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PGIIIS-N 1589 B-2K13

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

Statistics

(Stochastic Processes)

Paper - HCT-3.1

(New)

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 stochastic process and discuss the classification of one dimensional stochastic processes

2. Define persistent state, transient state an absorbing state.

3. 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

4. Explain birth and death process

5. Describe Immigration and Emigration processes.

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

7. Define delayed and equilibrium renewal processes

8. Explain Branching process with an example

Part - B (5×10=50)

9. a) Define Markov chain and transition probabilities

   b) Show that a state j is persistant or transient if and only if $\sum_{n=0}^{\infty} P_{jj}^{(n)} = \infty \, or < \infty$ **(4+6)**

10. State and prove the Basic limit theorem of a Markov chain. (10)

11. Show that

i) If state K is either transient or persistant null then for every state j

$P_{jk}^{(n)} \to 0 \text{ as } n \to \infty$

ii) If state K is a periodic, persistent non-null then for every state j, $P_{jk}^{(n)} \to \frac{F_{jk}}{\mu_{kk}} \text{ as } n \to \infty$

(5+5)

12. Stating the assumptions of the Poisson process derive its distribution (10)

13. Obtain stationary distribution of birth and death process (10)

14. Define a wiener process and obtain the backward diffusion equation of wiener process (3+7)

15. Define renewal process and show that for a renewal process $\{N(t), t \geq 0\}$, with probability 1, $\frac{N(t)}{t} \to \frac{1}{\mu} \text{ as } t \to \infty \text{ where } \mu = E\{X_n\} \to \infty$ (10)

16. For a Galton Watson process $\{X_n, n \geq 0\}$ with m=1 and $\sigma^2 < \infty$, show that

$$\lim_{n\to\infty} \frac{1}{n}\left\{\frac{1}{1-p_n(s)} - \frac{1}{1-s}\right\} = \frac{\sigma^2}{2} \text{ uniformly in } 0 \leq s < 1$$ (10)

PGIIIS -N 1590 B-2K13

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

Statistics

(Design and Analysis of Experiments)

Paper-HCT -3.2

(New)

Time : 3 Hours Maximum Marks :80

Instructions to Candidates :

Answer any **6** questions from part - **A** and any **five** questions from part - **B**

Part - A **(6x5=30)**

1. Define
   i) Gauss - Markov (G - M) model and
   ii) Estimability of a linear parametric function.
2. Obtain normal equations of a G - M model and obtain a solution
3. Define connectedness of a block design. Examine the same for the design:
   (1,2,2,) (3,3,4), (4,4,3), (2,1,1,)
4. Define BIBD and establish any two relationship among its parameters.
5. Define variance balanced design and show that RBD is variance balanced.
6. Out line scheffes test for contrasts.
7. State the one - way random effect model and the hypothesis of interest. Give one real life example of its application
8. Discuss confounding and its importance in factorial experiments (f.e)

Part - B **(5x10=50)**

9. State and prove a necessary and sufficient condition for estimability of a 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 State and prove G.M theorem

11. Describe the analysis of a LSD.

12 Under the usual assumptions of the model $E(y_{ij}) = \mu + \alpha_i + \beta(x_{ij} - \bar{x}.); i = 1,...t; j = 1,...r$, derive the likelihood ratio test of $H_{o:}\ \alpha_1 = ... = \alpha_t$

13 Derive and estimate of a missing observation in a RBD so as to minimize the error sum of squares. Set - up the appropriate ANOVA - table.

14 Out line the intro - block analysis of a BIBD

15. Write the effects of a 2^3 f.e as orthogonal contrasts. Out line the analysis of a partial confounding 2^3 f.e.with two replicates with ABC and AB as confounded effects.

16. Discuss with an example a split - plot design . Set - up the ANOVA - table of its analysis.

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PGIIIS-N 1593 B-2K13

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

Statistics

(Based on HCT 3.1)

Paper - HCP 3.1(Practical)

(New)

Time :2 Hours Maximum Marks : 30

Instructions to candidates:

Answer any two questions. All questions carry **equal** marks.

