Roll No. ______________________________ [Total No. of Pages : 2

PGIIIS 1576 B - 15

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

Statistics

(Practicals Based on HCT 3.1)

Paper - HCP 3.1

Time : 2 Hours Maximum Marks : 30

Instructions to Candidates

1) Answer any **two** questions

2) All questions carry **equal** marks.

1. Consider a markov chain With the following transition probabilities matrix (t.p.m)

$$P = \begin{matrix} 0 \\ 1 \\ 2 \end{matrix}\begin{pmatrix} 0 & 1 & 2 \\ 0 & 1 & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{pmatrix}$$

Show that the markov chain is irreducible, periodic with period 2 and the states of the markov chain are persistent - non - null.

2. Consider a markov chain having the transition probability matrix

$$P = \begin{matrix} \\ 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix}\begin{matrix} \begin{matrix} 0 & \;1 & \;2 & \;3 & \;4 & \;5 \end{matrix} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} & 0 & 0 & 0 \\ 0 & \frac{1}{5} & \frac{2}{5} & \frac{1}{5} & 0 & \frac{1}{5} \\ 0 & 0 & 0 & \frac{1}{6} & \frac{1}{3} & \frac{1}{2} \\ 0 & 0 & 0 & \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 0 & 0 & \frac{1}{4} & 0 & \frac{3}{4} \end{pmatrix} \end{matrix}$$

Find Stationares distribution concentrated on each of the irredueible closed set

3. a) The number of accidents in a town follows a poision process with a mean of 2 per day and the number X_i of people involved in the i^{th} accident has the distribution $P\{X_i = k\} = \frac{1}{2^k}$, $k \geq 1$ find the mean and variance of the number of people involved in accidents per week

b) The population of a country increases as yule-fussy process at the rate of 0.03 per year. The initial population is 10^{10}

i) Find the expected population after 20 years

ii) How many years will it take for the population to be 5×10^{10}?

4. Mr. X has exactly 3 children who independently of each other have equal probability 0.5 of being a boy or a girl the same pattern continues in the male dependant of Mr.X

i) What is the probabilities that the male dependant eventually become extinct?

ii) What is the rate fo increase of male population?

iii) If there is probability 0.2 of death for a boy and 0.25 for a girl, find the survival rate for male and female.

Roll No. ________________________________ [Total No. of Pages : 2

PGIIIS 1572 B-15
M.A./M.Sc. IIIrd 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. Discuss classification of one dimensional stochastic processes.

2. Show that for a Poisson process $\{N(t), t \geq 0\}$ $as\, t \to \infty, \frac{N(t)}{t}$ is an estimate of the mean rate λ

3. Obtain probability of ultimate ruin of Gamblers ruin problem.

4. Explain birth and death process.

5. Discuss briefly pure birth process.

6. Obtain the distribution of first passage time to a fixed point of a Wiener process.

7. Discuss reward process.

8. Prove that for a branching process.

   $\{x_n, n \geq o\}$ $P_n(s) = P_{n-1}(P(s))$

PART -B (5×10=50)

9. State and prove Chapman Kolmogorov equation for obtaining higherStep transition probabilities.

10. State and prove the basic Limit theorem of a Maslow Chain.

11. Show that if state K is either transient or persistent null then for every state j

$P_{jk}^{(n)} \to 0\, as\, n \to \infty$ and if state K is a periodic, persistent non - null then

$$P_{jk}^{(n)} \to \frac{F_{jk}}{\mu_{kk}} as\, n \to \infty$$

12. Prove that if $\{N(f), t \geq 0\}$ is a Poisson process then for s<t

$$P\{N(s) = k / N(t) = n\} = \binom{n}{k}\left(\frac{s}{t}\right)^k \left(1 - \frac{s}{t}\right)^{n-k}$$

13. Show that for an immigration and Emigration process.

$$P_n = \left(\frac{\lambda}{\mu}\right)^n P_0 \; if \; n \geq 1, Where \; P_0 = 1 - \frac{\lambda}{\mu}$$

