برنامج الدراسات العليا بقسم الإحصاء

تأسس قسم الإحصاء في عام 1974 ف، ومنذ ذلك التاريخ يمنح القسم درجة البكالوريوس في الإحصاء إضافة إلى تزويد طلبة الأقسام الأخرى بمقررات إحصائية تساند مقرراتهم الأساسية ، كذلك يمنح القسم درجة الماجستير في الإحصاء منذ عام 1987 ف .

وبناء على القرار رقم (982) لسنة 1981 الصادر من اللجنة الشعبية العامة بشأن تنظيم لائحة الدراسات العليا في جامعات الجماهيرية العظمى بضرورة البدء في الدراسات العليا ، عليه فقد بدأ القسم في تنفيذ برنامج الدراسات العليا منذ عام (1989/1988) وقد تم منذ ذلك الوقت وحتى فصل الربيع (2020/2019) تخرج عدد (101) خريج .

تمنح درجة الإجازة العالية (الماجستير) في الإحصاء وفقاً للشروط التي تنص عليها اللائحة الداخلية للدارسات العليا بالكلية وبعد إنجاز الطالب (39) وحدة دراسية مقسمة كالتالي :

إن عدد الوحدات الدراسية المطلوبة في البرنامج هو 39 وحدة. من بينها 33 وحدة للمقررات الدراسية والمتبقي هو 6 وحدات دراسية تكون مخصصة لأطروحة الماجستير التي تعتمد علي عمل مشروع بحثي. المقررات الدراسية المطلوبة في البرنامج تنقسم أيضا إلي جزئين هما:

(1) خمسة مقررات إجبارية تحمل (18 وحدة دراسية).

(2) خمسة مقررات اختيارية تحمل(15 وحدة دراسية)

(3) 6 وحدات دراسية للأطروحة ..

(1) المقررات الإجبارية15 وحدة دراسية

ت	رقم	اسم المقرر	عدد الوحدات	المتطلبات
1	**2501**	نظرية الإحصاء	4	2414 . 2301
2	**2502**	الاستدلال الاحصائي	4	2312 . 2313
3	**2503**	تحليل المتعدد المتغيرات	4	2411
4	**2504**	العمليات التصادفية	3	1302 ،2415
5	**2505**	منهجية البحث	3	

(2) المقررات الاختيارية12 وحدة دراسية من المقررات التالية

ت	رقم	اسم المقرر	عدد الوحدات	المتطلبات
1	**2601**	تصميم التجارب	3	2406
2	**2602**	نظرية المعاينة	3	2400
3	**2603**	نظرية اتخاذ القرار	3	2311 . 2312
4	**2604**	تحليل السلاسل الزمنية	3	2420 . 2504
5	**2605**	الاقتصاد القياسي	3	2205 . 2428
6	**2606**	نظرية الاحتمال	3	2402 ،1306
7	**2607**	بحوث العمليات	3	2413
8	**2608**	تحليل السكاني	3	2401
9	**2609**	التنبؤ والتحكم	3	2406
10	**2610**	الإحصاء الطبي	3	2422
11	**2611**	التحليل الرياضي لعلم الوراثة	3	2414 . 2428
12	**2613**	الانحدار اللامعلمي	3	2619
13	**2614**	تصميم التجارب في مسوح العينات	3	
14	**2615**	دراسات مستقلة	3	
15	**2616**	تحليل البيانات المتقدم	3	2430
16	**2617**	تحليل الصور	3	
17	**2618**	التحليل الحيزي	3	
18	**2619**	تقدير دالة الكثافة وانحدار كرنل	3	
19	**2620**	تنقيب البيانات	3	2503
20	**2626**	الإحصاء الحيوي*	3	-

*** لطلاب الدراسات العليا بقسم الكيمياء و علوم الحياة.**

M.SC. PROGRAMS IN STATISTICS

The department of Statistics offers M.Sc. degree in statistics in accordance with the resolution No. 892 (1981) passed by the general people congress prescribing the by-laws for higher studies in the Libyan universities.

REQUIREMENT OF CREDIT HOURS WITH COURSE TITLE:

The number of credit hours required is **39**. Out of these, **33** are in course work and the remaining **6** credit hours are on a dissertation based on a project work. The courses required for M.Sc. are again divided into two parts:

(a) Five compulsory courses carrying **18** credit hours, and

(b) Five elective courses carrying **15** credit hours.

Dissertation work may be started after cleaning the compulsory courses and the related elective courses. Details of the courses with their pre-requisites are given below:

(a) Compulsory Courses: 18 credit hours.