1. a) Suppose that the probability of a dry day (state 0) following a rainy day (state 1) is 1/3 and that the probability of rainy day following a dry day is 1/2 we have two state Markov chain. Write the t.p.m P and find the

   i) Probability that may 3 is a dry day given that May 1 is a dry day. And

   ii) Probability that may 5 is a dry day given that may 1 is a dry day.

   b) Consider a Markov chain on (0,1,2) having the t. p. m

$$
\begin{array}{c c} & \begin{array}{ccc} 0 & 1 & 2 \end{array} \\ \begin{array}{c} 0 \\ P=1 \\ 2 \end{array} & \begin{pmatrix} 1/3 & 1/3 & 1/3 \\ 1/4 & 1/2 & 1/4 \\ 1/6 & 1/3 & 1/2 \end{pmatrix} \end{array}
$$

   Obtain the stationary distribution. **(5+10)**

2. A barber shop has 4 chairs for waiting customers and one barber in attendance. Customer who arrive when all the chairs are occupied live without a haircut. The barber takes exactly 15 minutes for a haircut, and as long as there is somebody waiting he does not take any free time. The number of customers arriving in a 15 minutes interval is found to have the following distribution.

No.of arrivals:	0	1	2	3	4	5 and above
Probabilities:	0.20	0.70	0.07	0.02	0.01	0.00

   If Q_n = number of customers in the barber shop soon after the n^{th} haircut

   i) Obtain the transition probability matrix of the associated marlier chain.

ii) What is the length of the time during which barber will be continuously busy after starting with one arrival?

iii) What will be his expected earnings in 10 hours of his working day?

iv) What will be his expected earnings if the shop has only 3 chairs ? (The barber earn Rs 30 per haircut) **(4+5+2+4)**

3. Consider a Markov chain with the following t.p.m

$$P = \begin{array}{c} \\ 0 \\ 1 \\ 2 \end{array} \begin{array}{c} \begin{array}{ccc} 0 & 1 & 2 \end{array} \\ \begin{pmatrix} 0 & 1 & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{pmatrix} \end{array}$$

Show that the Markov chain is irreduciable, periodic. With period 2 and the states of the Markov chain are persistent non-null. **(15)**

4. a) The number of accidents in a town follows a Poisson 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) 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 decendant of Mr. X. What is the probability that the male decendant eventually become extinct? What is the rate of increase of male population? 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. **(5+10)**

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PGIIIS-N 1594 B-2K13

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

Statistics

(Based on HCT 3.2)

Paper - HCP 3.2

(New)

Time :2 Hours Maximum Marks : 30

Instructions to candidates:

1) Answer any **two** questions.
2) All questions carry **equal** marks.

1. An experiment was conducted to study the effect of two factors (glass type and phosphor type) on the brightness of a television tube. The response variable measured is the current (in microamperes) necessary to obtain a specified brightness level. The data are shown below:

	Phosphor type		
Glass type	1	2	3
1	280	300	290
	290	310	285
	285	295	290
2	230	260	220
	235	240	225
	240	235	230

i) State the model with the assumptions.

ii) Test for the interaction between the two factors.

iii) Test for the significance of the main effects of the two factors.

2. A partial confounding of 2^3 factorial experiment was carried out to determine how the two pan material (a_0, a_1), two brands of brownie mix (b_0, b_1) and two stirring methods (c_0, c_1) affect the scrumptiousness of brownies. Data are given below:

Replication 1				Replication 2			
Block I		Block II		Block I		Block II	
(1)	11	abc	15	ab	17	b	11
ab	16	a	15	abc	12	a	10

ac	12	c	10	(1)	09	ac	13
bc	10	b	09	c	12	bc	12

Identify the confounded effects and analyse the above data. Estimate the standard error of a main effect and a confounded effect.

3. A varietal trial was conducted with five varieties of hybrid maize. The trial was laid out in a randomized block design with three replications. At the time of harvest the number of plants per plot was also recorded along with the plot yield. The data of grain yield in pounds per plot and the number of plants. (Given in brackets) are presented below.

	Replications		
Varieties	I	II	III
A	48.25 (227)	56.27(226)	48.34(259)
B	99.50(248)	85.50(218)	58.50(234)
C	43.50(249)	58.50(256)	48.50(270)
D	52.50(264)	43.50(252)	40.20(248)
E	83.31(271)	65.25(263)	61.13(259)

Analyse the data and test whether the varieties are significantly different in respect of yield.

4. The following table relates to the field layout of a split plot design with three varieties of a plant. The split plot treatments being two dates of final cutting with four replications arranged in a randomized block design.

