Test Booklet Series **Test Booklet No.**

A

Test Booklet

(Mathematics)

Name of Applicant ..... Answer Sheet No. .....

Applicant ID/Roll No. : ..... Signature of Applicant : .....

Date of Examination : ..... Signature of the Invigilator(s)

Time of Examination : ..... 1. .....

2. .....

Duration : 2 Hour] **[Maximum Marks : 100**

IMPORTANT INSTRUCTIONS

(i) The question paper is in the form of Test-Booklet containing **100 (Hundred)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct. Choose the correct option or the most appropriate option.

(ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **100** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.

(iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **100** rows containing four circles each. One row pertains to one question.

(iv) The candidate should write his/her Application ID/Roll number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and NOWHERE ELSE.

(v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.

(vi) For every correct answer of the question **One (1) mark will be awarded**.

(vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.

(viii) To mark the answer on the Answer-Sheet, candidate should darken the appropriate circle in the row of each question with Blue or Black pen.

(ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the answer will be treated as incorrect.

(x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.

(xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.

(xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*

(xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.

PART–A

1. Research is
   (A) Searching again and again
   (B) Finding a solution to any problem
   (C) Working in a scientific way to search for the truth of any problem
   (D) None of the above

2. The conceptual framework in which research is conducted is called a
   (A) Synopsis of research
   (B) Research design
   (C) Research hypothesis
   (D) Research paradigm

3. What are the main characteristics of Scientific Research?
   (A) Empirical
   (B) Theoretical
   (C) Experimental
   (D) All the above

4. Which research design will be most appropriate to study the relationship between the level of aspirations and achievement of rural children?
   (A) Experimental Research Design
   (B) Ex Post Facto Research Design
   (C) Historical Research Design
   (D) Survey Research Design

5. The principles of fundamental research are used in:
   (A) action research
   (B) applied research
   (C) philosophical research
   (D) historical research

6. A shift in attitude in respondents between two points during data collection is called
   (A) Reactive effect
   (B) Maturation effect
   (C) Regression effect
   (D) Conditioning effect

7. Ethical Norms in research do not involve guideline for:
   (A) Thesis Format
   (B) Copyright
   (C) Patenting Policy
   (D) Data sharing Policy

8. The primary objective of an experimental research design is to:
   (A) Explore an unknown topic.
   (B) Establish cause-and-effect relationships.
   (C) Describe a population or situation.
   (D) Examine the relationship between variables without manipulation.

9. The research that aims at immediate application is:
   (A) Action Research
   (B) Empirical Research
   (C) Conceptual Research
   (D) Fundamental Research

10. A null hypothesis is
   (A) when there is no difference between the variables
   (B) the same as research hypothesis
   (C) subjective in nature
   (D) when there is difference between the variables

11. When the researcher rejects a true null hypothesis a ———————— error occurs.
   (A) Type I
   (B) Type A
   (C) Type II
   (D) Type B

12. The researcher is usually interested in supporting ..... when he or she is engaging in hypothesis testing:
   (A) The alternative Hypothesis
   (B) The null Hypothesis
   (C) Both alternative and null Hypothesis
   (D) Neither the alternative or null Hypothesis

13. A research design is often described as the "blueprint" for a research project. This emphasizes its role in:
   (A) Collecting data
   (B) Analysing data
   (C) Providing a strategy and framework for the study
   (D) Presenting findings

14. What is a cross-sectional research design?

(A) A design in which a data is collected at one point of time.

(B) A design in which data is collected over a period of time.

(C) A design in which data is collected from a representative sample of the population.

(D) A design in which data is collected from a non-representative sample of the population.

15. Match the measurement scale to the given variables:

Scale of measurement	**Variable**
(a) Nominal	(i) Height of student
(b) Ordinal	(ii) Time of day
(c) Interval	(iii) Caste
(d) Ratio	(iv) Rank of Army Personnel

Choose the correct answer from the options given below:

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

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

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

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

16. Which is the simplest form of Measurement?

(A) Ordinal (B) Nominal

(C) Ratio (D) Interval

17. The data is obtained through a survey conducted is called:

(A) Primary data (B) Secondary data

(C) Continuous data (D) Qualitative data

18. A survey in which the information is collected from each and every individual of the population is known as:

(A) Sample survey (B) Pilot survey

(C) Biased survey (D) Census survey

19. Interview is an example of which data?

(A) Primary data (B) Secondary data

(C) Both (A) and (B) (D) None of the above

20. What is the process of organizing raw data into rows and columns for systematic analysis called?
(A) Compilation
(B) Presentation
(C) Tabulation
(D) Classification

