Syllabus

Open University of Mauritius

BSc (Hons) Applied Statistics [OUbs030]

1. Introduction

- **Relevance and aim of the course**

  Statistics has a vital role to play in many areas, including business, finance, medicine and government policy making. Career opportunities are numerous, including vacancies for statisticians and data analysts in statistical offices or the private sector. In this programme, learners are trained in the collection, organization, analysis, interpretation, and presentation of data. Throughout the course, emphasis is laid on application of suitable statistical techniques including advanced modelling to real data using latest statistical software. The areas of applications cover economic, social and scientific fields. After a full grounding in basic of statistics in the first year, a wide range of important topics is available in the second and third year in applied statistics which are of most relevance and interest to you.

- **Why study at Open University of Mauritius?**

  The Open University of Mauritius (OU) provides the flexibility, recognised qualifications and world-class teaching learners are looking for. It offers courses on blended open and distance learning mode as well as full-time learning mode. Thus, everyone can earn a qualification while working; learners may also wish to work part-time and study part-time; and others, including, school-leavers can study full-time at the UCC campus in Mauritius.

  Those wishing to learn through the blended open and distance learning mode benefit from top-leading and comprehensive manuals, supported by innovative study materials and videos, in order to allow them to get an exceptional learning experience in their own time, at home, at work or wherever they choose – reading, watching or listening to materials supplied, working out course activities and assignments with regular support from the tutor who is always an email away. Tutorials are also organized at UCC campus or through the virtual classroom. Although the tutorials are mostly optional, they give a chance to interact with the tutors and fellow learners.

Open University of Mauritius has been set up by an Act of Parliament as per the Laws of Mauritius. OU is a member of the International Council for Open and Distance Education, African Council for Distance Education, and Association of Commonwealth Universities.

2. Entry Requirements

A. EITHER "Credit" in at least three subjects at School Certificate or General Certificate of Education O-Level or equivalent and "Pass" in at least two subjects at Higher School Certificate or General Certificate of Education Advanced Level or equivalent; including A-level Mathematics.

B. **OR** An appropriate equivalent Diploma or Certificate or Foundation Courses acceptable by The Open University of Mauritius.

Learners who do not qualify under options **A** and **B** may register for Foundation Courses offered by the Open University of Mauritius. Those who complete the Foundation courses successfully will be eligible for registration for the relevant degree courses.

Qualifications awarded by other recognised universities and institutions that have been approved by the Tertiary Education Commission or Mauritius Qualifications Authority and the Open University of Mauritius may also be considered for admission.

Mature candidates having a strong background of work experience and uncertified learning may be assessed for entry to programmes through the Accreditation of Prior learning (APL) and the Accreditation of Prior Experiential Learning (APEL). Applicants may be required to pass an entry test. Please consult the General Rules and Regulations of the Open University of Mauritius for further details.

3. Mode of Learning

The course is offered on the following mode (s): Blended Open Distance Learning and Full-time mode.

4. Programme Duration

BSc (Hons) Applied Statistics	Normal	Maximum Duration
Diploma	2 Years	3 Years
Degree	3 Years	6 Years

5. Minimum Credits Required for the Awards

For 3-year degree

BSc (Hons) Applied Statistics   105 Credits

5 (i)   **Degree Award**

For the award of the degree, all modules of the programme, including work placement, must be completed. Except for the work placement module, every module carries 4 credits except five modules carry 5 credits (involving advanced statistical exercises) and the dissertation carries 8 credits.

5 (ii)   **Diploma Award**

The diploma is provided as a possible exit point in the programme. A learner may opt for a Diploma in Statistics provided he/she satisfies the minimum requirements, as specified below has obtained a minimum of 60 credits.

Assessment

Each module carries 100 marks and will be assessed as follows (unless otherwise specified):

Assessment will be based on a written examination of two hours duration which would account for 70% of the final module grade and continuous assessment would account for 30% of the final module grade. Continuous assessment will be based on assignment(s), portfolios and mini-projects. For a learner to pass a module, an overall total of 40% for combined continuous assessment and written examination components would be required without minimum thresholds within the individual continuous assessment and written examination. Learners may re-sit up to a maximum of two failed modules for the semester of the programme.

Written examinations for all modules, whether taught in semester 1 or in semester 2 or both, will be carried out at the end of each semester (unless otherwise stated).

Work Placement of 3 months' duration must be satisfactorily completed for the award of the degree. Such requirement may be waived for learners studying through open and distance learning and currently in employment.

