"ज्ञान विज्ञान आणि सुसंस्कार यासाठी शिक्षण प्रसार"
प. पू. शिक्षणमहर्षि डॉ. बापुजी साळुंखे

Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
M. Sc – I & II (Statistics & Applied statistics)
Internal Examination (2023-24)

Notice

Date: 13/10/2023

All the students of M.Sc. – I (Statistics & Applied Statistics) & M.Sc.- II (Statistics) are hereby informed that, the Internal Examination of Semester – I & III will be held as per following time table.

M.Sc. – I (Statistics & Applied Statistics)

Sr.No.	Date	Time	Marks	Course Code	Course Name
1	25/10/2023	11.15 am to 12.15 pm	20	DSC17STA11	Distribution Theory
2	26/10/2023		20	DSC17STA12	Estimation Theory
3	27/10/2023		10	DSC17STA13	Statistical Computing
4	28/10/2023		20	DSE17STA11	Mathematical Statistics
				DSE18STA11	C Programming
5	30/10/2023		20	MIN17STA11	Research Methodology

M.Sc. – II (Statistics)

Sr.No.	Date	Time	Marks	Course Code	Course Name
1	25/10/2023	11.15 am to 12.15 pm	20	CC-2312C	Asymptotic Inference
2	26/10/2023		20	CC-2313C	Multivariate Analysis
3	27/10/2023		20	CC-2314C	Stochastic Processes
4	28/10/2023		20	CC-2315C	Data Mining
5	30/10/2023		20	CC-2316C	Time Series Analysis

Nature of Question Paper

a) For 20 Marks :-

Que. 1) 5 MCQ's each carrying 1 mark

Que. 2) Attempt any 3 questions out of 4 (5 X 3 = 15)

b) For 10 Marks :-

Que. 1) 2 MCQ's each carrying 1 mark

Que. 2) Attempt any 2 questions out of 3 (4 X 2 = 8)

Instruction :- Students should present at least 10 min. before examination.

(Ms. Pawar V. V.)
HEAD
DEPARTMENT OF STATISTICS
VIVEKANAND COLLEGE, KOLHAPUR

Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
M. Sc. I SEM-I Internal Examination 2023-24
Paper I: Distribution Theory

Marks: 20 **Time: 11:15 AM to 12:15PM** **Date: 25/10/2023**

Question 1.

I. If random variable X is symmetric about zero, then $E(X^{2k\pm1})$ is
(A) 0 (B) $2k \pm 1$ (C) $\frac{1}{2k\pm1}$ (D) None of the above

II. Which of the following is true about truncated random variables
(A) $P[X=x] > p[X_T = x]$ (B) $P[X=x] < P[X_T = x]$
(C) $P[X=x] = p[X_T = x]$ (D) None of these

III. If F is distribution function of X then which of the following is/are true?
(A) $F(x_1) \geq F(x_2)$ for $x_1 < x_2$ (B) $\lim_{h\to0} F(x-h) = F(x)$
(B) $F(-\infty) = 0$ and $F(\infty) = 1$ (D) All are correct

IV. If $X \sim B(4, \frac{1}{2})$ and Y is truncated binomial variate at $x = 0$ then $E(Y)$ is
(A) $\frac{32}{15}$ (B) $\frac{15}{32}$ (C) $\frac{29}{15}$ (D) $\frac{15}{29}$

V. Let X is random variable with density $f(x) = \frac{1}{k}\exp\{-\frac{1}{2}\left(\frac{x-4}{2}\right)^2\}$ then value of k is
(A) $\sqrt{2\pi}$ (B) $\sqrt{8\pi}$ (C) $\sqrt{4\pi}$ (D) $\sqrt{\pi}$

Question 2. Attempt any 3 questions out of 4 questions

1. If X and Y are $i.i.d.$ standard uniform variates then find density of $(X+Y)$
2. If X is symmetric r. v. about point a, then prove that $E(X) = Median = a$
3. If distribution function of r. v. X is
$$F(x) = \begin{cases} 0; x < 0 \\ 0.5 + \frac{x}{2}; 0 \leq x < 1 \\ 1; x \geq 1 \end{cases}$$
then decompose F into distribution function of discrete part and continuous part.
4. Define truncated Poisson distribution($truncated\ at\ x = 0$). Find its mean.