21. The graphical representation of a frequency distribution is called
(A) Bar chart
(B) Line chart
(C) Histogram
(D) Pie char

22. Identify the correct sequence of research steps:
(A) Selection of topic, review of literature, data collection, interpretation of findings
(B) Review of literature, selection of topic, data collection, and interpretation of findings
(C) Selection of topic, data collection, review of literature, interpretation of findings
(D) Selection of topic, review of literature, interpretation of findings, data collection

23. When a research problem is related to heterogeneous population, the most suitable sampling method is:
(A) Cluster Sampling
(B) Stratified Sampling
(C) Convenient Sampling
(D) Lottery Method

24. A researcher wants to study the long-term effects of a new teaching method on student performance over several years. Which research design would be most appropriate?
(A) Cross-sectional design
(B) Case study design
(C) Longitudinal design
(D) Survey design

25. From the list given below identify those which are called non-probability sampling procedures:
(i) Simple random sampling
(ii) Dimensional sampling
(iii) Snowball sampling
(iv) Cluster sampling
(v) Quota sampling
(vi) Stratified sampling
Choose the correct option
(A) (i), (ii) and (iii)
(B) (ii), (iv) and (v)
(C) (i), (iii) and (v)
(D) (ii). (iii) and (v)

26. Among the following types of sampling techniques, which one is also known as 'Judgmental' sampling?

(A) Quota sampling
(B) Convenience Sampling
(C) Cluster Sampling
(D) Purposive Sampling

27. The primary objective of an experimental research design is to:

(A) Explore an unknown topic.
(B) Establish cause-and-effect relationships.
(C) Describe a population or situation.
(D) Examine the relationship between variables without manipulation.

28. "Students from the pure mathematics background can crack a bank recruitment test"— Which type of hypothesis is this?

(A) Relational Hypothesis
(B) Descriptive hypothesis
(C) Two tailed Hypothesis
(D) Null Hypothesis

29. Parametric tests make assumptions on:

(A) The population size
(B) The underlying distribution
(C) The sample size
(D) The mean sample

30. If the researcher has a nominal data, which non parametric test will he/she can use :

(A) T-test
(B) Z-test
(C) Chi square test
(D) All the above

31. If a researcher needs to verify whether there is a significant difference between the means of two groups to test a hypothesis, which statistical method would he/she employ?

(A) Chi-square test
(B) Correlation coefficient
(C) Sign-test
(D) Student's t-test

32. Chi-square is used to analyse:

(A) Scores
(B) Ranks
(C) Frequencies
(D) None of these

33. On which of the following does the critical value for a chi-square statistic rely?

(A) The degrees of freedom
(B) The sum of the frequencies
(C) The row totals
(D) The number of variables

34. Calculated value of chi-square is always.....

(A) Positive
(B) Negative
(C) Zero
(D) None of these

35. Which of the following best describes the purpose of using ANOVA in research?

(A) ANOVA is used to compare the means of two groups.
(B) ANOVA is use to compare the means of more than two groups.
(C) ANOVA is used to determine the correlation between two variables.
(D) ANOVA is used to determine the interaction effect between dependent variables.

36. What do ANOVA calculate?

(A) T-Ratio
(B) Chi-square
(C) Z-Ratio
(D) F-Ratio

37. What is the primary goal of factor analysis?

(A) To predict a dependent variable from multiple independent variables.
(B) To reduce a large number of variables into a smaller set of underlying factors.
(C) To determine the causal relationship between variables.
(D) To calculate the correlation between two variables.

38. Which assumption is required for factor analysis?

(A) Extreme collinearity exists among variables.
(B) Variables have a skewed distribution.
(C) A linear relationship exists among variables.
(D) There are many outliers in the data.

39. When using Principal Component Analysis (a common method for factor analysis), what does the first principal component capture?

(A) The minimum variance.
(B) The mean deviation.
(C) The maximum variance.
(D) The average variance.

40. Which statistical measure is used to assess the sampling adequacy for conducting factor analysis?

(A) Kaiser-Meyer-Olkin (KMO) measure.
(B) Bartlett's test of sphericity.
(C) Eigenvalue.
(D) All of the above.