6. Grading

Percentage Range	Description	Grade	Grade Point
$70\% \leq x \leq 100\%$	Excellent	A	5
$60\% \leq x < 70\%$	Very Good	B	4

50% ≤ x < 60%	Good	C	3
40% ≤ x < 50%	Satisfactory	D	2
0% ≤ x < 40%	ungraded	U	0

7. Award

BSc (Hons) Applied Statistics

1st Class with Honours	: CPA ≥ 70
2nd Class 1st Division with Honours	: 60≤ CPA < 70
2rd Class 2nd Division with Honours	: 50≤ CPA < 60
3rd Class	: 45≤ CPA < 50
Pass	: 40≤ CPA < 45
No Award	: CPA < 40

If CPA < 40, the learner will have to repeat the entire academic year, and retake the modules as and when offered. However, s/he will not be required, if s/he wishes, to retake module(s) for which Grade C or above has been obtained. Learners are allowed to repeat twice once over the entire duration of the Programme of Studies. No award is made if CPA < 40.

A learner who fails a Dissertation and subsequently passes it will only be eligible for the award of Undergraduate Degree at a pass level.

8. Programme Plan

Year 1

Module Code	Module Name	Semester 1	Semester 2	Credit
OUbs030111	Essentials of Statistics	√		4
OUbs030112	Probability and Probability distributions I	√		4
OUbs030113	Survey and Sampling Techniques	√		4
OUbs030114	Real Analysis	√		4
OUbs030121	Probability and Probability distributions II		√	5
OUbs030122	Linear Models and Design of Experiments		√	4
OUbs030123	Time Series Analysis		√	4
OUbs030124	Parametric and Non-Parametric methods		√	4

Year 2

Module Code	Module Name	Semester 1	Semester 2	Credit
OUbs030211	Data Analysis using Statistical packages	√		5
OUbs030212/MGTPRIN100	Management principles	√		4
OUbs030213	Biostatistics	√		4
OUbs030214	Statistical Inference I	√		4
OUbs030221	Statistical Inference II		√	5
OUbs030222/RESMETH100	Research Methods		√	4
OUbs030223/ECOMET100	Econometrics		√	4
OUbs030224	Applied Stochastic processes		√	4

Year 3

Module Code	Module Name	Semester 1	Semester 2	Credit
OUbs030311	Big Data Analytics	√		5
OUbs030312/ECOSTAT100	Economic Statistics	√		4
OUbs030313	Statistical Quality Control	√		4
OUbs030314	Operational Research	√		4
OUbs030321	Data Science for Business		√	4
OUbs030322	Multivariate Analysis		√	4
OUbs030323	Advanced Statistical Modelling		√	5
OUbs030324	Dissertation		√	8

9. Course Contents

Essentials of Statistics [OUbs030111]

Aim of Module

This module introduces the learners to the importance of statistics in the sciences and in society in general. Basic concepts relating to descriptive statistics and application of statistical tests to data sets and graphical representations are introduced.

Module Contents

This module covers the concept and nature of statistical data; Descriptive statistics: types of data, histograms, ogive, sample mean, variance, standard deviation and quantiles; Statistical tests: z-and t-tests, \chi^2 tests and F distributions; Basic statistical inference: estimation, central limit theorem and model validation; Dispersion, skewness, correlation and rank correlation.

Learning Outcomes

By the end of this module, learners should be able to:

- Demonstrate a sound understanding of descriptive statistics;

- Apply statistical tests to data sets;

- Produce tabular and graphical representations of data; and

- Interpret and calculate simple summary measures of location and dispersion.

Learning Materials: OU manual

Probability and Probability distributions I [OUbs030112]

Aim of Module

Uncertainty is a key factor in all decision making processes, whether in everyday life, business, the social and physical sciences. This module deals with the basics of probability and probability distributions and provide a solid grounding in the fundamentals of random variables and their distributions.

Module Contents

This module covers <u>Probability and Conditional Probability</u>: Sample space, σ-field, Borel field, Induced-field and random variable, Inverse mapping and its properties, definition of measurable function, Borel function, Probability as a set function. Properties of probability function, Principle of inclusion-exclusion. Bon-Ferrori's inequality, Conditional probability and its properties, Bayes theorem, Independent events.; <u>Random variable, Distribution Function and Moments</u>: Notion of a random variable, Multi-dimensional random variables, Distribution function and its elementary properties, Examples of univariate distributions, Functions of a random variable, Mathematical

expectation and moments, Liapunov's inequality, Chebyschev's inequality; <u>Inversion Theorem, Conditional Expectation</u>: Characteristic function and its properties, Inversion theorem, Moment generating function and probability generating function, chf, mgf and pgf of some standard distributions. Joint distribution of two random variables, marginal and conditional distribution, Independent random variables, Conditional expectation and variance.

