

“ज्ञान विज्ञान आणि सुसंस्कार यासाठी शिक्षण प्रसार”
 प. पू. शिक्षणमहर्षि डॉ. बापुजी साळुंखे
Vivekanand College, Kolhapur (Empowered Autonomous)
 Department of Statistics
M. Sc – I SEM I (Statistics)
 Internal Examination (2022-23)



Vivekanand College Kolhapur (Autonomous)
 Department of Statistics
M.Sc.I Semester I
 Internal Examination 2022-23
 Paper: Real Analysis

Date: 05/12/2022 Marks: 20 Time: 11.30 am -12.30 pm

Notice

Date:

28/11/2022

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

M.Sc. – I (Statistics)

Sr. No.	Date	Time	Marks	Course Code	Course Name
1	5/12/2022	11.30 am to 12.30 pm	20	CC-2300A	Real Analysis
2	6/12/2022			CC-2301A	Linear Algebra
3	7/12/2022			CC-2302A	Distribution Theory
4	8/12/2022			CC-2303A	Estimation Theory
5	9/12/2022			CC-2304A	Statistical Computing

Nature of Question Paper

Que. 1) 10 MCQ's each carrying 1 mark

Que. 2) Attempt any 2 questions out of 3 (5 X 2 = 10)

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



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

Q1. Select the most correct alternative.

10

- Which one of them is not interval.
 (A) (1,2) (B) (12,13) (C) [3,π] (D) (2π,180)
- Which of the following numbers is not irrational.
 (A) π (B) √2 (C) √3 (D) 7
- A set A is said to be countable if there exists a function f:A→N such that
 (A) f is bijective (B) f is surjective (C) f is identity map (D) None of these
- Let A={x|x∈N∧x²≤7} Then supremum of A is
 (A) 7 (B) 3 (C) does not exist (D) 0
- A sequence {−1ⁿ} is the sequence {n+2n+1} {n+2n+1} is
 (A) convergent. (B) unbounded. (C) divergent. (D) bounded.
- A sequence {s_n} is said to be Cauchy if for ε>0, there exists positive integer n₀ such that
 (A) |s_n−s_m|<ε for all n,m>0 (B) |s_n−s_m|<n₀ for all n,m>ε
 (C) |s_n−s_m|<ε for all n,m>n₀ (D) |s_n−s_m|<ε for all n,m<n₀
- Every Cauchy sequence has a
 (A) convergent subsequence. (B) increasing subsequence.
 (C) decreasing subsequence. (D) positive subsequence.
- Which of the following is not true?
 (A) A subset S of a real number R is compact iff it is closed and bounded.
 (B) Every infinite bounded set of real numbers has a limit point.
 (C) The intersection of an arbitrary family of closed sets is also a closed set.
 (D) The limit point member of set.
- The sequence { $\frac{n+2}{n+1}$ } is ..
 (A) convergent subsequence. (B) increasing subsequence.
 (C) decreasing subsequence. (D) positive subsequence.
- If a sequence {a_n} {an} is convergent then the series ∑a_n∑an
 (A) is convergent. (B) is divergent. (C) may or may not convergent (D) none of these

Q2. Solve any two.

10

- P.T. A. Convergent sequence is bounded.
 B. A sequence cannot convergent to more than one limit.
- A. If s_n is a sequence of real numbers, then $\liminf_{n \rightarrow \infty} s_n \leq \limsup_{n \rightarrow \infty} s_n$
 B. Define Bounded sequence and subsequence
- Find inf and sup for the sequence s_n= 1+ $\frac{1}{n}$; n∈N

Que.1 Select the most correct alternative.(10Marks)

