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23-0009-AZ

TEST BOOKLET

STATISTICS

PAPER – II

Time Allowed: 3 hours

Maximum Marks: 300

INSTRUCTIONS TO CANDIDATES

Read the instructions carefully before answering the questions: -

1. This Test Booklet consists of **12(twelve) pages** and has **75 (seventy-five) items (questions)**.
2. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
3. **Please note that it is the candidate's responsibility to fill in the Roll Number and other required details carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet and the Separate Answer Booklet. Any omission/discrepancy will render the OMR Answer Sheet and the Separate Answer Booklet liable for rejection.**
4. Do not write anything else on the OMR Answer Sheet except the required information. Before you proceed to mark in the OMR Answer Sheet, please ensure that you have filled in the required particulars as per given instructions.
5. Use **only Black Ball Point Pen** to fill the OMR Answer Sheet.
6. This Test Booklet is divided into 4 (four) parts – **Part – I, Part – II, Part - III** and **Part – IV**.
7. All three parts are **Compulsory**.
8. **Part-I consists of Multiple Choice-based Questions.** The answers to these questions have to be marked in the **OMR Answer Sheet** provided to you.
9. **Part-II, Part-III and Part-IV consist of Conventional Essay-type Questions.** The answers to these questions have to be written in the separate **Answer Booklet** provided to you.
10. In Part-I, each item (question) comprises of 04 (four) responses (answers). You are required to select the response which you want to mark on the OMR Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose *ONLY ONE* response for each item.
11. After you have completed filling in all your responses on the OMR Answer Sheet and the Answer Booklet(s) and the examination has concluded, you should hand over to the Invigilator *only the OMR Answer Sheet and the Answer Booklet(s)*. You are permitted to take the Test Booklet with you.
12. **Penalty for wrong answers in Multiple Choice-based Questions:**

THERE WIL BE **PENALTY** FOR WRONG ANSWERS MARKED BY A CANDIDATE.

(i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to the question will be deducted as penalty.

(ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to the question.

(iii) If a question is left blank. i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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PART - I
(Multiple Choice-based Questions)

Instructions for Questions 1 to 50:

- ***Choose the correct answers for the following questions.***
- ***Each question carries 3 marks.*** ***[3x50=150]***

1. A sequential sampling plan is:
   (a) An infinite process
   (b) The process requiring much more sampling units than a fixed size sample
   (c) A process in which sampling terminates with probability one
   (d) All of the above

2. The graph of the proportion of defection in the lot against average sample number is:
   (a) OC curve (b) A.S.N. curve
   (c) Power curve (d) All of the above

3. Chance or random variation in the manufacturing product is:
   (a) Controllable (b) Not Controllable
   (c) Both (a) and (b) (d) None of the above

4. The Shewhart control charts are meant to:
   (a) detect whether the process is under statistical quality control
   (b) find the assignable causes
   (c) reflect the selection of samples
   (d) all of the above

5. The ratio of the rate of decrease in initial population l_x at age x to l_x is known as:
   (a) Nominal annual rate of mortality
   (b) Force of mortality
   (c) Central mortality rate
   (d) All of the above

6. The probability of rejecting a lot having $\overline{p}$ as the process average defectives is known as:
   (a) Consumer's risk (b) type II error
   (c) Producer's risk (d) all of the above

7. If the value of a series at any time t is a function of its value at some previous time intervals, such a time series is known as:
   (a) Autoregressive series
   (b) Fourier series
   (c) Harmonic series
   (d) None of the above

8. What is a T-score?
   (a) A standardized score with mean of 100 and a standard deviation of 10.
   (b) A standardized score with mean of 50 and a standard deviation of 10.
   (c) A standardized score with a mean of 0 and a standard deviation 1.
   (d) None of the above

9. Control charts in statistical quality control are meant for:
   (a) Describing the pattern of variation
   (b) Checking whether the variability in the product is within the tolerance limit or not
   (c) Uncovering whether the variability in the product is due to assignable causes or not
   (d) All the above

10. A curve showing the probability of accepting a lot of quality P is known as:
   (a) OC curve
   (b) A.S.N curve
   (c) Gompertz curve
   (d) None of the above

11. Which of the following provides details of manufacturing sector performance in India?
   (a) Whole Sale Price Index
   (b) Annual Survey of Industries
   (c) Index of Industrial Production
   (d) Wage rate Index

12. A researcher divided subjects into two groups according to gender and then selected members from each group for his sample. What sampling method was the researcher using?
   (a) Cluster
   (b) Stratified
   (c) Random
   (d) Systematic

13. The principal sources of Industrial Statistics in India is/are:
   (a) Index of industrial production
   (b) Annual Survey of Industries (ASI)
   (c) Economic Census
   (d) Micro, Small and Medium Enterprises (MSME)

14. Agriculture census in India is conducted at an interval of:
   (a) 3 Years
   (b) 5 Years
   (c) 8 Years
   (d) 10 Years

15. What is/are the major source(s) of data on official statistics?
   (a) Census and Sample Surveys
   (b) Administrative Records
   (c) Both (a) & (b)
   (d) Neither (a) nor (b)

