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Test Booklet Series

A

TEST BOOKLET

STATISTICS

T. B. C. : AD(P)-O-13/2018

Sl. No. 1025

Time Allowed : 3 Hours

Maximum Marks : 150

: INSTRUCTIONS TO CANDIDATES :

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET OF THE SAME SERIES ISSUED TO YOU.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D**, AS THE CASE MAY BE, IN THE APPROPRIATE PLACE IN THE ANSWER SHEET USING BALL POINT PEN (BLUE OR BLACK).
3. You have to enter your **Roll No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. **YOU ARE REQUIRED TO FILL UP & DARKEN ROLL NO., TEST BOOKLET / QUESTION BOOKLET SERIES IN THE ANSWER SHEET AS WELL AS FILL UP TEST BOOKLET / QUESTION BOOKLET SERIES AND SERIAL NO. AND ANSWER SHEET SERIAL NO. IN THE ATTENDANCE SHEET CAREFULLY. WRONGLY FILLED UP ANSWER SHEETS ARE LIABLE FOR REJECTION AT THE RISK OF THE CANDIDATE.**
5. This Test Booklet contains **150** items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose **ONLY ONE** response (answer) for each item (question).
6. You have to mark (darken) all your responses (answers) **ONLY** on the **separate Answer Sheet** provided by **using BALL POINT PEN (BLUE OR BLACK)**. See instructions in the Answer Sheet.
7. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. **There will be no negative marking for wrong answer.**
8. Before you proceed to mark (darken) in the Answer Sheet the responses to various items (questions) in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per the instructions sent to you with your **Admission Certificate.**
9. After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the *Answer Sheet* issued to you. You are allowed to take with you the candidate's copy / second page of the Answer Sheet along with the **Test Booklet**, after completion of the examination, for your reference.
10. Sheets for rough work are appended in the Test Booklet at the end.

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SEAT

1. The value of intra-class correlation coefficient lies between :

(A) 0 to 1

(B) $\frac{-1}{(k-1)}$ to $\frac{1}{(k+1)}$

(C) 0 to $\frac{1}{(k+1)}$

(D) $\frac{-1}{(k+1)}$ to +1

2. Which of the factors is not responsible for the choice of a chart, diagram and graph ?

(A) Objective of the display of data

(B) Type of data

(C) Locational advantage

(D) Size of the chart or graph

3. What would be the weighted mean of n natural numbers if weights are the corresponding numbers ?

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

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

(C) $\frac{2n+1}{4}$

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

4. Which of the following illustrate irregular variation ?

(A) An extended drought leading to higher food prices

(B) The effect of snow on ski slope business

(C) A one-time federal tax rebate provision for the purchase of new houses

(D) The energy use reduction after the 1973 oil embargo

5. A time series for the years 1985-1996 had the following relative cyclical residuals, in chronological order : –1%, –2%, 1%, 2%, –1%, –2%, 1%, 2%, –1%, –2%, 1%, 2%. The relative cyclical residual for 1997 should be :

(A) 3%

(B) –1%

(C) –2%

(D) Cannot be determined from the information given

6. Assume that a time series with annual data for the years 1988-1996 is described well by the second degree equation $\hat{Y} = 5 + 3x + 9x^2$. Based only on this secular trend, what will be the forecast value for 1997 ?

(A) 161

(B) 245

(C) 347

(D) 293.75

7. For a given year, if an adjusted seasonal index for some period is greater than 100, then the following must be true :

(A) The adjusted index for some other period is > 100

(B) The adjusted index for some other period is < 100

(C) The adjusted index for some other period is = 100

(D) (A) and (C) but not (B)

8. Which one of these is not true for mode ?

(i) It is highly affected by sampling fluctuations

(ii) It may not even exist, if values occur with equal frequencies

(iii) it can be considered as a 40% trimmed mean

(iv) It exists for higher values only

(A) Both (i) and (ii)

(B) (iii) only

(C) Both (iii) and (iv)

(D) All of these

9. Relative position of mean, median and mode is given. Match the pairs :

(i) Mean = median = mode (a) Positively skewed

(ii) Mean > Median > mode (b) Negatively skewed

(iii) Mean < median < mode (c) Symmetrical

(A) (i), (a)
(ii), (b)
(iii), (c)

(B) (i), (b)
(ii), (c)
(iii), (a)

(C) (i), (c)
(ii), (a)
(iii), (b)

(D) (i), (a)
(ii), (c)
(iii), (b)

10. Consider the statement "More than 70% of the residents of certain city earn less than the average wage for that city." When this statement could be called a correct statement ?

(A) If there were a small group of residents with very small wages

(B) If there were a high group of residents with very high wages

(C) If there were a high group of residents with very small wages

(D) If there were a small group of residents with very high wages

11. Shepard's correction is not valid for :

(A) Discrete distribution only

(B) The bell shaped distribution with flat tails

(C) Total frequency is sufficiently large

(D) Class widths are not too small as compared to range

12. Match the following pairs :

(i) Second degree polynomial (p) $Y_t = a + bt + ct^2$

(ii) Exponential (q) $Y_t = ab^{ct}$

(iii) Modified exponential (r) $Y_t = a + bc^t$

(iv) Gompertz (s) $Y_t = ab^{ct}$

(A) (i), (p)
(ii), (q)
(iii), (r)
(iv), (s)

(B) (ii), (r)
(iii), (q)
(i), (p)
(iv), (s)

(C) (i), (q)
(iii), (s)
(iv), (p)
(ii), (r)

(D) (i), (r)
(ii), (p)
(iii), (s)
(iv), (q)

13. What will be the value of X such that for n attributes A, B, C,....., M (A, B, C, ...M) $\geq$ [(A) + (B) + (C) + ... + (M)] – X, Where n is the total frequency.

