COMBINED TECHNICAL SERVICES EXAMINATION

(INTERVIEW POST)

COMPUTER BASED TEST

DATE OF EXAM: 22.07.2025 AN

PAPER – II – STATISTICS, ECONOMICS AND MATHEMATICS

(PG STANDARD) (CODE: 563)

1. Assertion (A) : A constraint like $x_1^2 + x_2 \leq 5$ is valid in LPP

Reason (R) : In LPP all constraints must involve with linear expressions of the variables only

(A) (A) is false, but (R) is true

(B) (A) is true, but (R) is false

(C) Both (A) and (R) are true; and (R) is the correct reason for (A)

(D) Both (A) and (R) are true; but (R) is not the correct reason for (A)

(E) Answer not known

2. Solution of the equation, $xr + 2p = 0$ is

(A) $z = \left(\frac{1}{x}\right) \times \phi_1(y) + \phi_2(y)$, ϕ_1, ϕ_2 are arbitrary function

(B) $z = \left(\frac{1}{x^2}\right) \times \phi_1(y) + \phi_2(y)$, ϕ_1, ϕ_2 are arbitrary function

(C) $z = -\left(\frac{1}{x}\right) \times \phi_1(y) + \phi_2(y)$, ϕ_1, ϕ_2 are arbitrary function

(D) $z = -\left(\frac{1}{x^2}\right) \times \phi_1(y) + \phi_2(y)$, ϕ_1, ϕ_2 are arbitrary function

(E) Answer not known

3. Complete integral of $zpq = p + q$ is

(1) $z^2 = 2(1+a)[x + (1/a)y] + b$

(2) $z^2 = (1+a)[x + (1/a)y] + b$

(3) $z^2 = (1-a)[x + (1/a)y] + b$

(4) $z^2 = (1+a)[x + ay] + b$

Where a, b are arbitrary constants

(A) (4) only
(B) (2) only
(C) (1) only
(D) (3) only
(E) Answer not known

4. Match the following

Second order PDE		Solution
(a) $\left(D^2+3DD'+2D'^2\right)z=x+y$	1.	$z=\phi_1(y+ix)+\phi_2(y-ix)+\dfrac{\cos(mx+ny)}{m^2+n^2}$
(b) $\left(D^2+2DD'+D'^2\right)z=e^{2x+3y}$	2.	$z=\phi_1(y-x)+\phi_2(y-2x)+\dfrac{(x+y)^3}{36}$
(c) $\left(D^2+D'^2\right)z=\cos(mx+ny)$	3.	$z=\phi_1(y+ix)+\phi_2(y-ix)+\dfrac{\sin(mx+ny)}{m^2+n^2}$
(d) $\left(D^2+D'^2\right)z=\sin(mx+ny)$	4.	$z=\phi_1(y-x)+x\phi_2(y-x)+\dfrac{e^{2x+3y}}{25}$

	(a)	(b)	(c)	(d)
(A)	2	3	4	1
(B)	2	4	1	3
(C)	4	3	1	2
(D)	3	1	4	2

(E) Answer not known

5. The complete integral of the partial differential equation $p^2 - 3q^2 = 5$ is

(A) $z = \sqrt{5+3a^2}\,x + ay + b$ where a and b are arbitrary constants

(B) $z = \sqrt{5+3a^2}$ where a and b are arbitrary constants

(C) $z = \left(5+3a^2\right)x + ay$ where a and b are arbitrary constants

(D) $z = \sqrt{5+3a^2}\,y + b$ where a and b are arbitrary constants

(E) Answer not known

6. The solution of $pz - qz = z^2 + (x+y)^2$ is

(A) $f\left(x+y,\ x^2+y^2+z^2+2xy-2x\right)=0$

(B) $f\left(x+y, \log\left(x^2+y^2+z^2+2xy\right)-2x\right)=0$

(C) $f\left(x+y, \log\left(x^2+y^2+z^2+2xz\right)-2z\right)=0$

(D) $f\left(x+y, \log\left(x^2+y^2+z^2+2yz\right)-2z\right)=0$

(E) Answer not known

7. Which of the following is a incorrect statement about the assignment problem?

(1) The classical assignment model deals with matching workers to jobs

(2) Skill variation affects the cost of completing a job

(3) The goal is to determine the minimum cost assignment of workers of jobs

(4) In the assignment problem represented by LPP of Hungarian method, the optimal solution is changed if a constant is added to or subtracted from any row or column of cost matrix

(A) (1) only
(B) (2) only
(C) (3) only
(D) (4) only
(E) Answer not known

8. If we were to use opportunity cost value for non-basic cell to test optimality, then it should be

(A) Equal to zero
(B) Any value
(C) Most positive number
(D) Most negative number
(E) Answer not known

9. Given a system of m simultaneous linear equations in a unknowns $(m < n)$ the number of basic variables will be

(A) m

(B) n

(C) $n - m$

(D) $n + m$

(E) Answer not known

10. The minimum number of lines covering all zeros in a reduced cost matrix of order n can be

(A) At the most n

(B) A the least n

(C) $n - 1$

(D) $n - 2$

(E) Answer not known

11. For optimal feasible solutions of the primal and dual systems, wherever the i^{th} variable is strictly positive in either system, the i^{th} relation of its dual is

(A) An equality

(B) Variables

(C) Not an equality

(D) Must be a constant

(E) Answer not known

12. A basic feasible solution to an linear programming problem must correspond to ———— of the set of all feasible solutions and conversely

(A) Degenerate extreme point
(B) Non-Degenerate extreme point
(C) An extreme point
(D) A particular point
(E) Answer not known

13. If total supply is greater than total demand, what is added to balance the problem?

(A) A dummy demand column
(B) A dummy supply row
(C) A dummy demand row
(D) A dummy supply column
(E) Answer not known

14. The equation $x^2y'' + xy' + (x^2 - \alpha^2)y = 0$ is called

(A) Hermite equation
(B) Bessel equation
(C) Legendre equation
(D) Ordinary equation
(E) Answer not known

15. Find the value of $\int_{-1}^{1} p_n(x)dx$, when $n=0$, by using Rodrigue's formula.

(A) 0

(B) 1

(C) 2

(D) -1

(E) Answer not known

16. The Wronskian of the three independent solution of $x''' - x'' - x' + x = 0$ in $[0, 1]$ (where $x' = \frac{dx}{dt}$) is

(A) e^t

(B) $4e^{-t}$

(C) e^{-t}

(D) $4e^t$

(E) Answer not known

17. The solution of $\left(D^4 - 6D^3 + 12D^2 - 8D\right)y = 0$ is

(A) $y = \left(c_1 x + c_2 x^2\right) + \left(c_3 x^3 + c_4\right)e^{2x}$

(B) $y = \left(c_1 x + c_2 x^2\right)e^x + \left(c_3 x^3 + c_4 x\right)e^{2x}$

(C) $y = c_1 + \left(c_2 + c_3 x + c_4 x^2\right)e^{2x}$

(D) $y = c_1 + \left(c_2 + c_3 x + c_4 x^2\right)e^x$

(E) Answer not known

18. Find the intervals on which the three function 1, $\sin x$, $\cos x$, $x > 0$ are linearly independent

(A) $(-\infty, 0)$

(B) $(0, \infty)$

(C) $(0, 0)$

(D) $(-\infty, \infty)$

(E) Answer not known

19. Match the following :

(a)	$p_n(1)$	1.	0
(b)	$p_2 m(0)$	2.	$\frac{(-1)^{n/2} n!}{2^n [(n/2)!]^2}$
(c)	$p_n(0)$ if n is odd	3.	1
(d)	$p_n(0)$ if n is even	4.	$(-1)^m \frac{(2m)!}{2^{2m}(m!)^2}$

