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PGIIIS-848 A-21

M.A./M.Sc. III Semester (CBCS) Degree Examination

STATISTICS

Stochastic Processes

Paper : HCT - 3.1

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer any Six questions from **Part - A** and Five questions from **Part - B**

PART - A

(6×5=30)

1. Define Markov chain. Give any two examples.
2. State and prove first Entrance theorem.
3. In usual notations , prove that a state I is recurrent if and only if $\sum_{n=0}^{\infty} P_{JJ}^{(n)} = \infty$
4. Show that the sum of two independent Poisson process is again a Poisson process.
5. State assumptions of Birth and Death Process.
6. Obtain a forward diffusion equation of a wiener process.
7. Define Renewal function. Show that renewal function satisfies renewal equation.
8. Explain Branching process with an example.

PART - B

(5×10=50)

9. Define stationary distribution of a Markov chain. Find the stationary distribution for the following probability matrix.

$$P = \begin{bmatrix} 1/3 & 1/3 & 1/3 \\ 1/4 & 1/2 & 1/4 \\ 1/6 & 1/3 & 1/2 \end{bmatrix}$$

10. State and prove Ergodic theorem of a Markov chain.

11. Show that a Markov chain is completely determined by one-step transition probabilities.

12. Obtain an Explicit expression for the difference of two independent Poisson processes.

13. Describe pure birth process and derive the expression for $P_n(t)$.

14. Obtain the forward Kolmogorov equation of a Weiner process.

15. Define renewal process and show that for a renewal process

$\left\{N(t), t \geq 0\right\}, \frac{N(t)}{t} \to \frac{1}{\mu} as\ t \to \infty$ with probability 1, where $\mu = E\left\{X_n\right\} < \infty$

16. Write short note on any **TWO** of the following **(5+5)**

a) Extinction Probability.

b) Pure death Process.

c) Immigration & Emigration Process.

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PGIIIS-850 B-19
M.A./M.Sc. III Semester (CBCS) Degree Examination
STATISTICS
Demography
Paper : SCT3.1(a)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer any **Six** questions from Part -A and **Five** questions from Part - B.

PART - A

(6×5=30)

1. Explain the different sources of demographic data.
2. Explain Whipple's index of identifying digit preference in age reporting.
3. Define reproduction and replacement rates. Discuss one measure for each.
4. Explain period and cohort analysis of Total Fertility Rate (TFR).
5. Define crude death rate and age specific death rate. Explain their limitations.
6. Distinguish between
   i) Complete and abridged life tables.
   ii) Current and cohort life tables.
7. Explain stable and stationary population models.
8. Define intrinsic birth and death rate and give their relationship with age structure.

PART - B

(5×10=50)

9. Explain Chandrasekar and Deming method of ascertaining the completeness of vital statistics registration.
10. a) Define: Fertility, Fecundity and TFR.
    b) Write the steps involved in estimating fertility levels using Brass P/F ratio. **(3+7)**
11. a) Define Infant Mortality Rate (IMR). Explain Lexis diagram of IMR.

b) Describe standardization of death rates and discuss the indirect method of standardization of death rates. **(4+6)**

12. Stating the assumptions, explain Greville's method of constructing abridged life table.

13. a) Define migration. Explain push-pull factors of migration.

b) Discus the impact of migration on population size and structure. **(5+5)**

14. Derive Lotka's stable population model. State its properties.

15. Define population estimation and projection. Describe matrix method of population projection.

16. Write short notes on any **Two** of the following. **(2×5=10)**

a) Myer's index of estimating the error in age reporting.

b) Momentum of population growth.

c) Mean length of generation.

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PGIIIS-850 A-21
M.A./M.Sc. III Semester Degree Examination
STATISTICS
Demography
Paper : SCT - 3.1(a)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer any **six** questions from Part - A and **Five** questions from Part - B.

PART - A

(6×5=30)

1. Explain the method of enumerating the data.
2. Explain the sample registration scheme of collecting the data.
3. Define IMR explain lexis diagram of IMR.
4. With usual notations, show that $m_x \cong \mu_{x+\frac{1}{2}}$
5. Define curtate expectation of life. How it is related to the probability survivals.
6. Discuss the different types of migration.
7. Define TFR. State its physical importance.
8. Explain stationary population theory.

PART - B

(5×10=50)

9. Define modern census. Explain its features. **(10)**
10. a) Explain UN index of measuring tendentious bias. **(5+5)**
    b) Explain Myers's index of Measuring age heaping.
11. Discuss different measures of fertility. **(10)**
12. Derive Dandekar's modified binomial distribution of fertility model. **(10)**
13. a) Define crude death rate and age specific death rate. Explain advantages and limitations.
    b) Explain the direct and indirect methods of standardized death rate. **(5+5)**

14. a) Explain the reed and Merrell method of constructing an abridged life table. **(5+5)**

b) Define force of Mortality. With usual notations, prove that $\mu_x = \frac{1}{e_x^0}\left[1 + \frac{d}{dx}e_x^0\right]$.

15. Stating the assumptions, derive Lotka's integral equations for stable population. **(10)**

16. Describe one of the method of estimation of migration. **(10)**

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PGIIIS-851 A-21

M.A./M.Sc. III Semester (CBCS) Degree Examination

STATISTICS

Statistical Methods

Paper : OET - 3.1

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer any six questions from Part - A and Five questions from Part - B

PART - A

(6×5=30)

1. Explain the following:
   i) Event
   ii) Compound event
   iii) Disjoint event and
   iv) Mutually exclusive events.
2. Define Normal distribution. State the properties of normal probability curve.
3. What is the probability of guessing correctly at least six of the ten answers in a TRUE-FALSE objective test?
4. Given the following data, where x denotes the number of times a catchment area experiences rain beyond a threshold in a year.