(A) (N – 1)n

(B) (n – 1)N

(C) (n + 1)N

(D) (N + 1)n

14. For a distribution, the distribution of the median from the first quartile is five times the distance of the third quartile from the median. Calculate a measure of skewness for the distribution :

(A) 0.67

(B) – 0.45

(C) – 0.75

(D) None of these

15. Value of the Spearman's rank correlation coefficient for a certain pair of number of observations was found to be $\frac{2}{3}$. The sum of square of the differences between corresponding ranks was 55. Find the number of pairs :

(A) 08

(B) 07

(C) 09

(D) 10

16. The analysis of the data collected in a survey may be broadly classified sequentially as follows :

(i) Statistical analysis

(ii) Tabulation of data

(iii) Scrutiny and editing

(iv) Reporting and Conclusion

(A) (ii), (iii), (iv), (i)

(B) (iii), (ii), (iv), (i)

(C) (i), (ii), (iii), (iv)

(D) (iii), (ii), (i), (iv)

17. In association of attributes of the following table :

	A	α
B	380	260
β	80	80

Find Yule's coefficient of association :

(A) 0.3595

(B) – 0.3595

(C) 0.3145

(D) None of these

18. Check the consistency of the data :

N = 1000, (A) = 600, (B) = 500, (AB) = 50

(A) Yes

(B) No

(C) Can't find

(D) Data is insufficient to examine consistency

19. In association of attributes, find the total number of class frequencies of all orders for n attributes :

(A) 2^n

(B) 2^{n+1}

(C) 3^{n+1}

(D) 3^n

20. The variance of n natural number is :

(A) $\frac{(n^2+1)}{12}$

(B) $\frac{(n+1)^2}{12}$

(C) $\frac{(n^2-1)}{12}$

(D) $\frac{(2n^2-1)}{12}$

21. If ρ is the correlation coefficient between X and Y, the correlation coefficient between 3X + 2 and Y is :

(A) 3ρ

(B) $3\rho + 2$

(C) ρ

(D) 9ρ

22. The empirical relationship between quartile deviation and standard deviation in a normal distribution is :

(A) 3 Q. D. ≅ 2 S. D.

(B) 4 Q. D. ≅ 3 S. D.

(C) 6 Q. D. ≅ 5 S. D.

(D) 5 Q. D. ≅ 7 S. D.

23. Find the value of Karl Pearson's coefficient of skewness for n = 4 :

(A) $\sqrt{\frac{1}{2}}$

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

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

(D) 2

24. Given $f(x, y) = xe^{-x(y+1)}$, for all $x \geq 0$, $y \geq 0$. Find the regression curve of Y on X :

(A) $y = \frac{1}{x}$

(B) $y = \frac{1}{x+1}$

(C) $y = \sqrt{\frac{1}{x}}$

(D) $\frac{1}{\sqrt{x}}$

25. From the data $r_{12} = 0.77$, $r_{13} = 0.72$, $r_{23} = 0.52$ and n = 18, find the value of partial correlation coefficient :

(A) 0.62

(B) 0.07

(C) 0

(D) 0.92

26. The correlation coefficient in a sample of n = 16 pairs of observations is 0.67. What is the value of probable error of correlation coefficient ?

(A) 0.012

(B) 0.092

(C) 0.210

(D) 0.401

27. Seasonal indices are calculated by using :

(A) Free hand curve method

(B) Moving average method

(C) Link relative method

(D) None of these

28. In analysis of time series population growth data which curve is most suitable :

(A) Arithmetic curve

(B) Logarithmic curve

(C) Second degree curve

(D) Logistic curve

29. Which one is considered as the merit of moving average method ?

(A) If does not provide trend values for all the time periods

(B) It cannot be used for forecasting

(C) If the fluctuations are regular and periodic this method completely eliminates the oscillatory movements affecting the series

(D) It introduces bias in the trend values if the trend is not linear

30. Which one of the following statements is false ?

(A) In a perfect positive correlation, each individual obtains the same z value on each variable

(B) Spearman's correlation coefficient is used when one or both variables are at least of interval scaling

(C) The range of correlation coefficient is from – 1 to + 1

(D) A correlation of r = 0.85 implies a stronger association than r = – 0.70

31. If two regression lines are $y = a + bx$ and $x = c + dy$, then the ratio of $\frac{a}{c}$ is equal to :

(A) $\frac{b}{d}$

(B) $\frac{1-b}{1-d}$

(C) $\frac{1+b}{1+d}$

(D) $\frac{b-1}{d-1}$

32. If two regression lines are $y = a + bx$ and $x = c + dy$, then the correlation coefficient between x and y is :

(A) $\sqrt{bc}$

(B) $\sqrt{ac}$

(C) $\sqrt{ad}$

(D) $\sqrt{bd}$

33. Which one of the following relationship is true ?

(A) $R_{1.23} \leq r_{12}$

(B) $R_{1.23} \geq r_{12}$

(C) $R_{1.23} = r_{12}$

(D) $R_{1.23} \geq -1$

34. The relationship between multiple correlation coefficient of x_1 on x_2 and x_3 and the standard error of estimate is given by the expression :

(A) $R_{1.23} = \sqrt{1 - \frac{S_{1.23}^2}{S_1^2}}$

(B) $R_{1.23} = \sqrt{1 - \frac{S_{1.23}^2}{S_2^2}}$

(C) $R_{1.23} = \sqrt{1 - \frac{S_{1.23}^2}{S_3^2}}$

(D) None of these

35. Sign of the possible presence of multicollinearity in a multiple regression are :

(A) Significant t values for the coefficients

(B) Low standard errors for the coefficients

(C) A sharp increase in a t value for the coefficient of an explanatory variable when another variable is removed from the model

(D) All of these

36. Suppose the estimating equation $\hat{Y} = 5 - 2X$ has been calculated for a set of data. Which of the following is true for this situation ?

(A) The Y – intercept of the line is 2

(B) The slope of the line is negative

(C) The line represents an inverse relationship

(D) Both (B) and (C) but not (A)

37. What is the chance of getting two sixes in two rollings of a single die ?

(A) $\frac{2}{36}$

(B) $\frac{1}{36}$

(C) $\frac{6}{36}$

(D) $\frac{2}{6}$

38. If A and B are events with $(A) = \frac{3}{8}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{4}$, find $P(A^C \cap B^C)$:

(A) $\frac{5}{8}$

(B) $\frac{3}{8}$

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

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

39. In a coin tossing experiment if the coin shows head, one die is thrown and the number is recorded. If the coin shows tail, two dice are thrown and their sum is recorded. What is the probability that the recorded number will be 2 ?