41. The process by which we estimate the value of dependent variable on the basis of one or more independent variable is called:

(A) Correlation
(B) Regression
(C) Residual
(D) Slope

42. The major characteristic of correlation analysis is to seek out

(A) Differences among variables
(B) Variations among variables
(C) Association among variables
(D) Regression among variables

43. A correlation coefficient (r) of –1.0 indicates a:

(A) Perfect positive correlation
(B) Weak positive correlation
(C) No correlation
(D) Perfect negative correlation

44. The statistical tool that studies the degree of association between two variables is called:

(A) Regression
(B) Standard error
(C) Index numbers
(D) Correlation

45. Which type of correlation analysis is appropriate for examining the relationship between variables with non-linear relationships?

(A) Pearson's correlation
(B) Spearman's rank correlation
(C) Both Pearson's and Spearman's
(D) Neither Pearson's nor Spearman's

46. What is the primary goal of cluster analysis?
    (A) Classifying data into predefined groups.
    (B) Predicting a continuous value.
    (C) Grouping similar data points together based on their characteristics.
    (D) Reducing the number of variables in a dataset.

47. The primary purpose of conjoint analysis is to:
    (A) Identify which customer segments are most profitable.
    (B) Determine the price elasticity of demand for an existing product.
    (C) Quantify the value that consumers place on different features of a product or service.
    (D) Predict sales volume for a new product with absolute certainty.

48. The most common type of conjoint analysis, which presents respondents with sets of product profiles and asks them to choose the one they prefer most, is known as :
    (A) Adaptive Conjoint Analysis (ACA).
    (B) Choice-Based Conjoint (CBC).
    (C) Full-Profile Conjoint Analysis.
    (D) Self-Explicated Conjoint Analysis.

49. Which statement is an accurate representation of a "trade-off" in conjoint analysis?
    (A) A decision to buy a product from one brand over another.
    (B) A decision to delay a purchase until a later date.
    (C) A customer choosing a larger screen over longer battery life for a phone.
    (D) A customer buying a product with all the most desired features.

50. What is the primary purpose of discriminant analysis?
    (A) To determine the effect of independent variables on a continuous dependent variable.
    (B) To identify the underlying structure or dimensions within a set of variables.
    (C) To classify cases into two or more distinct, pre-defined groups based on a set of predictor variables.
    (D) To cluster data points into a specific number of groups based on their similarities.

PART–B

(Mathematics)

51. The value of $\oint \frac{1}{z-a} dz$ over the simple closed curve C, where the point $z = a$ is outside C, is given by

(A) $2\pi i$ (B) $2\pi i(1 + i)$

(C) 0 (D) πi

52. Using Runge-Kutta (fourth order) method, where $\frac{dy}{dx} = x + y$ and $y(0) = 1$, approximation to $y(0.1)$ correct to five decimal places in steps of $h = 0.1$ is given by option :

(A) 1.11034 (B) 1.21034

(C) 1.12034 (D) 2.11034

53. For the nature of the infinite series $\frac{x^2}{2\log 2} + \frac{x^3}{3\log 3} + \frac{x^4}{4\log 4} + ... \infty$, the given series is said to be

(A) convergent if $x < 2$ and divergent if $x \geq 2$

(B) convergent if $x \leq 1$ and divergent if $x > 1$

(C) divergent if $x < 1$ and convergent if $x \geq 1$

(D) convergent if $x < 1$ and divergent if $x \geq 1$

54. The given matrix $\begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is said to be orthogonal for the values of a, b, c given by

(A) $a = \pm\frac{1}{\sqrt{2}}, b = \pm\frac{1}{\sqrt{6}}, c = \pm\frac{1}{\sqrt{3}}$ (B) $a = \pm\frac{1}{\sqrt{6}}, b = \pm\frac{1}{\sqrt{6}}, c = \pm\frac{1}{\sqrt{6}}$

(C) $a = \pm\frac{1}{\sqrt{2}}, b = \pm\frac{1}{\sqrt{6}}, c = \pm\frac{1}{\sqrt{6}}$ (D) $a = \pm\frac{1}{\sqrt{2}}, b = \pm\frac{1}{\sqrt{3}}, c = \pm\frac{1}{\sqrt{4}}$

55. A dice is thrown twice and sum of the numbers appeared is observed to be 6. What is the conditional probability that the number 4 has appeared at least once?

