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# Statistics for the College of Economic and Management Sciences

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(offered by the Department of Statistics)  
Telephone number 012 429 6464

## 1

### Introduction

Statistics is applied in fields which have economic, social and marketing research as well as population problems in common. Where data is used in a decision-making process, the expertise of a statistician is essential.

Statisticians are 'data engineers' who deal with problems such as how to obtain reliable information, analyse market trends and how to draw valid conclusions from data.

## 2

### General information

- All Statistics modules are YEAR MODULES and not semester modules. All examinations take place during October/November, with supplementary examinations in January/February.
- From 2007 all modules are linked to a year mark system. The year mark plus the October/November examination mark will be your final mark. Should you have a supplementary examination, the year mark is not incorporated into that examination mark. In Statistics the year mark is calculated according to marks earned in assignments. More details will be given, per module, in Tutorial letter 101.
- Mathematics at Matriculation level is NOT a prerequisite for the modules STS111, STS112 or STS105.
- There is an increasing demand from employers that students in statistics be trained in the use of statistical software. Our curriculum is under revision since 2006. First-year modules include computer printouts, but computer access is not essential. In STA203 students will be introduced to a statistical software package and access to a computer for STA203 and STA305 is compulsory. For all other undergraduate modules access to a computer is advised but (at this stage) not compulsory.
- Access to a computer is compulsory from the second level onwards as CDs form part of the study material in certain modules.
- A prescribed book forms part of the study material for most of the modules. All details per module are given in tutorial letter 101. The list of Unisa bookstores appears in *Unisa Services and Procedures 2007*.
- Credit for a degree is granted for:
  - (i) either STS101 and STS102 or STS111 and STS112
  - (ii) either STA205 or STA313
  - (iii) either STA312 or STA309

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### Transitional Arrangements

- A student who has passed:
  - (a) the modules STS101, STS102 (prior to 2006) retains credit for Statistics I and may now register for Statistics II as indicated below;
  - (b) only STS102 must forfeit credit for the module concerned and has to complete the modules STS111 and STS112 to obtain Statistics I.
  - (c) both STS101 and STS102 will receive credit for STS1113 and STS1124
  - (d) only STS101, will receive credit for STS1113 (continue with STS1124)
  - (e) only STS102, will have to pass both STS1113 and STS1124 (will not receive credit)
  - (f) both STA101 and STA105 will receive credit for STS1113 and STS1124
  - (g) only STA105, will receive credit for STS1113 (continue with STS1124)
- Students who did NOT pass any second-level Statistics modules prior to 2003, must pass two second-level Statistics modules to complete Statistics II.
- Students who passed Statistics II prior to 2002 but did not pass ANY third-level Statistics modules prior to 2006, must pass five third-level Statistics modules in order to complete Statistics III.

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### Syllabus

#### **NB**

All modules in this subject are offered as YEAR MODULES.

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#### **FIRST-LEVEL MODULES**

#### **NB**

- The modules STA101H, STA105M, STS101X and STS102Y have been phased out.
  - In the case of BCom specialisation where the choice of modules allows for only one module in statistics, the modules STS111 and STS112 are replaced with STS105.
  - The STS105 is a service module and does not meet the requirements for admission to second-level modules.
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#### **STS1113 Descriptive statistics and probability (3 hours)\***

Prerequisite: Rule G13, Part 1 of the Calendar

*Purpose:* to have an informed understanding of exploratory data analysis as used in graphical and tabular techniques; measures of central location, variability and linear relationships; simple sampling procedures. Students should be able to use probability as a tool to create discrete and continuous probability distributions, used extensively in statistical inference. The contents of this module have important applications in finance and are useful in several management sciences.

**STS1124 Data analysis and inference (3 hours)\***

*Co-requisite:* STS111

*Prerequisite:* Rule G13, Part 1 of the Calendar

*Purpose:* to have a basic perspective of the role of the sampling distribution of the mean, a proportion and the difference between two means in statistical inference, interval estimation and hypothesis testing. Students will be able to estimate single and combinations of population parameters; understand one-way analysis of variance; apply parametric and nonparametric tests such as two Chi-squared tests and the Wilcoxon signed rank sum test. They will also be familiar with simple linear regression and correlation, as well as with the basics of time series analysis and forecasting. The contents of this module are relevant in a wide variety of applications in business and economics and represent a significant contribution to the development of the student as a statistics practitioner.

**STS1055 Basic statistics (3 hours)\***

**NB**

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*This module does not meet the requirements for admission to second-level modules.*

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*Prerequisite:* Rule G13, Part 1 of the Calendar

*Purpose:* to gain an understanding of basic statistical concepts and turn data into information. After completion students should be able to distinguish between the different types of data and their summaries, have knowledge of different sampling methods and surveys; examine relationships between quantitative variables and categorical variables. They should be able to interpret probability concepts and apply the rules; differentiate between discrete and continuous random variables with the binomial and normal random variables as respective examples; understand sampling distributions for one mean and one proportion as well as for the difference of two means and two proportions – all as preparation for appreciation of statistical inference. Students should know how to compute confidence intervals and apply hypothesis testing for these parameters; learn about simple regression; inference for categorical variables using specific Chi-square tests.

