3.3.3.10 Statistics

Statistics is the scientific application of mathematical principles to the collection, analysis, and presentation of numerical data. How does a business determine if an available site for a new restaurant is a potentially successful location? How does the health authority assess statistical evidence for the effectiveness of a new vaccine? How does an insurance company determine the risk level of a new proposal?

Statisticians contribute to scientific inquiry by applying their mathematical and statistical knowledge to the design of surveys and experiments; the collection, processing, and analysis of data; and the interpretation of the results. Statisticians may apply their knowledge of statistical methods to a variety of subject areas, such as biology, business, economics, education, engineering, finance, marketing, medicine, psychology, public health, and sports. In particular, data science is an interdisciplinary field, driven by statistical ideas, for obtaining insights from data in various forms. It is often, but not always, concerned with methodology for big data problems, those which are at the forefront of the challenges of modern science.

Programme Structure and Curriculum Rationale

Statistics is an interdisciplinary subject by nature. In the development of Statistics, Mathematics and Computer Science respectively provide the theoretical foundation and the computational tools while real-world problems stimulate and guide further research. These considerations are reflected in the curriculum. In addition to Statistics modules, Statistics students are encouraged to read modules in Mathematics and Computer Science.

The core statistical education consists of probability and stochastic processes, statistical principles, computer-aided data analysis, and regression analysis. Honours students majoring in Statistics have the option to specialise in Data Science or in Finance and Business Statistics. The department has particular strengths in computational statistics, high-dimensional statistical analysis and statistical learning for data science, and in time series analysis, statistical methods for actuarial science and finance, and stochastic processes for Finance and Business Statistics.

Career Prospects

The world is becoming increasingly quantitative and data-focused. Many professions, organisations and businesses depend on numerical measurements to make decisions in the face of uncertainty. Statistics graduates may look forward to being employed as statisticians in government, medical and pharmaceutical industry, manufacturing and engineering companies, banking and financial institutions, research and tertiary institutions.

Further, there are many jobs that do not bear the word “statistician” but will rely much on the knowledge
and training that a student can acquire from studying Statistics at NUS. Some of these are business analyst, quality assurance engineer, pharmaceutical engineer, marketing professional, financial analyst, banking executive, telecommunication executive, actuary, data analyst, and risk analyst.

**Graduation Requirements (Statistics)**

To be awarded a B.Sc. or B.Sc. (Hons.) with a primary major in Statistics, candidates must satisfy the following:

<table>
<thead>
<tr>
<th>MODULE LEVEL</th>
<th>MAJOR REQUIREMENTS</th>
<th>CUMULATIVE MAJOR MCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level-1000 (16 MCs)</td>
<td>Pass ST1131 Introduction to Statistics</td>
<td>16</td>
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<td></td>
<td>or ST1232 Statistics for Life Sciences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or MA1101R Linear Algebra I</td>
<td></td>
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<tr>
<td></td>
<td>or MA1102R Calculus</td>
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<tr>
<td></td>
<td>or CS1010 Programming Methodology</td>
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<td></td>
<td>or CS1010E Programming Methodology</td>
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<td></td>
<td>or CS1010S Programming Methodology</td>
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<tr>
<td></td>
<td>or CS1010X Programming Methodology</td>
<td></td>
</tr>
<tr>
<td>MODULE LEVEL</td>
<td>MAJOR REQUIREMENTS</td>
<td>CUMULATIVE MAJOR MCS</td>
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<tr>
<td>Level-2000</td>
<td>Pass ST2131/MA2216 Probability ST2132 Mathematical Statistics ST2137 Computer Aided Data Analysis MA2311 Techniques in Advanced Calculus or MA2104 Multivariable Calculus or MA2108 Mathematical Analysis I or MA2108S Mathematical Analysis I (S)</td>
<td>32-33</td>
</tr>
<tr>
<td>(16-17 MCs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level-3000</td>
<td>Pass ST3131 Regression Analysis ST3236 Stochastic Processes I • Three other modules from ST32xx or ST4xxx modules • Two additional modules from ST32xx or ST4xxx modules or List A or List B modules</td>
<td>60-62</td>
</tr>
<tr>
<td>(28-29 MCs)</td>
<td></td>
<td></td>
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<tr>
<td>Level-4000</td>
<td>Pass ST4199 Honours Project in Statistics ST4231 Computer Intensive Statistical Methods ST4233 Linear Models • Two other modules from ST4xxx modules • One additional module from ST4xxx, ST5xxx or List B modules</td>
<td>92-94</td>
</tr>
<tr>
<td>(32-33 MCs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**List A**