Learning Outcomes

By the end of the module, learners should be able to:

- Define elementary probability concepts;

- Derive properties of probability models using their probability generating functions and moment generating functions; and

- List the axioms of probability and apply them in simple situations;

Learning Materials: OU manual

Survey and Sampling Techniques [OUbs030113]

Aim of Module

This module provides an overview and practical introduction to different methods of survey sampling. This module is intended to display grounding discussion in the total survey error framework, the theory and practice of probability-based methods for survey sampling and the derivation of standard errors for complex sample designs.

Module Contents

This module covers <u>Simple Random Sampling (With and Without Replacement)</u>: Estimation of population mean, total and proportion. Variances of the estimate and the estimation of variances. Optimal property of sample mean. Interval estimations. Estimations of sample size; <u>Stratified Sampling</u>: Estimation of the population mean and total and their variances. Estimation of variances, Choice of sample sizes in different strata according to proportional, Optimum and Neyman allocations and variances under these allocations. Comparisons of sampling strategies based on stratified and unstratified sampling. Estimation of gain due to stratification. Stratified sampling for proportion; <u>Ratio,</u>

Regression, Difference and Product Methods of Estimation: Variances of the estimates and their estimation. Comparison of sample mean, ratio and regression estimators. Unbiased and almost unbiased ratio estimates. Optimality of ratio and regression estimates. Ratio and Regression estimators in stratified sampling; Systematic Sampling: Estimation of the population mean and its variance, Comparison of systematic sampling with SRS and Stratified sampling in a population with linear trend; Double Sampling: Double sampling for stratification. Double sampling for ratio and regression method of estimation. Sampling on two occasions; Cluster Sampling: Estimates of population mean and their variances based on clusters of equal and unequal sizes. Variance in terms of intra class correlation coefficient. Optimum sampling unit. Sampling of clusters with probabilities proportional to size; Two Stage Sampling: Estimation of population total and mean with equal and unequal and known and unknown number of ssu's in fsu's. Variances and estimated variances. Optimum sampling and subsampling fractions (for equal fsu's only). Selections of fsu's with varying probabilities and with replacement. Comparison of two stages sampling with simple random sampling; Sources of Errors in Surveys: Sampling and non-sampling errors, Types of non-response, effect of non-response, Optimum sampling fraction among the non-respondents.

Learning Outcomes

After successful completion of this module, learners should be able to

- Design samples for surveys;
- Discuss methods for mitigating non-response errors; and
- Apply the different methods of survey sampling

Learning Materials: OU manual

Real Analysis [OUbs030114]

Aim of Module

In the first instance, the module is intended to explain a calculus approach to mathematical analysis and provide rigorous proofs of various fundamental results in classical analysis. Then, the calculus techniques and real analysis are used to solve differential and difference equations. Real numbers with its analysis are also discussed in this module.

Module Contents

The module covers real numbers and functions of one real variable; Calculus of one and several variables, inequalities; Taylor series; Properties of sequences of real numbers; First and second order

linear and simple non-linear differential equations; Linear first and second order difference equations; Application of differential and difference equations to solve simple problems.

Learning Outcomes

After completing this module, learners should be able to:

- Use calculus techniques to solve differential and difference equations; and
- Apply real numbers, functions, linear and simple non-linear differential equations in real life.

Learning Materials: OU manual

Probability and Probability distributions II [OUbs030121]

Aim of Module

The aim of this module is to develop learners' skills in probabilistic reasoning and to gain familiarity with some of the main techniques involved in the analysis of random systems. It also develops skills in the analysis of various modes of convergence of sequences of random variables and their inter-relationships. This module is supplemented by practical exercises using statistical packages.

Module Contents

The module covers function of <u>Random Variables: Chi-square, t and F-distributions</u>: Evaluation of distribution of functions of random variables, Gamma distribution, derivation of χ^2, t and F distributions through Gamma and Beta distributions; <u>Convergence of Sequence of Random Variables</u>: Various modes of convergence of sequences of random variables and their inter-relationships, Convergence of distribution function, convergence of rational functions of random variables (Cramer), Continuity theorem (Levy-Cramer); <u>Laws of Large Numbers and Central Limit Theorem</u>: Weak and Strong laws of large numbers, theorems on weak and strong laws of large numbers, central limit theorem-De Moivre-Laplace, Lindberg-Levy and Liapunov's versions.

