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ROLL No. [ ] [ ] [ ] [ ] [ ]

TEST BOOKLET No. **142**

TEST FOR POST GRADUATE PROGRAMMES

STATISTICS

Time: 2 Hours

Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of **this page**.

3. Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with a **Ball Point Pen.**

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 corresponding to the correct response fully by a **Ball Point Pen** as indicated in the example shown on the Answer Sheet.

6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.

7. Space for rough work is provided at the end of this Test Booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.

9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happening, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.

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STATISTICS

1. If $1^3 + 2^3 + 3^3 + ... + 100^3 = k^2$, then k is equal to

   (A) 10100 (B) 5000
   (C) 5050 (D) 1010

2. If $A = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{vmatrix}$, then A^3 is

   (A) A (B) $2A$
   (C) $9A$ (D) I

3. The inverse of $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 3 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ is

   (A) $\begin{bmatrix} 3 & -1 & -3 \\ -2 & 1 & 2 \\ 1 & -1/2 & -1/2 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & -1 & -3 \\ -2 & 1 & 2 \\ 1 & -1/2 & 1/2 \end{bmatrix}$

   (C) $\begin{bmatrix} 3 & -1 & -3 \\ -2 & 1 & 2 \\ 1 & 1/2 & -1/2 \end{bmatrix}$ (D) Does not exist

4. If $A = \begin{bmatrix} 2 & -1 & 4 \\ x & 0 & 1 \\ 1 & 2 & 0 \end{bmatrix}$ is a singular matrix, then x is equal to

   (A) -2 (B) 1
   (C) 3/8 (D) $-5/8$

5. The co-efficient of x^3 in e^{2x+1} is

(A) e^3 (B) $4e^3$

(C) $\frac{4e^3}{3}$ (D) e^2

6. If $a+b=3(c+d)$, which one of the following is the average of a,b,c and d?

(A) $c+d/4$ (B) $3(c+d)/8$

(C) $3(c+d)/4$ (D) $c+d$

7. A discrete random variable X takes the values 1,2,3 and 4 such that $3P(X=1)=2P(X=2)=5P(X=3)=P(X=4)$. Then $P(X=3)$ is equal to

(A) 6/61 (B) 3/61

(C) 2/61 (D) 1/61

8. 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

9. If a random variable X has mean 3 and variance 4, then $E(X^2+3X+2)$ is equal to

(A) 20 (B) 24

(C) 32 (D) 16

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10. Let X be a random variable with probability density function

$$f(x) = \begin{cases} \frac{1}{3}e^{-\frac{x}{3}} & ; x > 0 \\ 0 & otherwise. \end{cases}$$

Then $P(X > 3)$ is

(A) $1/e$
(B) $1/e^2$
(C) 1/3
(D) 0.75

11. A random variable X has MGF given by $M_x(t) = Exp\{5t + 3t^2\}$. Then the distribution of X is

(A) Uniform distribution over (5,7)
(B) Exponential distribution with parameter 3
(C) Normal distribution with mean 5 and variance 6
(D) Chi-square distribution with 3 $d.f$

12. For estimating the population proportion P in a class of a population having N units, the variance of the estimator p of P based on the sample of size n is

(A) $\frac{N}{N-1}.\frac{PQ}{n}$
(B) $\frac{N}{N-1}.\frac{PQ}{N}$
(C) $\frac{N-n}{N-1}.\frac{PQ}{n}$
(D) $\frac{N-1}{N-n}.\frac{PQ}{n}$

13. 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 in adjoining rooms?