- If $S = \{v_1, v_2, \dots, v_n\}$ is a set of vectors in a finite dimensional vector space V , then S is called a basis for V if:
 a) S spans V b) S is linearly independent c) either A or B d) both A and B
- Rank of matrix A is unchanged by which of following operations
 a) The interchange of two rows(or column) of A . c)Both (a) and (b)
 b) The multiplication of row(or column) of A by a non-zero scalar. d) neither (a) nor (b).
- If inverse of matrix exist, it is unique.
 a) True b) False
- If W is a subspace of a finite-dimensional vector space V , then
 a) $\dim(W) = \dim(V)$ always b) $\dim(W) \geq \dim(V)$ c) $\dim(W) \leq \dim(V)$
 d) none of the above.
- If A and B are square matrices of same order then, $\text{tr}(ABC) = \dots\dots$
 a) $\text{tr}(BCA)$ b) $\text{tr}(CBA)$ c) Both A and B d) either A or B.
- Are the vectors $v_1 = (2, 0, -1)$, $v_2 = (4, 0, 7)$, and $v_3 = (-1, 1, 4)$ linearly independent in R^3 ?
 a) linearly dependent b) linearly independent
 c) Data not complete d) none of the above
- For which value of x will the matrix given below become singular?

$$\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 0 & 0 \end{bmatrix}$$

 a) 4 b)6 c)8 d)12
- Which of the following is false?
 a) Every subspace of a vector space is itself a vector space.
 b) Every vector space is a subspace of itself.
 c) The intersection of any two subspaces of a vector space V is a subspace of V .
 d) The union of any two subspaces of a vector space V is a subspace of V
- Which of the following is not a basis for R^3 .
 a) $\{(1, 1, 1), (1, 2, 3), (2, -1, -1)\}$ b) $\{(2, 0, -1), (4, 0, 7), (-1, 1, 4)\}$
 c) $\{(1, 1, 2), (1, 2, 5), (5, 3, 4)\}$ d) All are bases
- The rank of a matrix A is the
 a) dimension of the row space of A . b) dimension of the column space of A .
 c) both A and B d) dimension of the null space of A .

Que 2. Attempt any 2 out of 3. (10 Marks)

- Prove that a subset of linearly independent set of vector is linearly independent.
- The rank of sum of two matrices can not be exceed sum of their ranks.
- If A and B are any square matrix of order n , then $q(AB) \geq q(A) + q(B) - n$.

Que.1 Select the most correct alternative.

10 Marks

- What is the mean of the exponential random variable with scale parameter θ and location parameter 'a'?
 a) $\frac{1}{\theta} + a$ b) $\frac{1}{\theta} - a$ c) $\theta - a$ d) $\theta + a$
- Let X be a continuous random variable which is also symmetric about 5 and $V(X) = 4$, Then $E(X) = ?$
 a) 9 b) 1 c) 5 d) 25
- If X is continuous symmetric random variable about a point 'a', then which of the following random variable is symmetric about '0'.
 a) $X^2 + a$ b) $X^2 - a$ c) $X - a$ d) $X + a$.
- Let X be a random variable such that $V(X) = \frac{1}{2}$ and $E(X) = \mu$. Then upper bound of $P[|x - \mu| > 1]$ using chebychev's inequality is
 a) $\frac{3}{8}$ b) $\frac{1}{2}$ c) $\frac{3}{2}$ d) 1
- Let X be the random variable with distribution function as $F(X)$ defined below, then which of the following is not true?
 a) $0 \leq F(X) \leq 1$ b) $\lim_{x \rightarrow -\infty} F(X) = 0$ c) $F(X)$ is decreasing d) $F(X)$ is right continuous.
- Let 'a' and 'b' be the two real numbers where $a < b$, then $P(a \leq X \leq b) = ?$
 a) $F(b) - F(a) + P(a)$ b) $F(b) - F(a) - P(b) + P(a)$ c) $F(b) - F(a) - P(b)$ d) $F(b) - F(a)$
- Let $X \sim C(\mu, \lambda)$. What is the distribution of $F(X)$?
 a) $C(0, 1)$ b) $N(0, 1)$ c) $C(\mu, \lambda)$ d) $U(0, 1)$
- $X \sim P(\lambda)$, then M.G.F of X is
 a) $e^{\lambda(e^t - 1)}$ b) $e^{\lambda(e^t + 1)}$ c) $e^{\lambda(e^t)}$ d) $e^{\frac{1}{2}(e^t + 1)}$
- $X \sim U(-\theta, \theta)$. What is second quartile of X .
 a) $\frac{\theta}{2}$ b) $-\frac{\theta}{2}$ c) θ d) 0
- $X \sim B(n, p)$, then p.g.f of X is.....
 a) $(p + qs)^n$ b) $(ps + q)^n$ c) $ps + q$ d) $p + qs$