No	Course Code	Course Title	Credit hours	Prerequisite
1	**2501**	Theory of Statistics	3	2301-2414
2	**2502**	Statistical Inference	3	2312-2313
3	**2503**	Multivariate Analysis	3	2411
4	**2504**	Stochastic Processes	3	2415-1302
5	**2505**	Advanced Research Methodology	3	2502−2501

(b) Elective Courses: 15 credit hours from the following:

No	Course Code	Course Title	Credit hours	Prerequisite
1	**2601**	Experimental Design	3	2406
2	**2602**	Theory of Sampling	3	2400
3	**2603**	Decision Theory	3	2312 - 2311
4	**2604**	Time Series Analysis	3	2420 - 2504
5	**2605**	Econometrics	3	2205 - 2428
6	**2606**	Probability Theory	3	2402-1306
7	**2607**	Operations Research	3	2413
8	**2608**	Population Analysis	3	2401
9	**2609**	Prediction Forecasting and control	3	2406
10	**2610**	Medical Statistics	3	2422
11	**2611**	Mathematical Genetics	3	2414 - 2428
12	**2613**	Non-parametric regression	3	2615
13	**2614**	Design Of Experiments in Survey Sampling	3	--
14	**2615**	Independent Study	3	--
15	**2616**	Advanced Data Analysis	3	2430
16	**2617**	Image Analysis	3	--
17	**2618**	Spatial Analysis	3	--
18	**2619**	Density Estimation and Kernel Regression	3	--
19	**2620**	Data Mining	3	2503
20	**2626***	Bio-Statistics	3	--

*** For M.Sc. students of Chemical and Biological sciences.**

Descriptions of Courses

2501 Theory of Statistics

Some probability distributions: Power series, Pareto, LogNormal, Cauchy, Weibull, Gumbel, Double exponential and logistic distributions. Compound distribution. Non-Central distributions: Non-central Chi-square, F, T and Beta distributions. Distribution of quadratic forms and Cochran's theorem. Order Statistics: Joint and marginal distribution of Order statistics, distribution of sample range, median, quintiles, maximum and minimum values. Asymptotic distribution of order statistics.

References:

(1) Johnson and Kolz: continuous univeriate distributions.V.I.II.

(2) Johnson and Kolz: Discrete distribution, Houghton Miffin company.

(3) Kendall and Stuart: The advanced theory of statistics V.2.

(4) Graybill: An introduction to linear statistical models, V.I, Mc Graw Hill.

2502 Statistical Inference

Review and Background of important topics , Uniqueness and completeness , Joint and minimal Sufficiency , Lehmann-Scheffe theorem , Jacknife theorem , Robustness , Estimation in case of truncated and censored distributions , Bayes estimator with mean square error loss function , Admissible and Minimax estimators , Location and Scale invariant estimator , Principal of Splines , M-estimator. Interval estimation : Pivotal methods , Bayesian Interval estimation , Fiducial interval estimation , Non-central confidence interval.

References:

(1) Advanced theory of statistics, Vol II, Kendal and Stuart; Charles Griffin.

(2) Theory of statistical inference, Zacks.

(3) Linear statistical inference and it's applications, Rao.

(4) Statistical inference, Silvey, S.D, Penguin 1970.

(5) Comparative statistical inference, Bernett, V.D. Wiley 1973.

2503 Multivariate Analysis

Multivariate Normal Distribution and its properties - A review; Maximum likelihood estimation of mean vector and covariance matrix of this distribution. Sampling distributions of simple correlation coefficient, Partial and multiple correlation coefficients, properties and uses; Hotelling's T2 -statistic and it's distribution, properties and uses; sample covariance matrix; Wishart distribution of estimates of mean vector and covariance matrix. General linear regression; estimation of parameters and test of hypotheses; Likelihood ratio test. Multivariate ANOVA: One-way and Two-way classification. Cluster analysis and classification; Discriminant function and related tests; distribution of characteristic roots of matrices; canonical correlation analysis; Principal component analysis and factor analysis; Distribution and test related with this analysis.

References:

(1) Anderson, T.W.: Introduction to multivariate analysis, Wiley.

(2) Rao, C.R: Linear statistical inference and its applications, Wiley.

(3) Khirsagar, A. M.: Multivariate analysis, Mareel Inc.

2504 Stochastic Processes

Introduction: Random Walk, Markov Processes, Branching processes - Review. Brownian Motion: Definition and examples, continuity of path, Maximum Variables, Multidimensional Brownian motion. Queuing processes: Single server queuing process, M/M/1 , M/G/1 , G/M/1, G/G/1 queues. Stationary processes: Covariance function, Mean square distance, Stationary processes - Time and frequency domain, prediction, filtering and regulation problems. Point Processes: The renewal process, stationary point processes, real valued processes with point processes. Gaussian processes: Definition and example, Stationary, Gaussian and Markovian processes.

References:

(1) Karlin, S.: A first course in stochastic processes and Taylor, H.M.