(A) 7/5 (B) 2/5

(C) 3/5 (D) 11/5

56. A unit vector normal to the surface $x^2 + 3y^3 + 2z^2 = 6$ at point (2, 0, 1) is given by

(A) $\frac{1}{\sqrt{2}}(i + k)$ (B) $i - j + k$

(C) $\frac{1}{\sqrt{3}}(i + k)$ (D) None of these

57. The first step in formulating a linear programming problem is given by the option

(A) understand the problem

(B) identify any upper or lower bound on the decision variables

(C) identify the decision variables

(D) state the constraints as linear combinations of the decision variables

58. The matrix A is defined as $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$, the matrix represented by

$$A^6 - 6A^5 + 9A^4 - 2A^3 - 12A^2 + 23A - 9I$$

in linear polynomial in A is given by the option

(A) 5A – 2I (B) 3A – I

(C) 7A – I (D) 5A – I

59. The matrix A is defined as A = $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$, the eigen values of the matrix is given by the option

(A) 1, 2, 3 (B) 1, –2, 3

(C) –1, –2, –3 (D) 1, 4, 1

60. The infinite series $1+\frac{3}{7}x+\frac{3.6}{7.10}x^2+\frac{3.6.9}{7.10.13}x^3+\frac{3.6.9.12}{7.10.13.16}x^4+....\infty$ is said to be convergent for

(A) $|x| > 1$ (B) $x \leq 1$

(C) $|x| > -1$ (D) $x < 2$

61. Matrix A is defined as A = $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, the inverse of matrix A is given by the option

(A) $\begin{bmatrix} 1 & -1 & 0 \\ -2 & -3 & -4 \\ -2 & 3 & -3 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 1 & 0 \\ -2 & 3 & -4 \\ -2 & 3 & -3 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & -1 & 0 \\ -2 & 3 & 4 \\ -2 & 3 & -3 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & -1 & 0 \\ -2 & 3 & -4 \\ -2 & 3 & -3 \end{bmatrix}$

62. If an artificial variable is present in the basic variable column of optimal simplex table, then the solution is said to be

(A) unbounded (B) optimal

(C) infeasible (D) None of these

63. For the system of equations : $x + 2y - z = 1$, $3x - 2y + 2z = 2$, $7x - 2y + 3z = 5$

(A) System is consistent

(B) System is inconsistent

(C) System has unique solution

(D) System has an infinite number of solutions

64. Data on the readership of a certain magazine show that the proportion of male readers under 35 is 0.40 and over 35 is 0.20. If the proportion of readers under 35 is 0.70, the proportion of subscribers that are 'females over 35 years' is given by

(A) 0.20 (B) 0.30

(C) 0.40 (D) 0.10

65. If $\phi(x, y) = \frac{x}{x^2 + y^2}$, the magnitude of the directional derivative along a line making an angle 30° with the positive direction of x-axis at point (0, 2) is given by

(A) $\frac{\sqrt{5}}{8}$ (B) $\frac{1}{\sqrt{2}}(i + k)$

(C) $\frac{\sqrt{3}}{8}$ (D) $\frac{\sqrt{3}}{8} i$

66. The solution of equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x \sin x$ is given by

(A) $(A + Bx)\, e^x + \frac{1}{2}(x \cos x + \cos x - \sin x)$

(B) $(A + Bx)\, e^{-x} + \frac{1}{2}(x \cos x + \cos x - \sin x)$

(C) $(A + Bx)\, e^x + \frac{1}{3}(x \cos x + \cos x - \sin x)$

(D) $(A + Bx)\, e^x + \frac{1}{2}(x \cos x + \cos x + \sin x)$

67. The system of equations

$$x + 2y - 3z = -1$$

$$3x - y + 2z = 7$$

$$5x + 3y - 4z = 2$$

is

(A) Inconsistent

(B) Consistent with trivial solution

(C) Consistent with unique solution

(D) Consistent with more than one solution

68. Using the method of separation of variables, the solution of equation $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x, 0) = 6e^{-3x}$, is given by

