

U.G. 3rd SEMESTER SYLLABUS
DEPARTMENT OF STATISTICS
COTTON UNIVERSITY

PAPER: STA301C

SAMPLING DISTRIBUTIONS
(Credits: 4+0+1=5)

UNIT I (Lectures: 18)

Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region.

Large sample tests: use of CLT for testing single proportion, difference of two proportions, single mean, difference of two means, standard deviation and difference of standard deviations by classical and p -value approaches.

UNIT II (Lectures: 16)

Exact sampling distribution: Definition and derivation of p.d.f. of χ^2 with n degrees of freedom (d.f.), nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of χ^2 distribution. Linear transformation, Fisher's lemma, Distribution of \bar{x} and S^2 . Tests of significance and confidence intervals based on the distribution.

UNIT III (Lectures: 16)

Exact sampling distributions: Student's- t and Fishers- t distributions, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution and distribution of correlation coefficient r (null case only). Test of significance and confidence Intervals based on t distribution.

UNIT IV (Lectures: 14)

Snedecore's F-distribution: Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $\frac{1}{F(n_1, n_2)}$. Relationship between t , F and χ^2 distributions. Test of significance and confidence Intervals based on F distribution.

PRACTICAL/LAB. WORK: (Credit:1)

List of Practicals

1. Testing of significance and confidence intervals for single proportion and difference of two proportions
2. Testing of significance and confidence intervals for single mean and difference of two means for large samples.
3. Testing of significance and confidence intervals for single mean and difference of two means and paired tests.
4. Testing of significance and confidence intervals for single standard deviation and difference of two standard deviations.
5. Exact Sample Tests based on Chi-Square Distribution.
6. Testing of goodness of fit.
7. Testing of independence of attributes.

U.G. 3rd SEMESTER SYLLABUS
DEPARTMENT OF STATISTICS
COTTON UNIVERSITY

8. Testing based on 2 X 2 contingency table without and with Yates' corrections.
9. Testing of significance and confidence intervals of an observed sample correlation coefficient.

SUGGESTED READING:

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): An Outline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.
2. Gupta S.C and Kapoor V.K (2007): Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons
3. Hogg, R.V. and Tanis, E.A. (2009): A Brief Course in Mathematical Statistics. Pearson Education.
4. Johnson, R.A. and Bhattacharya, G.K. (2001): Statistics-Principles and Methods, 4th Edn. John Wiley and Sons.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint).Tata McGraw-Hill Pub. Co. Ltd.
6. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.

PAPER: STA302C

SURVEY SAMPLING AND INDIAN OFFICIAL STATISTICS
(Credits: 4+0+1=5)

UNIT I (Lectures: 18)

Concept of population and sample, complete enumeration versus sampling, sampling and non sampling errors. Types of sampling: non-probability and probability sampling, basic principle of sample survey, different steps involved in a large scale sample survey, simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of population mean and population total, variances of these estimates, estimates of their variances and sample size determination. Idea of probability proportional to size sampling.

UNIT II (Lectures: 18)

Stratified random sampling: Technique, estimate of population mean, variance of the estimate, proportional and optimum allocations and their comparison with SRS. Practical difficulties in allocation, estimation of gain in precision, Systematic Sampling: Technique, estimates of population mean, variances of the estimates ($N = n \times k$). Comparison of systematic sampling with SRS and stratified sampling in the presence of linear trend.

UNIT III (Lectures: 20)

Introduction to Ratio and regression methods of estimation, first approximation to the population mean and total (for SRS of large size), variances of these estimates and estimates of these variances, variances in terms of correlation coefficient for regression method of estimation and their comparison with SRS. Multi- stage sampling: Two- stage sampling. Cluster sampling (equal clusters only), estimation of population mean and its variance, comparison with SRS.

U.G. 3rd SEMESTER SYLLABUS
DEPARTMENT OF STATISTICS
COTTON UNIVERSITY

UNIT IV (Lectures: 08)

Present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission. Government of India's Principal publications containing data on the topics such as population, industry and finance.

PRACTICAL/LAB. WORK (Credit:1):

List of Practicals

1. To select a SRS with and without replacement.
2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by WR and WOR and establish all properties relative to SRS.
3. For SRSWOR, estimate mean, standard error, the sample size
4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of above two methods relative to SRS
5. Estimation of gain in precision in stratified sampling.
6. Comparison of systematic sampling with stratified sampling and SRS.
7. Ratio and Regression estimation: Calculate the population mean and mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS.
8. Cluster sampling: estimation of mean or total, variance of the estimate, efficiency as compared to SRS.