	(a)	(b)	(c)	(d)
(A)	3	4	1	2
(B)	4	3	1	2
(C)	3	4	2	1
(D)	4	3	2	1

(E) Answer not known

20. The value of $J_{1/2}(x)$ is

(A) $\sqrt{\frac{2\pi}{x}}\sin x$

(B) $\sqrt{\frac{2\pi}{x}}\cos x$

(C) $\sqrt{\frac{\pi}{2x}}\cos x$

(D) $\sqrt{\frac{2}{\pi x}}\sin x$

(E) Answer not known

21. A market is said to be ———— when all the potential sellers and buyer are promptly aware of prices of commodities

(A) Pure market

(B) Perfect market

(C) Imperfect market

(D) Pure competition

(E) Answer not known

22. The externality created by asymmetric information prevents the achievement of

(A) Pareto efficiency

(B) Market failure

(C) Symmetric information

(D) Adverse selection

(E) Answer not known

23. The list of outcomes associated with combinations of each strategy and state of nature. If refers to

(A) Strategy
(B) State of nature
(C) Outcomes
(D) Pay off matrix
(E) Answer not known

24. A situation when the outcomes of a decision is uncertain but when the probably of each possible outcome is known or can be estimated, If refers to

(A) Choice
(B) Risk
(C) Uncertainty
(D) Symmetric information
(E) Answer not known

25. The ———— curve shows risk lover and his preference for Gambling.

(A) Downward to the right
(B) Vertical straight
(C) Convexity of utility
(D) Concave of utility
(E) Answer not known

26. A choice of a combination by a consumer reveals his definite preference for that over all other alternatives open to him, it implies

(A) Weak ordering
(B) Strong ordering
(C) Consistency
(D) Transistive
(E) Answer not known

27. "The rate of change of total utility caused by a small given change in the quantity of a commodity is denoted as

(A) Total utility
(B) Average utility
(C) Marginal utility
(D) Variable utility
(E) Answer not known

28. The Indifference curve analysis abandoned the concept of

(A) Ordinal utility
(B) Cardinal utility
(C) Scale of preference
(D) Ordinal numbers
(E) Answer not known

29. Right shoe and left shoe is an example for

(A) Perfect complements
(B) Perfect substitutes
(C) Giffen goods
(D) Inferior goods
(E) Answer not known

30. ———————— is subjective or introspective concept and defined as a power of a commodity.

(A) Aggregate aspects
(B) Demand
(C) Utility
(D) Satisfaction
(E) Answer not known

31. The term micro economic is derived from Greek Word

(A) Makros
(B) Mecroes
(C) Makross
(D) Meckros
(E) Answer not known

32. The LM curve slopes

(A) Upward from left to right
(B) Downward from left to right
(C) Upward from right to left
(D) Downward from right to left
(E) Answer not known

33. Which is the real sector equilibrium

(A) Product market
(B) Money market
(C) Capital market
(D) Call money market
(E) Answer not known

34. Where the saving and investment equality take place in the product market of the economy, the equilibrium is called as

(A) Real sector
(B) Interest elasticity
(C) Interest inelasticity
(D) Money sector
(E) Answer not known

35. Increase in the money supply bring down the rate of interest which in turn causes LM curve to shift to the

(A) Right
(B) Left
(C) Vertical
(D) Horizontal
(E) Answer not known

36. Match the following :

(a)	Jobless growth	1.	People are ruled by regressive regimes and women are given only a minor role
(b)	Ruthless growth	2.	Growth that causes people's cultural identity to wither
(c)	Voiceless growth	3.	Fruits of EG mostly benefits the rich, leaving millions of people in deep poverty
(d)	Rootless growth	4.	Overall economy grows but does not expand the opportunities for employment

	(a)	(b)	(c)	(d)
(A)	3	4	1	2
(B)	4	2	1	3
(C)	3	4	2	1
(D)	1	3	4	2

(E) Answer not known

37. "People are not poor because they have large families quite the contrary, they have large families because they are poor". Stated by

(A) Malthus
(B) Mahatma Gandhiji
(C) Mahmood Mamdani
(D) Robertson
(E) Answer not known

38. In India, the percentage increase in urban population has been consistently ———— than the percentage increase in rural population for all decades since 1911 indicating increasing urbanisation of Indian economy over the last ———— years.

(A) Greater, 100
(B) Lesser, 50
(C) Moderate, 25
(D) Much lesser, 75
(E) Answer not known

39. The coexistence of developed and underdeveloped sectors in a country's economy side-by side is termed as

(A) Self-sufficiency
(B) Dualism
(C) Indicator of economic development
(D) Soft states
(E) Answer not known

40. The planning commission has fixed new poverty line at per capita spending threshold (at June 2011 prices) at Rs. 32 per pay in urban areas and at ———— in rural areas

(A) Rs. 30
(B) Rs. 21
(C) Rs. 26
(D) Rs. 29
(E) Answer not known

41. The percentage of urban population in total population in 2011 is

(A) 27.8 percent
(B) 25.72 percent
(C) 31.20 percent
(D) 34.47 percent
(E) Answer not known

42. According to 2011 census LOW indices value was recorded in which district in Tamil Nadu

(A) Virudhunagar
(B) Ariyalur
(C) Villupuram
(D) Theni
(E) Answer not known

43. According to economic survey 2023-24, the gross enrolment ratio (percent) of Tamilnadu in Higher Education during 2021-22 was

(A) 45.0 percent
(B) 40.0 percent
(C) 47.0 percent
(D) 50.0 percent
(E) Answer not known

44. The non income indices component called as

(A) Population
(B) Life expectancy
(C) Goods and services
(D) Exports
(E) Answer not known

45. Assertion (A) : Government has been proclaiming the policy of developing new growth centres to diversity industrial structure.

Reason (R) : Policies resulted in concentration of industrial development in metropolitan areas

(A) (A) is true (R) is false, (R) is not the correct explanation of (A)
(B) (A) is false (R) is true (R) is correct explanation of (A)
(C) Both (A) and (R) are false
(D) Both (A) and (R) are true are (R) is the correct explanation of (A)
(E) Answer not known

46. Rates of growth of employment lagged behind with the result with the result that unemployment has increased significantly. This phenomenon is referred to as

(A) Jobless growth
(B) Spontaneous growth
(C) Slow growth
(D) Reversible growth
(E) Answer not known

47. According to economic survey highlights (2023-24), the unemployment rate in India is ———————— during 2022-23

(A) 4.8 percent
(B) 5.6 percent
(C) 3.2 percent
(D) 4.2 percent
(E) Answer not known

48. The Mahalwari system was introduced by

(A) Lord Cornwallis
(B) Lord Rippon
(C) Lord William Bentinck
(D) Lord Curzon
(E) Answer not known

49. In MSMEs, the medium enterprises are classified based on

(A) Investment upto Rs. 1 crores

(B) Investment up to Rs. 10 crores and turnover upto Rs. 5 crores

(C) Investment above Rs. 20 crore and turnover upto 100 crore

(D) Investment above Rs. 20 crore and turnover upto 75 crore

(E) Answer not known

50. In recent years the female labour force participation rate (LFPR) in India is

(A) 25 percent

(B) 31 percent

(C) 38 percent

(D) 48 percent

(E) Answer not known

51. At present, MSME sector creates more employment opportunities, contributes around 29% of India's GDP and this sector employs the total number of workers around

(A) 20 crore workers

(B) 30 crore workers

(C) 11 crore workers

(D) 5 crore workers

(E) Answer not known

52. Enabling farmers to practise scientific techniques of production is possible by

(A) Participation

(B) Cooperation

(C) Consolidation

(D) Support

(E) Answer not known

53. _____ five year plan proposal for land transfers by Government to Disadvantages and women farmers took place.

(A) Xth five year plan
(B) XIth five year plan
(C) XIIth five year plan
(D) XIIIth five year plan
(E) Answer not known

54. The growth rate of India at the time of Independence was much less at _____%

(A) 0.5%
(B) 0.75%
(C) 1.00%
(D) 1.20%
(E) Answer not known

55. The target of growth rate has all along been around 5% of national income with slightly higher rate in some of the plans. except in the

(A) first plan
(B) second plan
(C) third plan
(D) fourth plan
(E) Answer not known

56. The tax revenue as a percentage of GDP has gone up from around 7% in 1950-51 to about _____ percent in 2001-02.

(A) 8%
(B) 9%
(C) 10%
(D) 12%
(E) Answer not known

57. The LPG Model of Development was introduced in the year

(A) 1990
(B) 1991
(C) 1992
(D) 1994
(E) Answer not known

58. The ninth plan failed to achieve the GDP growth target of

(A) 6.5 percent
(B) 7 percent
(C) 7.5 percent
(D) 8 percent
(E) Answer not known

59. The fundamental failures of planning are

(i) Failure to Eliminate Poverty
(ii) Failure to Reduce Inequalities of Income and Wealth
(iii) Failure to check the growth of Black Money
(iv) Failure to implement land reforms

(A) (i), (ii), (iii) only
(B) (i), (ii) only
(C) (i), (ii), (iii) and (iv) only
(D) (i), (iii) only
(E) Answer not known

60. "_____ seeks to meet the needs and aspirations of the present without compromising the ability of future generations to meet their own needs".

