

# STATISTICS (STAT)

Updated January 30, 2023

**Chair:** Professor N. Rampersad; **Professors:** M. Ghahramani, S. Hossain; **Associate Professors:** J. Babb; Z. Mashreghi; **Assistant Professors:** G. Pokharel, L. Wickramasinghe; **Instructors:** S. Khan, M. Nasri

## DEGREES/PROGRAMS OFFERED

**3-Year BA**

**3-Year BSc**

**3-Year BSc (Business Stream)**

**4-Year BA**

**4-Year BSc**

**4-Year BSc (Business Stream)**

**4-Year BA (Data Science Stream)**

**4-Year BSc (Data Science Stream)**

**Minor**

## INTRODUCTION

Statistics is the science of data collection, summarization, analysis, and interpretation. A central issue of statistics is how to make inferences about populations of interest, using data obtained from samples or designed experiments. Statistical techniques are applied extensively in virtually every branch of the physical, social, biological, and human sciences. Statistical methodologies and principles of inference are based heavily upon statistical theory, which, in turn has an essential underlying mathematical foundation. Computer software is typically used for statistical analysis of large data sets.

The Statistics Department offers 3-Year and 4-Year BA or BSc degree programs. Students pursuing a 4-year BSc or BA in Statistics have the opportunity to take a Data Science Stream. Students pursuing a 3-year or 4-year BSc in Statistics also have the opportunity to take a Business Stream (see the “Science with a Business Stream” section of this Course Calendar).

As a student of Statistics, one may study theoretical statistics and probability theory, which focuses on the logical development of statistical methods. One may also take courses which focus on the application of statistical methodology to data sets from a variety of disciplines. The Statistics Department also offers courses in simulation, operations research, and stochastic modeling.

Students who are not Statistics majors will find that a background in statistics is valuable in many areas. Students considering graduate study in various fields may benefit from many of our applied courses. For some programs, certain Statistics courses are required. An understanding of statistical concepts is important for numerical literacy.

Statisticians often work collaboratively with specialists in other fields to develop methodologies and analyze data for research studies. They may assist economists in the analysis of consumer prices, or with the design and analysis of large-scale socioeconomic surveys. Statisticians may help biologists, chemists and engineers in the design and analysis of experiments, or work with medical researchers to test the effectiveness of new drugs. They may also work with researchers in fields such as agriculture, anthropology, climatology, education, epidemiology, and geography. Other opportunities can be found in finance, marketing, and quality management. Many statisticians find employment with private corporations and government agencies, including Statistics Canada.

## REQUIREMENTS FOR A 3-YEAR BA/BSc IN STATISTICS

**ADMISSION REQUIREMENT** Students must consult with a member of the Department in planning their course of study.

**GRADUATION REQUIREMENT** 90 credit hours

### RESIDENCE REQUIREMENT

Degree: Minimum 30 credit hours  
Major: Minimum 18 credit hours

### GENERAL DEGREE REQUIREMENT

Humanities: 12 credit hours in Humanities  
Writing: 3 credit hours of Academic Writing  
Indigenous: 3 credit hours in designated Indigenous requirement courses  
Maximum Introductory Courses: Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 48 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.  
Distribution: Minimum three (3) credit hours from each of five (5) different subjects.

## MAJOR REQUIREMENT

Single Major  
Double Major

Minimum 30 credit hours/Maximum 48 credit hours.  
Minimum 30 credit hours in Statistics and specified number of credit hours in the other department/program.

Required Courses:  
Core Courses

<b>STAT-1301(3)</b>	Statistical Analysis I <u>OR</u>
<b>STAT-1401(3)</b>	Statistics I for Business and Economics <u>OR</u>
<b>STAT-1501(3)</b>	Elementary Biological Statistics I
<b>STAT-1302(3)</b>	Statistical Analysis II <u>OR</u>
<b>STAT-2001(3)</b>	Elementary Biological Statistics II
<b>STAT-2301(3)</b>	Survey Sampling I
<b>STAT/MATH-2612(3)</b>	Mathematical Statistics I or the former STAT/MATH-3611
<b>STAT-2903(3)</b>	Statistical Computing I
<b>STAT-3103(3)</b>	Applied Regression Analysis
<b>STAT-3104(3)</b>	Analysis of Variance and Covariance
<b>STAT/MATH-3612(3)</b>	Mathematical Statistics II
<b>MATH-1101(6)</b>	Introduction to Calculus <u>OR</u>
<b>MATH-1103(3)</b>	Introduction to Calculus I <u>AND</u>
<b>MATH-1104(3)</b>	Introduction to Calculus II
<b>MATH-1201(3)</b>	Linear Algebra I
<b>MATH-2105(3)</b>	Intermediate Calculus I
<b>MATH-2106(3)</b>	Intermediate Calculus II