(2) Cox and miller; Theory of stochastic processes, Chapman and Hall Ltd.

(3) Feller, W.; An introduction to probability theory and it's applications; Wiley 1971.

(4) Fisz, M.; Probability theory and Math. Statistics.

(5) Doob, J.L.; Stochastic processes; J. Wiley, 1953.

2505 Advanced Research Methodology

Sequential methods: sequential probability ratio test, closed plans, operating characteristic function, average sample number function, sequential t - test, sequential estimation. Non-parametric methods: review, derivative of some common non-parametric test statistics and their asymptotic behavior.

Hypotheses Testing: Most powerful test, Neymann-peasson lemma, asymptotic efficiency of a test, unbiased and similar test, UMP, UMPU and LUMPU test, similar regions, Neymann theorem, power curves, Likelihood ratio tests, asymptotes distribution of likelihood ratio statistics. Test of independence in multi-way contingency table.

References:

(1) David: Order Statistics: John wily and Sons M.Y. 1970.
(2) Wald, I: Sequential analysis.
(3) Wetherill: Sequential methods in Statistics.
(4) Statistical inference, Silvey, S.D, Penguin 1970.
(5) Comparative statistical inference, Bernett, V.D. Wiley 1973.

2601 Experimental Design

Unit-I: Introduction to designed experiments, General block design and its information matrix. Criteria for connectedness, balance and orthogonality, Intrablock analysis (estimability, best point estimates, estimates of estimable linear parametric functions and testing of linear hypothesis).

Unit-II: Review of elementary designs, BIBD- recovery of interblock information, Youden design. Analysis of two way and three way non-orthogonal data. Missing plot technique in BIBD and PBIBD. Properties of block design, connectedness, orthogonality, balanced ness, variance balanced and efficiency balanced.

Unit-III: General factorial experiments, factorial effects, best estimates and testing the significance of factorial effects, study of 2 and 3 factorial experiments in randomized blocks, complete and partial confounding, split plot experiments.

Unit-IV: Optimality criteria, A-, D-, E-optimality, universal optimality of BBD and generalized Youden Square Designs. Optimal regression designs for multiple linear regression and quadratic regression with one explanatory variable, introduction to D-optimal design measure.

Unit-V: Response surface designs, method of steepest ascent, canonical analysis and ridge analysis of fitted surface. Robust designs and Taguchi methods. Mixture experiments. Cross-over designs, applications, analysis and optimality.

- Practicals on the above topics using statistical packages for data analytic illustrations.

References:

(1) Joshi, D.D. (1987) : Linear estimation and design of experiments. Wiley Eastern.
(2) Montgomery, C.D. (1976): Design and analysis of experiment. Wiley New York.
(3) Alok Dey (1986) : Theory of block designs. Wiley eastern.
(4) Aloke Dey (1988): Orthogonal Main Effect Plans, New Age International Publications.
(5) Das, M.N. and Giri, N.(1979) :Design and analysis of experiment. Wiley Eastern.
(6)Raghavarao,D.: Construction and combinatorial problems in Design of experiments, John Wiley Publications.
(7) M.N.Das & N.C. Giri : Design and Analysis of experiments, New Age International Publications.
(8) Nigam A.K., Puri,P.D. and Gupta V.K. : Characterisation and Analysis of Block Designs, New Age International Publications.
(9) Federer W.T. : Experimental Design, John Wiley Publications.

2602 THEORY OF SAMPLING

Single-stage sampling of unequal clusters: selection of unequal clusters with unequal probability without replacement; Horvitz-Thompson estimator; other methods of estimation; Estimation of standard errors. Sub-sampling: Two-stage and higher-stage sampling with equal clusters; optimum allocation of clusters; sub-sampling with unequal clusters; Multi-stage sampling PSU'S selected with equal and unequal probability with or without replacement; Unbiased and ratio estimates; random group methods, self-weighing estimates; non-linear estimates of standard errors; Stratified multistage sampling. Double Sampling: Use of double sampling for stratification; regression estimators; ratio estimators and PPS estimation; Optimum allocation. Repeated sampling, sampling on two or more occasions. Sources of errors in survey; Non-response and non-sampling error; Interviewer variability; interpenetrating sub-samples; error of measurement, Familiarity with large-scale sample survey.

References:

(1) Cochran, W.G.: Sampling techniques; Wiley.

(2) Raj, D.: Sampling theory; MacGraw – Hill.

(3) Kendall and Stuart; Advanced theory of statistics V.3, Charles Griffins.

2603 Decision Theory

General description of decision problems. Utility and loss function, decision rules, expected utility principle. Simple problem with finite decision and parameter spaces. Problems without prior distribution, Risk function, Dominance, admissibility, Completeness, minimax.Baysian decision rules: Baysian approach for more general problems with application to point estimation, discrimination, hypotheses testing. 2-decision problem with linear loss function. Baysian decision prediction.