(A) Sustainable Development
(B) Environmental Degradation
(C) Green GDP
(D) Environmental Accounting
(E) Answer not known

61. The targeted growth rate for the ninth plan period was _____ per annum.

(A) 5.5%
(B) 5.6%
(C) 6.5%
(D) 6.9%
(E) Answer not known

62. Reduce IMR to 25 and MMR to 1 per 1000 line birth and improve Child Sex Radio to 950 by the end of the

(A) Ninth plan
(B) Tenth plan
(C) Eleventh plan
(D) Twelth plan
(E) Answer not known

63. Profit making PSUs at prices that one well below the intrinsic worth of assets like "Selling silver for a song". This statement made by

(A) MR. Suresh Kumar
(B) Jean Dreze
(C) Mr. Paranjoy Guha Thakurta
(D) Mr. Jyotiraditya Scindia
(E) Answer not known

64. A Book "Planning and Poor" was written by

(A) M.N. Roy
(B) Shriman Narayan
(C) B.S. Minhas
(D) M.S. Swaminathan
(E) Answer not known

65. The 73rd and 74th amendments in the constitutions the finance commissions are also taking care of the

(A) regional
(B) local bodies and panchayats
(C) states
(D) central
(E) Answer not known

66. A payment received from foreign country is treated as _____ transactions.

(A) Credit
(B) Debit
(C) Savings
(D) Expenditure
(E) Answer not known

67. _____ refers to a persistent and long run BOP disequilibrium of a country and it is a _____ BOP debit.

(1) Temporary changes

(2) Fundamental disequilibrium

(3) Chronic

(4) Slight or mild

(A) (1) and (3) are correct
(B) (1) and (4) are correct
(C) (2) and (3) are correct
(D) (2) and (4) are correct
(E) Answer not known

68. All currency have _____ as reference variable for exchange rate.

(A) Euro
(B) Rupees
(C) Dollar
(D) Pound sterling
(E) Answer not known

69. Devaluation is referred to

(A) Revaluation policy
(B) Nation's development policy
(C) Income-Switching policy
(D) Expenditure-Switching policy
(E) Answer not known

70. If a country's 'Balance of Payments' are deficit, a country may purchase _____ from IMF.

(A) US doller
(B) SDR
(C) Pounds
(D) YEN
(E) Answer not known

71. If the sum of demand factors set against the sum of the supply factors is zero then there is _____ in the economy.

(A) Imbalance
(B) Balance
(C) Control
(D) Uncontrol
(E) Answer not known

72. Under perfect capital mobility and fixed exchange rates fiscal policy is _____ in maintaining internal balance.

(A) Effective
(B) Not effective
(C) Impotent
(D) Not impotent
(E) Answer not known

73. Two kinds of treasury bills are

(A) 60 day and 120 day bills
(B) 70 day and 140 day bills
(C) 95 day and 185 day bills
(D) 91 day and 182 day bills
(E) Answer not known

74. Mundellian model states

(A) Principles of effective use of monetary and fiscal policy for internal and external stability

(B) Discuss internal stability only

(C) Principles of effective use of fiscal policy only

(D) Discuss about external stability only

(E) Answer not known

75. The Mundell-Fleming model analysis the relationship between _____ instruments and _____ targets.

(1) One

(2) Two

(3) One

(4) Two

(A) (1) and (3) are correct

(B) (2) and (3) are correct

(C) (2) and (4) are correct

(D) (1) and (4) are correct

(E) Answer not known

76. In Agreement On Agriculture (AOA), WTO classifies domestic support in agriculture into three 'Boxes' and "The Subsidies that distort trade and must be reduced" under which category.

(A) Red Box

(B) Blue Box

(C) Amber Box

(D) Green Box

(E) Answer not known

77. The managing Director of the International monetary fund himself admitted that 'IMF is not a god that knows everything'. The managing director name is

(A) Schwartz
(B) Horst Kohler
(C) Michael Musa
(D) Robert Jack
(E) Answer not known

78. Buffer Stock Financing Facility (BSFF) was created in

(A) 1959
(B) 1969
(C) 1979
(D) 1989
(E) Answer not known

79. The IMF agreement fixed the par values of currencies of its members in terms of

(A) Dollar
(B) Pounds
(C) Silver
(D) Gold
(E) Answer not known

80. The _____ is a Permanent solution on food subsidies, public stockholding programmes.

(A) Multilateral Trade Agreement
(B) Trade Facilitation Agreement
(C) Plurilateral Trade Agreement
(D) Trade Policy Review Body
(E) Answer not known

81. What will be the output of the following python code?

```
i = 1
while true :
   if i % 3 = = 0 :
     break
   print (i)
   i + = 1
```

(A) 1 2
(B) 1 2 3
(C) 1 3
(D) Error
(E) Answer not known

82. Which of the following is invalid?

(A) "hello" + "world"
(B) 3 / 0
(C) 3 + 5
(D) True or false
(E) Answer not known

83. What is the output of the following code?

```
my_dict = {'a' : 1, 'b' : 2, 'c' : 3}
print (list (my_dict.keys()))
```

(A) ["a", "b", "c"]

(B) [1, 2, 3]

(C) {"a" : 1, "b" : 2, "c" : 3}

(D) {'a' : 1, 'b' : 2, 'c' : 3}

(E) Answer not known

84. The variance of the least square estimator $(\hat{\beta})$ for the model $Y = \beta X + \in$ is

(A) $\dfrac{\sigma^2}{\sum (X_i - \overline{X})^2}$

(B) $\dfrac{\sigma^2}{\left(\sum X_i^2\right)^2}$

(C) $\dfrac{\sigma^2}{\sum X_i^2}$

(D) $\dfrac{\sigma^2}{\sum X_i}$

(E) Answer not known

85. Which of the following statement(s) is (are) True.

In Machine learning :

Statement A : Supervised learning algorithms require the knowledge of both the outcome variable and the features.

Statement B : Unsupervised learning algorithms are set of algorithms which need the knowledge of the outcome variable in the data set.

(A) (A) true, (B) false

(B) (A) false, (B) true

(C) Both (A) and (B) true

(D) Both (A) and (B) false

(E) Answer not known

86. For testing the slope and intercept of simple linear regression model the test statistic are

(i) $|t| = \dfrac{\hat{\beta}_1 - \beta_{10}}{\sqrt{MS_{\text{Res}} / S_{xx}}}$

(ii) $|t| = \dfrac{\hat{\beta}_o - \beta_{oo}}{\sqrt{MS_{\text{Res}}\left(\dfrac{1}{n} + \dfrac{1}{S_{xx}}\right)}}$

(A) (i) correct (ii) false

(B) (i) false (ii) correct

(C) Both (i) and (ii) are correct

(D) Both (i) and (ii) are false

(E) Answer not known

87. Assertion [A] : Multiple correlation coefficient can never be negative.

Reason [R] : Multiple correlation coefficient depends on the covariance term which is greater than or equal to zero.

(A) [A] is true but [R] is false

(B) [A] is false but [R] is true

(C) Both [A] and [R] are true and [R] is the correct explanation of [A]

(D) Both [A] and [R] are true but [R] is not the correct explanation of [A]

(E) Answer not known

88. The residual sum of squares has _____ degrees of freedom associated with if since P Parameters are estimated in the regression model.

