

Assignment Question Paper

Session: 2023 -24

Max. Marks: 30

Program Name: M.Sc. (Statistics)

Course Code: PGSTAT/MASTAT- 101(N)

Course Name: Measure and Probability
Theory

Section A

S.N	Short answer type question (approx. 200 -300 words)	Marks 2*6=12
1	State and prove Jensen's inequality.	2
2	Using the convergence of the random variables to show that t distribution $\rightarrow N(0,1)$	2
3	Show that let $\{X_n\}$ be sequence of random variables such that $X_n \xrightarrow{d} X$. Then $E(X_n) \rightarrow E(X)$ and $E(X_n^2) \rightarrow E(X^2)$ as $n \rightarrow \infty$	2
4	If $X_n \xrightarrow{a.s.} (X)$, Let $\{a_n\}$ be sequence of real numbers such that $a_n \rightarrow a$ as $n \rightarrow \infty$, then show that $(a_n X_n) \xrightarrow{L} aX$	2
5	State and prove central limit theorem	2
6	Prove that any distribution function possesses the property $\lim_{X \rightarrow \infty} \int_x^\infty \frac{1}{t} dF(t) = 0$	2

Section B

S.NO	Short answer type question (approx. 500 -800 words)	6*3=18 Marks
1.	Explain WLLN. How is it different from SLLN and CLT?	6
2.	State and prove the Lebesgue convergence theorem for measurable functions	6
3.	Find the characteristic function for the probability density function is $f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$	6

Assignment Question Paper

Session: 2023 -24

Max. Marks: 30

Program Name: M.Sc. (Statistics)

Course Code: PGSTAT 102(N)

Course Name: Statistical Inference

Section A

S.N	Short answer type question (approx. 200 -300 words)	Marks 6*2=12
1	What are simple and composite hypothesis? State and prove Neyman- Pearson lemma for testing simple hypothesis against simple hypothesis.	2
2	.	2
3	A bank wants to find out the average savings of its customers in Delhi and Kolkata. A sample of 250 accounts in Delhi shows an average savings of Rs. 22500 while a sample of 200 accounts in Kolkata shows an average savings of Rs. 21500. It is known that standard deviation of savings in Delhi is Rs. 150 and that in Kolkata is Rs. 200. Can we conclude at 1 per cent level of significance that banking pattern of customers in Delhi and Kolkata is the same?	2
4	State and prove Rao Blackwell theorem.	2
5	State and prove Lehman Schaffer theorem	2
6	Explain most powerful critical region.	2

Section B

S.NO	Short answer type question (approx. 500 -800 words)	6*3=12 Marks
1.	Let $X_1, X_2, X_3, \dots, X_n$ be a random sample from $U(\theta, \theta + 1)$ s. t (1) $T_1 = \bar{X} - \frac{1}{2}$ (2) $T_2 = X_{(n)} - \frac{n}{n+1}$ <i>are both consistent for θ</i>	6
2.	Let $X_1, X_2, X_3, \dots, X_n$ be a random sample of size n from the Poisson distribution $P(\theta)$, Obtain Cramer Rao lower bound for the variance of unbiased estimator of θ^2 .	6
3.	Explain Best linear unbiased estimator .	6

Assignment Question Paper

Session: 2023 -24

Max. Marks: 30

Program Name: M.Sc. (Statistics)

Course Code: PGSTAT 103(N)

Course Name: Survey Sampling

Section A

S.N	Short answer type question (approx. 200 -300 words)	Marks 6*2=12												
1	Establish the result which justifies the statement stratification generally leads to greater precision than simple random sampling.	2												
2	Define systematic and circular systematic sampling.	2												
3	Prove that systematic sampling is more precise than SRS if the variation within the systematic sample is larger than the population variance as a whole.	2												
4	<p>A sample of 100 employees is to be drawn from a population of collages A and B. The population means and population mean squares of their monthly wages are given below</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Village 2</th> <th>Ni</th> <th>\bar{X}_i</th> <th>\bar{S}_i^2</th> </tr> </thead> <tbody> <tr> <td>Collage A</td> <td>400</td> <td>60</td> <td>20</td> </tr> <tr> <td>Collage B</td> <td>200</td> <td>120</td> <td>80</td> </tr> </tbody> </table> <p>Draw the samples using Proportional and Neyman allocation techniques and compare. Obtain the sample mean and variances for the Proportional Allocation and SRSWOR for the given information. Then Find the percentage gain in precision of variances of sample mean under the Proportional Allocation over the that of SRSWOR</p>	Village 2	Ni	\bar{X}_i	\bar{S}_i^2	Collage A	400	60	20	Collage B	200	120	80	2
Village 2	Ni	\bar{X}_i	\bar{S}_i^2											
Collage A	400	60	20											
Collage B	200	120	80											
5	Prove that the probability of selection of a sample of n from the population by SRSWOR is $1/N$.	2												
6	Discuss about the Desraj ordered estimates.	2												

Section B

S.NO	Short answer type question (approx. 500 -800 words)	6*3=12 Marks
1.	Drive to the first Approximation, the expression for the bias and variance of the ratio estimators.	6
2.	Prove that the two stage sampling is more efficient than one stage sampling. If $\rho < 0$, where ρ is the intra class correlation coefficient between the elements of the first stage units (equal first stage units)	6
3.	Discuss the method of collapsed strata. Drive the condition for which this method is as efficient as stratified sampling.	6

Assignment Question Paper

Session: 2023 -24

Max. Marks: 30

Program Name: M.Sc. (Statistics)

Course Code: PGSTAT/MASTAT- 201(N)

