 & 4 & 1 \\ 1 & 0 & 2 & 1 \\ -2 & -1 & -4 & -1 \\ 1 & 1 & 2 & 0 \end{bmatrix}$ is

(A) 4 (B) 3

(C) 2 (D) 1

99. Let F follow $F(m,n)$, then mean of the F-distribution is

(A) $\frac{m-1}{n-1}$ (B) $\frac{n-1}{m-1}$

(C) $\frac{m-2}{n-2}$ (D) $\frac{n}{n-2}$

100. Let $X_1, X_2, ..., X_n$ be a random sample from the distribution with *p.d.f.* $f(x,\theta) = \frac{1}{\theta} e^{-(x-\mu)}$, $x > \mu$ and $H_0 : \theta = \theta_0$ vs $H_1 : \theta \neq \theta_0$. Here

(A) both H_0 and H_1 are simple

(B) H_0 is simple and H_1 is composite

(C) H_0 is composite and H_1 is simple

(D) both H_0 and H_1 are composite

101. Let X be a $r.v.$ with $p.m.f.$ $p(x)=\frac{1}{3}\left(\frac{2}{3}\right)^x$, $x = 0,1,2......$ Then $E(X)$ is

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

102. The central line in a R-chart when σ' is known is

(A) $D_1\sigma'$
(B) $c_2\sigma'$
(C) $d_2\sigma'$
(D) $\overline{R}$

103. A cyclist pedals from his house to his college at a speed of 12 *km.p.h* and back from the college to his house at 18 *km.p.h*. Then the average speed is

(A) 15 *km.p.h*
(B) 14.8 *km.p.h*
(C) 14.4 *km.p.h*
(D) 13.8 *km.p.h*

104. The average salary of male employees in a firm is Rs. 5,200 and that of females is Rs. 4,200. The average salary of all the employees is Rs. 5,000. Then the ratio of male to female employees is

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

105. If $\mu_3' = -5, \mu_2' = 4, \mu_1' = -1$ about the origin A=10 for some data set, then μ_3 is equal to

(A) −9
(B) 9
(C) −15
(D) 5

106. Assume that n persons are seated on n chairs at a round table. Then the probability that two specified persons sit next to each other is

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

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107. Consider two events A and B. The probability of occurrence of A is 0.7 and non-occurrence of B is 0.5. The probability of at least one of the event will not occur is 0.6. What is the probability that at least one event will occur?

(A) 0.8
(B) 0.2
(C) 0.15
(D) 0.85

108. A continuous random variable X has a $p.d.f.$ $f(x)=3x^2, 0 \le x \le 1$. The median of the distribution is

(A) $\sqrt[3]{1/2}$
(B) $\sqrt{3/2}$
(C) $\sqrt{2/3}$
(D) $\sqrt[3]{1/3}$

109. A $r.v.$ Y has a Chi-square distribution with degrees of freedom n. Then the measure of skewness β_1 is

(A) 0
(B) <0
(C) >0
(D) $\sqrt{2n}$

110. Let (X,Y) be a bivariate $r.v.$ defined over $x, y=-1,0,1$ and $P(X=0, Y=1)=\frac{1}{3}$, $P(X=1, Y=-1)=\frac{1}{3}$ and $P(X=1, Y=1)=\frac{1}{3}$. Then $P(X=0 \mid Y=1)$ is

(A) $\frac{1}{3}$
(B) $\frac{1}{2}$
(C) 0
(D) $\frac{2}{3}$

111. The determinant of the matrix $A=\begin{bmatrix} 3 & 5 & 8 \\ -1 & 2 & -3 \\ 0 & 1 & 6 \end{bmatrix}$ is

(A) 23
(B) 67
(C) 45
(D) 57

112. Consider the data 32, 28, 29, 30, 34, 38, 41, 46, 52, 58, 30. The quartile deviation of the data is

(A) 328
(B) 8
(C) 15
(D) 6

113. Find the odd item in the following related to control charts:

(A) Control limits
(B) Warning limits
(C) Probability limits
(D) Specification limits

114. The probability distribution underlying the control limits of C-chart is

(A) normal
(B) binomial
(C) Poisson
(D) Chi-square

115. A square matrix A is said to be idempotent if

(A) $A^2 = O$
(B) $A^2 = I$
(C) $A^2 = A$
(D) $A^T = A$

116. If $A = \begin{bmatrix} -2 & -7 & 3 \\ 1 & 5 & 6 \\ -4 & 8 & -3 \end{bmatrix}$, then trace (A) is

(A) 0
(B) 3
(C) -30
(D) 30

117. If $A = \begin{bmatrix} 2 & 4 \\ 1 & 1 \end{bmatrix}$, then its characteristic equation is

(A) $\lambda^2 - 3\lambda + 2 = 0$
(B) $\lambda^2 - 3\lambda - 2 = 0$
(C) $\lambda^3 - 3\lambda + 2 = 0$
(D) $\lambda^2 + 3\lambda + 2 = 0$