References:

(1) Ferguson, T.S.: Mathematical statistics. A decision theoretical approach, Academic press, 1967.

(2) De Groot, M.H.: Optimal statistical Decision. Mc Graw-Hill 1970.

(3) Aitchison, J. and Dunsmore, I.R.: Statistical prediction analysis 1975, Cambridge.

Introduction reading:

(4) Lindly, D.V.: Making decision; Wiley 1971.

(5) B.W.: Elementary Decision theory; Mac Millan, 1971. Lindgren

2604 Time series analysis

A quick review on concepts of time series. Probability models for time series: stochastic processes, Stationary process. Auto correlation function. Auto-regressive processes: MA, AR, ARMA and ARIMA processes. Estimation of parameters of models: Estimation of auto covariance and auto-correlation functions. Estimation of parameters of different auto-regressive processes. Residual analysis. Stationary Processes: Spectral distribution and density function, Spectral analysis - Fourier analysis. Myquist frequency, Perio dogram analysis. Relationship between priodogram and auto correlation functions. Truncated autocorrelation function. First Fourier transforms. Ideas of bivariate time - series: Cross - covariance and cross - correlation functions. Cross spectrum - linear system.

References:

(1) Chatfield, C.: The analysis of time series, An introduction; Chapman& Hall.
(2) Box and Jankins: Time series analysis, Forecasting and control; Holden Day.
(3) Kendal, M.G. and Stuart: Advanced Theory of Statistics V.3, Charele's Griffin.
(4) Andrson, T.W.: Analysis of time series, Wiley and Sons.

2605 Econometrics

Theory Part: A short review of general linear model where assumptions break down. General linear model with stochastic regression. General linear model with lagged variables: Lagged explanatory variables, lagged dependent variable, Estimation of parameters. Simultaneous Equation Methods: (a) Identification: Simultaneous Equation system, Identification problems. (b) Estimation: Recursive system, Two-stage and three-stage least squares, Limited information (Least variance ratio) Estimators. Applied Part: Income distribution, Demand-supply curves; production and consumption function, Cobb-Web models, Cobb-Douglas production function, CES production function, Input - output analysis.

References:

(1) Johnston, J: Econometric methods, Mc Graw - Hill, N.Y.

(2) Golderger, A.S.: Econometric Theory, John-Wiley and Sons, N.Y.

(3) Leser, C.E.V, Econometric Techniques and problems; Charles Griffin, London.

(4) Klein, L.R.: A text book of Econometrics; Evanston, Row eterson & Co.

(5) Fisher, F.M.: The Identification problem in Econometrics, Mc Graw-Hill, N. Y.

2606 Probability Theory

Elements of measure theory: Topological space, Fields and Fields of subsets, measurable functions. Measure: Definition and properties, Finite and additive measure, Borel sets, Lebesgue measure, Lebesgue integral, Radon-Mikodyn theorem, Riemann-Stieltjes integral. Probability space, independent events, conditional probability and conditional probability space, Baye's rule.

Random variables: Random variable as a measurable function, independence, Distribution of random variable, Distribution and density functions, Parameters of distribution, Distribution of functions of random variable, Joint and marginal densities, Conditional densities, Convolutions, probability generating function, Characteristic functions. Sequences of random variables: Concepts of convergence, Weak and strong law for independent and identically distributed random variables, Laws of large numbers, Central limit theorem and some of it's extensions, Infinitely divisible and stable distributions.

References

(1) Feller, W: An introduction to probability theory and it's applications,Vol.II,Willy

(2) Cramer, H.: Random variables and probability Distributions,. Press Cambridge

(3) Renyi, A.: Probability theory, Morth Holland Pub. Company, Amsterdam.

(4) Fisz; M.: Probability theory and Math. Statistics, Wiley.

(5) Chung, K.L.: A course in Probability theory, Academic press.

(6) Papoulis, A.: probability, Random variables, Stochastic processes; Mc Graw-Hill

(7) Burril, C.W.: Measures Integration and probability, Mc Graw – Hill.

(8) Parzen, E.: Modern Probability theory and it's applications, J. Wiley.

(9) Aram J. Thomsian : The structure of probability and stochastic processes , Mc Graw- Hill .

2607 Operation Research

Constrained Optimization: The general mathematical programming problem; Linear programming as a special case, Mathematical formulation of some practical problems as linear programming pros, Graphical solution methods, Canonical and standard of L.P.P.; the simplex method; fundamental properties of solutions, corroboration of extreme points, Simplex algorithm. Duality theory-Writing dual of a L.P.P. and duality relations. The Transportation problem - Description, the transportation table, methods of finding initial basic feasible solutions, the transportation algorithm, degeneracy in T.P., unbalanced T.P. The assignment problem: Nature of the problem, it's mathematical formulation as a linear program, the assignment algorithm, the unbalanced A.P. Advanced topics in programming: Linear factorial programming, Factorial algorithm, Stochastic programming and chance constrained programming, concepts of quadratic, dynamic discrete programming.

