

PGSTAT-01 / MASTAT-01

Mathematical Analysis

Integral as a function of a parameter. Differentiation with in sign of integration, Fourier series, Functions of bounded variation. Absolutely continuous functions, Riemann Stieltjes integrals. Basic theorems. Metric spaces. Open and closed sets, Convergence of sequences, Completeness of \mathbb{R}^n . Baire's theorem. Cantor's ternary set as example of a perfect set which is nowhere dense. Continuity and uniform continuity of a function from a Metric space to a Metric space. Compact spaces and compact sets. Continuity and compactness.

PGSTAT-02 / MASTAT-02

Probability and Distribution

Probability space of a random experiment. Probability measures random variables as a measurable function. Field induced by a sequence of random variables, decomposition of distribution functions in purely discrete, absolutely continuous and singular components. Chebyshev inequality. Cauchy-Schwartz inequality. Holder inequality. Minkowski inequality, Jensen inequality. Lyapunov inequality. Kolmogorov inequality. Hájek-Rényi inequality. Sequences of distribution functions. Helly-Bray theorem. Different types of convergence of sequence of random variables distribution function of random vectors, Weak and strong law of large numbers. Khinchin. Borel and Kolmogorov theorems. Borel-Cantelli lemmas and zero-one law. Characteristic function. Inversion theorem. Continuity theorem. One dimensional central limit problem : Lindeberg-Levy, Lyapunov, Lindeberg-Feller theorems.

PGSTAT-03 / MASTAT-03

Statistical Inference

Estimation : Sufficiency. Completeness. Rao-Blackwell theorem, Lehman-Schaffer theorem, Cramer-Rao inequality minimal sufficiency. Completeness, Bounded completeness, Ancillary statistics. Basu's theorem on independence of Statistics, Exponential family, Bhattacharya bound. Chapman Robbins and Kiefer (CRK) bound, maximum likelihood estimation. Lehmann theorem for invariance. Cramer theorem for weak consistency, asymptotic normality. BAN and CAN estimators, asymptotic efficiency, relation between confidence estimation and hypotheses testing. Generalized Neyman Pearson lemma. UMP tests for distributions with MLR. LR tests and their properties. UMPU tests, similar regions, Neyman structure. Invariant tests.

PGSTAT-04 / MASTAT-04

Linear Models and Design of Experiments

Linear Estimation- estimable functions, estimations and error space, Best linear unbiased estimate (BLUE), Markov theorem distribution of quadratic form, Estimable linear hypotheses generalized F and T tests. Analysis of Variance : Two-way classification with equal number of observation per cell and Tukey's test general two-way classification. Analyses of covariance, 2^n , 3^2 and 3^3 factorial experiments complete and partial confounding. Balanced Incomplete Block Design (BIBD), construction of BIBD, intra block and inter block analysis, split plot design.

PGSTAT-05 / MASTAT-05

Survey Sampling

Sampling Theory : stratified sampling, Post-stratification and deep stratification. Methods of allocation, ratio and regression estimators, double sampling in ratio and regression estimation. Cluster sampling with equal clusters two stage and multi-stage sampling. Non sampling errors.

Varying probability sampling with and without replacement, cumulative total and Lahiri's methods of selection. Estimation of population mean. Desraj ordered estimates, Horvitz-Thompson estimator. Midzuno and Narain system of sampling.

PGSTAT-07(P) / MASTAT-07(P)

Practicals based on PGSTAT-03, 04 & 05

PGSTAT-08 / MASTAT-08

Stochastic Process

Two state Markov sequences, markov chains, determination of n-step transition probabilities, Chapman-Kolmogorov equations, first return and first passage probabilities, classification of states, communication states, periodicity, stationary probability distributions and limit theorems for ergodic chains, continuous time Markov processes. Poisson (point) process, birth and death processes, random walk and gambler's ruin problem.

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PGSTAT-09 / MASTAT-09

Decision Theory

Decision theoretic problem as a game, basic elements, optimal decision rules, unbiasedness, invariance, ordering. Bayes and minimax principles, generalized. Bayes rules, extended Bayes rules, admissibility, completeness, minimal complete class, separating and supporting hyperplane theorems, minimax theorem, complete class theorem, equalizer rules, examples, multiple decision problems.

PGSTAT-10 / MASTAT-10

Multivariate Analysis

Multivariate normal distribution, Characteristic function, Maximum likelihood estimators of the mean vector and covariance matrix, Multiple and partial correlation coefficients and partial correlation coefficients and their null sampling distributions, Wishart distribution. Hotelling's T.- Mahalanobis D² and their applications, Discriminant analysis.

PGSTAT-11 / MASTAT-11

Nonparametrics

Order statistics, Distribution of maximum, minimum and r-th order statistic, Joint distribution of r-th and s-th order statistic, distribution of range, confidence intervals for quantiles, Foulery's limits. Sign test. Wilcoxon test, Median test, Run test, one sample and two sample location tests. Application of U-statistic to rank tests. One sample and two sample Kolmogorov-Smirnov tests. Run tests. Pitman ARE.

PGSTAT-12 / MASTAS-12

Econometrics

Linear regression model. Assumptions, estimation of parameters by least squares and maximum likelihood methods tests of hypotheses and confidence estimation for regression coefficient R² and adjusted R² point and interval predictors, use of dummy variables, estimation of parametric by generalized equation (SURE) model and its estimation, simultaneous equations model, concept of structural and reduced forms, problem of identification rank and order conditions of indentifiability, indirect least squares, two stage least ranks.

PGSTAT-14(P) / MASTAT-14(P)

Practical based on PGSTAT-10 , 11 , 12 & 13

Practical based on MASTAT-10, 11, 12 & 13

PGSTAT-13 / MASTAT-13

Demography

Block -1. Migration

Unit-I : Introduction, Estimation of life time and inter-censal migration from place of birth statistics, estimation of internal migration from statistics on duration of residence, at a fixed proor date.

Unit -2 : Indirect measure of net internal migration based on growth rate method, methods to estimate intercensal migration-using vital statistics, life time survival ratio method and census survival methods, estimation of international migration.

Block-2. Stable Population Theory

Unit-1 : Introduction, basic concepts of stable, quasi-stable, stationary and non-stable populations, vital rates and characteristics of stationary stable population and quasi-stable population.

Unit-2 : Definition of intrinsic rates of natural increase, intrinsic birth rate and intrinsic death rate, their relationship, derivation of Lotka's formulae of fundamental relationship instable population.

Unit-3 : Computation of intrinsic rate of natural increase and construction of stable age distribution from the given fertility and mortality schedules, relationship between net reproduction rate(NRR), intrinsic rate of natural increase and mean length of generation, concept of mean interval between two generations.

Block-3.Fertility & Fertility Models.

Unit-1 : Introduction, crude birth rate (CBR), gross fertility rate (GFR,) age specific fertility rate) ASFR), total fertility rate (TFR), gross reproduction rate (GRR)

Unit-2 : Period and cohort measures, use of birth order statistics, child women ratio, own-children method, children ever born(CEB) data and with data on current fertility, Brass P/F ration for adjusting fertility rates.

Unit-3 : Simple model on time of first birth/conception and number of births/conception n specified time, birth interval models, study of fertility through birth interval analysis.

Block-4. Mortality

Unit-1 : Introduction, crude death rate (CDR), specific death rates (SDR), standardized death rate (STDR).

Unit-2 : Life table, abridge life table, model life table of UNO (old and new), coale and demn model, brass model through logit transformation.