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ATTENTION	Senate	DATE	March 8, 2024
FROM	Peter Hall, Chair Senate Committee on Undergraduate Studies	PAGES	1/1
RE:	Faculty of Science – Data Science Major and Honours (SCUS 23-43ii), (S.23-51 e. 3.ii)		

Acting under delegated authority at its meeting of March 7, 2024, the Senate Committee on Undergraduate Studies, effective Fall 2024, approved to revoke the upper and lower division requirement changes to the Data Science Major and Data Science Honours programs (SCUS 23-43ii) (S.23-51 e. 3.ii).



FACULTY OF SCIENCE

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MEMORANDUM

ATTENTION Peter Hall, Vice-President Academic and Vice-Provost **DATE** Feb. 20, 2024
FROM Nancy Hawkins, Associate Dean, Academic, Faculty of Science **PAGES** 1
RE: Retraction of SCUS 23-43

In Fall 2022, the Department of Statistics and Actuarial Science undertook a review of the Data Science program to address issues related its structure. In short, both the department and students agreed that there are too many required courses in the Data Science program. This results in issues around degree completion and is especially problematic for transfer students who come to SFU with a number of electives and need to go well beyond 120 units to complete the program. Therefore, one of the main goals was to make changes that reduce the time to degree completion.

The department made some major program modifications which were passed at SCUS (SCUS 23-43). There were two main components to the program modification: 1. removal of specific lower division required courses that are not prerequisites for any other required courses; and 2. a full revamp of the upper division requirements. They did not intend to trigger a Ministry review with these changes since they did not change the learning outcomes for the program. This led to a thoughtful and thorough reevaluation of the proposed program changes. They realized that they could accomplish their main goal of streamlining the program and reducing time to completion by removing select lower division courses and adding an alternative math course to increase flexibility (was submitted in October 2023 as SCUS 23-82 but was tabled pending the more extensive program modifications). The department feels, as they currently stand, the upper division requirements are sound and do not need to be changed at this time.

Thus, the Department and Statistics and Actuarial Sciences would like to retract the major program modifications that were passed as part of SCUS 23-43:

(ii) Upper and lower division requirement changes to the:

- Data Science Major (pg. 344-351)
- Data Science Honours (pg. 361-377)

Nancy Hawkins, PhD



Name of Program or Name of Faculty Department of Statistics and Actuarial Science
Rationale for change: There have been issues with the Data Science program being too structured (i.e. very little room for choice) and having too many required courses. This has been causing problems particularly for transfer students who transfer in with a lot of courses not required for the program (i.e. they end up needing to graduate with well over 120 units). There has also been an issue with course conflicts between required courses, given that students do not get to choose which courses to take, and it's not feasible to coordinate course scheduling across four different departments/schools. The intention here is to reduce the number of required courses and to allow for more course options. We believe the changes below accomplish this, while maintaining the program's learning and skill outcomes, and the interdisciplinary nature of the program.
Effective term and year: Fall 2023
The following program(s) will be affected by these changes: Data Science Major

Calendar Change: "to" and "from" sections are not required. All deletions should be crossed out as follows: ~~sample~~. All additions should be marked by a **bold**.

<h1>Data Science Major</h1> <p>Bachelor of Science</p> <p>The Faculty of Science, with the Departments of Statistics and Actuarial Science and of Mathematics, the Beedie School of Business, and the School of Computing Science, offers a major in Data Science (DATA) leading to a bachelor of science (BSc). This is a highly structured program providing a multidisciplinary approach to quantitative methods for business and industry in an environment of rapid changes in technology.</p> <p>The program is overseen by the Department of Statistics and Actuarial Science. A steering committee consisting of representatives from the above mentioned departments and faculty serve as liaison between participating departments and the program director.</p>

Students formally apply to be admitted into the program. Applications can be considered both for students entering Simon Fraser University, and for students already enrolled. Admission into the program is decided on a competitive basis. Students must maintain a 2.7 cumulative grade point average (CGPA) in DATA program course work to remain in the program and to graduate. It is strongly recommended that students contact the Statistics advisor or program director early about admission and scheduling.

