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No. of Questions : 50

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
PET 2024 (9019) Doctor of Philosophy(Statistics)

(To be filled by the Candidate)

Candidate Seat Number
(As per Admit card)

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OMR Sheet Number

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Invigilator's signature with Date

Candidate's Seat No. in Words : _____

Name of the Center : _____

Paper Code & Name of Examination : 9019- Doctor of Philosophy(Statistics)

Date: 03/10/2024

PET 2024 - EXAMINATION

Time: One Hours

Total Marks: 100

Important Instructions for the candidate

- Write your seat number and OMR Sheet number on the question paper in the earmarked space
- This question paper carries Fifty (50) Multiple-choice type questions and each question carries 2 Marks
- At the commencement of examination, the question paper will be given to the student.
- Each question has four alternative responses marked (A) (B) (C) and (D). You have to darken the circle as indicated below on the correct response against each question
Example: where (C) is correct answer

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- Your responses to the answer are to be indicated in the OMR Sheet. If you mark at any place other than in the circle in the OMR Sheet it will not be evaluated.
- Rough work is to be done at the end of this question paper.
- You have to return OMR answer sheet and question paper to the invigilator at the end of examination compulsorily and must not carry with you outside the examination hall.
- Use only Black / Blue ball point pen
- Use of any type of calculator or log table etc. is prohibited.
- There is no negative marking for incorrect answers

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

- परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात तसेच आपणास दिलेल्या उत्तर पत्रिकेचा क्रमांक त्याखाली लिहावा.
- या प्रश्नपत्रिकेतील सर्व प्रश्न सोडवणे अनिवार्य आहे.
- परीक्षा सुरु झाल्यावर विद्यार्थ्यांला प्रश्नपत्रिका दिली जाईल.
- प्रत्येक प्रश्नासाठी (A) (B) (C) (D) अशी चार विकल्प उत्तरे दिली आहेत, त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा निळा करावा.
उदा: जर (C) हे उत्तर योग्य असेल तर

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- या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे ओएमआर उत्तर पत्रिकेतच दर्शवावीत इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
- प्रश्नपत्रिकाच्या शेवटी कोऱ्या जागेवरच कच्चे काम करावे
- परीक्षा संपल्यानंतर विद्यार्थ्यांनी मूळ ओ. एम. आर उत्तरपत्रिका पर्यवेक्षकाकडे परत करणे आवश्यक आहे तथापि प्रश्नपत्रिका व ओ. एम. आर. उत्तरपत्रिका आपल्याबरोबर नेण्यास विद्यार्थ्यांला परवानगी नाही.
- फक्त काळ्या किंवा निळ्या बॉलपेनचाच वापर करावा
- कॅल्क्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही
- चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही

- | Q. No. | Question |
|--------|--|
| 1. | The m-step transition probability is denoted by.....
(A) $p_{jr}^{(m)}$ (B) $p_{jm}^{(jr)}$
(C) p_{jr} (D) $p^{(m)}$ |
| 2. | The zig-zag movement of small particles suspended in a liquid (or Gas) is called
(A) Bernoulli motion (B) Brownian motion
(C) Birth and death motion (D) z-z motion |
| 3. | The cells in the transportation problem can be classified as
(A) Assigned cells and empty cells (B) Filled cells and empty cells
(C) Occupied cells and unoccupied cells (D) Allocated cells and empty cells |
| 4. | What are the variables Qx as per defined in the quadratic programming model Maximize
$f(x) = cx + \frac{1}{2} x^T Qx$
(A) Q is a constant and x is a column vector.
(B) Q is a matrix and x is a column vector.
(C) Q is a matrix and x is a constant.
(D) Q is a constant and x is also a constant. |
| 5. | A company uses a Economic order quantity (EOQ) model for inventory control. the annual demand for the product is 10000 units, the ordering cost per order is rs.100 and the holding cost per unit per year is rs. 2 What is the EOQ for this product? (May select the most closest value)
(A) 100 units (B) 50 units
(C) 2000 units (D) 1000 units |
| 6. | If X is the matrix of n random samples from $N_4(\underline{\mu}, \Sigma)$ then distribution of
$(X - \underline{\mu}E_{1n})(X - \underline{\mu}E_{1n})'$ is
(A) $W_4(n, I_p)$
(B) $W_4(n - 1, I_p)$
(C) $W_4(n, \Sigma)$
(D) Non-central chi square with 4 degrees of freedom |
| 7. | Two random samples of size 20 and 30 are drawn from $N_5(\underline{\mu}^{(1)}, \Sigma)$ and $N_5(\underline{\mu}^{(2)}, \Sigma)$ respectively. If the value of Hotelling's T^2 statistic for testing the hypothesis $H_0: \underline{\mu}^{(1)} = \underline{\mu}^{(2)}$ is 120 then the value of Mahalanobi's squared distance between two samples is
(A) 180 (B) 1440
(C) 10 (D) 80 |
| 8. | Suppose $\underline{X} \sim N_p(\underline{0}, I)$ and $\underline{X}'A\underline{X} \sim \chi_r^2, r < p$ then which of the following statements is not true?
(A) $-A$ is idempotent matrix (B) $trace(A) = r$
(C) r eigen values of matrix A are 1 (D) A is non-singular |