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

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

(C) $\frac{7}{72}$

(D) $\frac{1}{36}$

40. If X is a discrete random variable having the p. m. f :

X = x	P(X = x)
−1	k
0	2k
1	3k

Find P (X ≥ 0) :

(A) $\frac{5}{6}$

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

(C) $\frac{2}{6}$

(D) $\frac{1}{6}$

41. If the random variable X has the p. d. f. :

$$f(x) = \begin{cases} \frac{1}{4}, & |x| < 2 \\ 0, & \text{otherwise} \end{cases}$$

Find P (| X | > 1) :

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

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

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

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

42. A continuous random variable has a p.d.f $f(x) = 3x^2$, $0 \le x \le 1$. Find a such that P (X ≤ a) = P (X > a) :

(A) $\left(\frac{1}{2}\right)^{\frac{1}{3}}$

(B) $\left(\frac{1}{3}\right)^{\frac{1}{2}}$

(C) $\left(\frac{1}{3}\right)^{\frac{1}{5}}$

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

43. If a random variable X has the probability density function

$$f(x) = \begin{cases} \frac{1}{2}(x+1), & \text{if } -1 < x < +1 \\ 0, & \text{elsewhere} \end{cases}$$

find the mean and variance :

(A) $\frac{1}{3}, \frac{1}{3}$

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

(C) $\frac{1}{2}, \frac{1}{3}$

(D) $\frac{1}{3}, \frac{2}{9}$

44. If the probability of success on each trial is 0.25, after how many trials can we expect first success ?

(A) 3

(B) 2

(C) 5

(D) 6

45. If X is uniformly distributed random variable with mean 1 and variance $\frac{4}{3}$, find P (X > 0) :

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

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

(C) $\frac{3}{4}$

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

46. Which of the following is not the characteristic of Normal distribution ?

(A) Mode lies at $x = \mu$

(B) Distribution is bell shaped

(C) Point of inflation is $x = \mu \pm 2.5\sigma$

(D) Q. D. = $\frac{Q_3 - Q_1}{2}$

47. Select the odd pair for Beta distribution of first kind :

(A) Mean = $\frac{m}{m+n}$

(B) Variance = $\frac{mn}{(m+n)^2(m+n+1)}$

(C) Harmonic mean = $\frac{m+1}{(m-n+1)}$

(D) Mode depends on values of m and n

48. If X is a random variable distributed normally with mean zero and variance σ^2, E (| X |) will be :

(A) $\frac{2}{5}\sigma$

(B) $\frac{3}{6}\sigma$

(C) $\frac{4}{5}\sigma$

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

49. For a normal distribution, the first moment about 10 is 40 and that the 4th moment about 50 is 48, what are the parameters of the distribution ?

(A) $\mu = 50, \sigma = 4$

(B) $\mu = 40, \sigma = 4$

(C) $\mu = 30, \sigma = 3$

(D) $\mu = 50, \sigma = 5$

50. Suppose X has an exponential distribution with mean equal to 10. Determine the value of x such that $P(X < x) = 0.95$:

(A) $-10 \log (0.02)$

(B) $-13 \log (0.05)$

(C) $-10 \log (0.05)$

(D) $-10 \log (0.01)$

51. If two variables x and y have one-to-one correspondence described by the function $y = f(x)$ then their modes are also related by the relationship :

(A) $\bar{y} = \{f(\bar{x})\}^2$

(B) $\bar{y} = f(\bar{x})$

(C) $\bar{y} = f(\bar{x}^2)$

(D) None of these

52. The joint p. d. f. $f_{xy}(x, y) = c$, a constant when $(0 < x < 3)$ and $(0 < y < 4)$ and 0 otherwise. What is the value of the constant c ?

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

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

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

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

53. $X \sim N(0, 1)$, find the p. d. f. of $|X|$:

(A) $\frac{\sqrt{2}}{\pi} e^{-\frac{1}{2}y^2}$

(B) $\frac{2}{\sqrt{\pi}} e^{-\frac{1}{2}y^2}$

(C) $\sqrt{\frac{2}{\pi}} e^{-\frac{1}{2}y^2}$

(D) $\frac{2}{\pi} e^{-\frac{1}{2}y^2}$

54. X is normally distributed and the mean of X is 12 and S. D. as 4. Find the probability of $P(X \geq 0)$:

(A) 0.0450

(B) 0.6418

(C) 0.0228

(D) 0.0111

55. If X is uniformly distributed with mean 1 and variance $\frac{4}{3}$, find $P(X < 0)$:

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

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

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

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

56. Consider a discrete random variable X with p.d.f

$$f(x) = \begin{cases} \frac{1}{x(x+1)}, & x = 1,2 \\ 0, & \text{otherwise} \end{cases}, \ldots\ldots\ldots$$

Which one of these is correct ?

(A) For the r. v. X its moments and m. g. f. exist unitedly

(B) The r. v. X may have no moments although its m. g. f. exists

(C) The r. v. X may have no moments although its m. g. f. does not exists

(D) Its m. g. f. does not exist at all

57. Let the r. v. X assumes the value r with the probability law $P(X = r) = q^{r-1}p$; $r = 1, 2, 3, \ldots\ldots$ Find the m. g. f. of X :

(A) $\frac{pe^t}{(1-qe^{-t})}$

(B) $\frac{pe^t}{(1-q^t)}$

(C) $\frac{pe^t}{(1-q)^t}$

(D) $\frac{pe^t}{(1-qe^t)}$

58. Which one of these is not a property of characteristic function for all real t :

(A) $|\varphi(t)| \leq 1$

(B) $\varphi_x(-t)$ and $\varphi_x(t)$ are conjugate functions

(C) $\varphi_x(t)$ is uniformly continuous in t

(D) If the distribution function of a r. v. X is symmetrical about zero, then $\varphi_x(t)$ is not real valued and odd function of t

59. For a distribution the cumulants are given by $K_r = n\{(r-1)!\}$, $n > 0$. Which distribution its characteristic function follows ?