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Vivekanand college, Kolhapur (Empowered Autonomous)
Department of Statistics
M.Sc. I Sem I Internal Examination 2023-24
Course Name: Estimation Theory

Date :26/10/2023 Time:11.15 am to 12.15 pm Total Marks 20

Q1) Choose Correct Alternative (1×5 = 5)

i)The sufficient statistic for σ^2 of N (0, σ^2) based on a single observation x is

a) x^2 b) x c) $|x|$ d) 2x

ii)If $X_1, X_2 ....$ Xn is a random sample of size n from N (θ, θ^2) then minimal sufficient statistic for θ is

a) $(\sum_{i=1}^{n} x_i , \sum_{i=1}^{n} x_i^2)$ b) $\sum_{i=1}^{n} x_i$ c) $\sum_{i=1}^{n} x_i^2$ d) None of these

iii) M.L.E is same as moment estimator if the distribution

a) belongs to exponential family b) holds regularity conditions

c) has support free from parameter of estimation d) has unique M.L.E.

iv)Moment estimator of θ based on random sample of size n from U(θ ,1) *is*

a)$2\bar{X}+1$ b) $2\bar{X}-1$ c) $\bar{X}-2$ d) $2\bar{X}-2$

v)The sufficient estimator of the parameter λ of Poisson distribution based on a sample X_1, X_2, X_3 is given by

a) $X_1+X_2+X_3$ b) $X_1+2X_2+X_3$ c) $X_1+X_2+2X_3$ d)$2X_1+X_2+X_3$

Q2) Attempt any Three (3×5 = 15)

i) Let $X_1, X_2, \cdots, Xn$ be a random sample from a distribution with pdf,

f (x, θ) = θ $x^{\theta-1}$; 0 < x < 1

Show that T=$\prod Xi$ is sufficient statistic for θ.

ii) Define one parameter exponential family of distributions. Obtain minimal sufficient statistic for this family.

iii) Let $X_1, X_2, \cdots, Xn$ be a random sample from N (μ,σ^2) where μ≥μ_0 then find the MLE of μ.

iv)Let $X_1, X_2, \cdots, Xn$ be a random sample from NB(k,p).Find the moment estimators of parameters of k and p.

Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
MSc I (Statistics &Applied statistics)
Internal Examination- 2023-24
Subject: Statistical Computing

Marks: 10 Time: 11:15am to 11:45am Date: 27/10/2023

Q1 Multiple Choice Questions (2 Marks)

i. **MS Excel 2019 has row limit of __________**

A. 1,048,576 B. 4,81,0576 C. 16384 D. 1,57,648

ii. **Which one is not a function in MS-excel**?

A. PROPER B. AVERAGE C. COUNT D. CLEAR

Q.2) Attempt Any Two. (8 Marks)

i. Explain Analysis tool pack in MSEXCEL.

ii. Explain any four Statistical functions in MSEXCEL.

iii. Explain following Logical functions in MSEXCEL

a) FALSE () b) TRUE() c) OR () d)AND()

Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
M.Sc.-I Sem-I Internal Examination 2023-24
Paper Name: Mathematical Statistics

Marks: 20 Time: 11.15 am to 12.15 pm Date: 28/10/2023

Instructions: All questions are compulsory.
Each question carries equal marks.