X	4	5	6	7
P(x)	0.3	0.5	0.1	0.1

   Find the mean, variance and standard deviation of x.
5. Define:
   i) Critical region
   ii) Level of significance
   iii) Statistical hypothesis
   iv) Types of errors.
   v) Power of the test.

6. Explain one sided and two sided hypothesis with an example.

7. Outline t-test for testing the significance of correlation.

8. Discuss about ANOVA. Write the schematic form of ANOVA in RBD.

PART - B

(5×10=50)

9. a) Prove that for two events A and B, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. Write the expression for $P(A \cup B)$ when A and B are independent.

   b) In an experiment, two fair dice of different colors are rolled. Let the two events E1, E2, be defined as follows:

   E1: The absolute difference of the number of spots on the dice is divisible by 2.

   E2: The absolute difference of the number of spots on the dice is divisible by 3.

   Find the probabilities of the events E1, E2, $E1 \cap E2$, and $E1 \cup E2$. **(5+5)**

10. a) Define Poisson distribution. Give examples.

    b) Obtain the mean and variance of Poisson distribution. **(5+5)**

11. a) Discuss the test procedure of testing equality of variance of two independent normal populations.

    b) The enzyme determinates made on a sample of 10 individuals from a population were 1, 1, 1.5, 2.5, 3, 1.9, 3.1, 1.5, 2.5, and 2. Assuming that the sample is from $N(2.5, \sigma^2)$

    Test $H_0 : \sigma^2 = 4.5$ v/s $\sigma^2 \neq 4.5$ at 5% level given that $P\left(\chi^2_{10} < K_1\right) = 0.025$ where $3.059 < K_1 < 3.94$ **(5+5)**

12. a) Discuss Z-test for testing mean of normal population.

    b) A sample of 100 students is selected from a population. The mean of selected students is 48kg with a standard deviation of 5kg. Test whether the populations mean weight is 50kg given that $\left(P(|Z| > 1.96) = 0.05\right)$ **(5+5)**

13. a) Distinguish between parametric and non-parametric tests.

    b) Obtain the mean and variance of normal distribution. **(5+5)**

14. a) Describe Mann-Whitney U-test for independent samples.

b) Two different foods are tested for the difference in weight gains. A random sample of 10 mice was given food A and other sample of 11 mice was given food B. The weight gains were recorded as follows.

Food A	17	14	15	18	12	13	16	11	18	19	
Food B	15	16	13	16	18	19	17	17	15	14	18

At 5% level, Test whether median weight gain for food A is different from the median weight gain for food B. Carryout the result using Normal Approximation. **(5+5)**

15. a) Describe completely randomized Design.

b) The owner of a large company wanted to compare the mean daily output of a particular item for three plants. For each plant, a random sample of four days gave the following data :

	Plants	
A	B	C
29	22	24
18	17	16
18	12	14
18	11	12

Do the sample data indicate a difference in the population means for the three plants?

Use a 5% level of significance given that $P\left(F_{2,9} > 4.26\right) = 0.05$. **(5+5)**

16. Write short notes on any **Two** of the following:

a) Standard normal distribution.

b) Simple and compound hypothesis

c) Testing for the proportions of two populations

d) Principles of experimental designs. **(5+5)**

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PGIIIS-849 A-21

M.A./M.Sc. III Semester (CBCS) Degree Examination

STATISTICS

Design and Analysis of Experiments

Paper : HCT - 3.2

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer any **six** questions from **Part - A** and **Five** questions from **Part - B.**

PART - A

(6×5=30)

1. Describe any one multiple comparison test procedure.
2. Define orthogonality of a design. Examine whether an RBD has this property.
3. Describe LSD. Setup ANOVA table.
4. Define BIBD, with usual notations show that $b \geq v$
5. Define Yates technique to compute sum of squares due to various efforts in a 2^3 factorial experiments.
6. Distinguish between complete and partial confounding in factorial experiments with illustrations.
7. What are random effects model? Obtain unbiased estimators of variance components in a one-way random effects model.
8. Describe a split plot design. Setup ANOVA table.

PART - B

(5×10=50)

9. State and prove a necessary and sufficient condition for estimability of linear parametric function hence examine the estimability of $\theta_1 - 4\theta_2 + \theta_3$ given $E(y_1) = \theta_1 + \theta_2$, $E(y_2) = \theta_1 - 2\theta_2 - \theta_3$ and $E(y_3) = 2\theta_1 - \theta_2 - \theta_3$.
10. In two-way classification model with interaction effects, obtain a solution to the normal equations. Discuss the test procedure to test for the significance of interaction effects.

11. In a LSD with single missing observation in the data, discuss the procedure to estimate missing value and outline the exact test to test the relevant hypothesis.

12. Outline the intrablock analysis of a BIBD.

13. State the one-way classification model with a single covariate. Stating the assumptions, derive the likelihood ratio test procedure to test the significance of the treatments.

14. Explain main effects and interaction effects in a 2^3 factorial experiments. Outline the analysis to test their significance.

15. Outline the analysis of a partial confounded 2^3 factorial experiment with 2 replicates ABC and AC as confounded effect.

16. Write short note on any **Two** of the following

    a) Gauss-Markov theorem.

    b) BLUE

    c) Testing of hypotheses in multiple regression model.