- MA3209 Metric and Topological Spaces or Mathematical Analysis III
- MA3218 Applied Algebra
- MA3227 Numerical Analysis II
- MA3229 Introduction to Geometric Modelling
Honours students majoring in Statistics have the option to qualify for specialisation in

1. Data Science or
2. Finance and Business Statistics.

(A) To be awarded a specialisation in Data Science, a candidate must pass at least six modules (24 MCs) from the following two lists, with at least two modules (8 MCs) from list DS 1, as part of the major
requirements for B.Sc. (Hons.) with a primary major in Statistics:

**DS 1**

ST3240 Multivariate Statistical Analysis

CS3243 Introduction to Artificial Intelligence*

CS3244 Machine Learning*

ST3248 Statistical Learning I

ST4248 Statistical Learning II

**DS 2**

ST3247 Simulation

CS3210 Parallel Computing*

MA3252 Linear and Network Optimisation

ST4234 Bayesian Statistics

CS4231 Parallel and Distributed Algorithms*

DSA4211 High-Dimensional Statistical Analysis

DSA4212 Optimisation for Large-Scale Data-Driven Inference

MA4268 Mathematics for Visual Data Processing*

*Modules with hidden pre-requisites (indicated in brackets):
For students who wish to read these modules for the Data Science specialisation, the Faculty/Department will provide them with academic advice on their study plans (where necessary) as such students would have to read ‘additional’ pre-requisite modules.

(B) To be awarded a specialisation in Finance and Business Statistics, a candidate must pass at least six modules (24 MCs) from the following two lists, with at least two modules (8 MCs) from each of the lists (FBS 1, FBS 2), as part of the major requirements for B.Sc. (Hons.) with a primary major in Statistics:

**FBS 1**
- ST3233 Applied Times Series Analysis
- ST3234 Actuarial Statistics
- ST3246 Statistical Models for Actuarial Science
- MA3269 Mathematical Finance I
- ST4245 Statistical Methods for Finance
- MA4269 Mathematical Finance II

**FBS 2**
- ST3232 Design and Analysis of Experiments
- ST3239 Survey Methodology
- ST3242 Introduction to Survival Analysis
- ST3244 Demographic Methods
- ST4238 Stochastic Processes II

### SUMMARY OF REQUIREMENTS

<table>
<thead>
<tr>
<th></th>
<th>B.Sc.</th>
<th>B.Sc. (Hons.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Requirements</td>
<td>20 MCs</td>
<td>20 MCs</td>
</tr>
<tr>
<td>Faculty Requirements</td>
<td>8 MCs*</td>
<td>8 MCs*</td>
</tr>
<tr>
<td>Major Requirements</td>
<td>60-62 MCs</td>
<td>92-94 MCs</td>
</tr>
<tr>
<td>Unrestricted Elective Modules</td>
<td>30-32 MCs</td>
<td>38-40 MCs</td>
</tr>
<tr>
<td>Total</td>
<td>120 MCs</td>
<td>160 MCs</td>
</tr>
</tbody>
</table>

* Faculty requirements of 12 MCs and 16 MCs [required for the B.Sc. and B.Sc. (Hons.) programmes respectively] are partially fulfilled through the reading of CS/MA modules within the major.
Students undertaking the B.Sc. and B.Sc. (Hons.) programmes are required to fulfil the remaining 8 MCs of Faculty requirements from any two (2) of the following subject groups: Chemical Sciences, Life Sciences, Physical Sciences and Multidisciplinary & Interdisciplinary Sciences; but not from the following groups: Computing Sciences and Mathematical & Statistical Sciences.