Bihar Public Service Commission

BPSC

Bihar Public Service Commission

Download

Bihar Public

Service Commission

(BPSC Mains)

Optional Subject-

Statistics

STATISTICS

Section-I

There are two sections. Candidates shall answer not more than three questions from each section.

I. Probability :

Sample space and events, probability measures and probability space, Statistical independence, Random variable as a measurable function, Discrete and continuous random variables, probability density and distribution functions, marginal and conditional distributions functions of random variables and their distributions, expectation and movements, conditional expectation, correlation co-efficient, convergence in probability in LP almost everywhere; Markov Chebyehve and Kolomogrov inequalities, Borel- Cantellilemma, weak and strong law of large numbers probability generating and characteristic functions Uniqueness and continuity theorems. Determination of distribution by moments Lindeberg. Levy central limit theorem. Standard discrete and continuous probability distributions, their interrelations including limiting cases.

II. Statistical Inference:

Properties of estimates, consistency, unbiasedness, efficiency, sufficiency and completeness Cramer Rao bond, Minimum variance unbiased estimation, Rao Block well and Lehman Sheffe's theorem methods of estimation by moment maximum likelihood, minimum Chi-square. Properties of maximum likelihood estimators confidence intervals for parameters of standards distributions.

Simple and composite hypotheses, statistical tests and critical region, two kinds of error power function unbiased tests, most powerful and uniformly most powerful tests Nyman Person Lemma, Optimal tests for simple hypotheses concerning one Parameter monotone likelihood ratio property and its use in constructing U.M.P. test, likelihood ratio criterion and its asymptotic distributing sign test for Location. Wilcoxon- Mann- Whitney test and Kolmogor Simirnov test for the two sample problem. Distribution free confidence intervals for quantitietion, Chi-square and Kolmogor tests for goodness of fit. Run test for randomness and confidence bands for distribution functions.

Notions of a sequential test, Walds, SPRT, its CC and ASN function,

III. Linear Interence and Multivariate Analysis:

Theory of least squares and Analysis of variance. Gaussa, Markoff theory, normal equations least square estimates and their precision. Tests of signification and intervals estimates based on least square theory in one way, two way and three way classified data. Regression Analysis, linear regression, estimates and tests about correlation of regression coefficient curve linear regression and orthogonal polynomials, test for linearity and regression Multivariate normal distribution, multiple regression, multiple and partial correlation. Mahalanobis D2 and Hotelling T2-Statistics and their applications (derivations of distribution of D2 and T2 excluded) Fisher's discriminant analysis.

Section- II

I. Sampling Theory and Design of Experiments

Nature and scope of sampling, simple random sampling, sampling from finite populations with and without replacement, estimation of the standard errors sampling with equal probabilities and PPS sampling. Stratified random and systematic sampling, Two stage and multi-stage sampling, multiphase and cluster sampling schemes. Estimation of population total and mean, use of biased and unbiased estimates auxiliary variables, double sapling standard errors of estimates cost and variance function ratio and regression estimates and their relative efficiency planning and organçation of sample surveys with special referene to recent large scale surveys conducted in India.

Principles of experimental designs, CRD, RBD, LSD, missing plot technique factorial experiemtns 2n and 3n design general theory of total and partial confounding and fractional replication. Analysis of split plot, BIB and simple lattice designs.

II. Engineering Statistics.

Concepts of quality and meaning of control, Different types of control charts like X-R charts, P charts np Charts and cumulative sum control charts. Sampling inspection Vs. 100 per cent inspection, single, double, multiple and sequential sampling plans for attributes inspection, OC, ASN and ATI curves. Concept of producer's risk and consumer's risk AQL, AGQL, LTPD etc. Variable sampling plans.

Definition of Reliability, maintainability and availability. Life distribution failure rate and bath-tub, failure curve exponential and Weibull models, Reliabilty of series and parallel systems and other simple configurations.

Different types of redundancy like hot and cold and use of redundancy in reliability improvement problems in life testing, conscred and turncated experiments for exponential model.

III. Operational Research

Scope and definition of OR different types of models, their construction and obtaining solution. Homogenous discrete time Markov chains, transition probability matrix, classification of states and ergodic theorems. Homogenous continuous time Markov chains. Elements of queuing theory, M/M/I and M/M/K queues, the problem of machine interference and GI/M/I and B/GI queues. Concept of scientific inventory management and analytical structure of inventory problems simple models with deterministic and stochastic demand with and without leadtime. Storage models with particular reference to dam type.

The Sturcute and formation of a linear programming problem. The Simplex procedure two phase mehods and charnes- M Method with artificial variables. The quality theory of linear programming and its economic interpretation. Sensitivity analysis. Transportation and Assignment Problems. Replacement of items that fail and those that deteriorate, group and individual replacement policies. Introduction to computer and elements of Fortran IV Programming Formats for input and output statements specification and logical statements and subroutines. Application to some simple statistical problems.

IV. Quantitative Economics

Concept of time-series, additive and multiplicative models, resolution into four components, determination of trend by free-hand drawing, moving averages and fitting of mathematical curves, seasonal indices and estimate of the variance of the random components. Definition, Construcion, interpretation and limitation of index numbers, lespevre Parsche Edgewoth- Marshall and Fisher index number their comparitions tests for index numbers and construction of cost of living index.

Theory and analysis of cosumer demand – Specification and estimation of demand functions. Demand elasticities. Theory of production, Supply functions and elasticities, input demand functions. Estimation of parameters in single equation model—classical least squares, generalçed least squares heteroscedasticiyt, serial correlation, Multicollieneraity, errors in variables model, simultaneous equation models – indentification, rank and order conditions. Indirect least squares and two stage least squares, short- term economic forecasting.

V. Demogrpahy and pshychometry.

Sources of demographic data: Census registration: NSS and other demographic surveys. Limitation and uses of demographic data. Vital rates and ratios: Definition construction and uses.

Life tables – complete and absidged: Construction of life tables from vital statistics and census returns uses of life tables. Logistic and other population growth curves.

Measures of fertility. Gross and net reproduction rates. Stables population theory. Uses of stable and quasi-stable population techniques in estimation of demographic parameters. Morbidity and its measurement Standard classification by cause of death. Health surveys and use of hospital statistics.

Educational and psychological statistics methods of Standardisation of scales and tests. IQ tests. Reliability of tests and T and Z scores.