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

14. 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 null and alternative hypothesis

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i) and (iv)
(D) All the four

15. A valid *t*-test to assess an observed difference between two sample mean value requires

(i) both populations are independent
(ii) the observations to be sampled from normally distributed parent population
(iii) the variance to be the same for both populations

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i) and (iii)
(D) All the three conditions

16. A two-tail statistical test is

(A) a statistical test for which the critical region comprises both large and small values of the test statistic
(B) a statistical test for which the critical region comprises either large or small values of the test statistic
(C) a statistical test for which the critical region comprises small values of the test statistic
(D) a statistical test for which the critical region comprises large values of the test statistic

17. The measure of central tendency which is not affected by the extreme values is

(A) Arithmetic Mean
(B) Median
(C) Geometric Mean
(D) Harmonic Mean

18. The sum of 10 items is 12 and the sum of their squares is 16.9. The standard deviation is

(A) 0.6 (B) 0.5
(C) 0.4 (D) 0.3

19. The variance of first n natural numbers is

(A) $(n^2+1)/12$ (B) $(n+1)^2/12$
(C) $(n^2-1)/12$ (D) $(2n^2-1)/12$

20. If a random variable X has mean 3 and standard deviation 5, then the variance of a variable $Y = 2X - 5$ is

(A) 45 (B) 100
(C) 15 (D) 40

21. A coin is tossed until a head appears. Then the sample space is

(A) Finite (B) Countably infinite
(C) Uncountable (D) Not defined

22. A player tosses two fair coins. He wins Rs. 5 if two heads appear, Rs.22 if one head appears and Rs.1 if no head occurs. Then his expected gain is

(A) Rs. 25/2 (B) Rs. 27/2
(C) Rs. 35/2 (D) Rs. 7/2

23. If the sample values are 1, 3, 5, 7 and 9, the standard error of sample mean is

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

24. Let X and Y be two independent Binomial random variables with parameters (2,1/3) and (7,1/3). Then $P[X+Y=3]$ is equal to

(A) $\binom{9}{3}\left(\frac{1}{3}\right)^3\left(\frac{2}{3}\right)^6$
(B) $\binom{9}{3}\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^6$
(C) $\binom{7}{2}\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^5$
(D) $\binom{9}{3}\left(\frac{1}{3}\right)\left(\frac{2}{3}\right)^8$

25. The m.g.f. of X is given by $M_X(t)=3/(3-t)$. Then the mean and variance of X are

(A) 1/3, 2/9
(B) 1/3, 1/9
(C) 1/9, 1/3
(D) 1/2, 1/4

26. Let (X,Y) follow Bivariate Normal with $E(X)=2$, $E(Y)=3$, $r(X,Y)=0.6$, $\text{Var}(X)=4$ and $\text{Var}(Y)=2$. Then the conditional mean of X given $Y=y$ is

(A) 0.8 y − 0.4
(B) 0.4 y − 0.8
(C) 0.2 Y − 0.4
(D) 0.4Y − 0.2

27. The regression line of Y on X given $\mu_X = 9.2$, $\mu_Y = 16.5$, $\sigma_X = 2.1$, $\sigma_Y = 1.6$, $\rho_{XY} = 0.84$; is

(A) $Y = 2X + 5$
(B) $Y = 0.64X + 10.612$
(C) $Y = 0.4X + 12.82$
(D) $Y = 0.64X + 22.388$

28. Let A be a square matrix. Then $A+A^T$ (T being the transpose) will be

(A) diagonal matrix
(B) symmetric matrix
(C) identity matrix
(D) skew symmetric matrix

29. If $D = diag(d_1, d_2, d_3)$, where each of d_1, d_2, d_3 is non zero, then D^{-1} is

(A) D
(B) $diag(d_1^{-1}, d_2^{-1}, d_3^{-1})$
(C) I_3
(D) Zero matrix

30. If $A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 0 & 5 \\ 1 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix}$, then trace $(A-B)$ is equal to

(A) 70
(B) −3
(C) 3
(D) 2

31. If $\begin{vmatrix} 1+x & 1-x & 1-x \\ 1-x & 1+x & 1-x \\ 1-x & 1-x & 1+x \end{vmatrix} = 0$, then the solution set is

(A) (1, 3)
(B) (0, 3)
(C) (0, 1)
(D) −1, 3

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32. Let A and B are two independent events. The probability that both A and B occurs is 1/20 and the probability that neither of them occurs is 3/5. Then $P(A)$ and $P(B)$ are equal to