		Replications			
Variety	Date of cutting	1	2	3	4
Ladak	A	2.17	1.88	1.62	2.34
	B	1.58	1.26	1.22	1.59
Cossack	A	2.33	2.01	1.70	1.78
	B	1.86	1.70	1.81	1.54
Ranger	A	1.75	1.95	2.13	1.78
	B	1.55	1.61	1.82	1.56

Analyse the data and test for the relevant hypothesis. Estimate the standard error of the difference between any two means of

i) varieties and

ii) dates of cutting.

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PGIIIS-N 1595 B-2K13

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

Statistics

(Based on SCT 3.1)

Paper - SCP 3.1

(New)

Time :2 Hours Maximum Marks : 30

Instructions to candidates:

1) Answer any **two** questions.
2) All questions carry **equal** marks.

1. Compute UN index for the following data.

Age	Population M	Population F	Age	Population M	Population F	Age	Population M	Population F
0	331785	325365	25	465218	446573	50	365480	349711
1	185669	174101	26	115620	112537	51	11250	10440
2	365214	347846	27	89456	89364	52	45890	42403
3	327896	328229	28	204530	185491	53	14560	13280
4	351256	339014	29	31025	29781	54	12546	10574
5	394562	373438	30	521026	500031	55	186540	186210
6	395420	382955	31	27654	24516	56	17890	17101
7	298560	255327	32	162451	137722	57	13250	11058
8	465261	437329	33	50125	45595	58	28450	27467
9	186542	192459	34	36452	32286	59	5620	4740
10	485672	459536	35	475620	453543	60	278951	260170
11	180215	161094	36	60125	58581	61	5562	5011
12	386580	386354	37	36452	33234	62	23456	22954
13	235890	208917	38	91025	88214	63	6540	6820
14	245621	215402	39	16897	15923	64	7521	6909
15	332546	310588	40	457890	416307	65	124500	118797
16	258791	226749	41	14562	12719	66	7152	6018

17	134256	124189	42	75620	66712	67	5210	4793
18	354680	330316	43	23456	22314	68	11254	9933
19	86759	85710	44	17890	15482	69	1891	1969
20	425560	386144	45	375689	266071			
21	89650	82106	46	25689	25754			
22	250120	239467	47	26789	25156			
23	100562	99159	48	58920	52572			
24	120125	78473	49	9012	8989			

(15)

2. Compute CDR, ASDR and ASDR for each sex for following data: England and Wales (1995)

Age group	Mid year population ('000)		No.of Deaths	
	Males	Females	Males	Females
1-4	1403	1335	0.40	0.34
5-14	3394	3219	0.61	0.42
15-24	3348	3172	2.45	0.91
25-34	4252	4076	4.10	1.84
35-44	3523	3480	5.86	3.64
45-54	5830	5900	44.20	27.79
55-64	2078.	2477	74.50	52.70
65-74	1032	1702	91.60	96 40
75 & above	240	708	46.60	107.50

(15)

3. The data in table below relate to the African country of malawi. The total number of urban women in the survey is 1334, and the total number of rural women in survey is 10518.

i) Calculate the general fertility rates for rural and urban areas

ii) Calculate total fertility rates for urban and rural areas. **(7+8)**

Age group	Percentage of all women in age group		Age specific fertility rates per woman	
	Urban areas	Rural areas	Urban areas	Rural areas
15-19	9.7	9.4	0.135	0.165
20-24	10.1	7.8	0.268	0.291
25-29	9.0	6.3	0.242	0.273
30-34	6.3	5.3	0.210	0.261
35-39	4.7	4.4	0.149	0.202
40-44	3.0	4.4	0.086	0.123
45-49	1.9	3.1	0.012	0.062

4. Construct the abridged life table given the following data. (15)

x	l_x	x	l_x
0-1	1,00,000	35-40	68315
1-5	86495	40-45	66367
5-10	77585	45-50	64204
10-15	77558	50-55	61239
15-20	74697	55-60	57003
20-25	73423	60-65	51432
25-30	71759	65-70	43131
30-35	70133	70^+	33389

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PGIIIS-N 1591 B-2K13

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

Statistics

(Demography)

Paper - SCT 3.1

(New)

Time 3 Hours Maximum Marks :80

Instructions to candidates:

Answer any **six** questions from part - A and any **five** quesions from Part **B**.