(A) p–1

(B) n–p–1

(C) n–p

(D) n–p–2

(E) Answer not known

89. When we fit a model $y = \beta_0 + \beta_1 x + \in$ then the $V(\hat{\beta}_\circ) =$

(A) $\frac{\sigma^2}{S_{xx}}$

(B) $\sigma^2\left(\frac{1}{n} + \frac{\bar{x}^2}{S_{xx}}\right)$

(C) $\sigma^2\left(\frac{\bar{x}^2}{S_{xx}}\right)$

(D) $\frac{\sigma^2}{n}$

(E) Answer not known

90. Variance inflation factors is used to check

(A) Inflection in Economy
(B) Market Deficiency
(C) Multicollinearity
(D) Factor selection
(E) Answer not known

91. When the response variable is binary there is considerable empirical evidence indicating that the shape of the response function should be

(A) Linear
(B) Nonlinear
(C) Both linear and nonlinear
(D) Neither linear nor nonlinear
(E) Answer not known

92. When plotting deviance residuals versus fitted values, it is customary to transform the fitted values to a constant information scale. Thus, for binomial responses, use

(A) $\hat{y}_i$
(B) $2\sin^{-1}\sqrt{\hat{\pi}_i}$
(C) $\sin^{-1}\sqrt{\hat{\pi}_i}$
(D) $2\sqrt{\hat{y}_i}$
(E) Answer not known

93. In logistic regression modes, the estimated increase in the odds ratio associated with a change of 'd' units in the predictor variable is

(A) $\exp\left(\frac{\hat{\beta}_1}{d}\right)$

(B) $\exp(d\,\hat{\beta}_1)$

(C) $\exp^{-(d\hat{\beta}_1)}$

(D) $\exp^{-\left(\frac{\hat{\beta}_1}{d}\right)}$

(E) Answer not known

94. Match the following canonical links for the generalized linear model.

	Distribution		Canonical link
(a)	Binomial	1.	μ_i
(b)	Poisson	2.	In (λ)
(c)	Exponential	3.	In $\left(\frac{\pi_i}{1-\pi_i}\right)$
(d)	Normal	4.	$\frac{1}{\lambda_i}$

	(a)	(b)	(c)	(d)
(A)	2	3	4	1
(B)	3	4	2	1
(C)	3	2	4	1
(D)	3	2	1	4

(E) Answer not known

95. Method used to estimate the parameter in logistic regression is

(A) ordinary least square

(B) method of moments

(C) maximum likelihood method

(D) generalized least squares

(E) Answer not known

96. Choose the incorrect statement.

If the Fourier series generated by a function $f(x)$ in the interval $[0, 2\pi]$ is $f(x) \sim \frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n \cos nx + b_n \sin nx)$

The coefficients are given by the formula :

(1) $a_0 = \frac{1}{2\pi}\int_0^{2\pi} f(t) \cos ntdt$

(2) $a_n = \frac{1}{\pi}\int_0^{2\pi} f(t) \cos ntdt$

(3) $b_n = \frac{1}{\pi}\int_0^{2\pi} f(t) \sin ntdt$

(A) (1) only

(B) (2) only

(C) (3) only

(D) (2) and (3) only

(E) Answer not known

97. Test the following function for continuity :

$f(x) = 2^{\frac{1}{x}}$, where $x \neq 0$ and $f(o) = 0$

(A) continuous at a point $x = 0$

(B) discontinuous at the origin

(C) oscillating near origin

(D) discontinuous for $x \neq 0$

(E) Answer not known

98. Find its value of $\int_{-\pi}^{\pi} \cos mx \cos nx dx$

(A) 1, $m \neq n$

(B) 0, $m \neq n$

(C) 2, $m \neq n$

(D) 3, $m \neq n$

(E) Answer not known

99. Match the following :

(a) The function defined by

$$f(x) = \begin{cases} x \sin \frac{1}{x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$$

1. removable discontinuity at the origin

(b) Function $f(x) = \frac{x - |x|}{x}$

2. has discontinuity of the first kind from the left

(c) If $[x]$ denotes largest integer $\leq x$ then the function $f(x) = x - [x] \forall x \geq 0$ at $x = 3$

3. is continuous for all x except zero

(d) The function defined by

$$f(x) = \begin{cases} \frac{\sin 2x}{x} & \text{when } x \neq 0 \\ 1 & \text{when } x = 0 \end{cases}$$

4. is continuous at $x = 0$

	(a)	(b)	(c)	(d)
(A)	1	2	3	4
(B)	4	3	2	1
(C)	3	2	1	4
(D)	4	1	3	2

(E) Answer not known

100. Let f be a real-valued and continuous on a compact interval $[a, b]$ in IR and suppose that $f(a)$ and $f(b)$ have opposite signs that is assume $f(a)\ f(b) < 0$. Then there is at least one point c in the open interval (a, b) such that

(A) $f(c) \neq 0$ (B) $f(c) = 1$

(C) $f(c) = c$ (D) $f(c) = 0$

(E) Answer not known

101. Multiply the following polynomials over the ring of integers.

$f(x) = 2x^0 + 5x + 3x^2 - 4x^3,\ g(x) = 3x^0 + 4x - x^3 + 5x^4.$

(A) $6x^0 + 23x + 29x^2 - 2x^3 - 11x^4 + 22x^5 + 19x^8 - 20x^9$

(B) $6x^0 + 23x + 19x^2 - x^3 - 10x^4 + 20x^5 + 19x^8 + 20x^9$

(C) $6x^0 + 19x + 2x^2 - 4x^3 - 3x^4 + 20x^5 + 10x^8 + 10x^9$

(D) $6x^0 + 10x + x^2 - x^3 - x^4 + 20x^5 + 10x^8 + 10x^9$

(E) Answer not known

102. Let R be a ring and let $a \in R$. Let T_a be the mapping of R into itself defined by

$xT_a = xa - ax$

Then $xT_a^{\,3} =$

(A) $x^2 - 2a\,xa + a^2x$ (B) $xa^2 - 2a\,xa + a^2x$

(C) $xa^3 - 3a\,xa^2 + 3a^2xa - a^3x$ (D) $xa^3 + 3a\,xa^2 - 3a^2xa + a^3x$

(E) Answer not known

103. Which of the following polynomial is primitive?

(A) $2x^2 + 4x + 8$

(B) $3x^2 + 12$

(C) $x^2 + 3x + 5$

(D) $4x^2 + 6x + 2$

(E) Answer not known

104. Which of the following statements are correct?

(1) Every finite Integral domain is a field

(2) Every integral domain is necessarily a field

(3) A finite commutative Ring without zero divisors is a field

(4) Every field is an Integral domain

(A) (1), (2), (3)

(B) (3), (4), (1)

(C) (2), (3), (4)

(D) (1), (2), (4)

(E) Answer not known

105. Match the following :

(a) $f(x) = 3x^2 + 2x + 1$ is

(b) $f(x) = \pi x^3 + (1 + i)x$ is

(c) $f(x) = x^5 + 2x^4 + x^3 + 2x^2 + 1$ is

(d) $f(x) = x^4 + 2x^3 + x + 1$ is

1. a polynomial ring of degree 5 in $Z_6[x]$
2. a polynomial ring of degree 4 in $Z_5[x]$
3. a polynomial ring of degree 2 in $Z_4[x]$
4. a polynomial ring of degree 3 in $C[x]$

	(a)	(b)	(c)	(d)
(A)	2	4	1	3
(B)	3	4	1	2
(C)	4	2	1	3
(D)	3	4	2	1

(E) Answer not known

106. Wedderburn's theorem states that

(A) Every finite division ring is a field

(B) Every finite ring is a field

(C) Every finite field is a division ring

(D) Every finite domain is a domain

(E) Answer not known

107. Let $\{a_n\}$ and $\{b_n\}$ be two sequences such that $a_n = b_{n+1} - b_n$ for $n = 1, 2, \ldots$. Then $\sum a_n$ converges if and only if

(A) $\lim_{n\to\infty} a_n$ exists

(B) $\lim_{n\to\infty} b_n \neq 0$ exists

(C) $\lim_{n\to\infty} a_n \neq 0$

(D) $\lim_{n\to\infty} a_n = \lim_{n\to\infty} b_n$

(E) Answer not known

108. The non-zero element 'a' in the Euclidean Ring R is a unit iff

(1) $d(a) < d(1)$

(2) $d(a) > d(1)$

(3) $d(a) = d(1)$

(4) $d(a) \leq d(1)$

(A) (1)

(B) (3)

(C) (2)

(D) (4)

(E) Answer not known

109. Assertion (A) : Ring $(Z, +, \cdot)$ of integers is a Euclidean ring for the Euclidean d, defined by $d(a) = |a|, \forall a \neq 0 \in Z$.