(A) Poisson distribution

(B) Beta-1 distribution

(C) Exponential distribution

(D) Gamma distribution

60. For two events A and B, $P(B) = 0.5$ and $P\left(\frac{A}{B}\right) = 0.25$, then $P(A - B)$ becomes :

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

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

(C) $\frac{3}{8}$

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

61. If X and Y are random variables, then :

(A) $E\{(XY)^2\} = E(X^2)\,E(Y^2)$

(B) $E\{(XY)^2\} = E(X^2Y^2)$

(C) $E\{(XY)^2\} \geq E(X^2)\,E(Y^2)$

(D) $E\{(XY)^2\} \leq E(X^2)\,E(Y^2)$

62. The Negative Binomial distribution NB (x; r, p) for r = 1 reduces to :

(A) Binomial distribution

(B) Poisson distribution

(C) Normal distribution

(D) Geometric distribution

63. Let X be a random variable with mean μ and variance σ^2. For what value of b, $E(X - b)^2$, as a function of b is minimised :

(A) $b = (\mu - 1)^2$

(B) $b = (\mu + 1)^3$

(C) $b = \mu + 1$

(D) $b = \mu$

64. If X has Binomial distribution with parameters n and p, then the unbiased estimate of $\frac{x + p\sqrt{n}}{n + \sqrt{n}}$ is :

(A) p^2

(B) $p + 2$

(C) p

(D) $\sqrt{p}$

65. In an examination 20% students failed in Statistics, 30% failed in Mathematics and 10% students failed in both the courses. One student is selected at random. Find the probability that he has failed in one course :

(A) 0.20

(B) 0.40

(C) 0.75

(D) Can not be found

66. If X is a Poisson variate with parameter $\theta = 1$, what is the mean deviation about mean ?

(A) $\frac{\sqrt{2}}{e}$

(B) $\sqrt{\frac{2}{e}}$

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

(D) None of these

67. Let X be a random variable and $Y = \frac{x-a}{h}$ be a function of X, then the m. g. f of Y i. e. $M_y(t)$ is :

(A) $e^{\frac{at}{h}} M_x\left(\frac{t}{h}\right)$

(B) $e^{\frac{at}{h}} M_x(t)$

(C) $e^{\frac{-at}{h}} M_x\left(\frac{t}{h}\right)$

(D) $e^{\frac{t}{h}} M_x\left(\frac{t}{h}\right)$

68. If $P(X > x + n \mid X > x) = P(X > n)$, where x and n are positive integers then which of the distributions the random variable X follows ?

(A) Binomial

(B) Geometric

(C) Poisson

(D) Gamma

69. If X is any Negative Binomial Distribution, find the corresponding E(X) :

(A) $\frac{rp}{q}$

(B) $\frac{rq}{p^2}$

(C) $\frac{rq}{p}$

(D) $\frac{rp}{q^2}$

70. If $f(x) = \frac{k}{2^x}$ is the probability density function of a random variable that can take on the values x = 0, 1, 2, 3, 4. What will be the value of k ?

(A) $\frac{31}{16}$

(B) $\frac{16}{31}$

(C) $\frac{15}{31}$

(D) $\frac{30}{16}$

71. If A and B are two independent events with $P(A \cap B) = \frac{6}{25}$ and $P(A/B) + P(B/A) = 1$, find P(A) :

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

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

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

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

72. For a Normal distribution, quartile deviation, mean deviation, standard deviation are in ratio :

(A) $\frac{4}{5} : \frac{2}{3} : 1$

(B) $\frac{2}{3} : \frac{4}{5} : 1$

(C) $1 : \frac{4}{5} : \frac{2}{3}$

(D) $\frac{1}{2} : 1 : \frac{4}{5}$

73. State which of the statements is false ?

(A) For normal distribution mean deviation about mean is greater than quartile deviation

(B) In case of normal distribution $\beta_1 = 3, \beta_2 = 0$

(C) If X and Y are two independent normal variates then X – Y is also a normal variate

(D) For normal distribution mean = median = mode

74. State which of the statement is true ?

(A) For the sequence $\{X_n\}$ of independent random variables, central limit theorem may hold but WLLN may not hold

(B) Linderberg-Levy theorem should be inferred as a particular case of Liapounoff's WLLN

(C) Both the central limit theorem and WLLN don't hold simultaneously for a sequence $\{X_n\}$ of random variables

(D) In the Binomial case, central limit theorem does not give good approximation if p is nearly $\frac{1}{2}$.

75. Which of these distributions has a pair of degrees of freedom ?

(A) Binomial

(B) Chi-square

(C) Poisson

(D) None of these

76. Which one of the following simple rules does not hold for convergence in probability :

If $X_n \xrightarrow{p} \alpha$ and $Y_n \xrightarrow{p} \beta$ as $n \to \infty$, then :

(A) $X_n \pm Y_n \xrightarrow{p} \alpha \pm \beta$ as $n \to \infty$

(B) $X_n Y_n \xrightarrow{p} \alpha\beta$ as $n \to \infty$

(C) $\frac{X_n}{Y_n} \xrightarrow{p} \frac{\alpha}{\beta}$ as $n \to \infty$, provided $\beta \neq 0$

(D) $(X_n)^{Y_n} \xrightarrow{p} \beta^{\frac{1}{\alpha}}$ as $n \to \infty$

77. If P(s) is the probability generating function for the r. v. X, then the probability generating function of $\frac{(x-a)}{b}$ will be :