16. The Simplex Method is used to solve -
   (a) linear programming problems
   (b) quadratic programming problems
   (c) nonlinear programming problems
   (d) none of the above

17. In a two-person zero sum game, the players have:
    (a) Opposing goals
    (b) Identical goals
    (c) Random goals
    (d) None of the above

18. The Minimax Theorem state that in every matrix game -
    (a) there is a unique solution
    (b) there is a solution that is optimal for both players
    (c) there is a solution that maximizes the payoff of one player and minimizes the payoff of the other player.
    (d) none of the above

19. The Hungarian Method is an algorithm used to solve:
    (a) Transportation problems
    (b) Assignment Problems
    (c) Linear programming problems
    (d) Game theory problem

20. The transition matrix of a Markov chain determines the -
    (a) probability of moving from one state to another
    (b) probability distribution of the states
    (c) expected value of the states
    (d) variance of the states

21. A Poisson process is:
    (a) A counting process with independent and identically distributed interarrival times:
    (b) A counting process with dependent and identically distributed inter arrival time
    (c) A continuous-time stochastic process
    (d) A discrete-time stochastic process

22. If μ and σ are the process mean and S.D., then the control limits $\mu \pm 3\sigma$ are known as:
    (a) Modified control limits
    (b) Natural control limits
    (c) Specified control limits
    (d) None of the above

23. The probability q_x of dying of a person between the age interval x and $(x+1)$ and the central mortality rate m_x are related as:
    (a) $q_x = 2\,m_x/(2 - m_x)$
    (b) $q_x = m_x/(2 + m_x)$
    (c) $q_x = 2\,m_x/(2 + m_x)$
    (d) None of the above

24. The maximum limit of percentage defectives in a finally accepted product is called:
    (a) Acceptance Quality Level (A Q L)
    (b) Average Outgoing Quality Limit (A O Q L)
    (c) Lot Tolerance Percentage Defective (LTPD)
    (d) All of the above

25. What does SPSS stand for?
    (a) Statistical Package for Social Sciences
    (b) Scientific Programming and Statistical Software
    (c) Systematic Programming for Statistical Solution
    (d) None of the above

26. Multi-collinearity can lead to:
    (a) Increased standard errors of regression coefficient
    (b) Biased estimates of regression coefficients
    (c) Difficulty in interpreting the effect of individual independent variable
    (d) All of the above

27. What does a percentile score represent?
    (a) The proportion of scores below a particular score.
    (b) The proportion of scores above a particular score.
    (c) The proportion of scores between two score
    (d) None of the above

28. A population have constant size and composition is called a -
    (a) Stable population
    (b) Stationary population
    (c) Mobile population
    (d) Discrete population

29. Expected sample size of S.P.R.T. is called:
    (a) Discrete random variable
    (b) Continuous random variable
    (c) Average sample number
    (d) All of the above

30. When the lot contains all defectives, the OC function for p =1 is:
    (a) L (p) = 0 (b) L (p) =1
    (c) L (p) =∞ (d) None of the above

31. What is test-retest reliability?
    (a) The extent to which different parts of a test measure the same construct.
    (b) The degree to which scores on a test are consistent over time.
    (c) The extent to which scores on a test correlate with scores on another measure of the same construct
    (d) None of the above

32. For the given five values 15,24,18,33,42 the three years moving averages are:
    (a) 19,22,33
    (b) 19,25,31
    (c) 19,30,31
    (d) 19,22,45

33. An abridged life table can be constructed by the method suggested by:
    (a) Reed Merrell
    (b) Greville
    (c) G. King
    (d) All of the above

34. Harmonic analysis method is based on the function Y_t expressed in the form of:
    (a) Taylor's function
    (b) Harmonic series
    (c) Fourier series
    (d) None of the above

35. The best method for finding out seasonal variation is:
    (a) Simple average method
    (b) Ratio to moving average method
    (c) Ratio to trend method
    (d) None of the above

36. The terms prosperity, recession, depression and recovery are in particular attached to:
    (a) Secular trend
    (b) Seasonal fluctuation
    (c) Cyclic movements
    (d) Irregularvariations

37. Laspeyre's index number possess:
    (a) Downward bias
    (b) No bias
    (c) Upward bias
    (d) None of the above

38. Consumer price index number is constructed for-
    (a) A well-defined section of people
    (b) All the people
    (c) Factory workers only
    (d) All of the above

39. Circular test for price indices is satisfied by the formula:
    (a) Based on geometric mean of price relatives
    (b) Obtained by Kelly's fixed weight method
    (c) Both (a) & (b)
    (d) Neither (a) nor (b)

40. If the group indices are 80, 120 & 125 and their respective group weights are 60, 20, & 20 the consumer price index is:
    (a) 108.33
    (b) 97.00
    (c) 98.49
    (d) none of the above

41. The death rate obtained for a segment of a population is known as:
    (a) Specific death rate
    (b) crude death rate
    (c) Standardized rate
    (d) vital index

42. The probability of living of a person in the age group x to $(x + n)$ can be obtained by the formula-
    (a) l_{x+n} / l_x
    (b) $(l_x - l_{x+n})/l_x$
    (c) $(l_x - l_{x+n})/l_x$
    (d) l_x / l_{x+n}