Reason (R) : $\forall a \neq 0, b \neq 0 \in Z$

$d(a) \leq d(ab)$ and

$a = qb + r,\ 0 \leq r < |b|$

$\Rightarrow$ either $r = 0$ or $d(r) < d(b)$.

(A) Both (A) and (R) are correct but (R) is not reason for (A)

(B) (A) is correct and (R) is the correct reason

(C) Both (A) and (R) are incorrect

(D) (A) is incorrect and (R) is correct

(E) Answer not known

110. Which of the following statements are correct?

(1) $(Z, +)$ is a group

(2) Set of all odd integers under addition is a group

(3) $(Z, -)$ is a group

(4) $(Z, \cdot)$ is a group

(A) (1) only (B) (2) only

(C) (3) only (D) (4) only

(E) Answer not known

111. A subgroup of G order p^m, where $p^m / O(G)$ but $p^{m+1} \nmid O(G)$ is called a _____ of G.

(A) Subgroup
(B) Cyclic group
(C) Quotient group
(D) p-sylow subgroup
(E) Answer not known

112. The number of distinct conjugate classes of S_n (group of all permutations on n symbols) is

(A) n
(B) n^2
(C) $n!$
(D) $p(n)$, the number of partitions of n
(E) Answer not known

113. If ϕ is a homomorphisms of G into $\overline{G}$ with kernel k, then k is a _____ of G.

(A) Cyclic subgroup
(B) Normal subgroup
(C) Quotient group
(D) Cyclic group
(E) Answer not known

114. If G is a group with binary operation $*$, and if a and b are any elements of G, then the linear equations $a * x = b$ and $y * a = b$ have _____ in G.

(A) Many solutions
(B) No solutions
(C) Unique solution
(D) Two solutions
(E) Answer not known

115. The mapping $\phi : \mathbb{C} \to \mathbb{C}^*$ defined by $\phi(z) = e^z \ \forall z \in \mathbb{C}$ is a homomorphisms of the additive group of complex numbers onto the multiplicative group of non-zero complex numbers. Then the kernel of ϕ is

(A) $\mathbb{C}$
(B) $\mathbb{C}^*$
(C) $\{n\pi i / n \in \mathbb{Z}\}$
(D) $\{2n\pi i / n \in \mathbb{Z}\}$
(E) Answer not known

116. The pair (x_1, x_2) is said to have a bivariate binomial distribution then its parameters are

(A) (n, p_1, p_2, p_{12})
(B) (n_1, n_2, p_1, p_2)
(C) (n, p_1, p_2)
(D) $(n_1, n_2, p_1, p_2, p_{12})$
(E) Answer not known

117. If $X \sim \beta_1(\mu, \gamma)$ then $(1 - X)$ will follow

(A) $\beta_1(\mu, \gamma)$
(B) $\beta_2(\gamma, \mu)$
(C) $\beta_1(\gamma, \mu)$
(D) $\beta_2(\mu, \gamma)$
(E) Answer not known

118. The moment generating function of multinomial distribution is

(A) $\left(p_1 e^{t_1} - p_2 e^{t_2} - \cdots - p_k e^{t_k}\right)$

(B) $\left(p_1 e^{t_1} + p_2 e^{t_2} + \cdots + p_k e^{t_k}\right)$

(C) $\left(p_1 e^{t_1} - p_2 e^{t_2} - \cdots - p_k e^{t_k}\right)^n$

(D) $\left(p_1 e^{t_1} + p_2 e^{t_2} + \cdots + p_k e^{t_k}\right)^n$

(E) Answer not known

119. F distribution is

(A) Negatively skewed

(B) Positively skewed

(C) Symmetrical

(D) Mesokurtic

(E) Answer not known

120. For the validity of Chebychev's inequality we must have constant k as

(A) $k < 1$

(B) $k \leq 1$

(C) $k > 1$

(D) $k \geq 0$

(E) Answer not known

121. Hypergeometric distribution tends to binomial distribution as

(A) $N \to P$ and $\frac{M}{N} \to \infty$

(B) $N \to \infty$ and $\frac{M}{N} \to P$

(C) $N \to P$ and $M \to \infty$

(D) $N \to \infty$ and $M \to P$

(E) Answer not known

122. Which of the following distribution the Mean and Variance are equal?

(A) Beta distribution

(B) Gamma distribution

(C) t-distribution

(D) χ^2-distribution

(E) Answer not known

123. If $\chi \sim \chi_n^2$ and the Mean of Chi-square distribution is n, mode is $n-2$ and variance is $2n$ then the Karl Pearson's coefficient of Skewness for Chi-square distribution is

(A) $\sqrt{2n}$

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

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

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

(E) Answer not known

124. The Skewness (β_1) and kurtosis (β_2) of normal distribution are

(A) $\beta_1 = 3,\ \beta_2 = 0$

(B) $\beta_1 = 0,\ \beta_2 = 3$

(C) $\beta_1 = 1,\ \beta_2 = 3$

(D) $\beta_1 = 2,\ \beta_2 = 3$

(E) Answer not known

125. Choose the correct option :

(a) Negative Binomial distribution may be regarded as the generalisation of Geometric distribution.

(b) Negative Binomial distribution has two parameters n and p.

(A) (a) is correct , (b) is incorrect

(B) (a) is incorrect , (b) is correct

(C) (a) and (b) are correct

(D) (a) and (b) are incorrect

(E) Answer not known

126. Choose the correct option :

(a) Lindeberg-Levy theorem has to be inferred as a particular case of Liapounoff's theorem.

(b) Lindeberg-Levy theorem does not assume the existence of the third moment.

(A) (a) is correct , (b) is incorrect

(B) (a) is incorrect , (b) is correct

(C) (a) and (b) are correct

(D) (a) and (b) are incorrect

(E) Answer not known

127. The moment generating function of a Gamma variate with parameters $\left(\frac{1}{2} \text{ and } \frac{n}{2}\right)$ is

(A) $(1-t)^{-n/2}$

(B) $(1-t)^{n/2}$

(C) $(1-2t)^{-n/2}$

(D) $(1-2t)^{n/2}$

(E) Answer not known

128. Choose the correct statement from the following options.

Statement (a) : Negative binomial distribution tends to Poisson distribution as $p \to \infty$, $r \to 0$ where $rQ = \lambda$.

Statement (b) : For a Negative binomial distribution the Mean < Variance.

(A) Both (a) and (b) are incorrect

(B) (a) incorrect (b) correct

(C) Both (a) and (b) are correct

(D) (a) correct (b) incorrect

(E) Answer not known

129. Find the value of $E[v - E(v)]^2$ where $E(v) = 4/9$ and $E(v^2) = \frac{1}{\beta(4,5)} \times \beta(6,5)$.

(A) $2/81$

(B) $16/81$

(C) $7/81$

(D) $25/81$

(E) Answer not known

130. To obtain the strong law of large numbers we make use of

(A) Kolmogorov Inequality

(B) Chebychev's Inequality

(C) Lyapunov's Inequality

(D) Khintt Chin's Inequality

(E) Answer not known

131. If $x_n \xrightarrow{p} \alpha$ and $y_n \xrightarrow{p} \beta$ as $n \to \infty$ then $x_n \pm y_n \xrightarrow{p}$ _____ as $n \to \infty$.

(A) $\alpha + \beta$ (B) $\alpha - \beta$

(C) $\alpha \pm \beta$ (D) α / β

(E) Answer not known

132. If two jointly distributed random variables X and Y are stochastically independent if and only if $F(x, y) =$

(A) $F_X(x) + G_Y(y)$ (B) $F_X(x)G_Y(y)$

(C) $F_X(x) - G_Y(y)$ (D) $\dfrac{F_X(x)}{F_Y(y)}$

(E) Answer not known

133. Choose the right answer about the relation between CLT and WLLN.

(I) Both CLT and WLLN hold for a sequence $\{x_n\}$ of iid random variables with finite mean μ and variance σ^2.

(II) WLLN require the existence of variance.