(A) $S^{\frac{a}{b}} P(S^b)$

(B) $S^{\frac{-a}{b}} \left(S^{\frac{1}{b}} \right)$

(C) $S^{\frac{-a}{b}} P(S^b)$

(D) Cannot be determined

78. The variance of t distribution for n. d. f. for $n > 2$ is found as :

(A) $\frac{n}{n-3}$

(B) $\frac{n}{n-2}$

(C) $\frac{n}{n-4}$

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

79. F distribution extends along abscissa from :

(A) 0 to 1

(B) $-\infty$ to $+\infty$

(C) $-\infty$ to 0

(D) 0 to $+\infty$

80. The significance of correlation coefficient and regression coefficient is tested by :

(A) χ^2

(B) F

(C) Student's t

(D) Z

81. If $X \sim N(0, 1)$ and $Y \sim \chi^2_n$, the statistic $\frac{\sqrt{n}x}{\sqrt{y}}$ is distributed as :

(A) Fisher's t

(B) F

(C) χ^2

(D) Z

82. The third moment of Chi-square distribution is _____ of its variance.

(A) 4 times

(B) 2 times

(C) 3 times

(D) 5 times

83. For distributions $F\upsilon_1, \upsilon_2$ and $\chi^2\upsilon_1$ and $\upsilon_2 \to \infty$, the relation between F and χ_2 is :

(A) $\upsilon_2 F = \chi^2$

(B) $\upsilon_1 F = \chi^2$

(C) $F = \chi^2$

(D) $\left(\upsilon_1 / \upsilon_2\right) F = \chi^2$

84. Which one of these can be considered as the disadvantage of non-parametric methods ?

(A) No assumption is needed about the parent distribution of data for analysis

(B) Non-parametric methods are very suitable to analyse the data which are measured in nominal scale or by ranks

(C) Parametric tests are more powerful than non-parametric tests

(D) Non-parametric method is suitable to handle the data on social aspects

85. The number of degrees of freedom in r × s contingency table using the Chi-square test is :

(A) r × s

(B) (r + 1) × (s + 1)

(C) (r – 1) × (s + 1)

(D) None of these

86. When performing a Chi-square hypothesis test, what happens when expected frequencies in several cells are too small ?

(A) The value of χ^2 will be overestimated

(B) The null hypothesis will be more likely to be rejected than it should be

(C) The degrees of freedom are greatly reduced

(D) Both (A) and (B) but not (C)

87. Let X ~ C (θ, 0). Find the MLE of θ :

(A) $\hat{\theta} = x^{\frac{1}{2}}$

(B) $\hat{\theta} = x^2$

(C) $\hat{\theta} = x$

(D) $\hat{\theta} = x^{\frac{1}{3}}$

88. Which of the statements is not true ?

(A) A consistent maximum likelihood estimator is not unique

(B) MLE, if they exist, are the functions of sufficient statistc

(C) The most efficient estimators are necessarily MLEs, but the converse is not true

(D) If $\hat{\theta}$ is the MLE of θ, g is some many-to-one function of θ, g(θ) then the MLE of g(θ) is $g(\hat{\theta})$:

89. Let $X_1, X_2, \ldots\ldots X_n$ be i. i. d with common p. d. f. :

$$f(x, \theta) = \begin{cases} \exp\{-(x-\theta)\}, & x \geq \theta + 1 \\ 0, & \text{otherwise} \end{cases}$$

Find its likelihood function :

(A) $\exp\left\{\sum_{i=1}^{n}(x_i - \theta)\right\}$, if $x_{(1)} \geq \theta$

(B) $\sum_{i=1}^{n}(x_i - \theta)$

(C) $\exp\left\{-\sum_{i=1}^{n}(x_i - \theta)\right\}$, if $x_{(1)} \geq \theta$

(D) $\exp\{-(x_i - \theta)\}$

90. Let $X_1, X_2, \ldots\ldots, X_n$, be a random sample drawn from the population with density :

$$f(x, \theta) = \begin{cases} 1, & \text{if } \theta < x < \theta + 1 \\ 0, & \text{otherwise} \end{cases}$$

Then sample mean $\bar{x}$ is _____ and _____ estimator of θ + (1/2).

(A) Unbiased and sufficient

(B) Unbiased and consistent

(C) Consistent and accurate

(D) Consistent and sufficient

91. Fill in the gaps of the following : Let a sequence of estimators $\{\delta_n\}$ be _____ for θ and g be some _____ function of δ_n. Then, $\{g(\delta_n)\}$ is consistent for $g(\theta)$.

(A) Consistent and continuous

(B) Continuous and sufficient

(C) Consistent and unbiased

(D) Unbiased and sufficient

92. Let a random variable X represents measured resistance values in ohms. It is known that the variance of X is $\sigma_x^2 = 13.7$. Mesurement of 12 sample resistors yields a sample mean of $\tilde{x} = 71.55$. What are the confidence limits on estimate of μ_x if it requires a confidence level of 95 % ?

(A) (69.49, 70.69)

(B) (68.01, 74.34)

(C) (69.46, 73.64)

(D) (68.35, 72.21)

93. In the test of randomness under the null hypothesis H_0 that the set of n observations is random, the number of runs U is a random variable with E(U) and Var(U) as follows :

(A) $\frac{n+2}{2}, \frac{n}{3}\left(\frac{n-2}{n-1}\right)$

(B) $\frac{n+2}{2}, \frac{n}{4}\left(\frac{n-2}{n-1}\right)$

(C) $\frac{n+2}{2}, \frac{n}{4}\left(\frac{n-1}{n-2}\right)$

(D) $\frac{n+2}{2}, \frac{n}{2}\left(\frac{n-2}{n-1}\right)$

94. Mann-Whitney's U-test is regarded as the best non-parametric test for location as the asymptotic relative efficieny (ARE) of it relative to two sample t-test is as follows :

(A) ≥ 0.864

(B) < 0.864

(C) $= 0.864$

(D) ≤ 0.864

95. In sampling from a finite population of size N, the corresponding 99 % confidence limit for μ is :

(A) $\bar{x} \pm 1.96 \frac{\sigma}{\sqrt{n}} \sqrt{\frac{n}{N}}$

(B) $\bar{x} + 2.58 \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N}}$

(C) $\bar{x} \pm 2.58 \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}$

(D) $\bar{x} \pm 2.58 \frac{s}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}$