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

33. Three numbers are chosen from 1 to 20. The probability that they are not consecutive is

(A) 186/190
(B) 187/190
(C) 188/190
(D) 189/190

34. If $P(A)=x, P(B)=2x$, $P(A\cap B)=1/2$ and $P(\bar{A}\cap\bar{B})=2/3$, then x is equal to

(A) 5/36
(B) 6/36
(C) 3/36
(D) 7/36

35. If $P(A\cup B)$=1/2 and $P(\bar{A})$=2/3, then $P(\bar{A}\cap B)$is equal to

(A) 1/3
(B) 1/4
(C) 1/5
(D) 1/6

36. When two dice are thrown, the probability of getting same numbers is

(A) 1/6
(B) 1/36
(C) 1/2
(D) 1/4

37. If A and B are events such that $P(A)=p_1$, $P(B)=p_2$, $P(A\cap B)=p_3$, then $P(\bar{A}\cup B)$ is equal to

(A) $1-p_1+p_2$
(B) $1-p_3$
(C) $1-p_1-p_2$
(D) p_1+p_2

38. A box contains 10 tickets. 2 of the tickets carry a price of Rs.8/- each, 5 of the tickets carry a price of Rs.4/- each and 3 of the tickets carry a price of Rs.2/- each. If one ticket is drawn, then the mean price is

(A) Rs.3.40 (B) Rs.2.80
(C) Rs.3.10 (D) Rs.4.20

39. A random variable X has the following probability distribution

$X = x_i$	-2	-1	0	1
$P(X = x_i)$	$(1-a)/4$	$(1+2a)/4$	$(1-2a)/4$	$(1+a)/4$

Then

(A) 'a' can have any real value (B) $1/4 \le a \le 1/3$
(C) $-1/2 \le a \le 1/2$ (D) $-1 \le a \le 1$

40. The probability that a man hits a target is 3/4. He tries 5 times. Then the probability that he hits the target at least 4 times is

(A) 81/256 (B) 81/128
(C) 5/128 (D) 1/128

41. The range of a random variable $X = \{1, 2, 3, \ldots\}$ and the probabilities are given by $P(X = k) = c^k/k!$, c is constant and $k = 1, 2, \ldots$ Then c is equal to

(A) $\log_{10}2$ (B) $\log_e 4$
(C) $\log_{1/e}(1/2)$ (D) $\log_{1/e}2$

42. If the sum of the mean and variance of binomial distribution for 5 trials is 1.8, then the binomial distribution is

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

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43. If X has a Poisson distribution and $P(X=2)=P(X=3)$, then the mean of the distribution is

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

44. The difference between mean and variance of a binomial distribution with $n=25$ is 1. Then the value of p is

(A) 0.04
(B) 0.2
(C) 0.96
(D) 0.8

45. Let $X_1 \sim N(2,1)$ and $X_2 \sim N(3,2)$ and X_1 and X_2 be independent. Then the distribution of $2X_1+3X_2$ is

(A) $N(12, 15)$
(B) $N(15, 12)$
(C) $N(22, 13)$
(D) $N(13, 22)$

46. A sufficient condition for an estimator T_n to be consistent for θ is that

(A) $\text{Var}(T_n) \to 0$ as $n \to \infty$
(B) $E(T_n) \to \theta$ as $n \to \infty$
(C) $\text{Var}(T_n)/E(T_n) \to 0$ as $n \to \infty$
(D) $E(T_n) \to \theta$ and $\text{Var}(T_n) \to 0$ as $n \to \infty$

47. Which one of the following is used to reduce the sampling error in the study of a heterogeneous population?

(A) Stratified sampling
(B) Cluster sampling
(C) Survey sampling
(D) Census sampling