Que 2. Attempt any 2 out of 3.

Marks

- State and Prove Probability integration transformation.
- State and Prove Jensen's Inequality, Where $g(x)$ is convex function.

$$3. F(X) = \begin{cases} 0 & ; x < 0 \\ \frac{1}{4} + \frac{x}{4} & ; 0 \leq x < 1 \\ \frac{1}{2} + \frac{x}{4} & ; 1 \leq x < 2 \\ 1 & ; x \geq 2 \end{cases} \quad \text{Find } E(X).$$



Vivekanand College, Kolhapur(Autonomous)
Department of Statistics
M.Sc. I Semester I

Internal Examination 2022-23

Paper: Estimation Theory

Date: 08/12/2022

Time: 11.30 am -12:30 pm

Marks:20

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)
M.Sc. Part- I (Statistics) (Sem-I) Examination:2022-2023
Sub: Statistical Computing

Day: Friday

Date: 09/12/2022

Time: 11.30am-12.30pm

Marks : 20.

Que.1 Select the most correct alternative (10 Marks)

- i) Let x_1, x_2, \dots, x_n is a random sample from $U(\theta-1/2, \theta+1/2)$ then sufficient statistic for θ is
A) $(x_{(1)} + \frac{1}{2}, x_{(n)} - \frac{1}{2})$ B) $x_{(1)}$ c) $x_{(n)}$ D) None of these.
- ii) MLE of θ based on random sample of size n from $U(0, \theta)$ is
A) $x_{(1)}$ B) $x_{(n)}$ C) Both A and B D) None of these.
- iii) If a random sample of size n is taken from $f(x, \theta) = \theta e^{-\theta(x-\alpha)} ; x \geq \alpha, \theta > 0$. Then MLE of (α, θ) is
A) $x_{(1)}$ and $\frac{n}{\sum_{i=1}^n x_i - x_{(1)}}$ B) $x_{(1)}$ and $\frac{n}{\sum_{i=1}^n x_i - x_{(n)}}$ C) Both A and B D) None of these.
- iv) Let x_1, x_2, \dots, x_n is a random sample from $N(\mu, \sigma^2)$, then MLE of (μ, σ^2) is
A) Sample mean and sample Variance B) Sample mean and Sample mean square
C) Both A and B D) None of these.
- v) Let x_1, x_2, \dots, x_n is a random sample from $\text{Exp}(\text{mean } \theta)$ then MLE of θ is
A) $x_{(1)}$ B) $x_{(n)}$ C) \bar{x} D) $\frac{1}{\bar{x}}$
- vi) Let x_1, x_2, \dots, x_n is a random sample from $N(\theta, \theta)$, then sufficient statistic for θ is
A) $\sum X_i^2$ B) $\sum X_i$ C) $\sum |X_i|$ D) $(\sum X_i, \sum X_i^2)$
- vii) Which of the flowing is a sufficient statistic for θ given that x_1, x_2, \dots, x_n is random sample from probability density function $f(X, \theta) = \theta X^{\theta-1} ; 0 < X < 1$.
A) \bar{x} B) $\prod X_i$ C) $x_{(1)}$ D) $x_{(n)}$
- viii) Let x_1, x_2, \dots, x_n is a random sample from $B(1, \theta)$ then the minimal sufficient statistic for θ is ...
A) $\sum X_i$ B) $x_{(1)}$ C) $x_{(n)}$ D) None of these.
- ix) Which of the following is not member of one parameter Exponential family.
A) Poisson B) Geometric C) Cauchy D) All of the above .
- X) Let T is complete sufficient statistic then family of T is said to be complete if ...
A) $E[g(T)]=0$ B) $P[g(T)=0]=1$ C) Both A and B D) None of these.