References:

(1) Taha,H.A. - Operation research - An introduction , Mac Millan .

(2) Vojda, S. - Mathematical programming, Addison – Wesley.

(3) Kantiswarup -Linear Fractional programming Operations Research, V.13 (1965) PP 1029 –1036.

(4) Garvin W.W - Introduction to linear Programming, Mc Graw – Hill.

(5) Sasiemi,M; Yaspan, A. and Friednien, L.Operational Research (Methods and Problems) J.Wiley.

(6) Gottfried, B.S. and Weisman, J. - Introduction to Optimization theory ; Prentic-Hill .

2608 POPULATION ANALYSIS

Collection of Census and vital statistics; Errors in census and vital statistics; Fertility and reproduction; Mortality projections and theories; Family formation, Composition and dissolution; Nuptiality; Distribution of population; Growth of population; Population estimates and projection; Health statistics; Morbidity analysis; Epidemeology; Survival analysis.

References:

(1) Demography - P.R. Cox.

(2) Principles of Demography - D.J. Bogne.

(3) Introduction to Demography - Spiegelman.

(4) The study of population - Houser and Duncan.

(5) Health and vital statistics - Bernard Benjamin.

2609 PREDICTION, FORECASTING AND CONTROL

Linear least squares prediction problem; Wiener and Kolmogrov methods; applications in standard stationary time series models; extension to filtering theory: recursive relations for predictors; standard forecasting techniques (IWMA, Brown, Holt); control of linear stochastic systems loss functions; Principle of certainty equivalence; Box-Jenkins feedback controllers; optimal regulation; estimation of parameters in linear system; estimation of transfer functions in open and closed loop system.

References:

(1) ASTROM, K.J. : Introduction to Stochastic Control Theory, (Academic Press 1971).

(2) BOX, G.: Time Series Analysis, Forecasting and Control, JENkINS, G.M. (Holden-Day, 1970).

(3) WHITTLE, P.: Prediction and Regulation by least-squares methods (English Universities press, 1963).

2610 MEDICAL STATISTICS

(1) ***Methodology and Model Building:*** Problem solving in human activity system-specifically in health and health care; the role of statistics in evaluating models; types of model; criteria for appropriateness of models. Discussion of journal articles with a health context.

(2) ***Linear programming:*** The linear model; primal and dual problems; shadow prices; reduced costs; sensitivity analysis; optimality in medical context. Discussion on the DHSS "Balance of Care" model.

(3) ***Simulation:*** Deterministic and probabilistic simulation models. Advantages and disadvantages in their use. Description of model for population cancer screening; it's validity and use in policy formulation; Gaming simulation; Monte-Carlo models; their use in resource allocation in hospital. Discussion of paper concerned with dialysis/renal transplantation.

(4) ***Drug Evaluation:*** Phases of investigation, randomized controlled trials, numbers of patients required, treatment allocation and stratification, placebo effects, within-patient comparisons. Statistics in the pharmaceutical industry.

(5) ***Distribution-Free Methods:*** Clinical measurement & ordinal scales, distribution free nature of ranks, one-sample and two-sample tests based on ranks, methods using empirical distribution function, comparison with parametric techniques, choice of test for a medical data set.

(6) ***Utility in Medicine: Utility functions:*** the fractile technique; utility axioms; application to the measurement of illness; individual utilities with respect to treatment options (e.g. 5 year survival lung cancer); community utilities providing an objective function for health services; benefit and cost assessment of health policy options. Discussion of journal articles.

(7) ***Analysis of Survival Data:*** Patient survival studies and " censored " observations; survivorship function and hazard functions; product-Limit estimate of survival curve; clinical life tables; estimation and inference in the exponential distribution; other distributions of survival time; use of concomitant information and regression models.

References:

(1) GROSS, A.J. and CLARK, V.A.: Survival Distribution: Reliability Applications in the Biomedical Sciences (Wiley 1975).

(2) PETO, R., PIKE, M.C. et. al.: Design and analysis of randomized clinical trials requiring prolonged observation of each patient. I.introduction and design. Br.J. cancer (1976) 34, 585.

(3) De NEUFVILLE, R. and STAFFORD, J.H.: System analysis for engineers and managers (McGraw-Hill 1971).

2611 Mathematical Genetics

Unit-I: Types of biological essays, Ratio estimators, asymptotic distributions; Fieller's theorem. Regression approaches to estimating dose-response relationships. Logit and probit approaches when dose-response curve for standard prepation is unknown; Quantal responses.