96. The significant or critical value of z for a single-tailed test (left or right) at level of significance α, is same as the following :

(A) Critical value of Z for a two-tailed test at level of significance $\frac{\alpha}{2}$

(B) Critical value of Z for a single-tailed test at level of significance 2α

(C) Critical value of Z for a two-tailed test at level of significance α

(D) Critical value of Z for a two-tailed test at level of significance 2α

97. A random sample of 500 apples was taken from a large consignment and 60 are found to be bad. Find the 98% confidence limits for the percentage of bad apples in the consignment. (value of Z at 95% confidence level is 2.33)

(A) (0.086, 0.153)

(B) (0.312,, 0.979)

(C) (0.401, 0.853)

(D) (0.666, 0.888)

98. In a test of difference between proportions, two samples are under consideration. In the first, a sample of size 100 shows 20 successes; in the second, a sample of size 50 shows 13 successes. What is the value of $\hat{p}$ for this situation ?

(A) $\frac{20+13}{150}$

(B) $\frac{20}{100}+\frac{13}{50}$

(C) $\frac{33}{150}\times\frac{117}{150}$

(D) None of these

99. For testing the significance of H_0: $\rho = 0$ as against H_1 : $\rho \neq 0$, the test statistic under null hypothesis of :

(A) $t = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2}$

(B) $t = \frac{r}{\sqrt{1-r^2}}\sqrt{n}$

(C) $t = \frac{r}{\sqrt{1+r^2}}\sqrt{n}$

(D) $t = \frac{r}{\sqrt{1-r^2}}\, n$

100. What is the correlation coefficient between the most efficient estimator and other estimator with efficiency ?

(A) 1

(B) $\sqrt{e}$

(C) e

(D) $\frac{1}{\sqrt{e}}$

101. Which one of the following do not fall under the properties of maximum likelihood estimator ?

(A) The first and second order derivatives $\frac{\partial \log L}{\partial \theta}$ and $\frac{\partial^2 \log L}{\partial \theta^2}$ exist and are continuous function of θ is a range R for almost all x.

(B) MLE are always consistent but need not be unbiased

(C) If MLE exists it cannot be efficient in the class of such estimators

(D) If a sufficient estimator exists, it is a function of MLE

102. The larger the difference between the expected and observed frequencies for each cell in a contingency table :

(A) The more likely it is that null hypothesis will be rejected

(B) The more likely it is that the populations proportions are different

(C) Both (A) and (B)

(D) None of these

103. Which of the statements is wrong ?

(A) The critical value of a statistic is the value which cuts off the region for the rejection of null hypothesis

(B) The χ^2 test requires that the sampling distribution should be normally distributed

(C) If null hypothesis is accepted, then it is concluded that the data analysis did not produce significant results

(D) When the results of hypothesis testing are statistically significant, they are unlikely to reflect sampling error

104. To be assumed that a hypothesis test is working correctly, it is desired that the value of $1 - \beta$ should be close to :

(A) 0.25

(B) 0.050

(C) 0.075

(D) 1.0

105. For test of hypothesis $H_0 : \mu_1 \leq \mu_2$, and $H_1 : \mu_1 > \mu_2$ the critical region at $\alpha = 0.10$ and $n > 30$ is :

(A) $z \leq 1.96$

(B) $z > 1.96$

(C) $z \leq -1.645$

(D) $z > 1.645$

106. Which of the statements is false ?

(A) Type-II error is the probability of accepting null hypothesis when it is true

(B) The estimated standard deviation of sampling distribution of a statistic is called standard deviation

(C) Type-I error is more harmful than Type-II error

(D) For a given level of significance, we can reduce β by increasing the sampling size

107. Let $X_1, X_2, X_3, \ldots\ldots X_n$ be a random sample from $N(\theta, 1)$. Obtain MVUE of θ.

(A) $\bar{X}_n$

(B) $\bar{X}_n^2$

(C) $\frac{1}{\bar{X}_n}$

(D) Can not be determined

108. The F-ratio used in testing for the existing of a regression relationship between a dependent variable and any of the independent variable is given by :

(A) $F = \frac{R^2}{1-R^2}\left[\frac{n-(k+1)}{n}\right]$

(B) $F = \frac{R^2}{1-R^2}\left[\frac{n+(k-1)}{n}\right]$

(C) $F = \frac{R^2}{1-R^2}\left[\frac{n-(k+1)}{k}\right]$

(D) $F = \frac{R^2}{1-R^2}\left[\frac{n+(k-1)}{k}\right]$

109. If X is a continuous random variable with mean μ and variance σ^2, then for any positive number k, $P\{|X-\mu| \geq k\sigma\} \leq \frac{1}{k^2}$ is known as :

(A) Liapunov's inequality

(B) Chebychev's inequality

(C) Bienayme-Chebychev's inequality

(D) Khintchine's inequality

110. According to Chebychev's inequality, the probability that :

(A) X will be from its mean by more that 2 standard deviations is less than or equal to 0.75

(B) X will be within 2 standard deviations of its mean, is greater than or equal to 0.95

(C) X will be within 2 standard deviations of its mean, is greater than or equal to 0.25

(D) X will be within 2 standard deviations of its mean, is greater than or equal to 0.75

111. The null hypothesis most often examined in nonparamteric tests (Choose one answer) :

(A) Includes specification of a population's parameters

(B) Is used to evaluate some general population aspect

(C) Is very similar to that used in regression analysis

(D) Simultaneously tests more than two population parameters

112. The sequence of C, D, C, D, C, D, C, D, C, D would probably be rejected by a test of runs as not being truly random because :

(A) The pattern C, D occurs only five times, this is not often enough to guarantee randomness

(B) The sequence contains too many runs

(C) The sequence contains too few runs

(D) The sequence contains only two symbols

113. Which is the major assumption we make when performing one-tailed tests for differences between means with small samples ?