6 credit hours from:

<b>STAT-2102(3)</b>	Business and Management Statistics
<b>STAT-2103(3)</b>	Intermediate Biological Statistics
<b>STAT-2104(3)</b>	Nonparametric Statistics
<b>STAT/MATH-2413(3)</b>	Introduction to Mathematical Finance
<b>STAT-2702(3)</b>	Statistics for Epidemiology or the former STAT-3701
<b>STAT-3102(3)</b>	Applied Multivariate Methods
<b>STAT-3105(3)</b>	Time Series and Forecasting
<b>STAT-3302(3)</b>	Survey Sampling II
<b>STAT/MATH-3412(3)</b>	Introduction to Operations Research
<b>STAT-3501(3)</b>	Simulation
<b>STAT-3904(3)</b>	Statistical Computing II
<b>STAT-4103(3)</b>	Statistical Learning
<b>STAT-4202(3)</b>	Statistical Inference
<b>STAT-4401(3)</b>	Probability Theory
<b>STAT-4501(3)</b>	Spatial Statistics
<b>STAT-4601(3)</b>	Statistical Design of Experiments

Combined Major:

Minimum 48 credit hours from 2 different majors with not less than 18 credit hours from each major subject.

Prescribed courses:

To be determined in consultation with the Department.

Students who have not obtained a grade of at least C in both **STAT-1301(3)** Statistical Analysis I (OR **STAT-1401(3)** Statistics I for Business and Economics OR **STAT-1501(3)** Elementary Biological Statistics I) AND **STAT-1302(3)** Statistical Analysis II (OR **STAT-2001(3)** Elementary Biological Statistics II) are advised not to proceed in a Statistics major.

Students are advised to take **MATH-1103(3)** Introduction to Calculus I AND **MATH-1104(3)** Introduction to Calculus II OR **MATH-1101(6)** Introduction to Calculus in their first year; **MATH-1201(3)** Linear Algebra I in their first or second year; and **MATH-2105(3)** Intermediate Calculus I, **MATH-2106(3)** Intermediate Calculus II, AND **MATH-2203(3)** Linear Algebra II in their second year.

Students planning to go on to graduate studies are advised to consult with the Department before choosing second year courses.

## REQUIREMENTS FOR THE 3-YEAR BSc STATISTICS WITH A BUSINESS STREAM

Students must complete the requirements of the 3-year BSc in Statistics degree (see previous section) and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar.

## REQUIREMENTS FOR A 4-YEAR BA/BSc IN STATISTICS

**ADMISSION REQUIREMENT** 30 credit hours previously completed in BA/BSc  
**GRADUATION REQUIREMENT** 120 credit hours

### RESIDENCE REQUIREMENT

Degree: 60 credit hours  
 Major: 30 credit hours

### GENERAL DEGREE REQUIREMENT

Humanities: 12 credit hours in Humanities  
 Social Sciences (BA only): 12 credit hours  
 Writing: Minimum three (3) credit hours of Academic Writing  
 Indigenous: 3 credit hours in designated Indigenous requirement courses  
 Maximum Introductory Courses: Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 78 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.  
 Distribution: Minimum three (3) credit hours from each of five (5) different subjects.

### MAJOR REQUIREMENT

Major: Minimum 48 credit hours/Maximum 72 credit hours.  
 Double Major: Minimum 48 credit hours in each Major as specified by the department/program.