Part - A **(6×5=30)**

1. Explain sources of demographic data.
2. Define TFR. State its importance and physical meaning.
3. What is child women ratio? What are its uses?
4. What is a life table? State the assumptions for constructing a life table.
5. With usual notations show that

$$n_x^q = \frac{2n.n^m{}_x}{2+n.n^m{}_x}$$

6. Discuss the different types of migration.
7. Explain age pyramid and its importance
8. Explain stable and stationary populations.

Part -B **(5 ×10=50)**

9. Explain Myre's index to assess the extent of digit preference in the single year age data.
10. Discuss different measures of fertility.
11. Derive Dandekar's modified Poisson distribution of fertility model.
12. Explain the columns of life table and their interrelationships.
13. Discuss the various measures of mortality.
14. Derive Greville's technique for constructing abridged life table.
15. a) Define migration. Explain push and pull factors of migration.

    b) Discuss the impact of migration on population size and structure. **(5 +5)**
16. Derive fundamental equation of Lotka's stable population model.

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PGIIIS-N 1592 B-2K13

M.A./M.Sc. IIIrd Semester (CBCS) Degree Examination
Statistics
(Statistical Methods)
Paper - OET 3.1
(New)

Time 3 Hours Maximum Marks :80

Instructions to candidates:

Answer any **six** questions from part - A and any **five** quesions from Part B.

Part - A (6×5=30)

Answer any **six** questions.

1. Discuss any relative measure of dispersion.
2. Define probability of an event of a finite sample space. Find the probability of selecting an odd number among the first 2n+1 natural numbers.
3. An ideal die and an ideal coin are tossed together once. Write down the sample space. Find the probability that the die shows an odd number and the coin shows a tail.
4. Define "Probability density function. Explain its properties
5. Explain statistical hypothesis along with examples.
6. What is an optimum test procedure? Explain.
7. Distinguish between parametric and non-parametric tests.
8. Outline the layout of LSD.

Part -B

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

9. a) Define standard deviation and outline its properties

   b) Obtain the coefficient of variation of first n natural numbers. (5 +5)

10. a) State and prove the addition rule of probability for two events

    b) n ideal die are rolled once. Define the following events:

    A: "The first die shows the number 1".

    B: "The n^{th} die shows the number 6".

    Find $P(A \cup B)$. (5 +5)

11. a) State and prove Baye's Theorem

b) there are three stores S_1, S_2 and S_3 selling bags. The respective percentages of defective bags in S_1, S_2 and S_3 are 10, 11 and 12 A customer randomly enters into one of the stores and selects a bag at random. If the bag selected was good one, find the probability that it was from S_3. (5 +5)

12. a) Define the following terms.

i) Two-tailed test

ii) Types of errors

iii) Size of a test

iv) level of significance.

vi) level - α test.

b) Discuss the 't test' for the mean of a normal population. (5 +5)

13. a) Explain the Chi-square test for testing the variance of a normal population with unknown mean.

b) The systolic BP of males and females of same age group are given below.

Males	110	95	100	112	115	
females	100	100	111	118	115	119

At 5% level of significance, test the hypothesis that there is more variation in the population of systolic BP of females given that $P\left(F_{4,5} > 5.19\right) = 0.05$ (5 +5)

14. a) Explain a test for testing the equality of proportions in two populations.

b) Outline 'sign test'. (5 +5)

15. a) Explain various types of linear correlation along with examples.

b) Discuss 'U test'. (5 +5)

16. Write short notes on any **two** of the following.

a) Conditional probability.

b) Normal test for a normal population.

c) Paired t - test.

d) Chi-square test for independence of attributes. (5 each)

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PGIIIS -N 1597 B-2K13

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

Statistics

(Based on OET 3.1)

Paper - OEP-3.1

(New)

Time : 2 Hours Maximum Marks :**30**

Instruction :

1. Answer any **two** questions
2. All questions carry **equal** marks.

1. a) The following table give the distribution of scores of two cricket players A and B. Decide the more consistent player.

Scores	No. of plays A	No. of plays B
0 to 40	25	25
40 -80	15	15
80-90	10	10
90-100	09	10

b) In an experiment, two fair dice of different colours are rolled. Let the four events E_1, E_2, E_3, and E_4 be defined as follows:

E_1:The absolute difference of the number of spots on the dice is divisible by 2.