Unit-II: Basic biological concepts in genetics. Mandel's law, Hardy-Weinberg equilibrium, Mating tables, estimation of allele Frequency (dominant / co-dominant cases).

Unit-III: Approach to equilibrium for X-linked gene, Natural Selection, mutation, genetic drift, equilibrium when both natural selection and mutation are operative.

Unit-IV: Non-random mating, inbreeding, phenotypic assortative mating. Analysis of family data (a) Relative pair data. I.T.O. matrices, identity by descent, (b) family data - estimation of regretation ratio under ascertainment bias (c) Pedigree data, Elston-Stewart algorithm for calculation of likelihoods.

Unit-V: Linkage, Estimation of recombination fraction, inheritance of quantitative traits, Models and estimation of parameters. Sequence similarity, homology and alignment. Algorithms for (a) pairwise sequence alignment (b) multiple sequence alignment, construction of phylogenetic trees, UPGMA, Neighbour joining, maximum parsimony and maximum likelihood algorithms.

References:

(1) Z.Govindarajulu (2000). Statistical Techniques in Bioassay, S.Kargar.
(2) D.J.Finney (1971) : Statistical Method in Bioassay, Griffin.
(3) D.J.Finney (1971) : Probit Analysis (3rd Edition) Griffin.
(4) G.B.Weatherile (1966) : Sequential Methods in Statistics, Methuen.
(5) C.C.Li. (1976) : First Course on population genetics, Boxwood Press, California.
(6) W.J.Ewens (1979) : Mathematical Population genetics, Springer Verlag.
(7) T.Nagylaki (1992) : Introduction to theoretical population genetics, Springer Verlag.
(8) R.Durbin, S.R.Eddy, A.Krogh, G.Mitchison (1998), Biological Sequence Analysis : Probabilistic Models of Proteins and Nucleic Acids.

2613 Non-Parametric Regression

Kernel regression refers to a general class of techniques for the non-parametric estimation of functions. The main goals of this course are to:

Develop the students intuition and mathematical skills required for a comprehensive understanding of kernel regression ; and hence smoothing problems in general. The main topics to be covered are as follows :

1. Introduction to smoothing problem.
   - Non-parametric Universe (tools and techniques).
2. Estimation of Density function and Histograms.
   - MSE and MISE criteria.
   - Asymptotic MSE and MISE approximations.
   - Exact MISE calculations.
3. Kernel regression.
   - Local polynomial kernel estimators.
   - Asymptotic MSE Approximation (linear case).
     - Fixed equally spaced design.
     - Random design.
   - Asymptotic MSE Approximation (general case).
   - Derivative estimation.
   - Bandwidth selection.
4. Kernel Regression with Independent data.
5. Kernel Regression with correlated data.
6. Application on Real data such as CD4+ , ICIP dataset use Rgni Statistical package.

References:

(1) Bowman A.W. and Azzalini A. (1997) Applies Smoothing Techniques for Data Analysis. New York , Oxford University Press.

(2) Fan J. and Gijbels I. (1996) Local Polynomial Modeling and its Applications. London, Chapman & Hall.

(3) Hardle W. (1990) Applied Non-Parametric Regression. Cambridge University Press.

(4) Hardle W. (1991) Smoothing Techniques with Implementation in S. Springer-Verlag.

(5) Wand M.P. and Jones M.C. (1995) Kernel Smoothing. Chapman & Hall.

2614 Design Of Experiments In Survey Sampling

Unit-I : Review of basic finite population sampling techniques (SRS, WR/WOR, Stratified, Systematic) and allocation problem in stratified sampling. Two stage sampling with equal number of second stage units, Double sampling, Cluster sampling. Randomized response technique [Warner's model : related and unrelated questionnaire methods]

Unit-II: Concept of Optimum estimator. Concept of sufficiency in survey sampling and use of Rao Blackwell theorem. Generalization of H-/T estimator, Difference estimator. Super population models. Design unbiased ness and model unbiased ness. Criteria for comparison, prediction approach, likelihood function.

Unit -III: Non-Sampling errors and biased responses, randomized responses for variables, errors in surveys, modeling observational errors, estimation of variance components, application to longitudinal studies (repetitive surveys).

Unit-IV: Weighing Design: Weighing design, estimation of weights, and construction of weighing design. Balance weighting design, chemical balance weighting design, singular & non-singular weighting design.

Unit-V: Mutually orthogonal Latin square design. Orthogonal main effect plans, orthogonal arrays and their constructions, fitting of second order rotatable design & second order rotatable design along with its variance.

Unit-VI: Analysis of covariance in a general Gauss-Markov model, Application to standard designs, Missing plot technique - general theory and applications.