118. Matrix A is said to be orthogonal if

(A) $|A| = 1$
(B) $AA^{-1} = I$
(C) $AA^T = I$
(D) $|A| = 0$

119. If λ is an eigen value of A, then $\frac{1}{\lambda}$ is an eigen value of

(A) $\frac{1}{A}$
(B) A^T
(C) $adj(A)$
(D) A^{-1}

120. Which one of the following statements is true for a degenerate *r.v.* ?

(A) Mean=0
(B) Variance=0
(C) Mean=Variance $(\neq 0)$
(D) Mean does not exist

121. If $P(s)$ is the probability generating function of a discrete *r.v.* X, then $P'(1)$ equals to

(A) $E(X)$
(B) $Var(X)$
(C) 1
(D) 0

122. The inequality $P\{|X| \geq a\} \leq \frac{E|X|^r}{a^r}$ is called the

(A) Chebychev's inequality
(B) Schwartz inequality
(C) Markov inequality
(D) Boole's inequality

123. The joint *p.d.f.* of a bivariate *r.v.* (X,Y) is given by $f(x,y) = e^{-(x+y)},\ x, y > 0$. Then the correlation coefficient $\rho(X,Y)$ is

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

124. Let X_1 follow $b(n, p_1)$ and X_2 follow $b(n, p_2)$ and $p_1 \neq p_2$. X_1 and X_2 are independent. Then the distribution of $X_1 + X_2$ is

(A) point binomial
(B) Poisson
(C) binomial
(D) not a binomial

125. If X has a Cauchy $C(1,0)$ distribution, then the distribution of $\frac{1}{X}$ is

(A) Laplace
(B) Beta
(C) $C(1,0)$
(D) $C(0,1)$

126. Let X and Y be *i.i.d.* $N(0,\sigma^2)$ *r.v*'s. Then the distribution of $\frac{X}{Y}$ is

(A) Chi-square
(B) F
(C) t
(D) Cauchy

127. Which one of the following is true?

(A) $X_n \xrightarrow{L} X \Rightarrow X_n \xrightarrow{P} X$
(B) $X_n \xrightarrow{P} X \Rightarrow X_n \xrightarrow{a.s} X$
(C) $X_n \xrightarrow{P} X \Rightarrow X_n \xrightarrow{L} X$
(D) $X_n \xrightarrow{P} X \Leftrightarrow X_n \xrightarrow{L} X$

128. WLLN does not hold if $X_1, X_2, \ldots, X_n$ is a sequence of *i.i.d.* observations from

(A) Cauchy
(B) Binomial
(C) Lognormal
(D) Poisson

129. Let X_1 and X_2 be a random sample from a distribution having the *p.d.f.* $f(x) = e^{-x},\ 0 < x < \infty$. Then $W = \frac{X_1}{X_2}$ has

(A) t-distribution
(B) F-distribution
(C) Chi-square distribution
(D) Cauchy distribution

130. Let X follow $U(0,1)$. Then $Y = -2\log X$ has

(A) Chi-square with one *d.f.*
(B) Chi-square with two *d.f.*
(C) Lognormal
(D) Exponential

131. In testing of hypotheses in the presence of nuisance parameters it is appropriate to use

(A) non-parametric tests
(B) large sample tests
(C) most powerful tests
(D) likelihood ratio tests

132. Among the following which one is not a contrast?

(A) $\mu_1 - 3\mu_2 - 2\mu_3 + 3\mu_4 = 0$
(B) $\mu_1 - 3\mu_2 + 2\mu_4 = 0$
(C) $\mu_1 - \mu_2 - \mu_3 + \mu_4 = 0$
(D) $\mu_1 + 2\mu_2 - \mu_3 - 2\mu_4 = 0$

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133. A fair coin is tossed continuously. What is the probability of getting the first head on the 4th draw?

(A) $\left(\frac{1}{2}\right)^4$ (B) $4C_1\left(\frac{1}{2}\right)^4$

(C) $4C_1\left(\frac{1}{2}\right)$ (D) $\left(\frac{1}{2}\right)$

134. The arithmetic mean of the series $n_{C_0}, n_{C_1}, \ldots\ldots n_{C_n}$ is

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

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

135. In systematic sampling, variance of the estimator of the population mean decreases

(A) when $\rho_{wsy} = 0$

(B) when $\rho_{wsy} \neq 0$

(C) when ρ_{wsy} takes large positive value

(D) when ρ_{wsy} takes large negative value

where ρ_{wsy} denotes the intra-class correlation coefficient.