More information can be found on our website: <https://www.sfu.ca/stat-actsci/undergraduate/current-students/program-info/data-science.html>.

Program Requirements

Students complete 120 units, as specified below.

Under program and University regulations, a general degree requires a total of 120 units, 44 of which are in upper division courses. Completion of all lower and upper division courses shown below is required. However, students should be aware of particular department requirements for course entry. Contact those departments for information.

Lower Division Requirements

~~Business Administration~~

Students complete all of

- ~~BUS 200 – Business Fundamentals (3)~~
- BUS 217W - Critical Thinking in Business (3)
- ~~BUS 251 – Financial Accounting I (3)~~
- BUS 272 - Behaviour in Organizations (3)

~~Computing Science~~

~~Students complete all of~~

- CMPT 120 - Introduction to Computing Science and Programming I (3)
- CMPT 125 - Introduction to Computing Science and Programming II (3)
- CMPT 225 - Data Structures and Programming (3)
- ~~CMPT 276 – Introduction to Software Engineering (3)~~

~~Mathematics and Computing Science~~

~~Students complete both of~~

- MACM 101 - Discrete Mathematics I (3)



~~MACM 201 – Discrete Mathematics II (3)~~

~~Data Science~~

~~Students complete~~

~~DATA 180 - Undergraduate Seminar in Data Science (1)~~

~~**STAT 240 - Introduction to Data Science (3)**~~

~~**STAT 260 - Introductory R for Data Science (2)**~~

~~**STAT 261 - Laboratory for Introductory R for Data Science (1)**~~

~~Mathematics~~

~~Students complete and one of~~

~~MATH 150 - Calculus I with Review (4)~~

~~MATH 151 - Calculus I (3)~~

~~MATH 154 - Mathematics for the Life Sciences I (3)~~

~~MATH 157 - Calculus I for the Social Sciences (3)~~

~~and both of~~

~~MATH 152 - Calculus II (3)~~

~~and one of~~

~~MATH 208W - Introduction to Operations Research (3)~~

~~**MACM 203 - Computing with Linear Algebra (2)**~~

~~and one of~~

~~MATH 232 - Applied Linear Algebra (3)~~

~~MATH 240 - Algebra I: Linear Algebra (3)~~

~~Statistics~~

~~Students complete all of~~

~~STAT 240 – Introduction to Data Science (3)~~

~~STAT 260 – Introductory R for Data Science (2)~~

~~STAT 261 – Laboratory for Introductory R for Data Science (1)~~

~~and one of~~



BUS 232 - Business Statistics (3)
STAT 201 - Statistics for the Life Sciences (3)
STAT 203 - Introduction to Statistics for the Social Sciences (3)
STAT 205 - Introduction to Statistics (3)
STAT 270 - Introduction to Probability and Statistics (3) *

*** Recommended**

Lower Division Recommended Courses

CMPT 276 - Introduction to Software Engineering (3)
MACM 201 - Discrete Mathematics II (3) OR CMPT 210 - Probability and Computing (3)
STAT 285 - Intermediate Probability and Statistics (3)

Upper Division Requirements

~~Business Administration~~

Students complete all of

BUS 343 - Introduction to Marketing (3)
~~BUS 360W - Business Communication (4)~~
BUS 439 - Analytics Project (3) *
BUS 445 - Customer Analytics (3) *
CMPT 354 - Database Systems I (3)
MATH 308 - Linear Optimization (3)

and one of

STAT 302 - Analysis of Experimental and Observational Data (3)
STAT 305 - Introduction to Biostatistical Methods for Health Sciences (3)
STAT 350 - Linear Models in Applied Statistics (3) *****

and one of

BUS 360W - Business Communication (4) **
MATH 402W - Operations Research Clinic (4)
CMPT 376W - Technical Writing and Group Dynamics (3) ***
STAT 300W - Statistics Communication (3) ***

(Note: For students who complete MATH 402W, CMPT 376W or STAT 300W as their UD W, a waiver for BUS 217W is possible. Please consult with the Statistics Advisor.)