48. The numbers for which the AM is 8 and GM is $\sqrt{55}$ are

(A) $-11, -5$
(B) 11, 5
(C) 55, 1
(D) 64, 55

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

(A) $\overline{X}$ (B) $\overline{X}^2$

(C) $\overline{X}(1-\overline{X})$ (D) $n.\overline{X}$

50. The probability that a student is not a swimmer is 1/5. Out of 5 students, the probability that 4 are swimmers is

(A) 512/3125 (B) 64/3125

(C) 128/3125 (D) 256/3125

51. Empirical relation of averages is given by

(A) Mean-Mode=2(Mean-Median)
(B) Mean-Mode=3(Mean-Median)
(C) Mean-Mode=4(Mean-Median)
(D) Mean-Mode=Median

52. The mean of the following distribution is

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

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

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

53. The point of intersection of the two types of ogives is the

(A) First quartile (B) Second quartile

(C) Third quartile (D) Fourth quartile

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54. The mean of a series is 10 and its CV is 40%. The variance of the series is

(A) 4 (B) 8
(C) 2 (D) 16

55. The regression coefficient is independent of

(A) Origin (B) Scale
(C) Both origin and scale (D) Neither origin nor scale

56. If $Var(X) = 1$, then $Var(2X \pm 3)$ is

(A) 5 (B) 13
(C) 47 (D) 1

57. A and B are independent events such that $P(A) = 0.7$, $P(B) = k$ and $P(A \cup B) = 0.8$. Then k is,

(A) 5/7 (B) 2/7
(C) 0.1 (D) 1/3

58. Which of the following is false?

(A) The normal distribution is unimodal
(B) The normal curve is bell shaped
(C) The skewness for normal distribution is not zero
(D) Mean = mode = median for a normal distribution

59. The probability that the sum of the scores is 11, when two dice are rolled is

(A) $\frac{1}{6}$ (B) $\frac{1}{12}$
(C) $\frac{1}{18}$ (D) $\frac{1}{36}$

60. Which of the following are valid statements for the binomial distribution?

(A) $np = 4;\ npq = 8$
(B) $np = 16;\ npq = 3/2$
(C) $n = 4;\ p = q = 1/2$
(D) $np = 10;\ npq = 20.5$

61. Let $X \sim U(2,5)$. Then the variance X is equal to

(A) $\frac{4}{7}$
(B) $\frac{7}{2}$
(C) $\frac{1}{4}$
(D) $\frac{3}{4}$

62. The *pdf* of a random variable X is $f(x) = k(2-x);\ 0 < x < 2$. Then k is

(A) $\frac{3}{4}$
(B) $\frac{4}{3}$
(C) 1
(D) $\frac{1}{2}$

63. The characteristic function of the Poisson distribution with parameter λ is

(A) $e^{\lambda(it-1)}$
(B) $e^{\lambda(e^{it}-1)}$
(C) $e^{\lambda it}$
(D) $e^{-\lambda it}$

64. The *pdf* of normal distribution is given by $f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(X-5)^2}$. The mean and variance are respectively

(A) 5, 1
(B) 25, 1
(C) 0, 1
(D) 1,0

65. The value of $\int_0^\infty e^{-\frac{x^2}{2}} dx$ is

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

66. Which of the following is not true?

(A) Binomial distribution is associated with the French Mathematician Bernoulli
(B) In a binomial distribution the mean is greater than variance
(C) If p=q =1/2, then the distribution is not symmetric
(D) The binomial distribution is a discrete distribution

67. Which of the following statements is always true regarding regression coefficients b_{yx} and b_{xy}?

(A) $b_{yx} > 0$
(B) $b_{yx} < 0$
(C) $b_{yx}b_{xy} = r$
(D) $b_{yx}b_{xy} = r^2$