Q1. Select the most correct alternative [5]

1. Every subset of countable set is .....
   a) Finite b) Infinite c) Countable d) None of these
2. Which of the following is not true
   a) The union of two countable set is countable
   b) The set of rational on [0,1] is countable
   c) The set of rational on [0,1] is uncountable
   d) Supremum is exist is unique
3. Let a∈R be a point, then any open interval containing point 'a' is called a .....
   a) Neighborhood of a point
   b) Deleted neighborhood of a point
   c) Interial point of a set
   d) None of these
4. The set of all limit points of a 'A' is called ....
   a) Limit point b) Derived set c) Closer of a set d) None of these
5. The function f(x) = $\sqrt{x}$, x∈[0,1] is uniformly continuous on ...
   a) [0,1) b) [0,1] c) (0,1] d) (0,1)

Q2. Attempt any three. [15]

1. State and prove Lagranges mean value theorem.
2. State and prove Archimedian theorem.
3. Define a) complete ordered field b) Ordered structure
4. Define field structure
5. State and prove Bolzano weiestrass theorem.

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

M. Sc. I Statistics Semester I (CBCS) Examination
Fundamentals of Computer Programming
Internal Examination (2023-24)

Day & Date: Saturday, 28-10-2023
Time: 11.15am to 12.15pm **Total Marks: 20**
Instructions: ***Figures to right indicate full Marks.***

Q. 1) Choose the correct alternative **5 Marks**

i) ------ loop is called as entry-controlled loop.

a) While b) do-while c) for d) none of these

ii) Who is the father of C language?

a) Steve Jobs b) James Gosling c) Dennis Ritchie d) Rasmus Lerdorf

iii) Which of the following arithmetic operator takes only integer operands?

a) + b) – c) / d) %

iv) Which of the following is a valid expression in C?

a) int basic_pay = 23000; b) int basic_pay = 23,000;
c) int basic pay = 23000; d) int $basic_pay = 23000;

v) What is the result of a logical or relational expression in C?

a)0 or 1 b) True or false
c)0 if false and a positive number if true. d)T or F

Q.2 Attempt any 3 Questions **(5*3=15 Marks)**

i) Explain in detail with example- a) if-else -if ladder b) switch statement

ii) Explain in detail structure of 'C'.

iii) Write note on Operators in C.

iv) What is flowchart? Explain different symbols used in flowchart? Draw flowchart to find area and perimeter of a rectangle.

Vivekanand College, Kolhapur (Empowered Autonomous)

Department of Statistics
MSc I (Statistics &Applied statistics)
Internal Examination- 2023-24
Subject: Research Methodology

Marks: 20 **Time: 11:15 to 12:15** **Date:30/10/2023**

Q1 Multiple choice Questions **(5Marks)**

i. Which is Warners Model Randomised Response Techniques?

a) $\lambda = \pi p+(1+\pi)(1+p)$ b) $\lambda = \pi p+(1-\pi)(1-p)$
c) $\lambda = \pi p+(1-p)(1-\pi)$ d) $\lambda = \pi p-(1-\pi)(1-p)$

ii. Cluster sampling, stratified sampling and systematic sampling are types of

a) Direct sampling b) Indirect sampling
c) Random sampling d) Non random sampling

iii. How many types of Research approaches.

a) 2 b)3 c)5 d)4

iv. Who defined "Research" as "systematized effort to gain new knowledge"

a) Tom & Zerry b) Redman and Mory
c) F.W Taylor d) Ross Taylor

v. A complete list of all the sampling units is called

a) Sampling design b) Sampling frame
c)Population frame d)Cluster

Q.2) Attempt Any Three. **(15 Marks)**

i. Define the following terms

a) plagiarism b) Intellectual Property Rights (IPR)
c) Scientific Research d) Patent e) Research method and methodology.

ii.. Find the Maximum Likelihood Estimator of Warners estimate of π.

iii. Explain Ratio &Regression estimator. Define Lahiri's Method.

iv. Define Research & Write a short note on Objective of Research.

Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
M.Sc.-II Sem-III Internal Examination 2023-24
Course Code: CC-2314C Stochastic Processes

Marks: 20 **Time: 11.15 am to 12.15 pm** **Date: 27/10/2023**

Instructions: All questions are compulsory.
Each question carries equal marks.

