BScHons (Mathematical Statistics) *Statistics and Data Science* (02240194)

Department	Statistics
Minimum duration of study	1 year
Total credits	135
NQF level	08

Admission requirements

1. Bachelor's degree with statistics **or** relevant bachelor's degree
2. A weighted average of at least 65% for Statistics at final-year level
3. An admission examination may be required

Note: Additional modules may be required in order to reach the desired level of competency
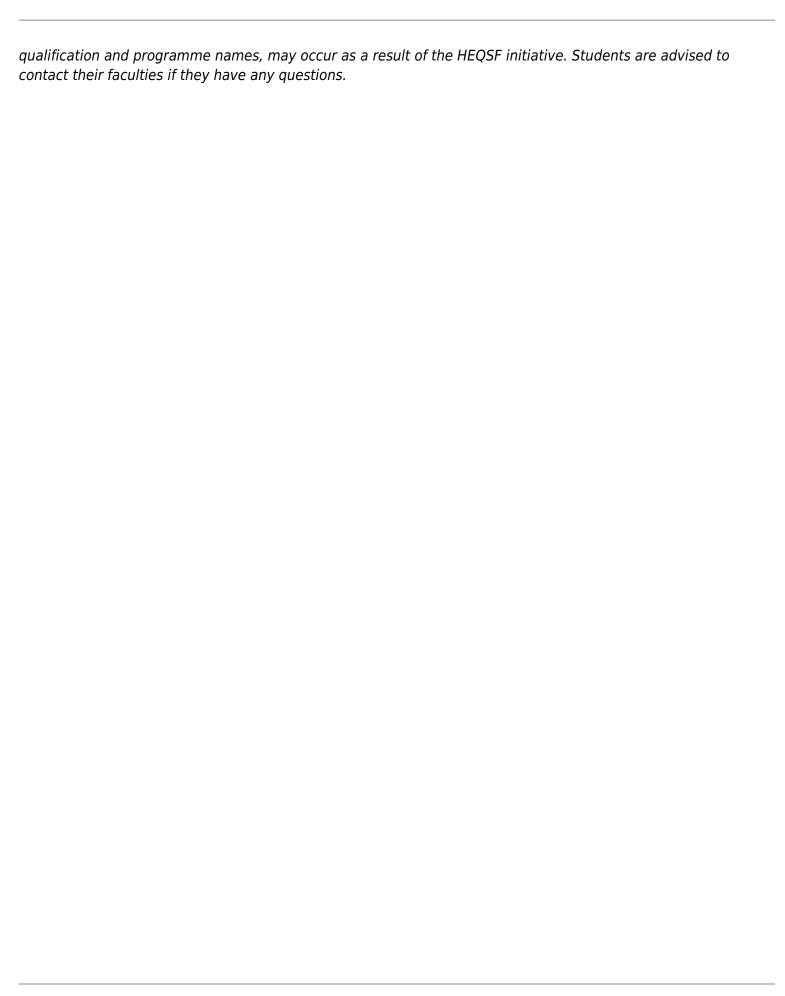
Other programme-specific information

- Details of compilation of curriculum are available from the Head of the Department of Statistics as well as from the departmental postgraduate brochure.
- A candidate must compile his/her curriculum in consultation with the head of department or his/her representative. It is also possible to include postgraduate modules from other departments. Refer to the Departmental website for further information.
- All honours students in Statistics/Mathematical Statistics must enrol for STK 796 which is a compulsory but non-credit-bearing module.
- An external student who does not fully meet the requirements to enter this degree can register, with permission from the head of department and the postgraduate committee for STK 310, 320, 353 and WST 212 in year 1 full-time for non-degree purposes. Provided a 65% average for these is achieved, the student can then complete the BScHons (Statistics) modules in year 2.

General information

University of Pretoria Programme Qualification Mix (PQM) verification project

The higher education sector has undergone an extensive alignment to the Higher Education Qualification Sub-Framework (HEQF) across all institutions in South Africa. In order to comply with the HEQSF, all institutions are legally required to participate in a national initiative led by regulatory bodies such as the Department of Higher Education and Training (DHET), the Council on Higher Education (CHE), and the South African Qualifications Authority (SAQA). The University of Pretoria is presently engaged in an ongoing effort to align its qualifications and programmes with the HEQSF criteria. Current and prospective students should take note that changes to UP

qualification and programme names, may occur as a result of the HEQSF initiative. Students are advised to contact their faculties if they have any questions.

Curriculum: Final year

Minimum credits: 135

Core credits: 75
Elective credits: 60 (choose four electives from the list)

A student cannot get credit for either RAL 780 or MET 720 with a WST undergraduate major.

