Indira Gandhi
National Open University
School of Sciences

MST-004
STATISTICAL INFERENCE

Block

2

ESTIMATION

Curriculum and Course Design Committee

Prof. K. R. Srivathasan
Pro-Vice Chancellor
IGNOU, New Delhi

Prof. Rahul Roy
Math. and Stat. Unit
Indian Statistical Institute, New Delhi

Prof. Parvin Sinclair
Pro-Vice Chancellor
IGNOU, New Delhi

Dr. Diwakar Shukla
Department of Mathematics and Statistics
Dr. Hari Singh Gaur University, Sagar

Prof. Geeta Kaicker
Director, School of Sciences
IGNOU, New Delhi

Prof. Rakesh Srivastava
Department of Statistics
M.S. University of Baroda, Vadodara

Prof. Jagdish Prasad
Department of Statistics
University of Rajasthan, Jaipur

Prof. G. N. Singh
Department of Applied Mathematics
I.S.M., Dhanbad

Prof. R. M. Pandey
Department of Bio-Statistics
All India Institute of Medical Sciences
New Delhi

Dr. Gulshan Lal Taneja
Department of Mathematics
M.D. University, Rohtak

Faculty members of School of Sciences, IGNOU

Statistics
Dr. Neha Garg
Dr. Nitin Gupta
Mr. Rajesh Kaliraman
Dr. Manish Trivedi

Mathematics
Dr. Deepika
Prof. Poornima Mital
Prof. Sujatha Varma
Dr. S. Venkataraman

Block Preparation Team

Dr. Ramkishan **(Editor)**
Department of Statistics
D. A. V. (PG) College
C.C. S. University, Merrut

Mr. Prabhat Kumar Sangal
School of Sciences, IGNOU

Dr. Parmod Kumar **(Language Editor)**
School of Humanities, IGNOU

Course Coordinator: Mr. Prabhat Kumar Sangal
Programme Coordinator: Dr. Manish Trivedi

Block Production

Mr. Sunil Kumar, AR (P),School of Sciences, IGNOU
CRC prepared by Mr. Prabhat Kumar Sangal, School of Sciences, IGNOU

Acknowledgement: I gratefully acknowledge my colleagues Mr. Rajesh Kaliraman and Dr. Neha Garg, Statistics Discipline, School of Sciences for their great support.

July, 2013

ISBN-978-81-266-

Further information on the Indira Gandhi National Open University may be obtained from University's Office at Maidan Garhi, New Delhi-110068 or visit University's website http://www.ignou.ac.in

Printed and published on behalf of the Indira Gandhi National Open University, New Delhi by the Director, School of Sciences.

Printed at:

ESTIMATION

In Block 1 of this course, you have studied the sampling distributions of different statistics as sample mean, sample proportion, sample variance, etc. and standard sampling distributions as χ^2, t, F and Z which provide a platform to the learners how to draw the inference about the population parameter(s) on the basis of the sample(s).

In present block, we shall be studying the estimation theory, through which we estimate the unknown parameter on the basis of sample data. Two types of estimation i.e. point estimation and interval estimation are discussed in this block. This block comprises four units.

Unit 5: Introduction to Estimation

Estimation admits two problems; the first is to select some criteria or properties such that if an estimator possesses these properties it is said to be the best estimator among all possible estimators and the second is to derive some methods or techniques through which we obtain an estimator which possesses such properties. This unit is devoted to explain the criteria of good estimator. This unit also explains different properties of good estimator such as unbiasedness, consistency, efficiency and sufficiency with different examples.

Unit 6: Point Estimation

This unit explores the basic concepts of point estimation. In point estimation, we determine a single statistic whose value is used to estimate the value of unknown parameter. In this unit, we shall discuss some frequently used methods of finding point estimate such as method of maximum likelihood, method of moments and method of least squares.

Unit 7: Interval Estimation for One Population

Instead of estimating the population parameter by a single value, an interval is used for estimating the population parameter within which we can be reasonably sure that the true value of parameter will lie. This technique is known as interval estimation. In this unit, we shall discuss the method of obtaining the interval estimates of population mean, population proportion and population variance of normal population. Also we shall explorer the interval estimation for population parameters of non-normal populations.

Unit 8: Interval Estimation for Two Populations

This unit is devoted to describe the method of obtaining the confidence interval for difference of population means, difference of population proportions and ratio of population variances of two normal populations.

Notations and Symbols

$X_1, X_2, \ldots, X_n$	:	Random sample
$x_1, x_2, \ldots, x_n$	:	Observed value of random sample
Θ	:	Parameter space and read as big theta
$f(x,\theta)$	:	Probability density (mass) function
$f\left(x_1, x_1, ..., x_n, \theta\right)$	:	Joint probability density (mass) function of sample values
$L(\theta)$	:	Likelihood function of parameter θ
$T = t(X_1, X_1, ..., X_n)$	:	Estimator
$E(T)$	:	Expectation of T
$Var(T)$	:	Variance of T
SE	:	Standard error
e	:	Efficiency
T^*	:	Most efficient estimator
MVUE	:	Minimum variance unbiased estimator
$\hat{\theta}$	:	Estimate of θ
$\frac{\partial}{\partial\theta}$	:	Partial derivative with respect to θ
$X_{(1)}, X_{(2)}, \ldots, X_{(n)}$	:	Ordered statistic
ML	:	Maximum Likelihood
M'_r	:	r^{th} sample moment about origin
M_r	:	r^{th} sample moment about mean
μ'_r	:	r^{th} population moment about origin
μ_r	:	r^{th} population moment about mean
$1-\alpha$	:	Confidence coefficient or Confidence level
$Q = q(X_1, X_1, ..., X_n, \theta)$	:	Pivotal quantity
E	:	Sampling error or margin of error