Learning Outcomes

After successful completion of this module, learners should be able to:

- Calculate Chi-square, t and F-distributions;

- Apply the Laws of Large Numbers and Central Limit Theorem;

- Calculate probabilities using probability models; and

- Describe the modes of convergence of sequences of random variables and their inter-relationships.

Learning Materials: OU manual

Linear Models & Design of Experiments [OUbs030122]

Aim of Module

Linear models are used widely in statistics. The most common models will be reviewed and their relationship to the general linear model explored. The main aim of the module is to present a standard approach for fitting linear models to data and for comparing alternative linear models with one another. It also provides the skills to develop, test linear models appropriate for a range of practical problems and apply experimental design models.

Module Contents

The module covers Linear Models: Definition and Classification, Estimation of parameter vector and common variance by maximum likelihood and least squares method, Estimable functions and their estimation, Gauss-Markoff theorem, Quadratic forms in Normal variables, Cochran's theorem; Experimental Design Models: Tests of hypothesis and sub-hypothesis and Principles of experimental designs (Randomisation replication and local control); Analysis of Basic Design I: Completely randomized, Randomised block and Latin square designs, Asymptotic relative efficiency; Analysis of Basic Design II: Missing plot technique, Analysis of covariance for completely randomized and randomized block designs; Factorial Designs: 2^n, 3^2 and 3^3 systems only, Complete and partial confounding and Fractional replication in 2^n systems; Incomplete Block Designs: Balanced incomplete block design, simple lattice design, Split-plot design, strip-plot design, Groups of experiments in Time and Space.

Learning Outcomes

After successful completion of this module, learners should be able to

- Outline the theory of general linear model and the principles of analysis of variance;
- Use Analysis of Basic Design I & II and factorial design; and
- Apply experimental design models.

Learning Materials: OU manual

Time Series Analysis [OUbs030123]

Aim of Module

Time series are widely available in various aspects of the economy and society. This module introduces learners to time series models in common use and their use for predicting future observations and/or estimating unobservable components like trend and seasonal effects.

Module Contents

The module covers differences of time series data compared to other data sets; Basic concepts of time series; Global models for trends and seasonal; the periodogram and spectral analysis; Local models and moving average methods; ARIMA modelling and forecasting; Exponential smoothing; Estimation of unobservable components using a software package

Learning Outcomes

After successful completion of this module, learners should be able to:

- Define the basic concept of time series data;
- List the theoretical bases of different methods of time series analysis; and
- Show the decomposition of time series into trend, seasonal and irregular components.

Learning Materials: OU manual

Parametric and Non-Parametric Methods [OUbs030124]

Aim of Module

The aim of this module is to develop learners' skills to important topics on how to calculate and interpret test of significance, one sample tests, asymptotic Relative Efficiency, general two sample problem.

Module Contents

The module covers <u>Test of significance</u>: Statistics and the concept of its sampling distribution, standard error of a sample moment, test based on normal, t, χ^2, F and Fisher's Z-transformation; <u>Order Statistics</u>: Joint and marginal distributions, distribution of range, asymptotic distribution of sample median, non-parametric approach; <u>One Sample Tests</u>: Sign test, Wilcoxon-Signed Rank test, Kolmogorov Smirnov One-Sample test; <u>Asymptotic Relative Efficiency</u>: Pitman's theorem, ARE for Sign test; <u>General Two-Sample Problem</u>: Walfowitz run Test, Wilcoxon-Mann-Whitney test, Kolmogorov-Smirnov two sample test (for samples of equal size), Median test, ARE for Mann-Whitney test; <u>Two sample Scale Problem</u>: Mood test, Ansari-Bradley test, Tests of randomness based on total number of runs and successive differences, Kendall's tau, Coefficient of association for Bivariate samples.

Learning Outcomes

After successful completion of this module, learners should be able to:

- Use significance test and test based on normal, t, χ^2, F and Fisher's Z-transformation;
- Apply one sample tests and general two sample problem and interpret the results; and
- Select an appropriate test of randomness based on total number of runs and successive differences.

Learning Materials: OU manual

Data Analysis using Statistical packages [OUbs030211]

Aim of Module

This module provides coverage of essential statistical concepts, data manipulation and analysis methods, and software skills in commercial analysis packages. This module aims at introducing learners to statistical packages which are suitable for data entry, data graphics and analysis. The widespread commercial statistical packages SAS, SPSS are introduced and utilised with Excel for most analyses. The statistical programming language R is also given brief attention. This module is supplemented by practical exercises using statistical packages.