14. Show that for a Wiener process

$\{*(t), 0 \leq t \leq T\}\, with\, x(0) = 0,\ M = 0$

$P\{M(T) \geq a\} = 2P\{x(T) \geq a\}$, for any a>0. Where M(T) is the maximum of X(t) in $0 \leq t \leq T$

15. State and prove the elementary theorem of a renewal process.

16. For a branching process $\{x_{n,} n \geq 0\}$ with $Bx_1 = m \,\&\, v(x_1) = \sigma^2$

show that $V(X_n) = \begin{cases} \dfrac{m^{n-1}(m^{n-1})}{m-1}\sigma^2 & , \; if \;\; m \neq 1 \\ n\sigma^2 & , \; if \;\; m = 1 \end{cases}$

Roll No. ____________________ [Total No. of Pages : 2

PGIIIS 1573 B-15
M.Sc. IIIrd 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. Define C-matrix of a block design. Show that it is a singular matrix.

2. Define an orthogonal design. Show that RBD is orthogonal.

3. Describe Tukey's multiple comparison method.

4. Prove that b $\geq$ t in case of a BIBD with b blocks and t treatments.

5. Define one way random effects model. How it differs from a fixed effects model?

6. What do you understand by complete and partial confounding? Discuss their advantages.

7. Explain a situation under which a split plot design is used. Set up the ANOVA table.

8. What is analysis of covariance technique? When is it used?

Part -B **(5×10=50)**

9. a) In a Gauss-Markov model, derive a necessary and sufficient condition for the linear parametric function to be estimable.

   b) Given the model:

   $E(y_1)=\theta_1-\theta_2+\theta_3$, $E(y_2)=\theta_2+\theta_3$, $E(y_3)=\theta_1-3\theta_2-\theta_3$, $E(y_4)=\theta_1-2\theta_2$, examine the estimability of $\theta_1+2\theta_3$. **(5+5)**

10. a) Define BLUE. Show that it is unique.

b) Let y_1, y_2, y_3 be independent random variables with common variance σ^2 and $E(y_1) = \theta_1 + 2\theta_2$, $E(y_2) = \theta_1 + \theta_3$, $E(y_3) = \theta_2 + \theta_3$. Obtain the BLUE of $\theta_1 - \theta_2$

11. Explain the analysis of variance of two way classified data with m observations per cell.

12. Out line the missing plot technique with reference to a LSD.

13. Outline the intrablock analysis of a BIBD.

14. For a 2^3 factorial experiment, show that main effects and interaction effects represent a complete set of orthogonal contrasts. Give the procedure for testing their significance.

15. Discuss the analysis of a 2^3 factorial experiment in which the interaction effect ABC is completely confounded.

16. Given the model $y_{ij} = \mu + \alpha_i + \beta_j(x_{ij} - \overline{x}) + e_{ij}, i = 1, 2, ..., t; j = 1, 2, ..., r, e_{ij}$ are iid as $N(0, \sigma^2)$, describe the likelihood ratio test for testing the hypothesis $H_0 : \beta = 0$.

Roll No. ____________________ [Total No. of Pages : 2

PGIIIS 1574 B-15

M.Sc. IIIrd Semester (CBCS) Degree Examination

Statistics

(Demography)

Paper : SCT 3.1(a)

Time : 3 Hours Maximum Marks : 80

Instructions to Candidates:

1) Answer any **six** questions from Part - A and **Five** questions from Part - B
2) All questions carry **equal** marks.

Part - A

(6×5=30)

1. What is age heaping? Explain Whipple's index of measuring age-heaping.

2. What are context and coverage errors? Explain Dejure and Defacto methods of population census.

3. Explain Brass P/F ratio method of estimating TFR using incomplete data

4. Define IMR. Explain the factors responsible for increasing IMR

5. Distinguish between CDR and ASDR. Establish the relationship between these two measures

6. With usual notations for a stable population, show that $r = \frac{\log R}{T}$

7. Explain reproduction rates. What is replacement level fertility?

8. Explain natural growth rate method and the residual method of Migration

Part - B

(5×10=50)

9. Explain chandrashekaran and deming method of estimation of missing observations in survey data.

10. What is Fertility rate? Discuss the measures of fertility with their merits and demerits

11. a) What is age standardization? Explain its importance in comparison of death rates of two regions

 b) Explain the direct and indirect methods of standardized death rates.