**SECOND-LEVEL MODULES**

Statistics II consists of TWO modules:

**STA203N Applied statistics (3 hours)\***

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*Access to a computer is compulsory for the module STA203 as a CD forms part of the study material.*

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*Prerequisite:* either STS101 and STS102 or STA101 and STA105 or STS111 and STS112. Access to a computer is compulsory.

*Purpose:* to enable students to identify the correct technique, manage the statistical software JMP to do the computations and interpret the results for decisions regarding tests for normality, independence and hypotheses concerning means, variances and regression.

Plus ONE of the following modules:

**STA206R Sampling and survey methods (3 hours)\***

*Prerequisite:* (STS101 and 102) or STA105 or STS111

*Purpose:* to gain insight into the practical aspects of survey problems, focusing on applications; sample survey design; estimation procedures and the fundamental role that probability plays in making inferences. After completion students should have appreciation for the importance of questionnaire design, methods of data collection, estimation procedures and sources of errors in surveys.

**STA208T Forecasting (3 hours)\***

*Prerequisite:* (STS101 and 102) or (STA101, 105) or (STS111 and STS112)

*Purpose:* to see forecasting as a structured process of classified techniques. After completion students can explore time series data, looking at seasonality, stationarity and trend; classify techniques for forecasting and assess accuracy of forecasts; deal with different characteristics of time series, such as smoothing methods and seasonal models; establish credibility in forecasting and implement the forecasting process.

**NB**

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*In the case of the BCom with specialisation in Quantitative Management STA202M may be chosen as an option.*

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**STA202M Distribution theory (3 hours)\***

*Prerequisite:* STA101, 105 and QMS101 or STS111, 112 and QMS101

*Purpose:* to gain insight into the role that formal theory plays in data analytic methods, discussing a wide variety of discrete and continuous distributions simultaneously. After completion students should understand the joint probability structure of two random variables (discrete and continuous case); be able to calculate expectation, variance, covariance, conditional expectation and moment-generating functions; have insight into distributions of functions of independent random variables; prove the law of large numbers and the central limit theorem under fairly strong assumptions; comprehend how the Chi-square, t, and F distributions are derived from the normal distribution.

**THIRD-LEVEL MODULES**

Statistics III consists of the following FIVE modules:

**STA305T Analysis of variance and regression (3 hours)**

*Prerequisite:* STA203 plus any other second-level Statistics module. Access to a computer is compulsory.

*Co-requisite:* STA311 and STA313

*Purpose:* to enable students to demonstrate an understanding of one- and two-way analysis of variance, fixed effects and mixed models, and simple and multiple linear regression.

**STA306U Sampling techniques (3 hours)\***

*Prerequisite:* STA203 plus any other second-level Statistics module.

*Advice:* Knowledge of the content of STA206 is advised.

*Purpose:* to gain more advanced insight into stratified random sampling; systematic and cluster sampling; estimation of the sample size; ratio and regression estimation; sampling with unequal probabilities; complex surveys; non-response.

**STA311R Mathematical techniques for statistics (3 hours)\***

*Prerequisite:* STA203 plus any other second-level Statistics modules

*Advice:* This module contains only different mathematical techniques and basic knowledge of grade 12 mathematics or the contents of the module QMS101 is strongly recommended.

*Purpose:* to gain a basic understanding of matrix presentations and be able to apply calculus in statistical calculations. After completion of this module students should have mastered the basics of matrix calculations; know about linear dependence and independence; determine the three matrix reductions; invert a matrix; find eigen values; apply all these techniques in statistics. Students should be able to solve problems where differentiation and integration techniques have to be applied.

**STA312S Time series (3 hours)\***

*Prerequisite:* STA203 plus any other second-level Statistics module.

*Co-requisite:* STA313

*Advice:* Knowledge of the content of STA208 is advised.

*Purpose:* to gain insight into Box-Jenkins methodology, AR, MA and ARIMA models; also to use statistical software for practical modelling of time series.

**STA313T Statistical distributions (3 hours)**

*Prerequisite:* STA203 plus any other second-level Statistics module

*Purpose:* to gain insight into a wide variety of discrete and continuous distributions. After completion students should understand the joint probability structure of two random variables (discrete as well as continuous); be able to calculate expectation, variance, covariance, conditional expectation and moment-generating functions; have insight into distributions of functions of independent random variables; comprehend how different distributions are derived from the normal distribution.