Module Contents

This module covers SPSS/STATA, R software; Statistical concepts; Data entry and exploration; Data manipulation and analysis methods; Different types of data and their numerical/graphical treatment; Basic statistical models and tests; Applying simple linear regression to analyse data; Applying multiple linear regression to analyse data;

Learning Outcomes

By the end of this module, learners should be able to

- Apply the software packages effectively to input, summarise and explore data;
- Analyse data using statistical packages; and
- Draw various statistical plots and fit simple linear and multiple linear regression models.

Management Principles [OUbs030212/MGTPRIN100]

Aim of Module

Within this fast-paced world, the role of managers is ever changing. Hence as a manager in the 21st century, you must be prepared for the challenges presented by a highly dynamic and rapidly changing business environment. This module therefore seeks to provide you with an understanding of the key concepts and skills relevant to the principles and practices of management.

Module Contents

This module covers The Nature of Management, Planning as a Management Function, Organizing as a Management Function, Directing as a Management Function, Controlling as a Management Function.

Learning Outcomes

After successful completion of this module, learners should be able to

- Compare and contrast management versus leadership;
- Apply the management functions (Planning, Leading, Organizing and Controlling);and
- Describe the principles and best practices of business management.

Learning Materials: OU manual

Biostatistics [OUbs030213]

Aim of Module

This module introduces fundamental concepts and definitions for biostatistics. It aims to enable learners to apply bio statistical methods to address public health research questions. The discipline of

biostatistics provides tools and techniques for collecting data, then summarizing, analysing and interpreting it. In particular, it supports learners further to reach a level of proficiency where they will be able to select the appropriate statistical analytical method to address specific research questions with a given data set, conduct the selected statistical analysis using SAS, present and interpret the results appropriately and draw valid and insightful conclusions about the research question.

Module Contents

An introduction to Biostatistics; Biostatistics issues, what role does statistics have in public health? Describing data, Planning/design of studies, quantifying information, comparing and selecting participants. Data collection, analysis, variability, inference, presentation, conveying/rectifying uncertainty of estimates based on the data, interpretation, Comparing means among two (or more) independent populations/Wilcoxon test, Cis for mean difference between two independent populations. Mann Whitney, ANOVA/Konskal wallis test.

Learning Outcomes

After completing this module, learners should be able to

- Define the fundamental concepts of biostatistics;
- Use the appropriate statistical analytical technique for different epidemiological study designs and datasets; and
- Conduct statistical analysis using advanced techniques on complex datasets with different types of variables.

Learning Materials: OU manual

Statistical Inference I [OUbs030214]

Aim of Module

This module provides an introduction to important topics in principles of statistical inference, its origins in decision support and the nature of statistical parameters. Specific topics include statistical decision problem, methods of estimation, point estimation and interval estimation with the different theorem application. It covers the theory underlying modern statistics and aim to give the learners a

solid grounding in (mathematical) statistics and the principles of statistical techniques in practical applications.

Module Contents

This modules covers <u>Point Estimation</u>: The general statistical decision problem, Examples point estimation, interval estimation etc. Criteria of Unbiasedness, Consistency and Efficiency of Statistical Distribution for which Cramer-Rao lower bound is attainable; <u>Point Estimation and Interval Estimation</u>: Sufficient Statistics, Fisher-Neyman criterion, Characterisation of distribution admitting sufficient statistics. Rao-Blackwell theorem, Completeness and Lehman-Scheffe theorem, Determination of confidence intervals based on small and large samples, Relation between confidence estimation and hypothesis testing and Unbiased confidence interval; <u>Methods of Estimation</u>: Method of maximum likelihood, Optimum properties of maximum likelihood estimates and Other methods of estimation (moments, minimum χ^2 and modified minimum χ^2).

Learning Outcomes

After completing this module, learners should be able to:

- Choose an appropriate method of estimation; and
- Derive point of estimation.

Learning Materials: OU manual

Statistical Inference II [OUbs030221]

Aim of Module

This module provide an introduction to statistical hypothesis testing and its application. The meaning and value of ubiquitous constructs such as p-values, confidence sets, and hypothesis tests are explained. The emphasis is also on the Sequential Analysis, definition of SPRT, fundamental relations among α, β, A, B, Determination of A and B in practice. This module is supplemented by practical exercises using statistical packages.