Que 2. Attempt any 2 out of 3. (10 Marks)

- a) State and prove Neyman Factorization theorem for discrete case.
b) Let x_1, x_2, \dots, x_n is a random sample from $U(\theta_1, \theta_2)$ then obtain maximum likelihood estimate of (θ_1, θ_2) .
c) State exponential family of distribution. Obtain minimal sufficient statistic for one parameter exponential family.

Q. 1. Select correct alternative [10]

- i) MS-Excel is a?
A. Spread sheet B. Graphical Software
C. Windows D. Workbook
- ii) The AVEDEV () function is used for
A. Mean deviation taken from mode
B. Mean deviation taken from median
C. Mean deviation taken from mean
D. Mean deviation taken from any value
- iii) ----- function returns the inverse of the right-tailed probability of the chi-squared distribution.
A. CHISQ.TEST () C. CHISQ.INV ()
B. CHINV () D. CHITEST ()
- iv) What does COUNTA () function do?
A. counts cells having alphabets C. counts empty cells
B. counts cells having number D. counts non-empty cells
- v) Which is a not regression function
A. Forecast () C. Slope ()
B. Trend () D. All of the above
- vi) A features that displays only the data in column (s) according to specified criteria
A. Formula B. Sorting C. Filtering D. Pivot
- vii) A function inside other function is called
A. Nested Function C. Inner Function
B. Round Function D. None of the above
- viii) What function will produce results that indicate whether a student has passed or failed a course by enter the text "Pass" or "Fail"?
A. Count B. CountA C. IF D. SUM
- ix) The process of arranging the items of a column in some sequence or order is known as:
A. Arranging C. Auto fill
B. Sorting D. Filtering
- x) What command allows you to highlight the cell(s) in a data table that matches your set-up information?
A. Cell Styles B. Conditional formatting C. Pivot table D. Data Table

Q.2 . Attempt any Two . [10]

1. Which functions are used to obtain mean, median, coefficient of skewness in MSEXCEL?
2. Analysis tool pack in MSEXCEL.
3. Explain following functions in MSEXCEL

i) IF () ii) VLOOKUP ()



“ज्ञान विज्ञान आणि सुसंस्कार यासाठी शिक्षण प्रसार”
 प. पू. शिक्षणमहर्षि डॉ. बापुजी साळुंखे
 Vivekanand College, Kolhapur (Empowered Autonomous)
 Department of Statistics
 M. Sc – I SEM II (Statistics)
 Internal Examination (2022-23)



Vivekanand College, Kolhapur (Autonomous)
 Department of Statistics
 M.Sc. I Semester II
 Internal Examination 2022-23
 Paper: Probability Theory
 Time: 11.30 am -12:30 pm

Date: 20/05/2023

Marks:20

Notice

Date: 08/05/2023

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

M.Sc. – I (Statistics)

Sr. No.	Date	Time	Marks	Course Code	Course Name
1	20/05/2023	11.30 am to 12.30 pm	20	CC-2306B	Probability Theory
2	16/05/2023			CC-2307B	Theory of Testing of Hypotheses
3	17/05/2023			CC-2308B	Linear Models and Regression analysis
4	18/05/2023			CC-2309B	Design and analysis of Experiment
5	19/05/2023			CC-2310B	Sampling Theory & Official Statistics

Nature of Question Paper

Que. 1) 10 MCQ's each carrying 1 mark

Que. 2) Attempt any 2 questions out of 3 (5 X 2 = 10)

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



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

Que.1 Select the most correct alternative. (10 Marks)