SUGGESTED READING:

1. Cochran W.G. (1984): Sampling Techniques (3rd Ed.), Wiley Eastern.
2. Choudhury, A. Survey Sampling: Theory and Methods, 2nd edition; CRC publication.
Des Raj and Chandhok P. (1998): Sample Survey Theory, Narosa Publishing House.
4. Goon A.M., Gupta M.K. and Dasgupta B. (2001): Fundamentals of Statistics (Vol.2), World Press.
5. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.
<http://mospi.nic.in/>
6. Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta.
7. Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok, C.(1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics

PAPER: STA303C

MATHEMATICAL ANALYSIS

(Credits: 4+0+1=5)

UNIT-I (Lectures: 14)

Calculus of one variable: Concepts of Limit, continuity and differentiability of functions of one variable. Maxima and minima. Infinite and Improper Riemann Integrals. Gamma and Beta functions: properties and relationship between them.

U.G. 3rd SEMESTER SYLLABUS
DEPARTMENT OF STATISTICS
COTTON UNIVERSITY

UNIT-II (Lectures: 10)

Calculus of several variables: Concepts of Limit, continuity, partial derivatives and differentiability of functions of several variables. Jacobian of transformation. Applications of Lagrange's multipliers.

UNIT-III (Lectures: 24)

Calculus of finite difference: Finite differences, Difference operators $E, \Delta, \nabla, \delta, \mu$ and relationship among them. Interpolation: Newton's forward, backward and Lagrange's interpolation formulae. Divided difference interpolation formulae. Central differences: Gauss and Stirling interpolation formulae. Inverse interpolation: Lagrange's inverse interpolation formula, Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule with error terms. Idea of Numerical differentiation.

UNIT-IV (Lectures: 16)

Solution of difference equations of first order. Roots of polynomial equations: Graphical method, Bisection method, Regula Falsi method, Newton Raphson and method of Iteration method.

Practical/ Lab work (Credit:1)

List of Practicals

1. Formation of difference table, fitting of polynomial and missing terms for equal interval of
2. differencing.
3. Interpolation based on Newton's Gregory forward difference interpolation formula.
4. Interpolation based on Newton's backward difference interpolation formula.
5. Interpolation based on Newton's divided difference and Lagrange's interpolation formula.
6. Interpolation based on Gauss forward, Gauss backward central difference interpolation formula.
7. Interpolation based on Stirling's central difference interpolation formula.
8. Problems based on Inverse interpolation formula.
9. Problems based on numerical differentiation.
10. Problems based on Trapezoidal Rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule.
11. Problems based on Bisection method, Regula Falsi method and Newton Raphson Method.

SUGGESTED READINGS

1. Appostol T.M. (1987): Mathematical Analysis, Second Edition, Narosa Publishing House, NewDelhi,.
2. Bartle, R. G. and Sherbert, D. R. (2002): Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore.
3. Ghorpade, Sudhir R. and Limaye, Balmohan V. (2006): A Course in Calculus and Real Analysis, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint.
4. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. (2003): Numerical methods for scientific and engineering computation, New age International Publisher, India.

U.G. 3rd SEMESTER SYLLABUS
DEPARTMENT OF STATISTICS
COTTON UNIVERSITY

5. Malik S.C. and Savita Arora (1994): Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi,.
6. Mukherjee, Kr. Kalyan (1990): Numerical Analysis. New Central Book Agency.
7. Sastry, S.S. (2000): Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India Pvt. Ltd., New Delhi
8. Shanti Narayan (1987): A course of Mathematical Analysis, 12th revised Edition, S. Chand & Co. (Pvt.) Ltd., New Delhi
9. Somasundram D. and Chaudhary B. (1987): A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi

(Generic Elective)

PAPER: STA304G

PROBABILITY DISTRIBUTIONS AND BASIC STATISTICAL INFERENCE
(Credits: 3+0+1=4)

UNIT I (Lectures: 08)

Random Variables: Discrete and continuous random variables, p.m.f., p.d.f. ,c.d.f. Illustrations of random variables and its properties. Expectation, variance, moments.

UNIT II (Lectures: 08)

Standard probability distributions: Bernoulli, Binomial, Poisson, geometric, normal, exponential.

UNIT III (Lectures: 16)

Idea of population and sample, estimate and estimator, parameter and statistic, standard error, Idea of statistical hypothesis, Type –I and Type –II errors, level of significance, concept of p-value, large sample test and confidence interval of sample mean and proportion(one sample and two sample) .

Statement and application of χ^2 , t and F distributions.

UNIT IV (Lectures: 16)

Analysis of variance, one-way and two-way classification. Brief exposure of three basic principles of design of experiments, treatment, plot and block. Analysis of completely randomized design, randomized block design.

PRACTICAL/LAB. WORK: (Credit:1)

List of Practicals

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$ given
2. Fitting of binomial distributions for n and p given
3. Fitting of binomial distributions computing mean and variance
4. Fitting of Poisson distributions for given value of lambda
5. Fitting of Poisson distributions after computing mean
6. Application problems based on binomial distribution
7. Application problems based on Poisson distribution
8. Problems based on area property of normal distribution

U.G. 3rd SEMESTER SYLLABUS
DEPARTMENT OF STATISTICS
COTTON UNIVERSITY

9. To find the ordinate for a given area for normal distribution

SUGGESTED READING:

1. Gupta S.C and Kapoor V.K (2007): Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
4. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