Module Contents

This modules covers <u>Testing of Hypothesis I</u>: Simple and Composite Hypothesis, Pure and Randomised Tests, Errors of the first and second kinds, Power of a test, Most powerful test, Neymann-Pearson Lemma and its generalisation, Derivation of common tests of a simple hypothesis against a simple alternative, Uniformly most powerful tests and UMP tests of one sided hypothesis for distributions with monotone likelihood ratio tests; <u>Testing of Hypothesis II</u>: UMP unbiased tests, similar tests with

Neymann structure, Locally best unbiased tests, type A and A_1 critical regions for the exponential family, Likelihood ratio tests, Derivation of common likelihood ratio tests and Asymptotic distribution of the logarithm of likelihood ratio; <u>Sequential Analysis</u>: Definition of SPRT, Fundamental relations among α, β, A, B, Determination of A and B in practice, Wald's fundamental identity and the derivation of O.C. and A.S.N. functions, Proofs of the ultimate termination of S.P.R.T., Tests for simple hypothesis, Efficiency of S.P.R.T., Examples based on Normal, Poisson, Binomial and Exponential distributions.

Learning Outcomes

After completing this module, learners should be able to:

- Test hypotheses;
- Derive tests of association between variables using the chi-square distribution; and
- Define SPRT and perform sequential analysis.

Research Methods [OUbs030222/RESMETH100]

Aim of Module

The objective of this module is to introduce the key elements of a research project and the key concepts related to research design. It will prepare learners to design and carry out business research studies for dissertation in a consistent and scientific manner.

Module Contents

Primary and secondary research; Quantitative research designs; Survey design and administration issues; Qualitative research; Sampling processes; Questionnaire design; Information collection process; Data analysis Interval estimation and Hypothesis testing; Single equation regression model; Two Variable regression analysis; Classical Normal Linear regression Model; Two Variable Regression; Multiple regression Analysis; Estimation and inference; Ethics in Research

Learning Outcomes

After completing this module, learners should be able to

- Acquire the key elements of a research project and the key concepts related to research design;

- Use appropriate research methods adapted to the needs of their dissertation; and
- Design and carry out research studies for their dissertation in a consistent and scientific manner.

Learning Materials: OU manual

Econometrics [OUbs030223/ECOMET100]

Aim of Module

This module provides an introduction to econometric theory and empirical work in econometrics. In particular, this module aims to equip learners with the following competencies: an awareness of the empirical approach to economics, experience in the analysis and use of empirical data in economics, understanding the nature of uncertainty and methods of dealing with it and the use of econometric software packages as tools of quantitative and statistical analysis.

Module Contents

The module envelopes estimation of parameters in a single equation model, Classical least squares, Generalised least squares, Heteroscedascity; Problems of multicollinearity, Errors in variables and errors in the equation; Test of independence of disturbances by Durbin-Watson Statistics, Estimation of parameter when disturbances are auto-correlated; Panel data models, Distributed log model and estimation of parameters; Indentifiability, Rank and order conditions, Estimation by indirect least squares and two stage least squares; Principal components, Two stage least squares and principal components, Three stage least squares and full information maximum likelihood.

Learning Outcomes

After completing this module, learners should be able to

- Define econometric methodology; and
- Describe the basic econometric techniques, examining both their theoretical justifications and limitations, and their practical application.

Learning Materials: OU manual

Applied Stochastic Processes [OUbs030224]

Aim of Module

This module introduces the concept of random process and enable learners to solve problems involving random processes from variety of applications. Learners are introduced with some of the properties and applications of Markov chains, Poisson process and Stochastic integrals. Learners completing this module will possess an enviable grasp of the utility and power of modern statistics for describing real-life situations.

Module Contents

The module covers a wide variety of stochastic processes and their applications; Markov chains; processes in continuous-time such as the Poisson process, the birth and death process and queues; modern Bayesian methods for data analysis; Chapman-Kolmogorov equation; Weiner process, methods for solution of diffusion equation; stochastic integrals, stochastic differential equations, their properties and methods of solution; simulation techniques

Learning Outcomes

After completing this module, learners should be able to

- Use stochastic integrals and perform basic operations; and
- Solve the stochastic differential equation.

Learning Materials: OU manual

Big Data Analytics [OUbs030311]

Aim of Module

The aim is to address these aspects and challenges of Big Data Analytics by introducing scalable parallel data mining algorithms which can be executed on computer clusters such as Hadoop; the introduction of data stream mining techniques and algorithms for the analysis of high velocity data; the introduction to sentiment analysis techniques for unstructured data such as micro-blogging data and social network data; and the introduction of scalable recommender systems.