(A) $u(x, t) = 6e^{-3x-2t}$

(B) $u(x, t) = -6e^{-3x-2t}$

(C) $u(x, t) = 6e^{-3x-t}$

(C) $u(x, t) = 6e^{-3x-4t}$

69. Particular Integral of $(D^2 - D'^2)\, z = \cos(x + y)$ is given by

(A) $\frac{x}{2} \cos(x + y)$

(B) $x \sin(x + y)$

(C) $2x \sin(x + y)$

(D) $\frac{x}{2} \sin(x + y)$

70. The quadratic form corresponding to the matrix $A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 0 & 3 \\ 5 & 3 & 4 \end{bmatrix}$ is given by

(A) $x_1^2 + 4x_3^2 + 4x_1x_2 + 10x_1x_3 + 3x_2x_3$

(B) $x_1^2 + 4x_3^2 + 4x_1x_2 + 10x_2x_3 + 6x_2x_3$

(C) $x_1^2 - 4x_3^2 + 4x_1x_2 + 10x_1x_3 + 6x_2x_3$

(D) $x_1^2 + 4x_3^2 + 4x_1x_2 + 10x_1x_3 + 6x_2x_3$

71. The total work done in moving a particle in a force field given by $F = 3xyi - 5zj + 10xk$ along the curve $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$ is

(A) 0 (B) 203

(C) 3/4 (D) 303

72. Using Euler's method, the approximate value of $y(2)$ for the initial value problem $\frac{dy}{dx} = x + 2y$, $y(1) = 1$, is given by the option :

(A) 9.25 (B) 6.55

(C) 9.05 (D) 9.55

73. Using Runge-Kutta fourth order method, the value of $y(0.2)$ with $h = 0.1$ for the initial value problem $\frac{dy}{dx} = x + y^2$, $y(0) = 1$ is given by the option :

(A) 1.2336 (B) 1.2736

(C) 1.1736 (D) 1.1326

74. Assuming that half the population are consumers of rice, the chance of an individual being a rice consumer is 1/2 and if 100 investigator each take 10 individuals to see whether they are rice consumers. How many investigators would you expect to report that three people or less is/are consumers?

(A) 17 (B) 23

(C) 19 (D) 11

75. The real symmetric matrix C of the quadratic form :

$Q(x_1, x_2, x_3) = x_1^2 + 4x_2^2 + 6x_3^2 + 2x_1x_2 + 3x_1x_3 + x_2x_3$ is given by the option

(A) $C = \begin{bmatrix} 1 & 1 & 1/2 \\ 1 & 4 & 1/2 \\ 1/2 & 1/2 & 6 \end{bmatrix}$ (B) $C = \begin{bmatrix} 1 & 1 & 3/2 \\ 1 & 4 & 4/2 \\ 3/2 & 4/2 & 6 \end{bmatrix}$

(C) $C = \begin{bmatrix} 1 & 1 & 3/2 \\ 1 & 4 & 1/2 \\ 3/2 & 1/2 & 6 \end{bmatrix}$ (D) $C = \begin{bmatrix} 1 & 1 & 3/2 \\ 1 & 4 & 1/2 \\ 3/2 & 1/2 & 3 \end{bmatrix}$

76. In a normal distribution, 31% of the items are under 45 and 8% are over 64. The mean and standard deviation of the distribution are given by

(A) 60 and 20 respectively
(B) 40 and 10 respectively
(C) 50 and 10 respectively
(D) 50 and 20 respectively

77. The Particular Integral of the equation : $(D^3 - 7D^2 + 10D)\, y = e^{2x} \sin x$ is given by

(A) $\frac{e^x}{50}(7 \cos x - \sin x)$
(B) $\frac{e^{2x}}{50}(7 \cos x - \sin x)$
(C) $\frac{e^{2x}}{50}(7 \cos x + \sin x)$
(D) $\frac{e^{2x}}{5}(7 \cos x + \sin x)$

78. In which option, algebraic structure is not semi group

(A) (N, +)
(B) (Z, –)
(C) (N, +), (Z, –)
(D) None of these

79. The value of $\int_c (x^2 + xy)dx + (x^2 + y^2)\, dy$, where c is the square formed by the lines : $y = \pm 1$, $x = \pm 1$, is given by