- Which of the following is correct?
 a) $\lim A_n \subseteq \overline{\lim A_n}$ b) $\lim A_n \supseteq \overline{\lim A_n}$ c) $\lim A_n = \overline{\lim A_n}$ d) $\lim A_n \neq \overline{\lim A_n}$
- A sigma field is closed under...
 a) Finite union b) Countable union c) Both countable and finite union d) None of these
- An arbitrary intersection of sigma field is...
 a) Not a Sigma field b) Is also a field c) None of these d) Is also a sigma field
- Arbitrary union of sigma field is:
 a) Field b) Need not be a Sigma field c) Sigma field d) Need not be a field
- A monotone field is always...
 a) Sigma field b) Not a sigma field c) Field d) Not a field
- $\mu(\cdot)$ is called measure if it satisfies
 a) $\mu(A) \geq 0$ b) If $A_i ; i = 1, 2, 3, \dots$ Are disjoint sets then $\mu(\bigcup_{i=1}^{\infty} A_i) = \sum_{i=1}^{\infty} \mu(A_i)$
 c) $\mu(\Omega) = 1$ d) (a), (b) and (c) also e) Only (a) and (b)
- Boole's Inequality is ...
 a) $P(\bigcup_{i=1}^n A_i) = \sum_{i=1}^n P(A_i)$ b) $P(\bigcup_{i=1}^n A_i) \geq \sum_{i=1}^n P(A_i)$
 c) $P(\bigcup_{i=1}^n A_i) \leq \sum_{i=1}^n P(A_i)$ d) None of the above.
- Which of the following is correct?
 a) $P(\lim A_n) \geq P(\overline{\lim A_n})$ b) $P(\lim A_n) \leq P(\overline{\lim A_n})$
 c) $P(\lim A_n) = P(\overline{\lim A_n})$ d) $P(\lim A_n) \neq P(\overline{\lim A_n})$
- μ is measure then Lebesgue measure is
 a) $\mu((a,b)) = b - a$ b) $\mu([a,b]) = b - a$ c) $\mu((a,b)) = b - a$ d) $\mu([a,b]) = b - a$
- A field is closed under...
 a) Finite union b) Countable union c) Both countable and finite union d) None of these

Que 2. Attempt any 2 out of 3. (10 Marks)

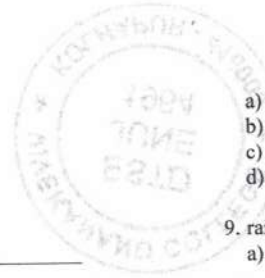
- Show by an example that a) Union of two fields need not be a field.
 b) A field need not be a sigma field.
- Write note on monotone increasing sequence and monotone decreasing sequence.
- Write note on Lebesgue Stieltjes measure.

Vivekanand College, Kolhapur (Autonomous)
Department of Statistics
M.Sc. I Semester II
Internal Examination 2022-23

Paper: Linear Models and Regression Analysis

Date: 17/05/2023 Time: 11.30 am -12:30 pm

Marks:20



- a) Lies between 0 and 1.
b) identically equal to zero
c) either 0 or 1
d) identically equal to 1
9. rank of error space is
a) $n-r$ b) n c) r d) $n+r$

Que.1 Select the most correct alternative.
(10 Marks)

1. If X and Y are uncorrelated variables then this implies.....
a) the absence of any linear relationship between them
b) the absence of any quadratic relationship between them
c) the absence of any logarithmic relationship between them
d) the absence of any trigonometry relationship between them
2. In regression analysis, the variable that is being predicted is the
a) response, or dependent, variable
b) independent variable
c) intervening variable
d) is usually x
3. When the error terms have a constant variance, a plot of the residuals versus the independent variable x has a pattern that
a) fans out b) funnels in c) fans out, but then funnels in d) forms a horizontal band pattern
4. In regression analysis, if the independent variable is measured in kilograms, the dependent variable
a) must also be in kilograms b) must be in some unit of weight
c) cannot be in kilograms d) can be any units
5. The coefficient of determination is ,
a) must also be equal to 1 b) lies between [-1, +1] c) lies between [0,1] d) lies between (0,1)
6. Rank of Hat matrix H= is
a) K b) k-1 c) k+1 d) n-(k+1)
7. A Necessary and sufficient condition for a linear parametric function $\lambda'\beta$ for the general linear model to be estimable is that λ' is
a) Linear combination of the row vectors of the matrix X
b) Linear combination of the column vectors of the matrix X
c) Both (a) and (b)
d) None of the above
8. A linear function of observation is said to be belongs to the error space iff its expected value is