Q1. Select the most correct alternative **[5]**

v. Consider a Markov chain $\{X_n, n\geq 0\}$ with state space $S=\{1,2\}$ and transition probability matrix
$P=\begin{bmatrix}0.2 & 0.8\\ 0.6 & 0.4\end{bmatrix}$. The stationary distribution for the given TPM is …….
a) (6/14, 8/14) b) (6/15, 9/15) c) (6/13, 8/13) d) (7/14, 9/14)

vi. If state j is persistent null then as $n\rightarrow 0$………
a) $P^{(n)}{}_{jj} \rightarrow 0$ b) $P^{(m)}{}_{ii} \rightarrow 0$ c) $P^{(m)}{}_{jj} \rightarrow 0$ d) $P^{(n)}{}_{ii} \rightarrow 0$

vii. Let $\{X_n, n\geq 0\}$ be a homogeneous Markov chain with the state space $S=\{0, 1\}$. If $P\{X_{n+1}=0/X_n=0\} = 0.4$ and $P\{X_{n+1}=1/X_n=1\} = 0.3$, then the transition probability matrix of the chain is ……
g) $P=\begin{bmatrix}0.4 & 0.6\\ 0.7 & 0.3\end{bmatrix}$ b) $P=\begin{bmatrix}0.6 & 0.4\\ 0.7 & 0.3\end{bmatrix}$ c) $P=\begin{bmatrix}0.4 & 0.6\\ 0.3 & 0.7\end{bmatrix}$ d) $P=\begin{bmatrix}0.4 & 0.6\\ 0.3 & 04\end{bmatrix}$

viii. Classify the following stochastic process based on the state space and index set. The number of individuals in a population at the end of each year.
a) Discrete time discrete state stochastic process
b) Discrete time continuous state stochastic process
c) Continuous time discrete state stochastic process
d) Discrete time continuous state stochastic process

v. A Markov chain is completely specified by ……..
a) Initial distribution b) One step transition probabilities c) Both a) & b) d) None of the above

Q2. Attempt any three out of four. **[15]**

v. Let $\{X_n, n\geq 0\}$ be a MC with state space $S=\{0,1,2\}$ and transition probability matrix

$P=\begin{bmatrix}3/4 & 1/4 & 0\\ 1/4 & 1/2 & 1/4\\ 0 & 3/4 & 1/4\end{bmatrix}$ and initial distribution (0.2, 0.3, 0.5). Obtain the realization of Markov chain up to X_3.

vi. Let $\{X_n, n\geq 0\}$ be a MC with state space $S=\{1,2,3\}$ and transition probability matrix
$P=\begin{bmatrix}0 & 2/3 & 1/3\\ 1/2 & 0 & 1/2\\ 1/2 & 1/2 & 0\end{bmatrix}$. Find the Stationary distribution.

vii. State and prove First Entrance Theorem.

viii. Let $\{X_n, n\geq 0\}$ be a MC with state space $S=\{1,2,3,4\}$ and transition probability matrix
$P=\begin{bmatrix}1/3 & 2/3 & 0 & 0\\ 1 & 0 & 0 & 0\\ 1/2 & 0 & 1/2 & 0\\ 0 & 0 & 1/2 & 1/2\end{bmatrix}$. Classify the MC.

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
MSc II – Sem III Internal Examination Oct. – 2023
Paper: Data Mining

Date: 28/10/2023 **Time: 11:15 am – 12:15 pm** **Marks: 20**

Q.1) Multiple Choice Questions: **(5 Mark)**

1) ________ refers to the entropy of sub dataset proportions.
a) Gini index b) Gain ratio c) Information Gain d) Intrinsic Information

2) Bagging can train k models in ________ and boosting can train k models __________.
a) Sequentially, Parallel b) Parallel, Parallel
c) Sequentially, sequentially d) Parallel, Sequentially

3) The ROC curve shows trade-off between the _______________.
a) TPR & TNR b) FPR & TNR c) TPR & FPR d) None

4) In Bootstrap, the training data is sampled ____________.
a) without replacement b) with replacement c) Both of a) and b) d) None

5) ________ is a measure of completeness.
a) Precision b) Sensitivity c) Recall d) Specificity

Q.2) Any three out of four: **(15 Marks)**

a) Explain KNN classifier.
b) Explain the steps of Adaboost algorithm.
c) Define Precision, Recall, Sensitivity, Specificity and Accuracy.
d) Define Classification Problem and State Its Steps.