and at least 5 courses from List 1 and 2, including a minimum of 3 courses from List 1 (which must include at least one STAT course and one CMPT course)

List 1

STAT 403 - Intermediate Sampling and Experimental Design (3)
STAT 452 - Statistical Learning and Prediction (3)
STAT 445 - Applied Multivariate Analysis (3)
STAT 475 - Applied Discrete Data Analysis (3)
STAT 485 - Applied Time Series Analysis (3)
CMPT 310 - Introduction to Artificial Intelligence (3)
CMPT 353 - Computational Data Science (3)
CMPT 459 - Special Topics in Database Systems (3)
CMPT 307 - Data Structures and Algorithms (3) ***
MATH 309 - Continuous Optimization (3) ***

List 2

BUS 345 - Marketing Research (3)
BUS 362 - Business Process Analysis (4)
BUS 437 - Decision Analysis in Business (3) *
BUS 440 - Simulation in Management Decision-making (4) *
BUS 441 - Web Analytics (3) *
CMPT 363 - User Interface Design (3)
CMPT 371 - Data Communications and Networking (3)
CMPT 340 - Biomedical Computing (3)
CMPT 419 - Special Topics in Artificial Intelligence (3)
CMPT 456 - Information Retrieval and Web Search (3)
CMPT 372 - Web II – Service-side Development (3) ***
CMPT 373 - Software Development Methods (3) ***
CMPT 410 - Machine Learning (3) ***
CMPT 420 - Deep Learning (3) ***
CMPT 454 - Database Systems II (3) ***
CMPT 467 - Visualization (3) ***
MACM 316 - Numerical Analysis I (3)
MATH 343 - Applied Discrete Mathematics (3) ***
MATH 345 - Introduction to Graph Theory (3) ***
MATH 348 - Introduction to Probabilistic Models (3)
MATH 408 - Discrete Optimization (3)
MATH 448 - Network Flows (3)
STAT 342 - Introduction to Statistical Computing and Exploratory Data Analysis - SAS (2)
STAT 360 - Advanced R for Data Science (2)
STAT 440 - Learning from Big Data (3) ***

STAT 410 - Statistical Analysis of Sample Surveys (3) ***

STAT 450 - Statistical Theory (3) ***

STAT 460 – Bayesian Statistics (3) ***

*** BUS 360W is recommended but not required. BUS 360W will be waived as a prerequisite for 400 division business courses for those in the Data Science Major, provided that an alternative approved upper division W course is in progress, or has been completed. Students should consult with a Department of Statistics and Actuarial Science Academic Advisor for further information on obtaining a waiver.**