Required Courses:	<b>STAT-1301(3)</b>	Statistical Analysis I <u>OR</u>
Core Courses	<b>STAT-1401(3)</b>	Statistics I for Business and Economics <u>OR</u>
	<b>STAT-1501(3)</b>	Elementary Biological Statistics I
	<b>STAT-1302(3)</b>	Statistical Analysis II <u>OR</u>
	<b>STAT-2001(3)</b>	Elementary Biological Statistics II
	<b>STAT-2301(3)</b>	Survey Sampling I
	<b>STAT/MATH-2612(3)</b>	Mathematical Statistics I or the former STAT/MATH-3611
	<b>STAT-2903(3)</b>	Statistical Computing I
	<b>STAT-3103(3)</b>	Applied Regression Analysis
	<b>STAT-3104(3)</b>	Analysis of Variance and Covariance
	<b>STAT/MATH-3612(3)</b>	Mathematical Statistics II
	<b>STAT-4202(3)</b>	Statistical Inference
	<b>MATH-1101(6)</b>	Introduction to Calculus <u>OR</u>
	<b>MATH-1103(3)</b>	Introduction to Calculus I <u>AND</u>
	<b>MATH-1104(3)</b>	Introduction to Calculus II
	<b>MATH-1201(3)</b>	Linear Algebra I
	<b>MATH-2105(3)</b>	Intermediate Calculus I
	<b>MATH-2106(3)</b>	Intermediate Calculus II

21 additional credit hours with at least one from 4000 level from the following list:	<b>STAT-2102(3)</b>	Business and Management Statistics
	<b>STAT-2103(3)</b>	Intermediate Biological Statistics
	<b>STAT-2104(3)</b>	Nonparametric Statistics
	<b>STAT/MATH-2413(3)</b>	Introduction to Mathematical Finance
	<b>STAT-2702(3)</b>	Statistics for Epidemiology or the former STAT-3701
	<b>STAT-3102(3)</b>	Applied Multivariate Methods
	<b>STAT-3105(3)</b>	Time Series and Forecasting
	<b>STAT-3302(3)</b>	Survey Sampling II
	<b>STAT/MATH-3412(3)</b>	Introduction to Operations Research
	<b>STAT-3501(3)</b>	Simulation
	<b>STAT-3904(3)</b>	Statistical Computing II
	<b>STAT-4103(3)</b>	Statistical Learning
	<b>STAT-4401(3)</b>	Probability Theory
	<b>STAT-4501(3)</b>	Spatial Statistics
	<b>STAT-4601(3)</b>	Statistical Design of Experiments

Combined Major: Minimum 60 credit hours from 2 different majors with not less than 24 credit hours from each major subject.  
 Prescribed courses: To be determined in consultation with the Department.

Students who have not obtained a grade of at least C in both **STAT-1301(3)** Statistical Analysis I (OR **STAT-1401(3)** Statistics I for Business and Economics OR **STAT-1501(3)** Elementary Biological Statistics I) AND **STAT-1302(3)** Statistical Analysis II (OR **STAT-2001(3)** Elementary Biological Statistics II) are advised not to proceed in a Statistics major. Students are advised to take **MATH-1103(3)** Introduction to Calculus I AND **MATH-1104(3)** Introduction to Calculus II OR **MATH-1101(6)** Introduction to Calculus in their first year; **MATH-1201(3)** Linear Algebra I in their first or second year; and **MATH-2105(3)** Intermediate Calculus I, **MATH-2106(3)** Intermediate Calculus II, AND **MATH-2203(3)** Linear Algebra II in their second year. Students planning to go on to graduate studies are advised to consult with the Department before choosing second year courses.

## REQUIREMENTS FOR THE 4-YEAR BSc STATISTICS WITH A BUSINESS STREAM

Students must complete the requirements of the 4-year BSc in Statistics degree (see previous section) and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar.

## REQUIREMENTS FOR A 4-YEAR BA/BSc IN STATISTICS (DATA SCIENCE STREAM)

<b>ADMISSION REQUIREMENT</b>	30 credit hours previously completed in BA/BSc 120 credit hours																																																								
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<b>STAT-4601(3)</b>	Statistical Design of Experiments

If **STAT-3102(3)**, **STAT-3104(3)** or **STAT-3105(3)** is taken as a core course, it cannot be used towards the 9 additional credit hours requirement. Students who have not obtained a grade of at least C in both **STAT-1301(3)** Statistical Analysis I (OR **STAT-1401(3)** Statistics I for Business and Economics OR **STAT-1501(3)** Elementary Biological Statistics I) AND **STAT-1302(3)** Statistical Analysis II (OR **STAT-2001(3)** Elementary Biological Statistics II) are advised not to proceed in a Statistics major.