Vivekanand college, Kolhapur (Empowered Autonomous)

Department of Statistics

M.Sc II Sem III Internal Examination 2023-24

Paper : ASYMPTOTIC INFERENCE

Total Mark:20 **Time: 11.15 am to 12.15 pm** **Date: 25/10/2023**

Q.1) Select most correct alternative among those given below. **(3)**

1) Let $X1, X2, \cdots, Xn$ be a random sample from $B(1, \theta)$ then consistent estimator for θ is

a) $\bar{X}$ b) $2\bar{X}$ c) $\bar{X}(1-\bar{X})$ d) $(1-\bar{X})$

2) Let $X1, X2, \cdots, Xn$ be a random sample from $\exp(\mu, \sigma)$ then consistent estimator for σ

a) $\bar{X}$ b) $\bar{X}(1-\bar{X})$ c) $\bar{X} - X(1)$ d) none of the above

3) Let $X \sim B(1, p)$. What is CAN estimator of $p(1-p)$?

a) $nX(1)$ b) $\bar{X}(1-\bar{X})$ c) $X(n)$ d) none of

Q.2) Attempt any one of the following. **(2)**

1) Is consistent estimator unique? Justify your answer.

2) Define weak and strong consistency.

Q.3) Attempt any four of the following. **(15)**

1) State and prove invariance property of CAN estimators under continuous transformation.

2) State and prove result related to consistency of sample mean and sample variance.

3) Let $X1, X2, \cdots, Xn$ be a random sample from exponential distribution with mean θ, show that $\bar{X}$ is consistent for θ. whereas $nX(1)$ is not consistent for θ.

4) State and prove invariance property of consistent estimator. Obtain consistent estimator for θ^2 based on random sample of size n from exponential distribution with mean θ.

Vivekanand College, Kolhapur (Empowered Autonomous)

Department of Statistics

M.Sc.-II Sem-III Internal Examination 2023-24

Course Code: CC-2313C Multivariate Analysis

Marks: 20 **Time: 11.15 am to 12.15 pm** **Date: 26/10/2023**

Instructions: All questions are compulsory.
Each question carries equal marks.

Q1. Select the most correct alternative **[5]**

i. Let $\underline{X} \sim N_p(\underline{\mu}, \Sigma)$ then Q= $(\underline{X} - \underline{\mu})'\Sigma^{-1}(\underline{X} - \underline{\mu})$ is distributed .....

a) χ^2_{p-1} b) χ^2_p c) χ^2_{p-q} d) None of these

ii. Let the data matrix is X = $\begin{bmatrix} 4 & -1 & 3 \\ 1 & 3 & 5 \end{bmatrix}$ then sample mean vector is ....

a) $\underline{\bar{x}} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$ b) $\underline{\bar{x}} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ c) $\underline{\bar{x}} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$ d) None of these

iii. Let $\underline{X} \sim N_p(\underline{\mu}, \Sigma)$, where C is non-singular lower triangular matrix such that $CC' = \Sigma$ then ......

e) $\underline{Y} = C(\underline{X} - \underline{\mu}) \sim N_p(\underline{0}, I_p)$ c) $\underline{Y} = C'(\underline{X} - \underline{\mu}) \sim N_p(\underline{\mu}, I_p)$

f) $\underline{Y} = C'(\underline{X} - \underline{\mu}) \sim N_p(\underline{0}, I_p)$ d) None of these

iv. Let $\underline{Y} \sim N_p(\underline{0}, I_p)$, then the characteristic function of $\underline{Y}$ is .....