(III) For the sequence $\{x_n\}$ of independent and uniformly bounded r.v's WLLN holds and CLT holds

(IV) For the sequence $\{x_n\}$ of independent r.v's CLT may not hold but the WLLN may hold

(A) (I) only (B) (II) only

(C) (III) only (D) (IV) only

(E) Answer not known

134. If the cumulants are given by $k_r = n\{(r-1)!\}$, $n \geq 0$ for a distribution then the characteristic function is

(A) $\varphi(t) = (1 - it)^{-n}$ (B) $\varphi(t) = (1 + it)^{n}$

(C) $\varphi(t) = (1 + it)^{-n}$ (D) $\varphi(t) = (1 - it)^{n}$

(E) Answer not known

135. In weak law of large number, if $EX_K = 0$ and $E|X_K|^{1+\delta} \leq C < \infty$ for all K and some δ then

(A) $S_n/n \underrightarrow{p} 0$ (B) $E\,S_n/n \underrightarrow{p} 0$

(C) $S_n/n \underrightarrow{p} 1$ (D) $E\,S_n/n \underrightarrow{p} 1$

(E) Answer not known

136. If finite population correction is ignored

(i) $V_{SR} = S^2/n$

(ii) $V_{prop} = \sum_{i=1}^{k} N_i : S_i^2/N$

(iii) $V_{opt} = \left(\sum_{i=1}^{k} N_i : Si\right)^2 \Big/ N^2 n$

(A) (i) true, (ii) true, (iii) false (B) (i) true, (ii) false, (iii) true

(C) (i) false, (ii) true, (iii) true (D) All (i), (ii) and (iii) are true

(E) Answer not known

137. If A and B are two events with $P(A) = 0.6$, $P(B) = 0.3$ and $P(A \cap B) = 0.2$ then $P(B/A)$ is

(A) 2/3

(B) 1/3

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

(D) 2/6

(E) Answer not known

138. Assertion (A) : The probability mass function $f(x) = \frac{1}{x(x+1)}, x = 1, 2 \ldots$ has no moments exists.

Reason (R) : $\sum \frac{1}{x}$ is a divergent series $F(x)$ does not exist and consequently no moments of x exists.

(A) (A) is true, but (R) is false

(B) Both (A) and (R) are true and (R) is the correct explanation of (A)

(C) (A) is false, (R) is true

(D) Both (A) and (R) are true, but (R) is not the correct explanation of (A) is correct

(E) Answer not known

139. If A, B and C are the subsets of a universal set S, then match the following laws.

(a)	Idempotency Law	1.	$(\overline{A}) = A$
(b)	Involution Law	2.	$(A \cap B) \cap C = A \cap (B \cap C)$
(c)	Complementary Law	3.	$A \cap A = A$
(d)	Associative Law	4.	$A \cap \overline{A} = \phi$

	(a)	(b)	(c)	(d)
(A)	3	1	2	4
(B)	3	1	4	2
(C)	1	3	2	4
(D)	1	3	4	2

(E) Answer not known

140. The random variable X takes the values 0, 1 and 2 with respective probabilities p, $1 - 2p$ and p, $0 \le p \le 1/2$. The value of $E(X) = 1$, $E(X^2) = 1 + 2p$. For what value of p is the $V(X)$ a maximum?

(A) 0
(B) 1
(C) 2
(D) 1/2
(E) Answer not known

141. The normal equations to find the parameters 'a' and 'b' in fitting . the straight line of the form $y_t = a + bt$ by least square method

(A) $na + b\sum t = \sum y_t$ and $a\sum t + b\sum t^2 = \sum ty_t$

(B) $nb + a\sum t = \sum y_t$ and $a\sum ty_t + b\sum t^2 = \sum t_t$

(C) $na + b\sum t = \sum y_t$ and $b\sum ty_t + a\sum t^2 = \sum t_t$

(D) $nb + a\sum t = \sum y_t$ and $b\sum ty_t + a\sum t^2 = \sum t_t$

(E) Answer not known

142. Wholesale price index numbers in India are issued by

(A) Ministry of commerce and industry

(B) Central statistical organisation

(C) United nations statistical office

(D) Technical advisory committee

(E) Answer not known

143. Which of the following methods cannot be used for predicting future trend

(A) Second degree parabola

(B) Ratio to trend method

(C) Link relative method

(D) Moving average method

(E) Answer not known

144. In auto regressive models

(i) Y_i and E_i are independent if $i > j$

(ii) E_i's are not independent of Y_i if $i \leq j$

Which of the above is true?

(A) (i) only
(B) (ii) only
(C) Both (i) and (ii)
(D) Neither (i) nor (ii)
(E) Answer not known

145. The circular test

$P_{ab} \times P_{bc} \times P_{ca} = 1$, $a \neq b \neq c$ is satisfied by

(a) Fisher's ideal method

(b) Simple geometric mean of the price relatives

(A) (a) true, (b) false
(B) (a) false, (b) true
(C) Both (a) and (b) are true
(D) Both (a) and (b) are false
(E) Answer not known

146. If the correlation between the price relatives X and the quantity relatives Y is positive then

(A) $P_{oi}^{La} < P_{oi}^{Pa}$

(B) $P_{oi}^{La} > P_{oi}^{Pa}$

(C) $P_{oi}^{La} = P_{oi}^{Pa}$

(D) $P_{oi}^{La} = -P_{oi}^{Pa}$

(E) Answer not known

147. With usual notations, In auto-regressive series Y_j and E_i are independent if

(A) for all i and j

(B) $i > j$

(C) $i < j$

(D) $i \leq j$

(E) Answer not known

148. Fisher's index number formula does not satisfy the _____.

(A) Circular test

(B) Factor reversal test

(C) Time reversal test

(D) Unit test

(E) Answer not known

149. In SRSWOR of size n from a population with N unity if $\bar{y}$ is an unbiased estimator of $\overline{Y}$ then its sampling variance is

(A) $V(\bar{y}) = \frac{N-n}{N-1}\left(\frac{\sigma^2}{n}\right)$

(B) $V(\bar{y}) = \frac{N-1}{N-n}\left(\frac{\sigma^2}{n}\right)$

(C) $V(\bar{y}) = \frac{N-n}{N-1}\left(\frac{n}{\sigma^2}\right)$

(D) $V(\bar{y}) = \frac{N-1}{N-n}\left(\frac{n}{\sigma^2}\right)$

(E) Answer not known

150. Consider a population of 6 units with values 1, 2, 3, 4, 5, 6. Then its, sampling variance (S^2) is

(A) $S^2 = 3.5$

(B) $S^2 = 4.5$

(C) $S^2 = 3.8$

(D) $S^2 = 4.8$

(E) Answer not known

151. In SRSWOR, if $N = 10$ then the probability of selecting a specified sample of 2 units is

(A) 1/45 (B) 1/42

(C) 1/43 (D) 1/44

(E) Answer not known

152. Systematic sampling would be more efficient as compared with SRSWOR if

(A) $e > \frac{1}{nk-1}$

(B) $e < \frac{1}{nk-1}$

(C) $e < nk-1$

(D) $e > nk-1$

(E) Answer not known

153. Which of the following are called finite population correction

(A) $\frac{N-n}{N}$ and $\left[\frac{N-n}{N}\right]^{-1/2}$

(B) $\frac{N-n}{N}$ and $\left[\frac{N-n}{N}\right]^{1/2}$

(C) $\frac{N}{N-n}$ and $\left(\frac{N}{N-n}\right)^{2}$

(D) $\frac{N}{N-n}$ and $\left(\frac{N}{N-n}\right)^{-2}$

(E) Answer not known

154. Assertion [A] : Systematic sampling is operationally more convenient than simple random sampling.

Reason [R] : Time and work involved is also relatively much more.