**** Recommended**

***** Course has extra prerequisite(s) (i.e. beyond what is required for the Data Science program)**

****** Recommended; course has extra prerequisite(s) (i.e. beyond what is required for the Data Science program)**

~~Computing Science~~

~~Students complete all of~~

~~CMPT 307 – Data Structures and Algorithms (3)~~

~~CMPT 310 – Introduction to Artificial Intelligence (3)~~

~~CMPT 353 – Computational Data Science (3)~~

~~CMPT 354 – Database Systems I (3)~~

~~CMPT 370 – Information System Design (3)~~

~~Mathematics~~

~~Students complete one of~~

~~MATH 308 – Linear Optimization (3)~~

~~MATH 309 – Continuous Optimization (3)~~

~~Statistics~~

~~Students complete one of~~

~~ECON 333 – Statistical Analysis of Economic Data (4)~~

~~STAT 302 – Analysis of Experimental and Observational Data (3)~~

~~STAT 305 – Introduction to Biostatistical Methods for Health Sciences (3)~~

~~STAT 350 – Linear Models in Applied Statistics (3)~~

~~and both of~~

~~STAT 403—Intermediate Sampling and Experimental Design (3)~~

~~STAT 452—Statistical Learning and Prediction (3)~~

~~and one of~~

~~STAT 445—Applied Multivariate Analysis (3)~~

~~STAT 475—Applied Discrete Data Analysis (3)~~

~~STAT 485—Applied Time Series Analysis (3)~~

~~Upper Division Recommended Courses~~

~~BUS 345—Marketing Research (3)~~

~~BUS 362—Business Process Analysis (4)~~

~~BUS 437—Decision Analysis in Business (3)~~

~~BUS 440—Simulation in Management Decision-making (4)~~

~~CMPT 308—Computability and Complexity (3)~~

~~CMPT 322W—Professional Responsibility and Ethics (3)~~

~~CMPT 373—Software Development Methods (3)~~

~~CMPT 376W—Technical Writing and Group Dynamics (3)~~

~~CMPT 405—Design and Analysis of Computing Algorithms (3)~~

~~CMPT 417—Intelligent Systems (3)~~

~~CMPT 419—Special Topics in Artificial Intelligence (3)~~

~~CMPT 470—Web-based Information Systems (3)~~

~~MACM 316—Numerical Analysis I (3)~~

~~MATH 343—Applied Discrete Mathematics (3)~~

~~MATH 345—Introduction to Graph Theory (3)~~

~~STAT 342—Introduction to Statistical Computing and Exploratory Data Analysis—SAS (2)~~

~~STAT 445—Applied Multivariate Analysis (3)~~

~~STAT 475—Applied Discrete Data Analysis (3)~~

~~STAT 485—Applied Time Series Analysis (3)~~

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~~Double Majors and Minors~~



~~Students wishing to complete a second major or a minor in addition to a Data Science (DATA) major must satisfy all DATA requirements. At least 34 upper division units must be allocated exclusively to the DATA major.~~

~~This includes at least nine units from each of the lists under the sub-headings Business Administration, Computing Science, and Statistics. Units used to satisfy DATA upper division requirements beyond these 34 can be applied simultaneously to the other major, minor or honours.~~



Name of Program or Name of Faculty Department of Statistics and Actuarial Science
Rationale for change: There have been issues with the Data Science program being too structured (i.e. very little room for choice) and having too many required courses. This has been causing problems particularly for transfer students who transfer in with a lot of courses not required for the program (i.e. they end up needing to graduate with well over 120 units). There has also been an issue with course conflicts between required courses, given that students do not get to choose which courses to take, and it's not feasible to coordinate course scheduling across four different departments/schools. The intention here is to reduce the number of required courses and to allow for more course options. We believe the changes below accomplish this, while maintaining the program's learning and skill outcomes, and the interdisciplinary nature of the program.
Effective term and year: Fall 2023
The following program(s) will be affected by these changes: Data Science Honours

Calendar Change: "to" and "from" sections are not required. All deletions should be crossed out as follows: ~~sample~~. All additions should be marked by a **bold**.

<p>Bachelor of Science</p> <p>The Department of Statistics and Actuarial Science and its partners, the Department of Mathematics, the Beedie School of Business, and the School of Computing Science, offer an honours program in Data Science (DATA) leading to a bachelor of science (BSc) with honours degree. This is a highly structured program providing a multidisciplinary approach to quantitative methods for business and industry in an environment of rapid changes in technology. The honours program offers specialization in one of three concentrations: Mathematics, Statistics, or Open Concentration.</p> <p>The program is managed by a steering committee consisting of representatives from the above-mentioned departments, and faculty serve as liaisons between participating departments and the program director.</p> <p>Students formally apply to be admitted into the program. Applications can be considered both for students entering Simon Fraser University, and for students already enrolled. Admission into the program is decided on a competitive basis. Students must maintain a 3.0 cumulative grade point average (CGPA) in DATA program course work to remain in the program and to graduate. It is</p>
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strongly recommended that students contact the Statistics advisor or program director early about admission and scheduling.

Students who wish to combine the DATA honours program with another major or minor program should consult with the Statistics advisor.

More information can be found on our website: <https://www.sfu.ca/stat-actsci/undergraduate/current-students/program-info/data-science.html>.

Program Requirements

Under University regulations, an honours degree requires the completion of a minimum of 120 units, including a minimum of 60 upper division units. Honours program students require a graduation cumulative grade point average of not less than 3.00.