68. If $X \sim N(0,1)$, then $E(X^7)$ is

(A) 7
(B) 1
(C) 0
(D) 2

69. If $X \sim P(\lambda)$ such that $P(X = 0) = P(X = 1)$, then $P(X = 2)$ is

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

70. The moment generating function of the Uniform distribution $U(a,b)$ is

(A) $\frac{e^{bt}-e^{at}}{t(b-a)}$ (B) $\frac{e^{bt}-e^{at}}{(b-a)}$

(C) $\frac{e^{b}-e^{a}}{t(b-a)}$ (D) $\frac{e^{t}}{(b-a)}$

71. If X is a positive valued continuous random variable, then $P\left(X=\frac{1}{2}\right)$ is

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

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

72. For which of the following distributions mean does not exist?

(A) Normal (B) Exponential

(C) Cauchy (D) Uniform

73. Among the following, which distribution has "lack of memory property"?

(A) Binomial (B) Poisson

(C) Geometric (D) Cauchy

74. Which of the following statements is true?

(A) $(A\cup B)^c = A^c \cup B^c$ (B) $(A\cap B)^c = A^c \cap B^c$

(C) $(A\cup B) = A\cup (A\cap B^c)$ (D) $(A^c \cap B)^c = A\cup B^c$

75. Which of the statements is false?

(A) The probability of an impossible event is zero
(B) A and B are independent then so is A and B^c
(C) A and B are independent implies they are disjoint
(D) Probability lies between zero and one inclusive

76. A box contains 3 red and 4 black balls. Two balls are drawn at random without replacement. The probability of getting one black ball and red ball is

(A) 12/21
(B) 1/35
(C) 1/2
(D) 2/7

77. The formula for inter quartile range is

(A) $Q_3 - Q_1$
(B) $Q_3 + Q_1$
(C) $(Q_3 - Q_1)/2$
(D) $(Q_3 + Q_1)/2$

78. The distribution function defined by $F(x) = P(X \leq x)$ of a random variable X is

(A) always continuous
(B) always left continuous
(C) at least right continuous
(D) at least left continuous

79. Which one of the following is not a measure of central tendency?

(A) Mean
(B) Variance
(C) Median
(D) Mode

80. The arithmetic mean of the squares of first n natural number is

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

81. Consider a sample of five observations $(-4, -2, 0, 2, 9)$. The geometric mean is

(A) zero
(B) positive
(C) negative
(D) imaginary

82. The mean of a set of observations is 42. If each observation is divided by 3 and 5 is added to each, the mean becomes

(A) 14
(B) 9
(C) 19
(D) 47

83. The mean of a set of 12 observations is 5. To this set another 8 observations having mean 2 is added. The mean of the combined set is

(A) 3.8
(B) 4.2
(C) 4.0
(D) 3.6

84. Let G_1 and G_2 be the geometric means of X's and Y's based on n values respectively. The geometric mean of the combined sample of $2n$ observations is

(A) G_1G_2
(B) $\frac{G_1+G_2}{2}$
(C) $\frac{G_1}{G_2}$
(D) $\sqrt{G_1G_2}$

85. The median of the observations 2 1 7 6 9 13 10 is

(A) 7
(B) 6
(C) 13
(D) 48/7

86. The mean deviation is minimum about

(A) mean
(B) mode
(C) first quartile
(D) median

87. In a distribution, the kurtosis measures

(A) the peakedness
(B) symmetry
(C) dispersion
(D) central tendency

88. The mean height of 10 students is 165 cms and standard deviation 5 cms. The coefficient of variation is

(A) 3 cms
(B) 3
(C) 3300
(D) 3300 cms

89. If a random variable X has mean 10 and variance 2, then $Y = 4X + 2$ has (mean, variance) given by

(A) (40,30)
(B) (10,32)
(C) (42,30)
(D) (42,32)

90. For a distribution, fourth central moment is 48 and standard deviation is 2. The distribution is

(A) Normal
(B) Leptokurtic
(C) Platikurtic
(D) Exponential

91. In a unimodal distribution, mean is smaller than the mode. The distribution is

(A) Positively skewed
(B) Negatively skewed
(C) Symmetrical
(D) None of the above