9. Let $\{X_n\}$ be a sequence of random variables then which of the following statement is always correct
- (A) $X_n \xrightarrow{a.s.} X \Rightarrow X_n \xrightarrow{p} X$ (B) $X_n \xrightarrow{p} X \Rightarrow X_n \xrightarrow{a.s.} X$
 (C) $X_n \xrightarrow{a.s.} X \Rightarrow X_n \xrightarrow{r} X$ (D) $X_n \xrightarrow{p} X \Rightarrow X_n \xrightarrow{r} X$
10. Let $F_X(x)$ and $F_Y(y)$ be distribution functions of random variables X and Y respectively then which one of the following is also a distribution function
- (A) $2F_X(x) - 0.7F_Y(y)$ (B) $F_X(x) - F_Y(y)$
 (C) $7F_X(x) - 6F_Y(y)$ (D) $0.3F_X(x) + 0.7F_Y(y)$
11. $\phi(t) = e^{-t^\alpha}$ is a characteristic function if and only if
- (A) $\alpha = 1$ (B) $\alpha = 2$
 (C) $\alpha = 0$ (D) $\alpha = 3$
12. Which of the following is not a vector space
- (A) $R(R)$ (B) $C(C)$
 (C) $R(C)$ (D) $C(R)$
13. If A is a countable set and B is a countable set then the most we can say about the Cartesian product $A*B$ is the_____.
- (A) Empty set (B) Finite set
 (C) Countable set (D) At most countable set
14. In a regression analysis if $SSE = 200$ and $SSR = 300$, then the coefficient of determination is.....
- (A) 0.6667 (B) 0.60
 (C) 0.3334 (D) 0.40
15. Which of the following is a common diagnostic tool used to identify leverage point in regression analysis
- (A) Standardized Residual (B) Variance Inflation Factor
 (C) Cook Distance (D) Normal Q-Q Plot
16. If for a set of explanatory variable X_2 and X_3 , the coefficients of the correlation is equal to 1 this means that between X_2 and X_3 , there exists
- (A) Perfect Collinearity (B) Very high Collinearity
 (C) Low level of Collinearity (D) No Collinearity
17. The small fraction of defectives P_1 , on the basis of which a lot is not rejected except for a small number of times, is called
- (A) Lot tolerance percentage defective (LTDP)
 (B) Rejecting quality level (RQL)
 (C) Acceptance quality level (AQL)
 (D) Lower limit of control Chart (LLC)
18. ----- is the arithmetic mean of the time required to perform maintenance action
- (A) MTBT (B) MTBF
 (C) MTTR (D) MRT

19. The information from an experiment stabilizes when error degrees of freedom are at least:
 (A) 6 (B) 8
 (C) 10 (D) 12
20. In a split plot design, less precision is attained for:
 (A) Main plot treatment (B) Sub-plot treatment
 (C) Block differences (D) All of the above
21. If $x_1, x_2, x_3, \dots, x_n$ be a random sample from an infinite population where $s^2 = \frac{1}{n} \sum_{i=1}^n (X_i - \bar{x})^2$, the unbiased estimator for population variance σ^2 is
 (A) $\frac{1}{n-1} s^2$ (B) $\frac{1}{n} s^2$
 (C) $\frac{n-1}{n} s^2$ (D) $\frac{n}{n-1} s^2$
22. A sufficient statistics is minimal if and only if it is a :
 (A) minimal sufficient statistics in a sequence of sufficient statistics
 (B) a function of every other sufficient statistics
 (C) a function of UMVU estimators
 (D) A function consistent statistics
23. Which of the following statements does not hold good incase of stratified sampling?
 (A) Stratified sampling is convenient
 (B) Stratified sampling is always good
 (C) Enables to ether information about different stratum separately
 (D) Reduces error for fixed cost
24. Two stage sampling design is more efficient than single stage sampling if the correlation between units in the first stage is :
 (A) Negative (B) Positive
 (C) Zero (D) None zero
25. Variance of \bar{x}_{st} under random sampling, proportional allocation and optimum allocation hold the correct inequality as :
 (A) $V_{ran}(\bar{x}_{st}) \leq V_{prop}(\bar{x}_{st}) \leq V_{opt}(\bar{x}_{st})$
 (B) $V_{ran}(\bar{x}_{st}) \geq V_{opt}(\bar{x}_{st}) \geq V_{prop}(\bar{x}_{st})$
 (C) $V_{ran}(\bar{x}_{st}) \geq V_{prop}(\bar{x}_{st}) \geq V_{opt}(\bar{x}_{st})$
 (D) $V_{ney}(\bar{x}_{st}) \leq V_{prop}(\bar{x}_{st}) \leq V_{opt}(\bar{x}_{st})$
26. Data collected from an archive or the records of an organization is called as
 (A) Internal data (B) Secondary data
 (C) External data (D) Primary data
27. Which of the following characteristic of quantitative data collection
 (A) Focus on understanding context and meanings
 (B) Collection of numerical data
 (C) Use of open-ended questions
 (D) Emphasis on subject experiences