136. In a $p \times p$ Latin square design with one observation missing, the degrees of freedom for the error is

(A) $p^2 - 2p + 1$ (B) $p^2 - 3p + 1$

(C) $p - 2$ (D) $p(p-1)$

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137. In stratified random sampling with SRSWOR in each stratum, an unbiased estimator of $Var(\overline{y}_{st})$, ignoring *f.p.c.*, is

(A) $\sum_h \frac{w_h s_h^2}{n_h}$ (B) $\sum_h \frac{w_h s_h^2}{N_h}$

(C) $\sum_h \frac{W_h s_h^2}{n_h}$ (D) $\sum_h \frac{W_h s_h^2}{N_h}$

138. In a two-way analysis of variance with m observations per cell, if x_{ijk} denote the k^{th} observation on i^{th} treatment and j^{th} block, then $\sum_i \sum_j \sum_k (x_{ijk} - \overline{x}_{ij})^2$ gives

(A) total sum of squares (B) S.S. due to treatments
(C) S.S. due to error (D) S.S. due to interaction

139. Identify the odd item in the following:

(A) Confounding (B) Replication
(C) Randomization (D) Local control

140. The purpose of replication is

(A) to estimate the missing observations
(B) to eliminate the interaction effect
(C) to average out the influence of chance factors
(D) to average out the effect of treatments

141. In simple random sampling with replacement the sample mean $\overline{y} = \frac{1}{n} \sum_{i=1}^{N} a_i y_i$, where a_i is random variable which takes the value 1 if i^{th} unit is in the sample and 0 otherwise. Then $Cov(a_i a_j)$ is

(A) $\frac{n}{N(N-1)}(\frac{n}{N}-1)$ (B) $\frac{n}{N}(1-\frac{n}{N})$

(C) $\frac{n^2}{N(N-1)}$ (D) $\frac{n(n-1)}{N(N-1)}$

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142. A simple random sample of size 3 is drawn from a population of size 5 with replacement. Then the probability of selecting 3 different units in the sample is

(A) $\frac{{}^5C_3}{5^3}$ (B) $\frac{12}{25}$

(C) $\frac{3!}{5!}$ (D) $\frac{3}{5}$

143. While comparing simple random sampling (R) with stratified random sampling with proportional allocation (P) and stratified random sampling with Neyman allocation (N), the following inequality is satisfied

(A) $Var(\overline{Y})_N \geq Var(\overline{Y})_P \geq Var(\overline{Y})_R$

(B) $Var(\overline{Y})_R \geq Var(\overline{Y})_N \geq Var(\overline{Y})_P$

(C) $Var(\overline{Y})_R \geq Var(\overline{Y})_P \geq Var(\overline{Y})_N$

(D) $Var(\overline{Y})_P \geq Var(\overline{Y})_N \geq Var(\overline{Y})_R$

144. X and Y are two related variables. The two regression equations are given by
$2x - y - 20 = 0$
$2y - x + 4 = 0$, then $\overline{X}$ is

(A) 10 (B) 11

(C) 12 (D) 4

145. (X,Y) have the joint $p.d.f$ $f(x,y) = 8xy,\ 0 < x < 1,\ 0 < y < x$. Then $E(X)$ is

(A) $\frac{1}{5}$ (B) $\frac{3}{5}$

(C) $\frac{2}{5}$ (D) $\frac{4}{5}$

146. If $\phi_x(t)$ is a characteristic function, then $\phi_x(0)$ is equal to

(A) 0 (B) ∞

(C) 1 (D) $E(X)$

147. Which one of the following is not a method for measuring the seasonal variation?

(A) Method of moving averages
(B) Method of simple averages
(C) Ratio to trend method
(D) Link relative method

148. For Strong law of large numbers, among the following statements, which statement is true?

(A) Every sequence $\{X_n\}$ of random variables obeys SLLN.

(B) Every sequence $\{X_n\}$ of independent random variables obeys SLLN

(C) Every sequence $\{X_n\}$ of independent random variables with finite mean obeys SLLN.

(D) Every sequence $\{X_n\}$ of independent random variables with uniformly bounded variance obeys SLLN.

149. Let $X_1, X_2, ..., X_n$ be a random sample from the distribution with $p.d.f.$

$f(x,\theta) = \frac{1}{\theta} e^{\frac{-x}{\theta}}, \ x > 0$. Then $m.l.e.$ of θ is

(A) $\bar{X}$
(B) $X_{(1)}$
(C) $\frac{1}{\bar{X}}$
(D) $\bar{X}e^{\bar{X}}$

150. Let X follow $N(\mu, \sigma^2)$. Then $t = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n}$ is

(A) an unbiased estimator of σ^2
(B) a consistent estimator of σ^2
(C) least square estimator of σ^2
(D) UMVUE of σ^2

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