43. Which command is used to conduct a t-test in SPSS?
    (a) ANOVA
    (b) F-test
    (c) T-test
    (d) Chi-square

44. Reed Merrell method of construction of abridged life-tables utilizes -
    (a) Age specific mortality rates
    (b) Central mortality rates
    (c) Both (a) & (b)
    (d) Neither (a) nor (b)

45. The relation between N.R.R. and G.R.R. is:
    (a) N.R.R. and G.R.R. are usually equal
    (b) N.R.R. can never exceed G.R.R.
    (c) N.R.R. is generally greater than G.R.R.
    (d) None of the above

46. Construction of life-tables is based on the assumption that:
    (a) Age specific death rates are constant at all ages
    (b) Death rates are uniformly distributed between two birth days.
    (c) Mortality rates are same for male and female population.
    (d) All of the above

47. If Laspeyre's price index is 324 and Paasche's price index 144, and then Fisher's ideal index is
    (a) 234
    (b) 180
    (c) 216
    (d) None of above

48. The age-specific death rate for the babies of age less than one year is specifically called:
    (a) Neonatal death rate
    (b) Infant mortality rate
    (c) Maternal mortality rate
    (d) Fetal death rate

49. In a transportation problem, the objective is to:
    (a) Minimize the total transportation cost
    (b) Maximize the total transportation cost
    (c) Minimize the total production cost
    (d) Maximize the total production cost

50. In a sequential probability ratio test, the criterion for acceptance of the lot with usual notations is:
    (a) $\lambda m \leq \frac{\beta}{1-\alpha}$
    (b) $\lambda m \geq \frac{\beta}{1-\alpha}$
    (c) $\lambda m \leq \frac{1-\alpha}{\beta}$
    (d) $\lambda m \geq \frac{1-\alpha}{\beta}$

PART - II
(Short Answer-type Questions)

Instructions for Questions 51 to 63:

- ***Write the answers in short for any 10 (TEN)out of the thirteen questions.***
- ***Each question carries 5 marks.*** ***[5x10=50]***

51. Explain the statistical basis and construction of p and np charts.

52. What is control charts? Explain the basic principles underlying the control charts.

53. What are Natural Tolerance Limits and Specification Limits? When do we use modified control limits?

54. What are the advantages and limitations of Simulation models?

55. Explain the meaning, scope and methodology of operational research.

56. What are the principle characteristics of Queues?

57. Why is Fisher's index number called ideal? Justify your answer with an illustration.

58. Explain the term multi-collinearity and discuss the ways of detecting its presence.

59. Explain the concepts of heteroscedasticity.

60. Give the uses of life table.

61. Differentiate between stationary population and stable population.

62. Define the following:
    (a) Z Score
    (b) Standard Score

63. Explain in brief the following:
    (a) Net Reproduction rate
    (b) Gross reproduction rate

PART - III
(Long Answer-type Questions)

Instructions for Questions 64 to 71:

- ***Answer any 5 (FIVE) out of the eight questions.***
- ***Each question carries 10 marks.*** ***[10x5=50]***

64. Describe double sampling plan and the general method of plotting OC curve of such a plan.

65. Describe X Bar and R Control Charts.

66. Discuss the various inventory costs. Derive economic lot size formula when shortage costs are allowed.

67. Develop mathematical model of a balanced transportation problem. Prove that it always has a feasible solution.

68. What are the various methods of determining trend? Explain the method of least squares in detail.

69. Define correlogram. Find the correlogram for second order auto-regression series.

70. What do you understand by a T- scale? Explain clearly the method of converting raw tests scores into T- Scores?

71. Explain Lotka and Dublin's stable population theory.

PART - IV
(Essay-type Questions)

Instructions for Questions 72 to 75:

- ***Answer any 2 (TWO) out of the four questions.***
- ***Each question carries 25 marks.*** ***[25x2= 50]***

72. (a) Explain and bring out the distinction between Acceptance Quality Level (A.Q.L.) and Average Outgoing Quality Limit (A.O.Q.L.)

    (b) Describe the method of double sampling plan and derive its -
    O.C. (Operational Characteristics)
    A.O.Q. (Average Outgoing Quality)
    A.S.N. (Average Sample Number) and
    A.T.I. (Average Total Inspection)

73. Use dual simplex method to solve:
    Max. $Z = -2x_1 - x_3$
    Subject to $x_1 + x_2 - x_3 \geq 5, x_1 - 2x_2 + 4x_3 \geq 8$ and $x_1, x_2, x_3 \geq 0$.

74. For the following data prove that Fisher's Ideal Index satisfices both the time reversal test and the factor reversal test and calculate its value.

	Base Year		Current Year	
Commodity	**Price**	**Quantity**	**Price**	**Quantity**
A	6	50	10	56
B	2	100	2	120
C	4	60	6	60
D	10	30	12	24

75. (a) Describe the structure of a complete life table. Explain how the different columns of a life table may be computed on the basis of observed age mortality rates.

    (b) Explain in brief the methods of construction of abridged life table.