E_2:The absolute difference of the number of spots on the dice is divisible by 3

E_3:The absolute difference of the number of spots on the dice is divisible by 4

E_4:The square root of the sum of the number of spots on the dice is divisible by 4.

Compute the probabilities of the events E_1, E_2, E_3, E_4, $E_1 \cap E_2, E_1 \cup E_2$ **(10+5)**

2. a) A certain breed of rat shows a mean weight gain of 75 gms during the first 5 months of life. Sixteen of these rats were fed a new diet from birth until age of 5 months. These 16 rats had a mean $\bar{x}=70.75$ and s=3.85. Is there any reason to believe at 5% level, that the new diet causes a change in the average amount of weigh gain? $\left(P\left(|t_{15}|>2.131\right)=0.05\right)$

b) 23 living sheep fed with pingue (a toxin - producing rubber weed) were studied 13 died and 10 survived. Their weights in pounds at the time of introduction of the pingue into their diets were as follows.

Died	Survived
46, 55, 61, 75, 71, 59, 64, 67,60, 62	57, 62, 67, 45, 73, 74, 57, 66,64, 74
59, 63, 66	

At 5% level of significance test the hypothesis that the average weights of the two groups in the population were same $\left(P\left(|t_{21}|>2.08\right)=0.05\right)$ **(5+10)**

3. a) As a microbiologist you want to obtain microscopic slides of uniform thickness. One company claims that its slides have a very small variance $\sigma^2=0.121 micron^2$. Using a sensitive micrometer, you randomly sample 50 slides with a resultant sample variance of $s^2=0.0213$ micron^2. Is the companies quoted value consistent with your data at 5% level of significance?

$(28.366<c_1<32.357, 65.41<c_2<71.42, P\left(\chi^2_{49}<c_1\right)=P\left(\chi^2_{49}>c_2\right)=0.05)$

b) 12 pairs of patients seen in a dental clinic were obtained by carefully matching on such factors as age, sex intelligence and initial oral hygiene scores. One member of each pair received instruction on how to brush the teeth and on other oral hygiene matters. 6 months later, all 24 subjects were examined and assigned an oral hygiene score by a dental hygienist unaware of which subjects had received the instructions. A low score indicates a high level of oral hygiene.

Oral hygiene scores of 12 subjects receiving oral hygiene instructions (X_i) and 12 subjects not receiving instructions (y_i)

Pair No.	01	02	03	04	05	06	07	08	09	10	11	12
X_i	1.5	2.0	3.5	3.0	3.5	2.5	2.0	1.5	1.5	2.0	3.0	2.0
Y_i	2.0	2.0	4.0	2.5	4.0	3.4	3.5	3.0	2.5	2.5	2.5	2.5

At 5% level of significance test the hypothesis that teaching was beneficial. **(5+10)**

4. a) An experiment was conducted to study the effects of a certain drug in lowering heart rate in adults. The independent variable x is the dose of the drug in mg and dependent variable y is the reduction in the heart rate. At 5% level of significance test for the significance of correlation between x and y given that $P(|t_3| > 3.182) = 0.05$

x	0.5	0.75	1.00	1.25	1.50
y	10	09	12	12	14

b) Research wish to compare four physical fitness programs designed for business executives. The executives were randomly assigned to one of the four programs. The following table shows the differences between the executives' physical fitness scores before and after participating in the program

A	B	C	D
13	11	12	22
24	13	17	26
19	15	15	22
18	14		
19			
21			

At 5 % level, can we conclude from the date that the four programs differ in effectiveness given that $P(F_{3,15} > 8.7) = 0.05$? **(7+8)**

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PGIIIS-O 1600 B-2K13

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

Statistics

(Testing of Hypothesis - 2)

Paper - 3.1

(Old)

Time :3 Hours Maximum Marks : 80

Instructions to candidates:

Answer any **six** question from part - A and **five** questions from Part - B

Part - A (6×5=30)

1. Define
   a) α-similar tests
   b) Test with Neyman structure and
   c) Unbiased test.
2. Define a consistent test. Give an example to show that every test need not be consistent.
3. For real parameter family $\{f(x,\theta):\theta\in \textcircled{H}\}$ derive the asymptotic distribution of likelihood ratio (LR) statistic for testing $H_o:\theta=\theta_o$ against $H_1:\theta\neq\theta_o$.
4. Define multiparameter exponential family. State the result which shows that there exist a UMPU test.
5. State any three properties of LR test
6. Distinguish between parametric and nonparametric inference.
7. Describe the procedure of single sample sign test paired - sample sign test.
8. Outline one-sample Kolmogorov Smirnov test procedure.