92. To fit a third degree polynomial, the number of normal equations is

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

93. For two random variables (X,Y) with means $\overline{X}$ and $\overline{Y}$ respectively, the two regression lines intersect at the point

(A) $(\overline{X},0)$
(B) $(\overline{X},\overline{Y})$
(C) $(0,\overline{Y})$
(D) $(0,0)$

94. Covariance between X and Y is 9.6; variance of X is 9 and variance of Y is 16. Then the correlation coefficient is

(A) 0.2
(B) 0.8
(C) 0.9
(D) 1

95. For two attributes A, B, $(A) = 47$, $(B) = 40$, $(AB) = 15$ and $N = 80$. Then $(\alpha\beta)$ is

(A) 12
(B) 21
(C) 8
(D) 32

96. The regression equations are given by $5x = 22 + y$ and $64x = 24 + 45y$. Then regression coefficient b_{yx} is

(A) $\frac{1}{5}$
(B) $\frac{45}{64}$
(C) 5
(D) $\frac{64}{45}$

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97. For (X,Y), $r_{xy} = -\frac{1}{2}$. If $b_{yx} = -\frac{1}{8}$, then b_{xy} is

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

98. The two regression lines of x, y will coincide if r_{xy} is equal to

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

99. The correlation coefficient between x and y is -0.4. The correlation coefficient between $3x$ and $2y$ is

(A) -0.6 (B) 0.9
(C) -0.4 (D) 0.2

100. The limits of correlation coefficient are

(A) $[-1,1]$ (B) $(-1,1)$
(C) $(-1,0)$ (D) $(-\infty, \infty)$

101. The regression coefficient of X on Y is $-1/6$ and that of Y on X is $-3/2$. Then the correlation coefficient is

(A) -0.5 (B) 0
(C) 1 (D) 0.5

102. The rank correlation coefficient was given by

(A) Fisher (B) Rao
(C) Neyman (D) Spearman

103. The rank correlation for the following data on ranks given by two judges for 5 contestants is:

Contestants	1	2	3	4	5
Judge 1	5	4	3	2	1
Judge 2	1	2	3	4	5

(A) 0
(B) −1
(C) 1
(D) 1/2

104. Two events A and B are such that $A \cap B = \phi$. Then they are

(A) mutually exclusive events
(B) independent events
(C) mutually exclusive and exhaustive
(D) impossible events

105. The probability of three independent events are $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{4}$ and $P(C) = \frac{1}{5}$. Then $P(A \cup B \cup C)$ is equal to

(A) $\frac{4}{5}$
(B) $\frac{1}{15}$
(C) $\frac{14}{15}$
(D) $\frac{3}{5}$

106. Let $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(A \cap B) = \frac{1}{4}$. Then $P(A/A \cup B)$ is equal to

(A) $\frac{1}{2}$
(B) $\frac{6}{7}$
(C) $\frac{3}{4}$
(D) $\frac{4}{7}$

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107. If $P(E/F) = P(E)$, then $P(F/E)$ is

(A) $P(F)$
(B) $P(E \cap F)$
(C) $P(E \cup F)$
(D) $P(E) + P(F)$

108. A continuous random variable X has $p.d.f.$

$$f(x) = \begin{cases} k & , \quad 0 \le x \le 1 \\ 0 & , \quad otherwise. \end{cases}$$

The value of k is

(A) $\frac{2}{3}$
(B) 1
(C) $\frac{1}{4}$
(D) $\frac{3}{4}$

109. A continuous random variable X has $p.d.f.$ $f(x) = 3x^2 \quad 0 \le x \le 1$.
If $P(X \le a) = P(X > a)$, the value of a is

(A) $\frac{1}{6}$
(B) $\left(\frac{1}{2}\right)^{1/3}$
(C) $\frac{1}{2}$
(D) $\frac{3}{4}$