References:

1) Chaudhari,A. and J.W.E. Vos (1988) : Unified theory and Strategies of Survey Sampling. North-Holland, Amsterdam.
2) Chaudhari A.& R. Mukherjee (1988): Randomized responses: Theory and Techniques, New York
3) Cochran, W.G. : Sampling techniques [3rd Ed.1977] Wiley.
4) Des Raj and Chandak (1998) : Sampling theory, Narosa.
5) Sukhatme et al (1984) : Sampling theory of surveys with applications, Iowa state University Press & IARS.

2616 Advanced Data Analysis

1. Introduction to several software packages for statistical data analysis such as SPSS , Minitab , Matlab .
2. Presenting the S language as a powerful tool in analyzing data in both Rgui and S-plus environments. This will include the data input to the package anf file handling. Retrieval of the data (objects) from the input file and output.
3. Loading the package , and different libraries , finding out the facilities in the package. Use of different facilities of the package.
4. Write functions to handle the Vector , Matrix and Array manipulations with their graphics interface.
5. Data analysis using statistical techniques with the emphasis on multivariate Analysis , Regression Smoothing , Image Analysis , Density Estimation , Time Series Analysis and Data Mining Analysis , ... etc .
6. Some programming techniques using simulations for theoretical investigations with sorting out the output results.

References:

(1) Becker R.A. , Chambers J.M. and Wilks A.R. (1995) New S language (A programming Environment for Data Analysis and Graphics). Ward worth and Brooks/Cole , Computer science series.
(2) Hardle W. (1991) Smoothing techniques with Implementation in S spring-verlag
(3) Manual of R (2005)

2617 Image Analysis

Definitions and general ideas : Pixel , Neighborhood , Gibbs distribution , Markov Chain Mont Carlo (MCMC) , Gibbs sampler , Metropolis-Hasting algorithm.
Types of Images : Grey-level images , High-level images, Ultrasound images.
Image Modeling : Bayesian models , Markov Random Field models (MRF) , Models for binary and Categorical image.
Image Estimation : Local and polynomial trends , Maximum Likelihood Estimation , Posterior mean (PM) and maximum a posterior estimates (MAP).

References:

(1) Winkler G. (1995) Image Analysis , Random Fields and dynamic Monte Carlo Methods. Springer, Berlin.
(2) Grenander U. (1993) Fundamentals of Digital Image Processing. Englewood Cliffs, Prentice Hall.
(3) Possola A. (1991) Spatial Statistics and Imaging. IMS, Hayward, CA.

2618 Spatial Analysis

Types of data, spatial point patterns, contagious distribution, quadrant analysis, Testing for non-randomness, distance methods. Nearest neighbor analysis, spatial autocorrelation, joint count statistics, testing hypothesis of spatial correlation.

Geostatistics: the general geostatistics model, Gaussian model.

Parametric estimation of covariance structure : Variogram analysis, MLE estimation.

General Linear Spatial models (GLSM): Bayesian inference for GLSM, prediction A Spatial model for count data and binomial data.

References:

(1) Riply B.D. (1981) Spatial Statistics , Wiley, New York.

(2) Cressie N.A.C. (1993) Statistics for Spatial Data, Wiley, New York.

(3) Riply B.D. (1988) Statistical inference for Spatial Processes, Cambridge University Press, Cambridge.

2619 Density Estimation and Kernel Regression

Density estimation and Kernel regression refers to a general class of techniques for the non-parametric estimation of functions. The main goals of this course are to develop the students intuition and mathematical skills required for a comprehensive understanding of the density estimation tactics; and hence smoothing problems in general using the kernel regression.

The main topics to be covered are as follows:

1. Density estimation in the exploration and presentation of data
   - Histograms
   - The Naive estimator
   - The Kernel estimator
   - The variable Kernel estimator
   - Maximum Penalized Likelihood estimators
   - General Weighted function estimator

2. The Kernel method for univariate data
   - Measure of discrepancy: MSE and MISE
   - The bias and variance
   - The ideal window width and kernel

3. Introduction to smoothing problem
   - Non-parametric universe (tools and techniques)

4. Kernel regression
   - Local polynomial kernel estimators
   - Asymptotic MSE approximation (linear case)
     - §Fixed equally spaced design
     - §Random design

References:

(1) Bernard W. Silverman (1986) Density estimation for Statistics and data analysis. London, Chapman & Hall.
(2) Fan J. and Gijbels I. (1996) Local polynomial modeling and its applications. London, Chapman & Hall.
(3) Hardle W. (1990) Applied non-parametric regression. Cambridge University Press.
(4) Hardle W. (1991) Smoothing techniques with implementation in S. Springer-Verlag.
(5) Wand M.P. and Jones M.C. (1995) Kernel Smoothing. Chapman & Hall.