(A) 3/8
(B) 5/12
(C) 1
(D) 0

80. The solution of the differential equation : $(D^2 - D'^2 + D + 3D' - 2)z = 0$ is given by

(A) $z = e^{-2x} f(y + x) + e^x g(y - x)$
(B) $z = e^{-x} f(y - x) + xe^{-x} g(y - x)$
(C) $z = e^x f(y - x) + x\, e^{-x} g(y - x)$
(D) $z = e^{-x} f(y - x) + xe^x g(y - x)$

81. The solution of equation $(y + z)p - (x + z)q = x - y$ is given by

(A) $f(x + y + z, x^2 - y^2 - z^2) = 0$
(B) $f(x + y - z, x^2 + y^2 + z^2) = 0$
(C) $f(x + y + z, x^2 - y^2 + z^2) = 0$
(D) $f(x + y + z, x^2 + y^2 - z^2) = 0$

82. By method of variation of parameters, the solution of equation $y'' + y = \text{cosec } x$ is given by

(A) $A \cos x + B \sin x - (x \sec x + \log \tan x)$

(B) $A \cos x + B \sin x + x \cos x + \sin x \cdot \log \sin x$

(C) $A \cos x \cdot \sin x - \cos x \log (\sec x \cdot \tan x)$

(D) $A \cos x + B \sin x - x \cos x + \sin x \cdot \log \sin x$

83. Bag A contains 2 white, 1 black and 3 red balls, bag B contains 3 white, 2 black and 4 red balls and bag C contains 4 white, 3 black and 2 red balls. One bag is selected at random and 2 balls are drawn at random. If the selected balls happen to be red and black, the probability that both balls come from bag B is given by

(A) 20/53 (B) 30/53

(C) 10/53 (D) 20/51

84. The solution of equation $x^2p^2 + y^2q^2 = z^2$ is given by

(A) $\log z = a \log x + \sqrt{(1-a^2)} \log y + c$

(B) $\log z = 2a \log x - \sqrt{(1+a^2)} \log y + c$

(C) $\log z = a \log x + \sqrt{(1-a^2)} \log xy + c$

(D) $\log z = a \log x^2 + \sqrt{(1-a^2)} \log y + c$

85. The system of equations : $-2x + y + z = a$, $x - 2y + z = b$, $x + y - 2z = c$ doesn't have a solution unless

(A) $a + b + c = 0$ (B) $a - b + c = 0$

(C) $a + b - c = 0$ (D) None of these.

86. Particular Integral of $(D^3 - 7DD'^2 - 6D'^3)z = \sin(x + 2y) + e^{2x+y}$ is given by

(A) $-\frac{1}{85}\cos(x + 2y) - \frac{1}{12}e^{2x+y}$ (B) $-\frac{1}{75}\cos(x + 2y) + \frac{1}{12}e^{2x+y}$

(C) $-\frac{1}{75}\cos(x + 2y) - \frac{1}{12}e^{2x+y}$ (D) $-\frac{1}{75}\cos(x + 2y) - \frac{1}{12}e^{3x+y}$

87. A vector field F is given by $F = i(\sin y) + x(1 + \cos y)j$. Then value of integral $\int_C F.d\bar{r}$, where C is the circular path given by $x^2 + y^2 = a^2$, is given by

(A) $3\pi a^2$ (B) $2\pi a^2$

(C) πa^2 (D) $\frac{1}{2}\pi a^2$

88. For any group G, let Aut (G) denote the group of automorphism of G. Which of the following is true?

(A) If G is finite, then Aut (G) is finite.

(B) If G is cyclic, then Aut (G) is cyclic.

(C) If G is infinite, then Aut (G) is infinite

(D) If Aut (G) is isomorphic to Aut (H) where G and H are two groups, then G is isomorphic to H.

89. Maximize $Z = 8x_1 + 6x_2$

subject to the constraints : $2x_1 + x_2 \leq 1000$, $x_1 + x_2 \leq 800$, $x_1 \leq 400$, $x_2 \leq 700$, $x_1 \geq 0$, $x_2 \geq 0$, the solution of L.P.P. is given by the option :

(A) $x_1 = 200$, $x_2 = 600$, Max. $Z = 5200$

(B) Infeasible solution

(C) $x_1 = 200$, $x_2 = 400$, Max. $Z = 4000$

(D) Unbounded solution

90. If $u = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic function, the corresponding analytic function $f(z)$ is given by the option :

(A) $f(z) = (1 - i)z^2 - (2 + 3i)z + ic$ (B) $f(z) = (1 + i)z^2 - (2 + 3i)z + ic$