Part - B (5×10=50)

9. Derive LRT for testing $H_o:\sigma^2=\sigma_0^2$ against $H_1:\sigma^2\neq\sigma_0^2$, based on a sample from $N(\mu,\sigma^2)$ - distribution, when μ is known.
10. Let $X_1,X_2,\ldots,X_m$ and $Y_1,Y_2,\ldots Y_n$ be two independent random samples from $N(\mu,\sigma^2)$ *and* $N(\mu_2,\sigma^2)$ respectively. Derive LRT for testing $H_o:\mu_1=\mu_2$ *against* $H_1:\mu_1\neq\mu_2$, when σ^2 in known.
11. If λ is the likelihood ratio for testing $H_0:\theta=\theta_0$ *against* $H_1:\theta\neq\theta_0$, based on a sample from $V(0,\theta)$, obtain the asymptotic distribution of $-2\log_e\lambda$

12. Obtain UMPU test of size α for testing $H_0 : \theta = \theta_0$ *against* $H_1 : \theta \neq \theta_0$. based an a random sample from Poisson distribution with parameter θ

13. Let $X_1, X_2, \ldots, X_n$ be a random sample from $f(x, \theta) = e^{-(x-\theta)}, x > \theta$. Derive likelihooa ratio test for testing $H_0 : \theta = \theta_0$ *against* $H_1 : \theta \neq \theta_0$ comment on the asymptotic distribution of $-2\log_e \lambda$, if λ is likelihood ratio statistic.

14. Describe the procedure of run test to test randomness of a sample. Derive the null distribution of the statistic based on runs.

15. Describe the procedure of Mann-Whitney U-statistic for testing the equality of two populations. Show that Mann-whitney V-Statistic and Wilcox on-rent sum statistics are linearly related.

16. a) Define one and two sample V-statistics.

    b) State one-sample V-statistic theorem due to Hoeffding. Use it to obtain asymptotic distribution of sign statistic.

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PGIIIS-O 1601 B-2K13

M.A./M.Sc. IIIrd Semester (Non-CBCS) Degree Examination
Statistics
(Stochastic processes - 1)
Paper - 3.2
(Old)

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
   a) Stochastic Process
   b) Independent increment process
   c) Markov process.
2. Define Markov chain. Give an example.
3. Define
   a) Persistent State
   b) Transient state
   c) Periodic state.
4. The transition probability matrix of a Markov chain with S = (1, 2, 3) is given by

$$P = \begin{pmatrix} 1/3 & 0 & 2/3 \\ 1 & 0 & 0 \\ 0 & 1/2 & 1/2 \end{pmatrix} \text{ compute } P_{12}^{(2)} \text{ and } f_{12}^{(2)}$$

5. Discuss spectral decomposition method of obtaining higher step transition probabilities.
6. Obtain the expected duration of the game D_2
7. Describe branching process with an example.
8. Describe stationary distribution and first passage time distribution

Part - B

9. a) Describe absorption probability of a M.C.

   b) Prove that state j is persistent or transient according to $\sum_{n=0}^{\infty} P_{jj}^{(n)} = \infty \text{ or } < \infty$ (3+7)

10. In a finite irreducible MC, prove that all the states are positive recurrent. (10)

11. State and prove the Ergodic theorem of a Markov Chain. (10)

12. Obtain stationary distribution of the Markov chain having the t.p.m. (10)

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

13. Show that for two-state Markov chain

$$P=\begin{pmatrix}1-a & a\\ b & 1-b\end{pmatrix},0<a,b<1$$

$$P^n=\frac{1}{a+b}\begin{pmatrix}b & a\\ b & a\end{pmatrix}+\frac{(1-a-b)^n}{a+b}\begin{pmatrix}a & -a\\ -b & b\end{pmatrix},n=0,1,2$$ (10)