110. If X has a uniform distribution on $[0,\beta]$, then its distribution function is

(A) βx
(B) $\frac{x}{\beta}$
(C) $\frac{\beta}{x}$
(D) $\frac{1}{\beta x}$

111. Let $(X_1,\ldots,X_n)$ be a random sample from a normal population $N\left(\mu,\sigma^2\right)$. The standard error of $\overline{X}=\sum_{i}^{n} X_i / n$ is

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

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

112. Let $(X_1,\ldots,X_n)$ be a random sample from a normal distribution $N\left(\mu,\sigma^2\right)$. An unbiased estimator of σ^2 is

(A) $\frac{1}{\sqrt{n}}\sum_{1}^{n} X_i^2$ (B) $\frac{n}{n-1}\sum_{1}^{n} X_i^2$

(C) $\frac{1}{n}\sum_{1}^{n}(X_i-\overline{X})^2$ (D) $\frac{1}{n-1}\sum_{1}^{n}(X_i-\overline{X})^2$

113. If X has a chi-square distribution with 10 *d.f.*, then variance of X is

(A) 20 (B) 18

(C) 10 (D) 16

114. Let X and Y be two independent χ^2 variables. Which of the following also has χ^2 distribution?

(A) X/Y (B) $X-Y$

(C) $X+Y$ (D) XY

115. W.S. Gossett gave which of the following distributions?

(A) t (B) χ^2

(C) F (D) normal

116. Let X and Y be independent χ^2 variables with m and n $d.f.$ respectively. The following has F distribution with (m,n) $d.f.$

(A) $\frac{mX}{nY}$ (B) $\frac{nX}{mY}$
(C) $\frac{X+m}{Y+n}$ (D) $\frac{X+n}{Y+m}$

117. Let X have F distribution with (4,8) $d.f.$ The distribution of $1/X$ will be

(A) F with (8,4) $d.f.$ (B) χ^2 on 4 $d.f.$
(C) t on (12) $d.f.$ (D) F with (3,5) $d.f.$

118. For testing independence of two attributes in a (m,n) contingency table, the degrees of freedom of χ^2 is

(A) $m+n-1$ (B) $mn-1$
(C) $(m-1)(n-1)$ (D) $m-n$

119. χ^2 test is used for

(A) testing a single population variance
(B) testing a single population mean
(C) testing the equality of two population
(D) testing the equality of two population variance

120. From two independent normal distributions $N(\mu_1, \sigma^2)$ and $N(\mu_2, \sigma^2)$, two random samples of sizes 10 and 20 are taken. For testing equality of means μ_1, μ_2, the $d.f.$ for the t-test is

(A) 30 (B) 29
(C) 31 (D) 28

121. It is desired to test the hypothesis, based on a random sample of size 20, H_0 : mean = 0 in a normal population. The appropriate test would be

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

122. For testing $H_0 : \rho = 0$ in a bivariate normal distribution $BN(\mu_1, \mu_2, \sigma_1, \sigma_2 \rho)$, the test used is

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

123. For testing equality of two population variances, the test used is

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

124. The F distribution is

(A) positively skewed
(B) negatively skewed
(C) symmetrical
(D) based on negative valued random variable.

125. In a simple hypothesis

(A) the distribution is completely determined
(B) is two sided
(C) the distribution is not completely determined
(D) is one sided

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126. For a normal distribution $N(\mu,\sigma^2)$, the following hypothesis is composite

(A) $\mu=0, \sigma=4$
(B) $\mu>0, \sigma=2$
(C) $\mu=2, \sigma=1$
(D) $\mu=4, \sigma=9$

127. For testing H_0 against H_1, the second kind of error is

(A) P(Accept H_0/H_1 true)
(B) P(Reject H_0/H_0 true)
(C) P(Accept H_0/H_0 true)
(D) P(Reject H_0/H_1 true)

128. If $H_0:\mu=0$ and $H_1:\mu=4$, the power of a test is

(A) P(Acc. $H_0/\mu=0$)
(B) P(Rej. : $H_0/\mu=0$)
(C) P(Rej. $H_0/\mu=4$).
(D) P(Acc. $H_0/\mu=4$)