Course Name: Linear Model and design
of Experiments

Section A

S.N	Short answer type question (approx. 200 -300 words)	Marks 2*6=12
1	Explain basic principle of design of experiments.	2
2	Define Partial Confounding.	2
3	Discuss about the split plot design.	2
4	What is Random effects model?	2
5	Explain Yates method of statistical analysis of 2^3 factorial experiment?	2
6	Describe general linear regression model along with the assumptions usually made. Find out least square estimators for its parameters and examine their properties.	2

Section B

S.NO	Short answer type question (approx. 500 -800 words)	6*3=18 Marks
1.	<p>A person wanted to purchase a lot of electric drills. He got quotations from five manufacturers. For the selection, he wanted to conduct an experiment to estimate the time taken by each making a hole in a metallic sheet. As the sheet might not be uniform all over in respect of thickness and hardness, he marked 20 places on the sheet and applied four drills from each concern in 4 randomly selected places to make holes. The time for making each hole was recorded and these formed the observations. The observations in seconds are shown below in brackets along with marks of the drills denoted by D1, D2, D3, D4 and D5.</p> <p>D1 (19) D3 (22) D4 (20) D1 (20) D5 (29) D2 (24) D5 (30) D3 (24) D2 (26) D4 (25) D1 (16) D2 (22)</p>	6

	<p>D5 (28) D3 (25) D5 (31) D4 (28)</p> <p>D4 (27) D1 (16) D2 (27) D3 (20)</p> <p>Conduct the experiment by adopting a completely randomized design</p>	
2.	<p>Carry out ANOVA for the following design:</p> <p>A ,5 B ,7 C ,7 D, 8 E ,9</p> <p>B, 7 C, 9 D ,8 E ,8 A ,5</p> <p>C, 6 D ,5 E, 9 A ,8 B, 9</p> <p>D, 5 E, 6 A ,8 B, 5 C, 7</p> <p>E ,8 A ,9 B, 5 C, 7 D ,6</p>	6
3.	<p>Explain factorial Experiments.</p>	6

Assignment Question Paper

Session: 2023 -24

Max. Marks: 30

Program Name: M.Sc. (Statistics)

Course Code: PGSTAT 202(N)

Course Name: Non- Parametric

Section A

S.N	Short answer type question (approx. 200 -300 words)	Marks 6*2=12
1	Explain disadvantages for a non parametric test	2
2	Explain the computation of median test for two independent samples with the help of steps and examples.	2
3	Explain median test with a focus on its assumptions.	2
4	Explain Run test with a focus on its assumptions.	2
5	Explain sign test.	2
6	Distinguish between parametric and non parametric tests.	2

Section B

S.NO	Short answer type question (approx. 500 -800 words)																		
1.	Compute one sample median test for the following data: 34, 32, 22, 34 ,43, 45 ,56, 54 ,56, 43, 22, 36, 43, 33.																		
2.	<p>A new approach to prenatal care is proposed for pregnant women living in a rural community. The new program involves in-home visits during the course of pregnancy in addition to the usual or regularly scheduled visits. A pilot randomized trial with 15 pregnant women is designed to evaluate whether women who participate in the program deliver healthier babies than women receiving usual care. The outcome is the APGAR score measured 5 minutes after birth. Recall that APGAR scores range from 0 to 10 with scores of 7 or higher considered normal (healthy), 4-6 low and 0-3 critically low. The data are shown below.</p> <table border="1" style="width: 100%; border-collapse: collapse;"><tbody><tr><td style="width: 15%;">usual Care</td><td style="width: 10%;">8</td><td style="width: 10%;">7</td><td style="width: 10%;">6</td><td style="width: 10%;">2</td><td style="width: 10%;">5</td><td style="width: 10%;">8</td><td style="width: 10%;">7</td><td style="width: 10%;">3</td></tr><tr><td>New Program</td><td>9</td><td>9</td><td>7</td><td>8</td><td>10</td><td>9</td><td>6</td><td></td></tr></tbody></table>	usual Care	8	7	6	2	5	8	7	3	New Program	9	9	7	8	10	9	6	
usual Care	8	7	6	2	5	8	7	3											
New Program	9	9	7	8	10	9	6												

3.	<p>The following data shows the age at diagnosis of type II diabetes in young adults. Is the age at diagnosis different for males and females?</p> <p>Males: 19 22 16 29 24</p> <p>Females: 20 11 17 12</p>
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Assignment Question Paper

Session: 2023 -24
Program Name: M.Sc. (Statistics)
Course Code: PGSTAT 203(N)

Max. Marks: 30

Course Name: Stochastic Process

Section A

S.N	Short answer type question (approx. 200 -300 words)	Marks 6*2=12
1	What is stochastic process? What are the main elements distinguishing stochastic process?	2
2	Let C_1 and C_2 be two communicative classes of a Markov chain and "S" be a state, which belongs to C_1 but not C_2 ? Prove that C_1 and C_2 are disjoint?	2
3	Explain Gambler's ruin problem. Give an example?	2
4	Distinguish between discrete and continuous state stochastic process with examples?	2
5	Define stationary probability distribution.	2
6	State and prove the Chapman Kolmogorov equation for a Markov Chain? Giving some counter example, and show that the equations are satisfied by non-Markovian processes.	2

Section B

S.NO	Short answer type question (approx. 500 -800 words)	6*3=12 Marks
1.	Find the probability distribution of inter arrival time for a Poisson process.	6
2.	Find out the probability generating function of a Simple Branching Process.	6
3.	State and prove fundamental theorem of probability of extinction in Branching Process.	6