(A) Unknown population variances are equal

(B) Sampling fractions are quite small

(C) The samples are chosen using judgemental sampling techniques

(D) (B) or (C) but not (A)

114. A two tailed test of two variances is to be performed for samples 1 and 2 with $n_1 = 15$ and $n_2 = 12$. If $\alpha = 0.10$, which of the following represents the upper value to which $\frac{s_1^2}{s_2^2}$ should be compared ?

(A) $\frac{1}{F(14,11,0.05)}$

(B) $\frac{1}{F(14,11,0.95)}$

(C) F(11, 14, 0.05)

(D) F(11, 14, 0.95)

115. The regression estimator is always more efficient than the sample mean, unless :

(A) $\rho = 1$

(B) $\rho = -1$

(C) $\rho = \infty$

(D) $\rho = 0$

116. The systematic sample mean $\bar{y}_{sy}$ is more efficient than the simple random sample mean $\bar{y}$ if :

(A) $S^2 > S_w^2$

(B) $S^2 = S_w^2$

(C) $S^2 < S_w^2$

(D) Can not be determined

117. The relative precision of systematic sample mean with simple random mean depends on the value of ρ. Hence :

(i) $\rho = \frac{-1}{(N-1)}$ (a) Estimate based on systematic sampling is more efficient

(ii) $\rho < \frac{-1}{(N-1)}$ (b) Two methods give equal precision

(iii) $\rho > \frac{-1}{(N-1)}$ (c) It reverses of (a)

(A) (i), (c)
(ii), (b)
(iii), (a)

(B) (ii), (a)
(i), (b)
(iii), (c)

(C) (i), (b)
(ii), (a)
(iii), (c)

(D) (i), (c)
(ii), (a)
(iii), (b)

118. When ratio estimate $\hat{R}$ is unbiased :

(A) $\rho(\hat{R}, \bar{x}) = 1$

(B) $\rho(\hat{R}, \bar{x}) = 0$

(C) $\rho(\hat{R}, \bar{x}) = \infty$

(D) $\rho(\hat{R}, \bar{x}) = -1$

Where ρ stands for correlation coefficient

119. When the variance of regression estimator is less than that of ratio estimator ?

(A) $\beta < R$

(B) $\beta = R$

(C) $\beta > R$

(D) $\beta = 0.5R$

120. What will be the relative efficiency of cluster sampling as compared to simple random sampling ?

(A) The efficiency of cluster sampling increases as mean square between clusters increases

(B) The efficiency of cluster sampling increases as mean square between clusters decreases

(C) The efficiency of cluster sampling decreases as mean square between clusters decreases

(D) Can not be found

121. Which of these can not be counted towards non-response error ?

(A) Not at home

(B) Refusal

(C) Last schedule

(D) Poor statistical analysis

122. Match the following :

No. of digits	Random number table
(i) 15, 000	(a) Tippet
(ii) 10,400	(b) Fisher Yates
(iii) 20.000	(c) Kendal & Babington
(iv) 25,000	(d) Rand Corporation

(A) (i), (b)
(ii), (a)
(iii), (d)
(iv), (c)

(B) (ii), (a)
(i), (c)
(iii), (b)
(iv), (d)

(C) (i), (d)
(ii), (c)
(iii), (a)
(iv), (b)

(D) (i), (c)
(ii), (b)
(iii), (d)
(iv), (a)

123. For the same number of elements in the sample the relationship between V_c (variance when clusters of size M are taken) and V_e (variance when elements are taken directly) is :

(The notations have usual meanings).

(A) $V_c = [1 - (n - 1)\rho] V_e$

(B) $V_c = [1 + (N - 1)\rho] V_e$

(C) $V_c = [1 + (M - 1)\rho] V_e$

(D) $V_c = [1 + (M - n)\rho] V_e$

124. The variance in the cluster sampling depends on :

(i) Number of clusters in the sample, variance S_y^2 and total population size

(ii) Number of clusters in the sample, variance S_y^2, size of cluster M and intra-cluster correlation coefficient ρ.

(iii) Number of clusters in the sample, standard deviations S_y, total population size and intra-cluster correlation coefficient ρ.

(A) (i)

(B) Both (i) and (ii)

(C) Both (ii) and (iii)

(D) (ii)

125. The allocation of sample numbers n_h to strata could best be determined by :

(C_h is the cost of collecting information from a unit in stratum h)

(A) $n_h \propto \frac{\sqrt{C_h}}{\sqrt{A_h}}$

(B) $n_h \propto \frac{A_h}{C_h}$

(C) $n_h \propto \frac{A_h}{\sqrt{C_h}}$

(D) $n_h \propto \frac{\sqrt{A_h}}{\sqrt{C_h}}$

126. It is desired to estimate a population proportion with a coefficient of variation of a_0 or less. Then the sample size required to achieve this is given by the formula (P is the population proportion) :

(A) $n \geq \frac{1-P}{P}\frac{1}{a_0^2}$

(B) $n \geq \frac{P}{1-P}a_0^2$

(C) $n \geq \frac{1-P}{P}a_0^2$

(D) $n \geq \frac{1}{P}\frac{1}{a_0^2}$

127. In planning and execution of sample survey find the correct order of the steps involved :

(i) Sampling unit

(ii) Sample selection

(iii) Frame

(iv) Population to be covered

(A) (i), (iii), (ii), (iv)

(B) (iv), (iii), (i), (ii)

(C) (iv), (i), (iii), (ii)

(D) (ii), (iii), (iv), (i)

128. If the sample size n is sufficiently large so that terms of $0\left(\frac{1}{n^2}\right)$ can be ignored, the ratio estimator $\bar{y}_r$ is more efficient than the simple mean $\bar{y}$ if :

(A) $\rho = \frac{1}{2}\frac{C_x}{C_y}$

(B) $\rho < \frac{1}{2}\frac{C_x}{C_y}$

(C) $\rho > \frac{1}{2}\frac{C_x}{C_y}$

(D) $\rho > \frac{C_y}{C_x}$

129. Pick out the one which is not related to CRD :

(A) It is easy to layout the design

(B) The relative loss of information due to missing data is smaller in comparison with any other

(C) It gives misleading results if blocks are not homogenous

(D) It allows complete flexibility as any number of treatments and replicates may be used

130. As per W. G. Cochran, on the basis of series of field experiments obtained, the following results for the efficiencies of LSD relative to RBD and CRD as CRD : RBD : LSD is :

(A) 6 : 10 : 5

(B) 10 : 6 : 5

(C) 5 : 6 : 10

(D) 6 : 5 : 10

131. Error in study of design of experiment includes all types of extraneous variations. Which one of these does not belong to that group ?