129. For testing $H_0:\theta=5$ against $H_1:\theta=10$ in the $p.d.f.$ $f(x;\theta)=\frac{1}{\theta}e^{-x/\theta}(x\geq 0)$ one observation X is taken and the critical region is $X\geq 15$. The probability of type II error is

(A) $e^{5/2}$
(B) $1-e^{-3/2}$
(C) $1-e^{-4}$
(D) $e^{-7/2}$

130. The level of significance of a test is also known as

(A) critical region
(B) power
(C) size
(D) standard error

131. The theorem which provides most powerful critical region for testing a simple hypothesis against a simple alternative is known as

(A) Neyman Pearson lemma
(B) Cramer-Rao inequality
(C) Wald's lemma
(D) Neyman Fisher Factorization theorem

132. For testing $H_0 : \mu = 4$ in a normal distribution $N(\mu, \sigma^2)$, the t-test is applicable only if

(A) $\sigma = 1$
(B) $\sigma = 4$
(C) σ known
(D) σ unknown

133. The most appropriate test for testing $H_0 : \sigma^2 = \sigma_0^2$ in a normal distribution $N(\mu, \sigma^2)$ is

(A) χ^2 – test
(B) t – test
(C) F – test
(D) z test

134. Which one of the following is not a sampling distribution?

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

135. For testing $H_0 : \mu_1 = \mu_2$ in two independent normal distributions with common variance, two random samples have $n_1 = 25$, $\bar{X}_1 = 200$, $n_2 = 250$, $\bar{X}_2 = 1205$ and $s = 23$. The test statistic t value is

(A) 50
(B) 7.7
(C) 7.54
(D) 23

136. Sequential probability ratio test was given by

(A) Wald
(B) Fisher
(C) Cramer
(D) Chebychev

137. To test the randomness of a sample, the following test is used

(A) Sign test
(B) Run test
(C) Median test
(D) F-test

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138. Which of the following distribution is identified by a pair of degrees of freedom?

(A) Chi square distribution (B) t distribution
(C) F distribution (D) Normal distribution

139. Histogram is suitable for the data presented as

(A) continuous grouped frequency distribution
(B) discrete grouped frequency distribution
(C) individual series
(D) All of the above

140. The idea of posterior probability was introduced by

(A) Pascal (B) Peter and Paul
(C) Rev. Fr. Thomas Bayes (D) M. Loe've

141. Circular systematic sampling is used when

(A) N is a multiplie of n (B) N is a whole number
(C) N is not divisible by n (D) None of the above

142. Sampling error can be reduced by

(A) choosing a proper probability sampling
(B) selecting a sample of adequate size
(C) using a suitable formula for estimation
(D) All of the above

143. The term ANOVA was introduced by

(A) Karl Pearson (B) R.A. Fisher
(C) C.R. Rao (D) Spearman

144. The number of hypothesis tested in an ANOVA pertaining to a two way classification is

(A) 1
(B) 3
(C) 2
(D) None of the above

145. Replication in an experiment eliminates

(A) human bias
(B) completion among neighbouring plots
(C) heterogeneity among blocks
(D) None of the above

146. In an estimator T_n of population parameter Θ converges in probability to Θ as $n \to \infty$. Then T_n is said to be

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

147. Factorisation theorem for sufficiency is known as

(A) Rao-Blockwell theorem
(B) Crammer-Rao inequality
(C) Chapman-Robins theorem
(D) Neyman-Fisher theorem

148. If $x_1, x_2, \ldots x_n$ be a random sample from an infinite population where $S^2 = \frac{1}{n}\sum_i (x_i - \bar{x})^2$. The unbiased estimator for the population variance σ^2 is

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

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149. Consumer price index is also known as

(A) value index
(B) cost of living index
(C) quantity index
(D) price index

150. The curve showing the probability of accepting a lot is known as

(A) OC Curve
(B) ASN Curve
(C) Compertz Curve
(D) AQL Curve

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