(C) $f(z) = (1 + i)z^3 - (2 + 3i)z^2 + ic$ (D) $f(z) = (1 + i)z^2 - (2 + 3i)z^{-1} + ic$

91. If $u = \dfrac{\sin 2x}{\cosh 2y + \cos 2x}$ is given function, the corresponding analytic function $f(z)$ is given by the option :

(A) $f(z) = (1 - \text{i})z^2 + c$ (B) $f(z) = \cos z + ic$

(C) $f(z) = \tan z + c$ (D) $f(z) = \cos z - (2 + 3i) \tan z + c$

92. The bilinear transformation which maps the points $z = 1, i, -1$ into the points $w = i, 0, -i$ is given by the option :

(A) $w = \dfrac{iz+1}{-z+1}$ (B) $w = \dfrac{iz-1}{iz+1}$

(C) $w = \dfrac{iz+1}{-iz+1}$ (D) $w = \dfrac{iz-1}{-iz+1}$

93. The degree of the extension $Q(\sqrt{2} + \sqrt[3]{2})$ over the field $Q(\sqrt{2})$ is

(A) 1 (B) 2

(C) 3 (D) 6

94. A bag contains 7 white, 6 red and 5 black balls. Two balls are drawn at random. Find the probability that they will both be white.

(A) 7/51 (B) 9/51

(C) 3/51 (D) 11/45

95. In a class of 200 students, the mean and the standard deviation of scores were 40 and 15, respectively. However, scores 43 and 35 were misread as 34 and 53, respectively. The standard deviation according to the corrected figures is :

(A) 13.97 (B) 14.97

(C) 15 (D) 13

96. Bottles are filled with liquid detergent with the help of an automatic filling machine. When a random sample consisting of 20 bottles is considered, a sample variance of full volume of $s^2 = 0.0153$ (*fluid ounces*)^2 is observed. If the variance is too large to fill volume, an undesirable proportion of bottles will get under or overfilled. Let us approximate that the fill volume is normally distributed, then

(A) At the 95% level of confidence, it is indicated by the data that the process standard deviation can be as large as 0.17 fluid ounce

(B) $\sigma^2 \geq 0.0587$

(C) $\sigma^2 \geq 0.0277$

(D) None of the above is true

97. Let X = {1, 2, 3, 4, 5}. Then which of the following is topology on X?

(A) $T_1 = \{X, \phi, \{1, 2, 3\}, \{2, 3, 5\}, \{1, 5\}\}$

(B) $T_2 = \{X, \phi, \{1\}, \{2\}, \{1, 2\}, \{4, 5\}, \{1, 2, 4, 5\}, \{1, 4, 5\}, \{2, 4, 5\}\}$

(C) $T_3 = \{X, \phi, \{1, 2, 3\}, \{1, 2, 4\}, \{1, 3, 5\}\}$

(D) None of these

98. Consider the symmetric group S_5. Then, which of the following is not correct?

(A) The number of distinct cycles of length 3 in S_5 is 20

(B) The number of distinct cycles of length 2 in S_5 is 10

(C) The number of elements of order 6 in S_5 is 20

(D) The number of elements of order 6 in S_5 is 10

99. Given integers a and b, let $N_{a,b}$ denote the number of positive integers $k < 100$ such that $k \equiv a \bmod 9$ and $k \equiv b \bmod 11$. Then which of the following statements is correct?

(A) $N_{a,b} = 1$ for all integers a and b.

(B) There exist integers a and b satisfying $N_{a,b} > 1$.

(C) There exist integers a and b satisfying $N_{a,b} = 0$.

(D) There exist integers a and b satisfying $N_{a,b} = 0$ and there exist integers c and d satisfying $N_{c,d} > 1$.

100. The cumulative distribution function of a random variable X is given by

$$F(x) = \begin{cases} 0, & x < 2 \\ \frac{1}{10}\left(x^2 - \frac{7}{3}\right), & 2 \le x < 3 \\ 1, & x \ge 3 \end{cases}$$

Which of the following is true?

(A) $F(x)$ is continuous everywhere

(B) $F(x)$ increases only by jumps

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

(D) $P\left(X = \frac{5}{2} \mid 2 \le X \le 3\right) = 0$

ROUGH WORK

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