Module Contents

This module provides an introduction to Big Data Analytics principles and challenges; Data mining techniques and tools for Large Data set Analysis, in particular parallel data mining techniques; Data mining algorithms and tools for the analysis of fast streaming real time data; Data mining techniques for building recommender systems; Data mining techniques and algorithms for unstructured data analysis

Learning Outcomes

After completing this module, learners should be able to:

- Describe the challenges of Big Data Analytics;
- Apply algorithms and techniques to tackle these challenges; and
- Use some state-of-the art software tools for the implementation of Big Data Analytics solutions and become familiar with real world applications of Big Data Analytics.

Learning Materials: OU manual

Economic Statistics [OUbs030312/ECOSTAT100]

Aim of Module

This module introduces the basic concepts relevant to the field of Economics Statistics, ranging from data representation and collection of hypothesis testing, correlation and prediction. These concepts are regularly applied in the world of economics, finance and banking for understanding the market and designing appropriate strategies. The module has the specificity that the concepts and analysis are demonstrated by examples and data drawn from the fields of banking, finance and economics. It also equips learners with the necessary background for investigating real-world data.

Module Contents

The module covers the types of data applied in economics and finance; economical and financial data collection in Mauritius; concept of probability and the potential for application in the economic and financial sectors; introduction to optimization and game theory; concept of correlation and causation; estimate of line of best fit and prediction; introduction to index numbers; basic theory of index numbers; types of index numbers, consumer price indices and their uses; errors in index numbers; re-basing techniques; administrative data; surveys of businesses; other economic surveys.

Learning Outcomes

By the end of this module, learners should be able to:

- Define and distinguish types of data applied in economics and finance;
- Apply the techniques for data description based on statistical measures of central tendency and dispersion; and
- Apply index numbers in economic decision making process.

Statistical Quality Control [OUbs030313]

Aim of Module

This module provides an introduction to key concepts and tools that underpin the issue of quality and reliability in statistical process control. The emphasis is also on the interpretation and concepts of Bayesian interpretation.

Module Contents

The module covers Process Control: Control charts for variables ($\overline{X}$, R, s charts) and attributes (p, np and c-charts). Revision of control limits, O.C. functions; Product Control: Sampling inspection plans for attributes, Single sampling plan, OC, AOQ, AOQL, LTPD and ASN. Double sampling plan. Plan evaluation and design, Dodge-Roming table; Reliability of a Unit: Basic characteristics for Exponential, Normal, Lognormal, Weibull, Gamma and Gumbel failure laws; Reliability of Renewable Unit: Basic characteristics of Renewal process and its asymptotic behaviour and problems based on them; System Reliability: Reliability of a system with independent units connected in (a) series (b) parallel. Reliability of renewable systems, point estimation procedures for exponential failure law from experimental-data for (N,C,T), (N,C,r), (N,B) and (N,B,r) plans; Bayesian Estimation: Bayes estimation, Exponential, Weibull and Normal distribution and Reliability estimation.

Learning Outcomes

After completing this module, learners should be able to

- Construct control charts for variables;
- Assess reliability of statistical process operation; and
- Apply Bayes' theorem to calculate probabilities in simple situations.

Learning Materials: OU manual

Operations Research [OUbs030314]

Aim of Module

Organisations very often have to make decisions under tight constraints in view of optimising on resources to achieve maximum profitability. In a competitive environment, it is not wise to waste resources and in this regard, a scientific approach needs to be adopted to come up with optimal solutions for specific problems. Therefore, Operations Research methods can be applied in different contexts such as in the optimisation of resources, linear programming, transportation problem and in inventory control problems. This module aims at equipping the learners with the necessary tools to find optimal solutions to problems involving the operation of a system.

Module Contents

The module covers Linear Programs and Duality: Formulating linear programs, Simplex algorithm, Dual linear program, Duality theorem, Dual simplex method; Transportation and Assignment Problems: Formulation of Transportation problem and Assignment problem, Solution of transportation problem, Degeneracy in Transportation, Solution of Assignment problem; Determination Inventory: The components of an inventory system, Demand and replacement pattern. The problem of EOQ with uniform demand and several production runs of unequal length. The problem of EOQ with finite rate of replenishment. The problem of EOQ with shortages; Probabilities-Inventory Systems: Order level systems, Stochastic order level systems with continuous and discrete demand; Replacement and Sequencing Models: Replacement of items that fail, Replacement of items that deteriorate, Sequencing of n-jobs on two-machines and three-machines with no passing; CPM and PERT: Determination of critical tasks, PERT, Probability of completing the project on schedule.