10. The covariance and between any linear function belonging to the error space and any BLUE is ...
a) Zero b) between 0 and 1 c) is equal to 1 d) zero or one

Que 2. Attempt any 2 out of 3.
(10 Marks)

1. Describe multiple linear regression model stating the assumption, obtain mean and variance of least square estimate $\hat{\beta}$ of β .
2. Test procedure of testing individual regression coefficient in a multiple linear regression model.
3. Prove that 'The coefficient vector of ant BLUE (when expressed in terms of the observations) is orthogonal to the coefficients vector of any linear functions of observations belonging to the error space.'



Vivekanand College, Kolhapur (Autonomous)
Department of Statistics
M.Sc. I Semester II
Internal Examination 2022-23
Paper: Testing of Hypothesis
Date: 16/05/2023 Time: 11.30 am -12:30 pm
Marks:20



Que 2. Attempt any 2 out of 3.
(10 Marks)

1. A sample of size one is taken from exponential pdf with parameter θ for testing $H_0: \theta = 1$ against $H_1: \theta > 1$ having test function $\phi = \begin{cases} 1 & x \geq 2 \\ 0 & x \leq 2 \end{cases}$
Find size of test and power function.
2. Using NP lemma obtain MP test of size 0.05 for testing $H_0: f(x) \sim N(0,1)$ against $H_1: f(x) \sim C(0,1)$. Also find power of the test.
3. A random sample of size n is drawn from $N(\theta, \sigma^2)$ where σ^2 is known. Find the MP test of size α for testing $H_0: \theta = \theta_0$ against $H_1: \theta = \theta_1$ ($\theta_1 > \theta_0$) also obtain power of the test.

Que.1 Select the most correct alternative.
(10 Marks)

- 1) In the context of testing statistical hypothesis, which of the following statement is true
.....
A) reject H_0 when H_0 is true is type II error
B) reject H_0 when H_1 is true is power of the test
C) $H_1: \mu_1 \neq \mu_2$ is one tailed alternative
D) $H_0: \mu = 4.6$ is simple null hypothesis
- 2) A parametric hypothesis which completely specifies all the parameters in a probability distribution is called as ...
A) Simple hypothesis
B) Simple or composite hypothesis
C) Composite hypothesis
D) None of these
- 3) If critical region is entire sample space, then the level of significance of test is
A) Not defined
B) one
C) zero
D) any number in $[0, 1]$
- 4) A function defined on sample space to interval $[0, 1]$ is called
A) Structure function
B) Test function
C) simple function
D) None of these
- 5) A test function which can takes any value in interval $[0, 1]$ is called
A) Randomized test function
B) Non randomised test function
C) Both A and B
D) Neither A nor B
- 6) Let ϕ be the test function then which of the following function is test function...
A) $1 - \phi(x)$
B) $e^{-\phi(x)}$
C) $1 - e^{-\phi(x)}$
D) All of these
- 7) Let ϕ_1 and ϕ_2 are two test functions then which of the following function is not test function...
A) $\text{Min} \{ \phi_1, \phi_2 \}$
B) $\phi_1(x) \cdot \phi_2(x)$
C) $\phi_1(x) + \phi_2(x)$
D) $e^{-[\phi_1(x) + \phi_2(x)]}$
- 8) A test of size α for testing simple null and alternative hypothesis which maximizes power of the test is called ...
A) Most powerful test
B) Uniformly Most powerful test
C) Unbiased test
D) Trivial Test
- 9) A test in which power of test is greater than size of the test is called
A) Critical test
B) Biased test
C) Unbiased test
D) Trivial Test
- 10) rejecting null hypothesis when it is true leads to
A) Type I error
B) Type II error
C) Both Type I & Type II error
D) None of these



VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

M.Sc. Part- I (Statistics) (Semester-II) Examination

Course Code: CC-204

Course: Design and Analysis of Experiments

Day: Thursday 18/05/2023

Time: 11.30 am to 12.30pm

Marks: 20

Instructions: 1) All the questions are compulsory.

2) Figures to the right indicate full marks.

Q. 1. A) Select correct alternative

10 Mark

1. Consider a BIBD with parameter (v, b, r, k, λ) . If $v = b = 11$ and $r = 5$, then:
(a) $k = 5, \lambda = 2$ (b) $k = 5, \lambda = 1$ (c) $k = 2, \lambda = 5$ (d) $k = 11, \lambda = 1$
2. A completely randomized design has n plots and 10 treatments. While calculating the F-ratio for assessing equality of treatment effects, the experimenter forgot to divide the numerator and denominator sums of squares by corresponding degrees of freedom. But the statistician said that the calculated F-ratio is correct. Hence n is equal to:
(a) 10 (b) 20 (c) 30 (d) 19
3. The incidence matrix of a block design is given by:

$$N = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

Hence the design is:

- (a) connected and not orthogonal (b) not connected and not orthogonal
(c) not connected and orthogonal (d) connected and orthogonal
4. Suppose N is the incidence matrix of a BIBD with parameters (v, b, r, k, λ) , then:
(a) $\text{rank}(NN') = v$ (b) $\text{rank}(NN') = b$ (c) $\text{rank}(NN') = v - 1$ (d) $\text{rank}(NN') = b - 1$
5. Identify the treatments x_1, x_2, x_3 and x_4 from blocks 1, 2, 3, 4 respectively so that the design is BIBD:
Block 1: A, B, C, x_1 Block 2: A, x_2 , C, E Block 3: A, B, D, x_3
Block 4: A, x_4 , D, E Block 5: B, C, D, E
(a) $x_1 = B, x_2 = E, x_3 = C, x_4 = D$ (b) $x_1 = D, x_2 = B, x_3 = E, x_4 = C$
(c) $x_1 = C, x_2 = D, x_3 = B, x_4 = E$ (d) $x_1 = E, x_2 = C, x_3 = D, x_4 = B$
6. Consider the following statements about BIBD (a, b, k, r, λ) :
(1) If $a = b$, the design is said to be symmetric
(2) $\lambda(k - 1) = r(a - 1)$
(3) The adjusted treatment sum of squares is free from block effects Which of the above are correct? (a) Only 1 is correct (b) Only 1 and 2 are correct
(c) Only 3 is correct (d) Only 2 and 3 are correct
7. The degrees of freedom for the error sum of squares in a Latin square design with V rows, V columns and V treatments with two missing observation is:
(a) $V^2 - 3$ (b) $(V - 1)(V - 2) - 2$ (c) $(V - 1)(V - 2)$ (d) $(V - 1)^2 - 2$
8. In BIBD, the number of blocks is:
(a) greater than or equal to number of plots
(b) greater than or equal to number of treatments
(c) less than or equal to number of plots
(d) less than or equal to number of treatments
9. In BIBD, if the number of treatments is equal to the number of plots in a block, then BIBD:
(a) reduces to CRD (b) reduces to RBD

- (c) reduces to LSD (d) reduces to Graeco LSD
10. Multiple comparison of treatment means given by Dunnett is used for:
(a) comparison of one particular treatment with other treatment means
(b) comparison of any two treatment means
(c) comparison of any three treatment means
(d) comparison of several treatment means simultaneously

Q.2 Solve any one

10 Mark

1. Derive RBD using fixed effect model.
2. Explain Scheffe's method for comparing all contrasts.
3. Explain BIBD using fixed effect models and estimation of the model parameters.



VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)
M.Sc. Part-I (Statistics) (Sem-II) Internal Examination: May 2023
Course Code: DSC – 1004A

Section -II: Sampling Theory and Official statistics

Day:Friday Time: 11.30 am to 12.30pm Date: 19/05/2023 Marks : 20

Instructions: (for example)

- 1) All the questions are compulsory.
- 2) Figures to the right indicate full marks.
- 4) Use of log table/calculator is allowed.

Q.1 Select correct alternative [10]

- 1) The probability of not selecting a specified unit in SRSWOR of n unit from a population of N unit is _____
 - a) $\frac{1}{n}$
 - b) $1 - \frac{1}{n}$
 - c) $\frac{1}{N}$
 - d) $1 - \frac{n}{N}$
- 2) If the population is in a linear trend then ratio $V(\bar{y})_{st} : V(\bar{y})_{sy} : V(\bar{y})_{WOR}$ is----
 - a) n:1:n:1
 - b) 1:n:1/n
 - c) 1/n:1:n
 - d) 1/n:n:1
- 3) A random sample of size 10 is selected from a population of size 200 with variance 20 by SRSWOR, then the variance of sample mean is
 - a) 2.10
 - b) 2.22
 - c) 1.90
 - d) 1.80
- 4) In a random sample of size 10 from a population of size 150, probability of selecting a 50th unit of population in a sample is
 - a) 1/10
 - b) 1/150
 - c) 1/15
 - d) 10
- 5) In stratified sampling unbiased estimate of population mean is.....
 - a) weighted mean of the strata sample means
 - b) mean of strata sample means
 - c) reciprocal of mean of strata sample means
 - d) all of these
- 6) If the population of size 1000 is divided into 2 homogeneous groups of sizes 600 and 400 resp. If a random sample of size 100 is obtained from it under proportional allocationunits have to be selected from both groups.
 - a) 70,30
 - b) 60,40
 - c) 40,60
 - d) 30,70
- 7) The systematic sampling is more precise than simple random sampling if ...
 - A) The variance within the systematic sampling is less than the total variance in the population.
 - B) The variance within the systematic samples is more than the total variance in the population.
 - C) The variance between the systematic samples is less than the total variance in the population.
 - D) Both A and C
- 8) Based on the random sample of size n = 100 taken by using SRSWOR it is observed that sample mean = 150 and standard error S.E. (sample mean) = 8.1 then the 95% confidence interval for population mean is ...
 - A) (134.124, 165.876)
 - B) (125.700, 174.300)
 - C) (145.950, 154.050)
 - D) (141.900, 158.100)

9) If ρ_{wsy} denotes the intra-class correlation coefficient between pairs of units that are in the same systematic sample and if $\rho_{wsy} = 0$ then,

- A) Systematic sampling is as efficient as SRSWOR
- B) Systematic sampling is more than efficient as SRSWOR
- C) Systematic sampling is as efficient as SRSWOR but less efficient than SRSWOR
- D) Systematic sampling is more efficient than SRSWOR

10) The variance of the usual estimator is a stratified sampling design is given by, $V^2 = \sum_{h=1}^L \frac{w_h^2 s_h^2}{n_h} (1 - f_h)$ in the standard notations. We wish to obtain an allocation that minimizes the sample size. Then,

- A) Such an optimal allocation does not exist.
- B) Proportional allocation is optimal.
- C) The optimal allocation is the one for which n_h is proportional to S_h
- D) The optimal allocation is the one for which n_h is proportional to $W_h S_h$

Q.2 Solve any two. [10]

- a) Determine sample size in SRSWR when prescribed relative error.
- b) Explain Neyman allocation. Obtain $V(\bar{y}_{st})$ under it.
- c) Write note on circular systematic sampling.