14. Discuss the applications of stochastic models for social network. (10)

15. Show that for a Branching process $\{X_n,n\geq 0\}$ the following relation holds. (10)

$$p_n(s)=p(p_{n-1}(s))$$

16. For a Galton - Watson process with m = 1 and $\sigma^2<\infty$ show that

$$\lim_{n\to\infty}\frac{1}{n}\left\{\frac{1}{1-p_n(s)}-\frac{1}{1-s}\right\}=\frac{\sigma^2}{2}$$ (10)

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PGIIIS-O 1602 B-2K13

M.A./M.Sc. IIIrd Semester (Non-CBCS) Degree Examination
Statistics
(Design and Analysis of Experiments)
Paper - 3.3
(Old)

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. In a Guass - markov set up $\left(Y, A\theta, \sigma^2 I\right)$ prove that every parametric function $l'\theta$ is estimable iff r(A) is equal to number of unknown parameters in θ
2. For a block design, define connectedness and balance.
3. For the one way random effects model given by $Y_{ij} = \mu + A_i + G_{ij}$ i = 1, ... a, j=1,2,....b where A_i's are *iid* $N\left(0, \sigma_A^2\right)$ and G_{ij}'s are *iid* $N\left(0, \sigma^2\right)$ propose a test for testing $H_o : \sigma_A^2 = 0$ (assuming that A_i's and G_{ij}'s are independent.
4. Describe a balanced Incomplete Block Design? With usual notations prove that $b \geq t$
5. Explain the principles of local control and randomization.
6. What is the difference between partial confounding and total confounding? Illustrate your answer by means of examples.
7. For a 2^3 factorial experiment give the treatment contrasts representing the interactions of order one.
8. Explain yate's method of analysis in a 2^m factorial experiment.

Part - B **(5×10=50)**

9. Describe in detail any two methods for multiple comparisons.
10. Discuss in detail the two way ANOVA case with equal frequency in the cells but without interaction.
11. Suppose Y_1, Y_2, Y_3 are random variates with a common variance σ^2 and with $E(Y_1) = \theta_1 + \theta_2, EY_2 = \theta_1 + \theta_3, E(Y_3) = \theta_3 + \theta_2$ show that $C_1\theta_1 + C_2\theta_2 + C_3\theta_3$ is estimable iff $C_1 = C_2 + C_3$.

12. Outline a method for testing $H_o: l'\theta = 0$, where, $l'\theta$ is an estimable function of a Gauss - Markov model, under normality assumption.

13. Out line the missing plot technique with reference to a randomized complete block design with one observation missing set up the ANOVA table.

14. Derive the variance of the estimate of a simple treatment contrast under a BIBD. Hence evaluate the efficiency of the design in relation to a randomized complete block design with an equal number of replications.

15. What is a random effects model? In what way it is different from a fixed effect model? Give a situation where random effects model is the appropriate model rather than the fixed effect model. How do you carry out the analysis?

16. Explain the analysis of one-way model with a single covariate.

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PGIIIS-O 1603 B-2K13

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

Statistics

(Demography)

Paper - 3.4(a)

(Old)

Time :3 Hours Maximum Marks : 80

Instructions to candidates:

Answer any six from Part - A and five from Part - B

Part - A (6×5=30)

1. Explain methods of enumeration and systems of census.
2. Explain UN index of measuring sex.
3. Explain a method of sample surveys and the importance of sample surveys.
4. Define
   i) CDR
   ii) ASDR

   Explain their merits and demerits.
5. Explain life table with stating its assumptions.
6. With usual notations, show that

$$\mu_x = \frac{1}{e_x^o}\left[1 + \frac{de_x^o}{dx}\right]$$

7. Define TFR. state its importance and physical meaning.
8. Explain age pyramid and its importance.

Part - B (5×10=50)

9. Explain Mysse's Index of asserting digit preference in age heaping
10. What are different sources of demographic data? Explain modern census with its features.
11. Define
    i) infant mortality rate
    ii) Standardized death rates Explain different methods of infant mortality rate and give its limitations.
12. Derive Dandakar's modified Poisson distribution of fertility model.
13. Explain different columns of abridged life table and give relationship between ${}_nq_x$ and ${}_nm_x$.

14. Show that Reed - merrel method is a particular case of Greville's method of construction of life table.

15. Describe one of the methods of estimation of migration.

16. Explain different measures of fertility.