Learning Outcomes

After completing this module, learners should be able to:

- Apply linear programming;
- Choose an appropriate methods for optimising resources using transportation and assignment problem and inventory modes; and
- Use CPM and PERT in the context of operational research.

Data Science for Business [OUbs030321]

Aim of Module

Data science is a set of fundamental principles that guide the extraction of valuable information and knowledge from data. The aim of this module is to develop learner's understanding of data science in

the context of business examples. It also shows how the principles of data science provide understanding of many of the most common methods and techniques used in data science.

Module Contents

This module covers data science solutions for business problems; introduction to predictive modelling, fitting model to data; machine learning; similarity and clustering; decision analytic thinking; visualizing model performance; data science and business strategy; Ethics and Legal implications: Data protection Act.

Learning Outcomes

By the end of this module, learners should be able to:

- Formulate context-relevant questions and hypotheses to drive data scientific research;
- Identify, obtain and transform a data set to make it suitable for the production of statistical evidence communicated in written form;
- Conduct ethical statistical analysis based on data science; and
- Assess the legal implications for protecting data.

Multivariate analysis [OUbs030322]

Aim of Module

This module provides introductory and advanced training in the applied analysis of multivariate data. Emphasis is upon practical analysis of data and the extraction of answers from real-life data. Basic theory is given covering matrix algebra, metrics and general measures of similarity. In many experiments or surveys, several different variables are recoded for each of many individuals. The problems associated with this sort of data can be tackled using multivariate data analysis techniques. The methods to be discussed will be descriptive in nature and include the following topics: principal component analysis, canonical variants analysis, cluster analysis and factor analysis.

Module Contents

The module covers <u>Multivariate Normal Distribution Theory</u>: The multivariate normal distribution, Distribution of linear combinations of normally distributed variables. Conditional, marginal distributions. Independence of variables. Characteristic, moment generating functions. Distribution of quadratic forms; <u>Estimation of Parameters in Multivariate Normal Distribution</u>: Maximum likelihood estimation of mean vector and the variance covariance matrix and independence of their distributions. Test of hypothesis on means. Sufficient statistics for mean vector and variance covariance matrix; <u>Hotelling's T^2</u>: Distribution of the Hotelling's T^2. T^2 – Statistics as a function of

likelihood ratio criterion. Invariance property of T^2. Uses of T^2 – Statistics. Distribution of Mahalanobis's D^2; Wishart Distribution: Definition and its distribution. Characteristic function. Additive property of Wishart distribution. Generalised variance and its distribution. Testing of sets of variates and equality of covariance. Multivariate analysis of variance; Discriminant Analysis: Classification of observations into one or two or more groups. Estimation of the misclassification probabilities. Test associated with discriminant functions; Principal Component: Definition and properties of principal components. Computation of principal components; Canonical Correlations and Canonical Variates: Definition and estimation of canonical correlations and variates; Factor Analysis: Basic assumptions of factor analysis. The mathematical model. Estimation of the factor loadings. Relationship between factor analysis and principal component.

Learning Outcomes

After completing this module, learners should be able to

- State the role of multivariate analysis in statistics;
- Identify the most appropriate statistical techniques for a multivariate dataset; and
- Carry out commonly used multivariate data analysis techniques and interpret results.

Learning Materials: OU manual

Advanced Statistical modelling [OUbs030323]

Aim of Module

This module will introduce the main ideas of linear and generalised linear statistical modelling and will provide training in applied statistical modelling. It further provides learners to a solid grounding in the fundamental theory and practice of advanced statistical modelling and the analysis of observational, experimental data, multiple linear regression and generalized linear models.

Module Contents

The module covers the statistical models: what statistical models are and what they are for; distributions, point and interval estimation and hypothesis testing; simple linear regression models for normal data; multiple regression; multiple regression with qualitative explanatory variables; less linear models for non-normal data; generalised linear models.

Learning Outcomes

After completing this module, learners should be able to:

- Define the theory of statistical modelling of data from real applications;

- Compare the analysis of observational, experimental data, multiple linear regression and generalized linear models; and
- Use advanced statistical software to analyse real data from surveys, designed experiments and other sources

Learning Materials: OU manual

Dissertation [OUbs030324]

The research project will allow the learner to examine thoroughly an area or a problem related to businesses. The project will draw upon significant concepts and techniques introduced during the taught part of the course and will look for to merge the theory and practice of management through the achievement of a considerable and related in-depth piece of work. The review of the final year project will be based on the compliance of a report which should be in the range of 12,000–15,000 words.