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PGIIIS-N-1572-B-17

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, Markov process and Independent increment process
2. Define Persistent state, periodic state and ergodic state
3. Prove that the state j is persistent or transient according as

$$\sum_{n=0}^{\infty} P_{jj}^{(n)} = \infty \text{ or } \angle\infty$$

4. Discuss imigration and emmigration process
5. Explain briefly pure death process
6. Obtain forward diffusion equation of a Wiener process
7. Define renewal function M(t) and show that the renewal function

$$M(t) = F(t) + \int_{o}^{t} M(t-x)dF(x)$$

8. Define branching process and probability of ultimate extinction of branching process

Part-B

(5x10=50)

9. Obtain transition probability and discuss the spectral decomposition method of obtaining higher step transition probabilities.

10. Obtain $_P(n)$ for two state markov chain having t.p.m $P=\begin{pmatrix}1-a & a\\ b & 1-b\end{pmatrix}1, 0<\text{a, b}<1.$

11. Obtain explicit expression for P_2 and q_2 of gramblers ruin problem

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 distribution of the first passage time to a fixed point for a wiener process.

15. Let $\{Y(t), t \geq 0\}$ is a renewal reward process generated by $\{X_n, Y_n\}$, suppose $E(X)=E(X_n)$ *and* $E(Y)=E(Y_n)$ then show that with probability 1

$$\frac{Y(t)}{t} \to \frac{E(Y)}{E(X)} \text{ as } t \to \infty$$

16. Show that for a branching process $\{X_0, n \geq 0\}$ the following relation holds

i) $P_n(s)=P_{n-1}(P(s))$

ii) $P_n(s)=P(P_{n-1}(s))$

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PGIIIS-N-1573 B-17

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 **Six** questions from Part - A and any five questions from Part - B.*

Part - A

(6×5=30)

1. Given the model : $E(y_1) = \theta_1 + 2\theta_2$, $E(y_2) = 2\theta_1 + \theta_2$ and $E(y_3) = \theta_1 - \theta_2$, examine the estimability of $\theta_1+\theta_2$.
2. Describe Scheffe's test for contrasts.
3. Define an orthogonal design. Show that RBD is orthogonal.
4. Is a BIBD an orthogonal design? Justify your answer.
5. For a 2^3 factorial experiment, show that main effects and interaction effects represent a complete set of orthogonal contrasts.
6. What do you understand by total confounding and partial confounding? Discuss their advantages.
7. Distinguish between ANOVA and ANCOVA.
8. Illustrate with an example, the advantages of a split plot experiment.

Part - B

(5×10=50)

9. Derive the BLUE of an estimable linear parametric function in a Gauss-Markov model.
10. Explain the analysis of variance of two-way classified data with equal observations per cell and with interaction.

11. Write down the linear model for a k x k LSD and obtain its normal equations. How will you test for differences among the treatments?

12. Outline the exact test of equality of treatment effects in an RBD with a single missing observation.

13. Outline the intra block analysis of a BIBD.

14. Give the layout of 2^3 factorial experiment so as to confound AB in replicate I, BC in replicate II and ABC in replicate III. Outline the analysis to test for the relevant hypothesis.

15. State the one-way analysis of covariance medal and derive a test statistics for testing the equality of treatment effects in this model.

16. a) Discuss what are split-plot designs. Set-up the ANOVA table of its analysis.

    b) Outline Yates technique to find the effect totals for a 2^n factorial experiment.

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PGIIIS-N-1574 B-17

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 questions from Part - B.*

Part - A **(6×5=30)**

1. What is census? Distinguish between census and sample survey.
2. What are converge and constant errors present in census data.
3. Distinguish between trude death rate and age-specific death rates.
4. Explain lexis diagram of infant mortality rate.
5. What is life table? Distinguish between complete and abridged life tables.
6. With usual noting, show that $n^q x = \frac{2^n{}_n m_x}{2 + n_n m_x}$.
7. Define migration. Explain push and full factors of migration.
8. Explain monitum of population growth.

Part - B **(5×10=50)**

9. Derive Dandekar's modified poisson distribution of fertility model.
10. Explain Myrse index of asserting digit preference in age heaping.
11. Explain Greville's method of construction of life table.
12. Explain standardization of death rates and discuss the indirect method of standardization of death rates.

13. Discuss between fertility rates and reproduction rates. Discuss one measure for each.

14. Define infant mortality rate (IMR). Discuss the various methods of IMR.

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

16. Describe a procedure to obtain the intrinsic rate of growth of the stable population.

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PGIIIS-N 1576 AB-17

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

STATISTICS

((PRACTICAL) BASED ON HCT 3.1)

Paper : HCP 3.1

(New)

Time : 2 Hours Maximum Marks : 30

Instruction to candidates:

Answer any two questions and all questions carry equal marks.

1. Consider a markov chain with three states 0, 1, 2 with t. p. m.

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

and $P\{X_0 = i\} = 1/3$, for all $i = 0, 1, 2$.

Find i) $P[X_2 = 1 / X_0 = 0]$

ii) $P[X_3 = 2 / X_0 = 1]$

iii) $P[X_4 = 1 / X_0 = 2]$

2. Obtain a stationary distribution of the following t.p.m.

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

3. There are two food stores A and B in a certain area. An investigation of the preferences of customers reveals that with probability 0.15 a customer of store A one week would go over to store B next week and with probability 0.10 a customer of store B would go over to store A. initially 60% of people buy from store A and 40% from store B.

   i) What do you expect to be the percentage of purchases in the two stores after 4 weeks?

   ii) What is the expected duration of a customer remaining with the same store for A and B?