a) $\underline{Y} \sim N_p(\underline{X}, I_p)$ c) $\underline{Y} \sim N_p(\underline{\mu}, \Sigma)$

b) $\underline{Y} \sim N_p(\underline{0}, I_p)$ d) None of these

v. If $\underline{X} \sim N_p(\underline{\mu}, \Sigma)$, the marginal distribution of $\underline{X}^{(1)}$ is ......

a) $\underline{X}^{(2)} \sim N_p(\underline{\mu}^{(1)}, \Sigma_{11\, q \times q})$ c) b) $\underline{X}^{(1)} \sim N_q(\underline{\mu}^{(1)}, \Sigma_{11\, q \times q})$

b) $\underline{X}^{(1)} \sim N_{p-q}(\underline{\mu}^{(1)}, \Sigma_{11\, q \times q})$ d) None of these

Q2. Attempt any three out of four. **[15]**

i. Derive conditional distribution of $\underline{X}^{(2)}$ given $\underline{X}^{(1)} = \underline{x}^{(1)}$.

ii. Let $\underline{X} \sim N_p(\underline{\mu}, \Sigma)$, let $\underline{X}$ is partition as $\underline{X} = \begin{bmatrix} \underline{X}^{(1)}_{q \times 1} \\ \underline{X}^{(2)}_{(p-q) \times 1} \end{bmatrix}$ then prove that $\underline{X}^{(1)}$ & $\underline{X}^{(2)}$ are independent iff Σ_{12}=0.

iii. Explain likelihood estimator of $\underline{\mu}$ &Σ if $\underline{X} \sim N_p(\underline{\mu}, \Sigma)$.

iv. Let $\underline{X} \sim N_3(\underline{\mu}, \Sigma)$, where $\underline{\mu} = \begin{matrix} 2 \\ 3 \\ -1 \end{matrix}$ & $\Sigma = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 3 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ then find distribution of

a) $\begin{bmatrix} 2X_1 - X_2 \\ X_1 + X_3 \end{bmatrix}$ b) $[X_1 + 2X_2 - X_3]$ c) $\begin{bmatrix} X_1 - X_2 \\ X_1 - X_2 \\ X_1 + X_3 \end{bmatrix}$

Vivekanand College, Kolhapur (Empowered Autonomous)
Department of Statistics
M. Sc. II SEM-III Internal examination 2023-24
Paper: Time Series Analysis

Date: 30/10/2023 Time: 11:15AM to 12:15PM Marks: 20

Q. 1 Multiple choice questions **5 Marks**

I. Which of the following functions/measures are useful to choose the best model?
(A)ACF, PACF (B) AIC, BIC (C) Variance stabilization (D) All of these

II. In Holt's two parameter exponential smoothing method, estimate of the slope at initial time can be
(A)$Y_2 - Y_1$ (B)$\frac{(Y_4-Y_1)}{3}$ (C) 0 D. All of these

III. If $\{X_t\}$is sequence of uncorrelated random variables with zero mean and unit variance then $\{X_t\}$ is
(A) White noise as well as IID noise (B). White noise but not IID noise
(C) IID noise but not white noise (D) Not stationery series

IV. Which of the following statement/s is/are true?
Statement1: ACF represents time series uniquely
Statement2: Different time series can have same ACF function.
(A) Only 1 is true (B) Only 2 is true (C) Both are true (D) None is true

V. In trend estimation moving average method, $q = 4$ then W_t is moving average of total____two sided terms
(A) 4 (B) 8 (C) 7 (D) 9

Q.2 Attempt any 3 out of 4 questions **15 Marks**

I. Discuss general procedure of time series modeling.
II. Define $AR(p)$ process. Prove that, $AR(1)$ process is stationary.
III. Define Auto-covariance function and find it for $X_t = 10 + Z_t + 0.4Z_{t-1} + 0.8Z_{t-7}$ where $Z_t \sim WN(0,2)$
IV. Define classical additive time series model. Explain Winter's exponential smoothing method for removing trend and seasonality.