(A) [A] is true but [R] is false

(B) [A] is false but [R] is true

(C) Both [A] and [R] are true and [R] is the correct explanation of [A]

(D) Both [A] and [R] are true and [R] is not the correct explanation of [A]

(E) Answer not known

155. The probability of a specified sample of n units, ignoring order, is

(A) $1/N$

(B) n/N

(C) $1\Big/\binom{N}{n}$

(D) $\binom{N}{n}$

(E) Answer not known

156. The efficiency of cluster sampling ———— as the mean square between clusters decreases

(A) Decreases

(B) Increase

(C) Either decreases or increases

(D) Neither decreases nor increases

(E) Answer not known

157. The probability of selecting a sample from N_{C_n} samples is

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

(C) $\frac{1}{N_{C_n}}$ (D) $\frac{1}{N-n}$

(E) Answer not known

158. The degrees of freedom for error in RBD is

(A) $(t-1)(r-1)$ (B) $(t+1)(r-1)$

(C) $(t-1)(r+1)$ (D) $(t+1)(r+1)$

(E) Answer not known

159. If blocks do not contain full set of treatments in each and every block is called

(A) Incomplete block design (B) Complete block design

(C) Youden square design (D) Split-plot design

(E) Answer not known

160. In 2^n factorial experiments, confounding can be carried out through

(A) Contrasts

(B) Modula technique

(C) Either (A) or (B)

(D) Neither (A) nor (B)

(E) Answer not known

161. The missing values of ANOVA for four replicates of a 2^3 design with ABC confounded.

Source of variation	Degrees of freedom
Replicates	3
Blocks ABC	1
Error for ABC	–
A	1
B	1
C	1
AB	1
AC	1
BC	1
Error	–
Total	31

(A) 1, 20
(B) 2, 19
(C) 3, 18
(D) 4, 17
(E) Answer not known

162. Which of the following statements are true about balanced incomplete block design?

(1) Each treatment occurs once and only once in r blocks
(2) Each pair of treatments occurs together in λ blocks
(3) $Vb = rk$

(A) (1) and (2) are correct
(B) (2) and (3) are correct
(C) (1) and (3) are correct
(D) (3) only correct
(E) Answer not known

163. Which of the following estimation make use of auxiliary information for increasing precision?

(A) ratio estimator
(B) regression estimator
(C) both (A) and (B)
(D) neither (A) nor (B)
(E) Answer not known

164. Variance of each factorial effect is

(A) σ_e^2 / r
(B) σ_e^2 / r^2
(C) $\sigma_e^2 / 2r$
(D) $\sigma_e^2 / 2^n r$
(E) Answer not known

165. In split-plot design the whole plot error (SSE_1) and the sub-plot Error (SSE_2) are usually

(A) $SSE_1 = SSE_2$
(B) $SSE_1 \neq SSE_2$
(C) $SSE_1 < SSE_2$
(D) $SSE_1 > SSE_2$
(E) Answer not known

166. Identify a false statement

(i) Most powerful test is an unbiased test.
(ii) Unbiased test can be applied to composite hypotheses
(iii) N-P lemma is an unbiased test
(iv) Unbiased test can be applied to two tailed test, when sample comes from normal distribution

(A) (i)
(B) (ii)
(C) (iii)
(D) (iv)
(E) Answer not known

167. Which of the following becomes key indicator of accept the null hypothesis?

(A) t-value falls in w and $\overline{w}$

(B) t-value lies between w and $\overline{w}$

(C) t-value falls in w

(D) t-value falls in $\overline{w}$

(E) Answer not known

168. What does the Monotone Likelihood Ratio (MLR) property mean for a family of probability distributions?

(A) The likelihood ratio is always constant

(B) The likelihood ratio is independent of the observed data

(C) The likelihood ratio is always random variable

(D) The likelihood ratio depends on the observed data only through a statistic, and it is non-decreasing with respect to that statistic

(E) Answer not known

169. For testing $H_0 : \theta = \theta_0$ vs $H_1 : \theta = \theta_1$, the critical region w and consequently the test based on it is said to be unbiased if

(A) $\beta < \alpha$

(B) $1 - \beta < \alpha$

(C) $\beta > \alpha$

(D) $1 - \beta \geq \alpha$

(E) Answer not known

170. Which type of error is more serious?

(A) Type I error
(B) Type II error
(C) Both type I and type II errors
(D) Neither type I error nor type II error
(E) Answer not known

171. Identify an unbiased estimator for σ^2 in a normal distribution $N(\mu, \sigma^2)$ an a sample of size 'n'

(i) $\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$

(ii) $\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$

(iii) $\frac{n}{n-1}\sum_{i=1}^{n}(x_i)^2$

(iv) $n\sum_{i=1}^{n}(x_i - \bar{x})^2$

(A) (i) only
(B) (ii) only
(C) (iii) only
(D) (iv) only
(E) Answer not known

172. Which of the following is true about maximum likelihood estimator?

(i) MLE are always consistent and unbiased estimators

(ii) If MLE exists it is the most efficient in the class of such estimator

(iii) If a sufficient estimator exists it is a function of maximum likelihood estimator

(A) (i) only

(B) (i) and (ii) only

(C) (ii) and (iii) only

(D) (i) and (iii) only

(E) Answer not known

173. Let $X_1, X_2, \ldots . X_n$ be iid $V\left(\theta - \frac{1}{2}; \theta + \frac{1}{2}\right)$, $\theta \in R^{-1}$ then the statistic $T(x) = \left(X_{(1)}; X_{(n)}\right)$ is

(A) Complete but not minimal sufficient

(B) Minimal sufficient but not complete

(C) Both (A) and (B)

(D) Neither (A) nor (B)

(E) Answer not known

174. For normal population $N(\mu, \sigma^2)$

(a) : MLE $(\mu) = \bar{x}$ is unbiased and consistent estimator of μ

(b) : MLE $(\sigma^2) = s^2$ is consistent but not unbiased estimator of σ^2

(A) (a) True, (b) False

(B) (a) False, (b) True

(C) Both (a) and (b) are True

(D) Both (a) and (b) are False

(E) Answer not known

175. For Cauchy's distribution, ———— is a consistent estimator of the population mean

(A) Sample mean

(B) Sample median

(C) Sample mode

(D) Sample geometric mean

(E) Answer not known

176. Find suitable comment on the validity of the following statements for testing the hypothesis that there is no difference among the four treatments applied to a particular crop

(i) If the yield's mean values are compared use ANOVA test

(ii) If the yield's median values are compared use Kruskal-Wallis test

(A) (i) is true

(B) Only (ii) is true

(C) Both (i) and (ii) are true

(D) Neither (i) and nor (ii) are true

(E) Answer not known

177. A non parametric test is said to be consistent for a specified alternative, if the power of the test, when the alternative is true, approaches ———— as the sample size approaches infinity

(A) 0

(B) 1

(C) n

(D) ∞

(E) Answer not known

178. When there are pairs of observations on two things being compared we can use

(A) Median test

(B) Run test

(C) Sign test

(D) Mann-Whitney -Wil Coxon U-Test

(E) Answer not known

179. When the knowledge of the sampled population is not known, then the test used to test the equality of several population means is

(A) t-test

(B) one-way analysis of variance

(C) Kruskal-Wallis test

(D) Friedman test

(E) Answer not known

180. The standard deviation of Mann-Whitney u test is

(A) $\frac{\sqrt{(n_1+n_2)(n_1+n_2+1)}}{12}$

(B) $\sqrt{\frac{n_1 n_2 (n_1-n_2+1)}{12}}$

(C) $\sqrt{\frac{n_1 n_2 (n_1+n_2+1)}{12}}$

(D) $\sqrt{\frac{n_1 n_2 (n_1-n_2-1)}{12}}$

(E) Answer not known

181. The radical R of a Banach Algebra A is a

(A) Proper closed one sided ideal

(B) Proper closed two sided ideal

(C) Not an ideal

(D) Not a proper closed two sided ideal

(E) Answer not known

182. If A is a Banach Algebra and R is a radical defined by

R = $\cap$ maximal left ideals of A

= $\cap$ maximal right ideals of A

then identify the incorrect statement from the following

(1) If r is an element of R, then $1-r$ is regular

(2) If r is an element of R, then $1-xr$ is regular for every x

(3) If r is an element of A, with the property that $1-xr$ is regular for every x, then r need not be an element of R

(4) If r is an element of R, then $1-rx$ is regular for every x

(A) (1) only

(B) (2) only

(C) (3) only

(D) (4) only

(E) Answer not known

183. A projection on Hilbert space H whose range and null space are orthogonal is called

(A) Projection

(B) Perpendicular projection

(C) Invariant

(D) Closed linear subspace

(E) Answer not known

184. A Hilbert space is a

(A) Complete inner product space
(B) Compact linear space
(C) Complete normed space
(D) Complete metric space
(E) Answer not known