Core modules

Introduction to statistical learning 720 (EKT 720)

Module credits	15.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	RAL 780 or WST 311, 312, 321
Contact time	1 lecture per week, 1 web-based period per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

The emphasis is on the theoretical understanding and practical application of advances in statistical modelling. The following topics are covered: Single equation models: Nonparametric regression. Bootstrap procedures within regression analysis, k-nearest neighbour classification. Modelling categorical dependent variables - Logit/Probit models. Multiple outputs. Linear regression of an indicator matrix. Ridge regression. Non-linear regression modelling. Some new developments in regression and classification.
Simultaneous equation models: Specification, identification and estimation of simultaneous equation models.

Multivariate techniques 720 (MET 720)

Module credits	15.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to either BScHons Statistics and Data Science or BComHons Statistics and Data Science.
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Point and Interval estimation. Sampling distributions, central limit theorem, simulations and Bootstrap. Bayesian inference, posterior distribution. Hypotheses testing using confidence intervals, ratio tests, simulated null distributions and power function. A student cannot get credit for this module with a WST undergraduate major.

Regression analysis 780 (RAL 780)

Module credits	15.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to either BScHons Statistics and Data Science or BComHons Statistics and Data Science.
Contact time	1 lecture per week, 1 web-based period per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Matrix methods in statistics. Simple and multiple regression models. Sums of squares of linear sets. Generalised t- and F-tests. Residual analysis. Diagnostics for leverage, influence and multicolinearity. Indicator variables. Regression approach to analysis of variance. Weighted least squares. Theory is combined with practical work. A student cannot get credit for this module with a WST undergraduate major.

Research report: Statistics 795 (STK 795)

Module credits	30.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to either BScHons Statistics and Data Science or BComHons Statistics and Data Science.
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Year

Module content

Refer to the document: Criteria for the research management process and the assessment of the honours essays, available on the web: www.up.ac.za under the Department of Statistics: Postgraduate study.

Research orientation 796 (STK 796)

Module credits	0.00
NQF Level	08
Service modules	Faculty of Economic and Management Sciences

Prerequisites	Admission to the relevant programme.
Contact time	Ad Hoc
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Year

Module content

A compulsory bootcamp must be attended as part of this module – usually presented during the last week of January each year (details are made available by the department). The bootcamp will cover the basics of research to prepare students for the research component of their degree. The bootcamp should be done in the same year as registration for STK 795/WST 795. Each year of registration for the honours degree will also require the attendance of three departmental seminars. Students should ensure that their attendance is recorded by the postgraduate co-ordinator present at the seminars. The department approves the seminars attended. In addition, students are required to present their STK 795/WST 795 research in the department during the year of registration for these modules.

Elective modules

Text and behavioural analytics 725 (EKT 725)

Module credits	15.00
NQF Level	08
Prerequisites	Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Mixtures of distributions and regressions, frequentist and Bayes estimation. Latent components, soft allocation and belongings. Applications in unstructured data, including text data. Identification and interpretation of behavioural patterns.

Sampling techniques 720 (SFT 720)

Module credits	15.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science

Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Simple random sampling. Estimation of proportions and sample sizes. Stratified random sampling. Ratio and regression estimators. Systematic and cluster sampling. Introduction to spatial statistics. Spatial sampling – both model and design based approaches.

Statistical process control 780 (SPC 780)

Module credits	15.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to either BScHons Statistics and Data Science or BComHons Statistics and Data Science.
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Quality control and improvement. Shewhart, cumulative sum (CUSUM), exponentially weighted moving average (EWMA) and Q control charts. Univariate and multivariate control charts. Determining process and measurement systems capability. Parametric and nonparametric (distribution-free) control charts. Constructing control charts using Microsoft Excel and/or SAS. Obtaining run-length characteristics via simulations, the integral equation approach, other approximate methods and the Markov-chain approach.

Simulation and computation 710 (STC 710)

Module credits	15.00
NQF Level	08
Prerequisites	Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Efficient programming, Monte Carlo simulation, sampling of discrete and continuous probability models, General transformation methods, Accept-reject methods, Monte Carlo integration, importance sampling, numerical optimisation, Metropolis-Hastings algorithm, GIBBS sampling.

Capita selecta: Statistics 720 (STC 720)

Module credits	15.00
NQF Level	08
Prerequisites	Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

This module considers specific topics from the diverse field of statistics as deemed supportive towards the training of the cohort of scholars.

Linear mixed models 781 (STK 781)

Module credits	15.00
NQF Level	08
Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to either BScHons Mathematical Statistics or BComHons Mathematical Statistics or BScHons Statistics and Data Science or BComHons Statistics and Data Science
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 1 or Semester 2

Module content

Specification of linear mixed model, model assumptions, estimation (REML and ML), diagnostics, hypothesis tests, interpretation of parameter estimates, calculating predicted values. Specific models: two- and three-level models for clustered data, intraclass correlation coefficients, repeated measures data, random coefficient models for longitudinal data, models for clustered longitudinal data, models for data with crossed random factors. Using statistical software to analyse LMMs.

Regulations and rules

The regulations and rules for the degrees published here are subject to change and may be amended after the publication of this information.

The General Academic Regulations (G Regulations) and General Student Rules apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations.

University of Pretoria Programme Qualification Mix (PQM) verification project

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