(A) Inherent variability in the experimental material

(B) Lack of uniformity in methodology

(C) Lack of representativeness of the sample

(D) Lack of skilled human power

132. What is the d. f. of the total sum of squares in analysis of two way classified data with m observations per cell for fixed effect model ? (The notations have usual meanings)

(A) mpq + 1

(B) mpq – 1

(C) 1 – mpq

(D) mpq

133. Arrange the various steps in order of carrying out the ANOVA of a two-way classified data with one observation per cell :

(i) Partitioning of various sum of squares and degrees of freedom

(ii) ANOVA table

(iii) Test statistic to be used

(iv) Mathematical model, assumptions used and hypotheses to be tested

(A) (iv), (iii), (ii), (i)

(B) (iv), (i), (iii), (ii)

(C) (i), (iii), (iv), (ii)

(D) (i), (ii), (iii), (iv)

134. How many number of observations are saved in a 4 × 4 LSD over a complete 3 way layout ?

(A) 46

(B) 48

(C) 50

(D) 52

135. The mean yield of four treatment combinations in a 2^2 factorial experiment is :

(A) $\frac{1}{2}(b + 1)(a + 1)$

(B) $\frac{1}{4}(a + 1)(b + 1)$

(C) $\frac{1}{2}(a + 1)(b + 1)^2$

(D) $\frac{1}{2}(a + 1)^2(b + 1)$

136. In factorial experiment, if the contrasts are orthogonal, what will be the value of sum of the product of the coefficients of the corresponding treatment means ?

(A) 1

(B) ∞

(C) 0

(D) –1

137. In a 4 × 4 Latin square design, what will be the observation on missing plot $\hat{x}$, where R = 99.8, C = 17.4, T = 25.4 and S = 354.8 (the notations have usual meanings) ?

(A) 19.13

(B) 21.75

(C) 12.13

(D) 17.25

138. What will be the value of the total sum of squares in a two way analysis of variance ?

(A) $\Sigma\Sigma(x_{ij} - \bar{x}_j)^2$

(B) $\Sigma\Sigma x_{ij}^2 - n(\bar{\bar{x}})^2$

(C) $\Sigma\Sigma(x_{ij} - \bar{\bar{x}})^2$

(D) None of these

139. Which of the assumptions associated with ANOVA testing is to be discarded ?

(A) The observation are independent

(B) Various effects are additive

(C) Each population has the same variance

(D) The samples are drawn from a non-Normal population

140. What is the total number of factorial effects in 2^n factorial experiment ?

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

(B) $2^n + 1$

(C) 2^n

(D) $2^n - 1$

141. In RBD, what is the least significant difference (l. s. d.) or critical difference (C.D) for testing the significance of the difference between any two treatment means containing the missing observations. (The notations have usual meanings).

(A) $\sqrt{MSE\left(\frac{2}{r}\right)}t_{(r-1)(v-1)-1}\left(\frac{\alpha}{2}\right)$

(B) $\sqrt{MSE\left(\frac{2}{r}\right)}t_{(r-1)(v-1)}(\alpha)$

(C) $\sqrt{MSE\left(\frac{2}{r}\right)}t_{rv-1}\left(\frac{\alpha}{2}\right)$

(D) $\sqrt{MSE\left(\frac{2}{r}\right)}t_{(r-1)(v-1)}\left(\frac{\alpha}{2}\right)$

142. In multivariate analysis, eigen values and eigen vectors are used for the followins, except :

(A) Path coefficient analysis

(B) Principle component analysis

(C) Factor analysis

(D) Correlation ratio

143. Given a system of m simultaneous linear equation in n unknown (m < n), the number of basic variables will be :

(A) m

(B) n

(C) n – m

(D) n + m

144. The role of artificial variable in simplex method is :

(A) To aid in finding initial basic feasible solution

(B) To start phases of simplex method

(C) To find shadow prices from the final simplex table

(D) None of these

145. A necessary and sufficient condition for a basic feasible solution to a minimization LPP to be an optimum is that (for all j) :

(A) $z_j - c_j \geq 0$

(B) $z_j - c_j \leq 0$

(C) $z_j - c_j = 0$

(D) $z_j - c_j > 0$ or $z_j - c_j < 0$

146. Which of the following is a correct statement ?

(A) If the primal problem is in its standard form, dual variables will be non-negaive

(B) Dual simplex method is applicable to an LPP, if initial basic feasible solution is not optimum

(C) Dual simplex method always leads to degenerate basic feasible solution

(D) If the number of primal variables is very small and the number of constraints is very large, then it is more efficient to solve the dual rather than the primal problem

147. The initial solution of a transportation problem can be obtained by applying any known method. However, the only condition is that :

(A) The solution must be optimum

(B) The solution should be non-degenerate

(C) The rim conditions are satisfied

(D) All of these

148. An assignment problem is considered as a particular case of transportation problem, because :

(A) All the rim conditions are 1

(B) All x_{ij} are either 0 or 1

(C) The number of rows equals to columns

(D) All of these

149. Why is multivariate normal so important ? One of the reasons does not subscribe to it :

(A) It is easy to obtain multivariate methods based on the particular distribution

(B) Precision can be easily meaured

(C) Many natural phenomena may also be modelled using this distribution

(D) (A) and (C) but no (B)

150. The dual of the primal maximization LPP having m constraints and n non-negative variables :

(A) Should be a minimization LPP

(B) Should have n constraints and m non-negaive variables

(C) Both (A) and (B)

(D) Dual for this does not exist

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