2620 Data Mining

Introduction to the fundamental concepts of data mining. Motivation for and applications of data mining. Data preprocessing and exploratory data analysis. The classification problem (an overview). Estimating prediction error using re-substitution error or training error (also known as apparent error in statistical literature), the traditional method and most commonly used for estimating the true prediction error. Statistical approaches for classification and prediction like:

(i) Linear and Quadratic Discreminant Analysis (LDA and QDA)

(ii) Tree-based classification as non-parametric method

(iii) K- Nearest Neighbor and Spline method

(iv) Neural Networks

(v) Hierarchical and k-means clustering

References

(1) Breiman, L. et al. (1984): Classification and Regression Tress. Belmont, California.

(2) Hastie, T. at al. (2001): The elements of statistical learning. Springer. New York.

(3) Johnson, A. and Wichern, W. (2002): Applied Multivariate Statistical Analysis. Prentice Hall.

(4) Mardia, K. et al. (1979): Multivariate Analysis. Academic Press.

(5) Mclachlan, G. (1992): Discriminant Analysis and Statistical Pattern recognition. Wiley, New York.

2626 Applied Bio-Statistics : *(for Biological Sciences)*

Part one : Basic Statistical Theory

***-Basic concepts to statistical parametric inference* :** ideas of sampling methods, properties of sampling distributions, and decision theory approach to one sample and two samples inference .

***-Basic concepts to statistical non-parametric inference* :** some non-parametric tests for frequency data , test for randomness, and comparing averages .

***-Inferences in regression analysis* :** overview of regression , prediction of new observation , confidence intervals in linear regression, *ANOVA* to regression analysis, interpretation of coefficient of determination for linear models, and general linear test approach .

***-Basic principles in experimental design* :** single factor *ANOVA* and multiple comparisons tests (CRD) for balanced and unbalanced cases, and two factor *ANOVA* (RBD) with missing data and distinction between nested & crossed factors .

Part two : Data Analysis & Decision Making

***-General idea about software users* :** introduction to data input to the package and file handing, and retrieval of the data from the input file and output.

-Data analysis applications : to the parametric inference, to non-parametric inference, to the regression models, and to the experimental design.

-Decision Making : under a report discussing small problem from biological filed including results and their interpretations.

References:

(1) Wayne W. Dantel : Bio-Statistics " A Foundation for Analysis in the Health Sciences ". John Wiley .
(2) Fowler J. & Cohen L. : Practical Statistics for Filed Biology. John Wiley.
(3) Remington R. & Schork M. : Statistics with Applications to The Biological and Health Sciences. Prentice-Hall .
(4) Ernest A. Blaisdell : Statistics in Practice. Saunders College Publishing .
(5) Rosner Bernard : Fundamentals of Bio-Statistics. Duxbury Press.

2627 : Special Topics

قائمة بأسماء أعضاء هيئة التدريس الذين يقومون بالتدريس في الدراسات العليا بقسم الإحصاء

م	الاسم	الجنسية	الدرجة العلمية	تاريخ التعيين بالجامعة	التخصص
1	د. ياسمينة بوزيد الفقيه	ليبية	أستاذ	1979	Regression Analysis
2	د. جبريل محمد شامية	ليبي	أستاذ	1983	Environmental Statistics
3	د. محمد مسعود ميكائيل	ليبي	أستاذ مشارك	1981	Time series Analysis
4	د. احمد محمد مامي	ليبي	أستاذ	1995	Data Smoothing
5	د. سالم محمد القزيري	ليبي	أستاذ	1995	Image Analysis
6	د. يوسف محمد القماطي	ليبي	أستاذ مشارك	1995	Data Mining
7	د. رامي صلاح جبريل	ليبي	أستاذ مشارك	1996	Data Mining in Bioinformatics
8	د. فتحي محمد الرملي	ليبي	أستاذ	1997	Image Analysis
9	د. عبد الغفار فرج المنفي	ليبي	أستاذ	1997	Applied Statistics
10	د. عادل محمد الشركسي	ليبي	أستاذ مشارك	1996	Financial Time series Analysis
11	د.اسعد محمد اقنيبر	ليبي	أستاذ مساعد	2000	Multivariate Analysis. Shapes and Directions Analysis
12	د. انتصار نصر السعيطي	ليبيه	أستاذ مساعد	2001	Generalized Linear Models
13	د. فائزة فرج الخفيفي	ليبيه	أستاذ مساعد	1999	Non –Parametric Statistics
14	د. محمد سالم اقويدر	ليبي	أستاذ مساعد	2002	Mathematical Statistics
15	د. نوري حسين بادي	ليبي	أستاذ مساعد	2019	Medical Statistics

16	د.لبوبكر محمد جابر	ليبي	أستاذ مساعد		

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