185. If $\{e_i\}$ is an orthonormal set in a Hilbert space H and if x is any vector in H and $S = \{e_i : (x, e_i) \neq 0\}$ then S is

(A) empty only
(B) countable only
(C) either empty or countable
(D) uncountable only
(E) Answer not known

186. Taylor series with center $z_0 = 2i$ of $f(z) = \dfrac{1}{1-z}$ is

(A) $\sum_{k=0}^{\infty} \dfrac{(z-2i)^k}{(1-2i)^{k+1}}$

(B) $\sum_{k=0}^{\infty} \dfrac{(z-2i)^{k+1}}{(1-2i)^k}$

(C) $1 + \dfrac{z-2i}{(1-2i)^2} + \dfrac{z-2i}{(1-2i)^3} + \ldots.$

(D) $\sum_{k=0}^{\infty} (z-2i)^{k+1}$

(E) Answer not known

187. Suppose that f is holomorphic in an open set Ω except possibly at a point z_0 in Ω. If f is bounded on $\Omega - \{z_0\}$, then z_0 is a

(A) Essential singularity
(B) Removable singularity
(C) Isolated singularity
(D) Pole singularity
(E) Answer not known

188. If $w = f(z) = \dfrac{1+z}{1-z}$, find $\dfrac{dw}{dz} =$

(A) $2/(1-z)^2$
(B) $5/(1-z)^2$
(C) $3(1-z)^2$
(D) $4(1-z)$
(E) Answer not known

189. Cauchy-Riemann equations are

(A) $\dfrac{\partial u}{\partial x} = \dfrac{\partial v}{\partial y}, \dfrac{\partial u}{\partial y} = -\dfrac{\partial v}{\partial x}$
(B) $\dfrac{\partial u}{\partial x} = \dfrac{-\partial v}{\partial y}, \dfrac{\partial u}{\partial y} = \dfrac{\partial u}{\partial x}$
(C) $\dfrac{\partial u}{\partial x} = \dfrac{-\partial v}{\partial y}, \dfrac{\partial u}{\partial y} = -\dfrac{\partial v}{\partial x}$
(D) $\dfrac{\partial u}{\partial x} = \dfrac{\partial v}{\partial y}, \dfrac{\partial u}{\partial y} = \dfrac{\partial v}{\partial x}$
(E) Answer not known

190. Consider the power series $\sum_{n=1}^{\infty} \frac{2^n}{n^2}$ the radius of convergence is

(A) $R = \infty$ (B) $R = 0$

(C) $R = 1$ (D) $R = e$

(E) Answer not known

191. Which of the following is /are correct?

(1) $u = e^{-x}(x \sin y - y \cos y)$ is not a harmonic

(2) $f(z) = u + iv$ where $u = e^{-x}(x \sin y - y \cos y)$ and $v = e^{-x}(y \sin y + x \cos y) + c$ is analytic

(3) $u = e^{-x}(x \sin y - y \cos y)$ is harmonic

(A) (2) and (3)

(B) (3) only

(C) (2) only

(D) (1) and (2)

(E) Answer not known

192. The function $f(z) = \int_0^z e^{\lambda} \sin^3 \lambda \, d\lambda$ has at $z = 0$, a zero of order

(A) 3 (B) 4

(C) 2 (D) 1

(E) Answer not known

193. The Maclaurin series expansion of the entire function $f(z)=z^2e^{3z}$ is

(A) $\sum_{n=0}^{\infty}\frac{3^n}{n!}z^{n+2}$

(B) $\sum_{n=2}^{\infty}\frac{3^n}{n!}z^{n+2}$

(C) $\sum_{n=0}^{\infty}\frac{3^{n+1}}{n!}z^{n+2}$

(D) $\sum_{n=2}^{\infty}\frac{3^{n+2}}{n!}z^{n+2}$

(E) Answer not known

194. Match the functions with their series expansion.

Functions		Series	
(a)	e^z	1.	$1-\frac{z^2}{2!}+\frac{z^4}{4!}-\ldots(-1)^{n-1}\ \frac{z^{2n-2}}{(2n-2)}!\infty<\ldots\lvert z\rvert$
(b)	$\sin z$	2.	$z-\frac{z^3}{3}+\frac{z^5}{5}-\ldots(-1)^{n-1}\frac{z^{2n-1}}{2n-1}+\ldots\lvert z\rvert<1$
(c)	$\cos z$	3.	$1+z+\frac{z^2}{2!}+\frac{z^3}{3!}+\ldots+\frac{z^n}{n!}+\ldots\lvert z\rvert<\infty$
(d)	$\tan^{-1} z$	4.	$z-\frac{z^3}{3!}+\frac{z^5}{5!}\ldots(-1)^{n-1}\frac{z^{2n-1}}{(2n-1)!}\ldots.\lvert z\rvert<\infty$

	(a)	(b)	(c)	(d)
(A)	3	1	2	4
(B)	4	1	2	3
(C)	3	4	1	2
(D)	4	2	1	3

(E) Answer not known

195. Let X and Y be Banach spaces and $F: X \to Y$ be a linear map which is closed and surjective. Then F is

(A) Continuous and closed

(B) Continuous and open

(C) Discontinuous and closed

(D) Discontinuous and open

(E) Answer not known

196. Which of the following is called Holder's inequality

(A) $\|xy\| \leq \|x\| \|y\|$

(B) $\|x+y\|_p \leq \|x\|_p + \|y\|_p 1 \leq p < \infty$

(C) $\sum_{i=1}^{n} |x_i y_i| \leq \|x\|_p \|y\|_q, 1 \leq p < \infty, \frac{1}{p} + \frac{1}{q} = 1$

(D) $\|x+y\|_p \geq \|x\|_p + \|y\|_p, 1 \leq p < \infty$

(E) Answer not known

197. If $u(re^{i\phi}) = \frac{1}{2\pi} \int_0^{2\pi} \frac{R^2 - r^2}{R^2 - 2rR\cos(\theta - \phi) + r^2} u(\mathrm{Re}^{i\theta})\, d\theta$ is known as

(A) Poisson's formula in polar coordinates

(B) Schwarz's formula in polar coordinates

(C) Mean value property

(D) Cauchy formula in polar coordinates

(E) Answer not known

198. The consequence of Banach Steinhaus theorem, states that 'A non-empty subset X of a normed linear space N is bounded iff

(A) $f(x)$ is a bounded set of numbers

(B) $\{f(x_i)\}$ is bounded for each $x_i \in X$

(C) $f(x)$ is a bounded set of numbers for each f in N^*

(D) $f(x)$ is a bounded set of numbers for each f in N

(E) Answer not known

199. A Banach space is a complete normed linear space. Then match the following spaces with their norms defined.

Space		Norm
(a) R	1.	$\|x\|_p \left(\sum_{i=1}^{n} \|x_i\|^p \right)^{1/p}$
(b) R^n	2.	$\|x\|_p = \left(\sum_{n=1}^{\infty} \|x_i\|^p \right)^{1/p}$
(c) l_p^n	3.	$\|x\| = \left(\sum_{i=1}^{n} \|x_i\|^2 \right)^{1/2}$
(d) l_p	4.	$\|x\| = \|x\|$

	(a)	(b)	(c)	(d)
(A)	4	3	1	2
(B)	3	1	4	2
(C)	4	3	2	1
(D)	2	3	4	1

(E) Answer not known

200. Which one of the following is correct?

If M is a closed linear subspace of a normed linear space N and if T is the natural mapping of N onto N/M defined by $T(x)=x+M$ then T is continuous linear transformation for which $\|T\|\leq 1$.

(1) $T(x+M)=T(x)+T(y), T(\alpha x)=\alpha T(x)$ and $\|T(x)\|\geq\|x\|$

(2) $T(x+M)=T(x)+T(y), T(\alpha x)=\alpha T(x)$, and T is unbounded

(3) $T(x+M)=T(x)+T(y), T(\alpha x)=\alpha T(x)$, T is bounded and $\|T\|\leq 1$

(4) T is a linear transformation but not continuous and $\|T\|\leq 1$

(A) (4) only

(B) (3) only

(C) (2) only

(D) (1) only

(E) Answer not known