Students are advised to take **MATH-1103(3)** Introduction to Calculus I AND **MATH-1104(3)** Introduction to Calculus II OR **MATH- 1101(6)** Introduction to Calculus in their first year; **MATH-1201(3)** Linear Algebra I in their first or second year; and **MATH-2105(3)** Intermediate Calculus I, **MATH-2106(3)** Intermediate Calculus II, AND **MATH-2203(3)** Linear Algebra II in their second year.

Students planning to go on to graduate studies are advised to consult with the Department before choosing second year courses.

Combined Major: Minimum 60 credit hours from 2 different majors with not less than 24 credit hours from each major subject.

## REQUIREMENTS FOR A MINOR IN STATISTICS

Degree:	Students completing any undergraduate degree program are eligible to complete the Minor.
Minor:	18 credit hours in the Minor subject, with a minimum of 12 credit hours above the 1000-level
Residence Requirement:	Minimum 12 credit hours in the Minor subject
Required courses:	<b>STAT-1301(3)</b> Statistical Analysis I OR <b>STAT-1401(3)</b> Statistics for Business and Economics OR <b>STAT-1501(3)</b> Elementary Biological Statistics I <b>STAT-1302(3)</b> Statistical Analysis II OR <b>STAT-2001(3)</b> Elementary Biological Statistics II <b>STAT-2301(3)</b> Survey Sampling I
Restrictions:	Any other nine credit hours at the 2000 level or higher (not including STAT-2001(3)) Students cannot declare the same subject as a Major and a Minor.

## GENERAL INFORMATION

### Prerequisites

Pre-Calculus Mathematics 40S or Applied Mathematics 40S.

## COURSE LISTINGS

<b>STAT-1301(3)</b>	Statistical Analysis I	<b>STAT-3104(3)</b>	Analysis of Variance and Covariance
<b>STAT-1302(3)</b>	Statistical Analysis II	<b>STAT-3105(3)</b>	Time Series and Forecasting
<b>STAT-1401(3)</b>	Statistics I for Business and Economics	<b>STAT-3302(3)</b>	Survey Sampling II
<b>STAT-1501(3)</b>	Elementary Biological Statistics I	<b>STAT/MATH-3412(3)</b>	Introduction to Operations Research
<b>STAT-2001(3)</b>	Elementary Biological Statistics II	<b>STAT-3501(3)</b>	Simulation
<b>STAT-2102(3)</b>	Business and Management Statistics	<b>STAT/MATH-3612(3)</b>	Mathematical Statistics II
<b>STAT-2103(3)</b>	Intermediate Biological Statistics	<b>STAT-4202(3)</b>	Statistical Inference
<b>STAT-2104(3)</b>	Nonparametric Statistics	<b>STAT-4401(3)</b>	Probability Theory
<b>STAT-2301(3)</b>	Survey Sampling I	<b>STAT-4501(3)</b>	Spatial Statistics
<b>STAT-MATH-2413(3)</b>	Introduction to Mathematical Finance	<b>STAT-4601(3)</b>	Statistical Design of Experiments
<b>STAT/MATH-2612(3)</b>	Mathematical Statistics I or the former STAT/MATH-3611	<b>EXPERIMENTAL COURSES</b>	
<b>STAT-2702(3)</b>	Statistics for Epidemiology or the former STAT-3701	<b>STAT-3904(3)</b>	Statistical Computing II
<b>STAT-2903(3)</b>	Statistical Computing I	<b>STAT-4103(3)</b>	Statistical Learning
<b>STAT-3102(3)</b>	Applied Multivariate Methods		
<b>STAT-3103(3)</b>	Applied Regression Analysis		

## COURSE DESCRIPTIONS

All course descriptions for all undergraduate programs can now be found in one large PDF called "All course descriptions" in the "Academic Calendar" section of the University website: <http://uwinnipeg.ca/academics/calendar/index.html>