12. What are abridged life tables? Derive the probability of distribution associated with a life table function $l(x)$

13. a) Define force of Mortality and derive. $\mu_x = \frac{1}{l_x}\frac{d}{dx}l_x$

 b) Explain the columns of life table

14. a) Define Migration. Explain push pull factors of Migration

 b) Discuss the impact of Migration on population size and structure.

15. Define stable population with usual notations prove that $C(x)=be^{-rx}P(x)$ under constant fertility and mortality schedule.

16. a) What are the Mathematical methods of population estimation? Explain any one of them

 b) Explain the component method of estimating the population.

Roll No. ______________________________ [Total No. of Pages : 3

PGIIIS 1575 B-15

M.Sc. IIIrd 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

Answer any **Six** questions: **(6×5=30)**

1. Define probability when the sample space is finite. Give an example.

2. Define a random variable. What are its types?" Give examples.

3. Discuss various types of statistical hypothesis along with examples.

4. What is an optimum test procedure?

5. The regression line of y on x is y-10.5 = 4.5 (x-9.5) and that of x on y is x-9.5 = 1.62(y-10.5). Find the means, variances and the correlation coefficient.

6. Outline one sample sign test.

7. Explain the layout of LSD.

8. Explain the analysis of Variance. What are its uses?

Part - B

Answer any **Five** questions. **(5×10=50)**

9. a) Obtain the coefficient of variation of the first 19,999 natural numbers.

   b) Outline the properties of standard deviation. **(5+5)**

10. a) For two independent events A and B. Prove that

$$P(A \cup B) = P(A) + P(B)P(\bar{B}) \, where \, P(\bar{B}) = 1 - P(B)$$

b) B_1, B_2.........B_k are disjoint events such that $UB_i = \Omega$ (sample space) and $P(B_i)>0$ i = 1,2.......k. For any event A. Find P(A). **(5+5)**

11. a) Define:

i) Test procedure.

ii) Critical region.

iii) Types of errors.

iv) Level of significance.

v) Size of a test.

b) Outline the steps in writing an optimum test procedure. **(5+5)**

12. a) Let $X : N(\mu_1, \sigma^2), Y : N(\mu_2, \sigma^2)$ where X and Y are independent and σ^2 is not known. Write down the optimum test for testing $H_0 : \mu_1 - \mu_2 \le a$ Vs $H_1 : \mu_1 - \mu_2 > a$. Where a is a real number.

b) The weights in kg of 5 couple are given below. At 5% level of significance can we conclude that on an average. The weights of husbands and those of wives are same? Use $P(|t_4| > 2.306) = 0.05$

Weight of husband	Weight of wife
60	55
55	60
65	65
70	65
60	60

(5+5)

13. a) Briefly explain linear regression.

b) Using the data of question 12 b) test for the significance of correlation between the weights of husbands and weights at 5% level given that $P(|t_3| > 3.182) = 0.05$. **(5+5)**

14. a) Describe mann-whitney u-Test.

b) Out line the analysis of variance in CRD. **(5+5)**

15. a) Briefly explain the chi-square test of independence of attributes.

b) At 5% level, test whether eye colour and hair colour are associated using the following table given that $P(\alpha_2^2 > 5.991) = 0.05$. **(5+5)**

	Hair colour	
Eye colour	Black	Brown
Black	50	30
Brown	40	40
Green	10	30

16. Write short notes on any **Two** of the following. **(5)**

a) Normal distribution.

b) Testing for the variances of two independent normal populations

c) Testing for the proportions of two populations

d) RBD.