4. A branching process $\{Xn , n \geq 0\}$, $X_0 = 1$ has off - spring distribution given by (0.5, 0.3, 0.2). Find

   i) The generating function of X_2.

   ii) The probability of Ultimate extinction.

   iii) The probability of extinction exactly at the 3rd generation.

   iv) The correlation coefficient between (X_1, X_3).

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PGIIIS-N-1577 B-17

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

STATISTICS

(Based on HCT 3.2)

Paper : HCP 3.2 (Practical)

(New)

Time : 2 Hours Maximum Marks : 30

Instructions to Candidates :

*i) Answer any **two** questions.*

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

1. A chemist wishes to test the effect of four agents on the strength of a particular types of cloth. Because there might be variability from one bolt to the other, the chemist decides to use a randomized block design with the bolts of cloth considered as blocks. He selected five bolts and apple id all four chemicals in random order to each bolt. The resulting strength with one observation missing are shown below:

	BOLT				
CHEMICAL	1	2	3	4	5
A	73	-	74	71	67
B	73	67	75	72	70
C	75	68	78	73	68
D	73	71	75	75	69

i) Estimate the missing observation by the method of least squares.

ii) Carry out the test to examine the equality of the effects of the chemicals on the strength of the fibre.

iii) Estimate standard error of $\left(\bar{Y}_A - \bar{Y}_B\right)$ and standard error of $\left(\bar{Y}_C - \bar{Y}_D\right)$.

2. An engineer is studying the mileage performances characteristics of five types gasoline additives. In the road test, he wishes to use cars as blocks. however because of a time constraint, he must use an balanced incomplete block design. the data is given below:

	Car				
Additive	1	2	3	4	5
1		17	14	13	12
2	14	14		13	10
3	12		13	12	9
4	13	11	11	12	
5	11	12	10		9

i) State the model with assumptions.

ii) Carry out the analysis and test for the appropriate hypotheses.

iii) Estimate the standard error of the estimate of the difference between any two treatment effects.

iv) Find the efficiency factor of this design.

3. An engineer is interested in the effects of cutting speed (A), tool geometry (B) and cutting angle (C) on the life (in hours) of a machine tool. Two levels of each factor are chosen and 2 replicates of a 2^3 factorial design are run. The results follows. Analyse the data.

Replication I		Replication II	
Block I	Block II	Block I	Block II
abc 39	(1) 22	bc 50	a 43
c 44	bc 60	ab 47	b 34
a 32	ab 55	ac 37	c 45
b 35	ac 40	(1) 31	abc 41

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

		Replications		
Varieties	Date of cutrting	1	2	3
Ladak	A	2.17	1.88	1.62
	B	1.58	1.20	1.22
Cossack	A	2.33	2.01	1.70
	B	1.86	1.70	1.81
Ranger	A	1.75	1.95	2.13
	B	1.55	1.61	1.82

Analyse the data and test for the relevant hypotheses. Estimate the SE of the difference between any two means of

i) Varieties and

ii) Dates of cutting

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PGIIIS-N-1578 B-17

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

STATISTICS (NEW)

Paper : SCP 3.1 (Practical)

(Based on SCT 3.1 (a))

Time : 2 Hours Maximum Marks : 30

Instructions to Candidates :

*i) Answer any **two** questions.*

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

1. Male population of Rajasthan (1991) by single years of age is given below.

Age	Population	Age	Population	Age	Population	Age	Population	Age	Population
0	657150	24	198598	48	111492	72	17545	96	233
1	359770	25	911791	49	18001	73	5310	97	184
2	713060	26	228157	50	715191	74	4530	98	441
3	656125	27	178820	51	21690	75	69160	99	390
4	690270	28	390021	52	88293	76	4930		
5	768000	29	60306	53	27840	77	3130		
6	778375	30	1021057	54	23120	78	6910		
7	553887	31	52170	55	372750	79	1310		
8	902590	32	300173	56	34991	80	75280		
9	379001	33	95720	57	24308	81	1544		
10	945208	34	68738	58	55917	82	4361		
11	341309	35	929163	59	10360	83	1607		

12	772934	36	118706	60	539121	84	1391
13	442807	37	69686	61	10573	85	17833
14	461023	38	173239	62	46410	86	1433
15	643134	39	32820	63	13360	87	1004
16	485540	40	874197	64	14430	88	1215
17	258445	41	27821	65	243297	89	427
18	684996	42	142332	66	13170	90	113973
19	172469	43	45770	67	10003	91	358
20	811704	44	33372	68	21187	92	830
21	171756	45	641760	69	3560	93	226
22	489587	46	51443	70	244584	94	183
23	199721	47	51945	71	4210	95	2248

Compute Whipple's and Myers's index.

2. Compute CBR, GFR, ASFR and TFR for the following data of Rajasthan for the year 1991.

Age Group	Female Population	No. of Births
15-19	1091746	176931
20-24	1650372	525663
25-29	1640545	432982
30-34	1387217	234706
35-39	1113986	108642
40-44	886484	42984
45-49	750655	18301

Total Population = 44005990

3. Compute CDR and ASDR for following data: England and Wales (1995)

Age group	Mid year Population (000)		No. of Deaths (1000)	No. of Deaths (1000)
	Males	Females	Males	Females
1-4	1403	1335	0.40	0.34
5-14	3394	3219	0.61	0.42
23-24	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

4. Construct abridged life table by using Greville's method.

Age Group	${}_nm_x$
0-1	0.0167
1-5	0.0011
5-10	0.0005
10-15	0.0003
15-20	0.0008

20-25	0.0011
25-30	0.0012
30-35	0.0023
35-40	0.0033
40-45	0.0023
45-50	0.0046
50-55	0.0069
55-60	0.0097
60-65	0.00172
65-70	0.0252
70+	0.0828

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