28. A measurement scale in which values are categorized to represent qualitative differences and ranked in a meaningful manner is classified as
- (A) Interval scale (B) Ordinal scale
(C) Valid scale (D) Nominal scale
29. The difference between values of Parameter and Statistics is called as
- (A) Type I error (B) Type II error
(C) Sampling error (D) Error in calculation
30. is concerned with discovering and testing certain variables with respect to their association or disassociation
- (A) Exploratory (B) Descriptive
(C) Diagnostic (D) None of the above
31. prevent a researcher from blind search and intellectual wandering
- (A) Data (B) Research tools
(C) Sample (D) Research design
32. Research design is a blue print, outline and a
- (A) Plan (B) Strategy
(C) System (D) Guide
33. In the process of conducting research ‘Formulation of Hypothesis’ is followed by
- (A) Statement of Objectives (B) Analysis of Data
(C) Selection of Research Tools (D) Collection of Data
34. What is a Research Design?
- (A) A way of conducting research that is not grounded in theory.
(B) The choice between using qualitative or quantitative methods.
(C) The style in which you present your research findings e.g. a graph
(D) A framework for every stage of the collection and analysis of data.
35. Which of these describes a Type 1 error?
- (A) A ‘false positive’
(B) When you claim evidence for an effect when there isn’t one
(C) Both A and B
(D) Neither A nor B
36. Why would an ANOVA be required?
- (A) To study a single main effect
(B) To study more than one main effect
(C) To study the interaction between two or more variables
(D) None of the above
37. Which of the following best describes the purpose of defining research objectives in a study?
- (A) To identify the research methodology.
(B) To specify the goals that the research aims to achieve.
(C) To determine the population sample size.
(D) To list the statistical tools used for data analysis.

38. Which of the following types of research is concerned with establishing cause-and-effect relationships?
 (A) Descriptive research (B) Exploratory research
 (C) Explanatory research (D) Qualitative research
39. Which of the following is NOT considered a criterion for good research?
 (A) Objectivity (B) Systematic approach
 (C) Biased interpretation (D) Accuracy
40. When defining a research problem, conducting a literature review helps in:
 (A) Identifying gaps in existing knowledge and areas that need further exploration.
 (B) Collecting raw data for analysis.
 (C) Developing solutions before conducting the research.
 (D) Avoiding the use of any existing knowledge or studies.
41. Which technique helps in defining a research problem by formulating working hypotheses?
 (A) Literature review (B) Exploratory interviews
 (C) Problem validation surveys (D) Pilot studies
42. What is the primary purpose of a research abstract?
 (A) To review existing literature
 (B) To provide a detailed methodology section
 (C) To summarize the key findings, objectives, and significance of the research
 (D) To list all the references used in the research
43. The bibliography of a research paper includes:
 (A) A summary of the research findings.
 (B) A list of sources, books, articles, and other references used in the research.
 (C) An analysis of primary data.
 (D) A detailed explanation of the research methodology.
44. The references section of a research paper should:
 (A) List every book ever read by the researcher.
 (B) Include only the sources cited in the paper.
 (C) List every source ever published on the topic, regardless of use.
 (D) Provide links to every website visited during the research.
45. A review article in a research journal is typically:
 (A) An article that presents new experimental data.
 (B) A summary of existing research on a particular topic.
 (C) A short, opinion-based essay.
 (D) A presentation of research findings for public policy.
46. Sampling error is caused bymethod of analysis of data.
 (A) Proper (B) Improper
 (C) Sampling (D) Faulty

47. What is the difference between a technical report and a popular report?
- (A) A technical report is written for a general audience, while a popular report is for technical experts.
 - (B) A technical report is more detailed and written for experts, while a popular report is simpler and aimed at a general audience.
 - (C) A technical report includes only financial data, while a popular report includes research findings.
 - (D) A technical report has no conclusions, while a popular report is conclusion-heavy.
48. Probability of selection varies at each subsequent draw in:
- (A) Sampling without replacement
 - (B) Sampling with replacement
 - (C) Random sampling
 - (D) Linear sampling
49. To meet requirement of the principle of validity of sampling methods, one must adopt:
- (A) Purposive sampling
 - (B) Restricted sampling
 - (C) Probability sampling
 - (D) Any types of sampling
50. Stratified sampling is not preferred when the population is:
- (A) Infinite
 - (B) Finite
 - (C) Homogeneous
 - (D) Non-homogeneous