Mathematics Concentration Requirements

Lower Division Requirements

~~Business Administration~~

Students complete all of

- ~~BUS 200 - Business Fundamentals (3)~~
- ~~BUS 217W - Critical Thinking in Business (3)~~
- ~~BUS 251 - Financial Accounting I (3)~~
- ~~BUS 272 - Behaviour in Organizations (3)~~

~~Computing Science~~

~~Students complete all of~~

- ~~CMPT 120 - Introduction to Computing Science and Programming I (3)~~
- ~~CMPT 125 - Introduction to Computing Science and Programming II (3)~~
- ~~CMPT 225 - Data Structures and Programming (3)~~
- ~~CMPT 276 - Introduction to Software Engineering (3)~~

~~Mathematics and Computing Science~~

~~Students complete all of~~

- ~~MACM 101 - Discrete Mathematics I (3)~~
- ~~MACM 201 - Discrete Mathematics II (3)~~
- ~~MACM 203 - Computing with Linear Algebra (2)~~

MACM 204 - Computing with Calculus (2)
STAT 240 - Introduction to Data Science (3)
STAT 260 - Introductory R for Data Science (2)
STAT 261 - Laboratory for Introductory R for Data Science (1)
STAT 270 - Introduction to Probability and Statistics (3)

~~Data Science~~

~~Students complete~~

DATA 180 - Undergraduate Seminar in Data Science (1)

~~Mathematics~~

~~Students complete~~ and one of

MATH 150 - Calculus I with Review (4) *
 MATH 151 - Calculus I (3)
 MATH 154 - Mathematics for the Life Sciences I (3)
 MATH 157 - Calculus I for the Social Sciences (3)

and all of

MATH 152 - Calculus II (3)
 MATH 208W - Introduction to Operations Research (3)
 MATH 242 - Introduction to Analysis I (3)
 MATH 251 - Calculus III (3)

and one of

MATH 232 - Applied Linear Algebra (3)
 MATH 240 - Algebra I: Linear Algebra (3) *

~~Statistics~~

~~Students complete all of~~

~~STAT 240 - Introduction to Data Science (3)~~
~~STAT 260 - Introductory R for Data Science (2)~~
~~STAT 261 - Laboratory for Introductory R for Data Science (1)~~
~~STAT 270 - Introduction to Probability and Statistics (3)~~

* Recommended

Lower Division Recommended Courses

CMPT 276 - Introduction to Software Engineering (3)

STAT 285 - Intermediate Probability and Statistics (3)

Upper Division Requirements

~~Business Administration~~

Students complete all of

- BUS 343 - Introduction to Marketing (3)
- ~~BUS 360W - Business Communication (4)~~

Computing Science

Students complete all of

- ~~CMPT 307 - Data Structures and Algorithms (3)~~
- ~~CMPT 310 - Introduction to Artificial Intelligence (3)~~
- ~~CMPT 353 - Computational Data Science (3)~~
- CMPT 354 - Database Systems I (3)

~~Mathematics and Computing Science~~

- MACM 316 - Numerical Analysis I (3)
- MATH 402W - Operations Research Clinic (4)**

~~Mathematics~~

Students complete one of

- MATH 308 - Linear Optimization (3)
- ~~MATH 309 - Continuous Optimization (3)~~

and one of

- MACM 409 - Numerical Linear Algebra: Algorithms, Implementation and Applications (3)
- MATH 320 - Introduction to Analysis II (3)
- MATH 340 - Algebra II: Rings and Fields (3)
- MATH 343 - Applied Discrete Mathematics (3)
- MATH 345 - Introduction to Graph Theory (3)
- MATH 348 - Introduction to Probabilistic Models (3)

and

- ~~MATH 402W - Operations Research Clinic (4)~~

and one additional 400-level MATH course

Statistics

~~Students complete~~ **and** one of

~~ECON 333 - Statistical Analysis of Economic Data (4)~~

STAT 302 - Analysis of Experimental and Observational Data (3)

STAT 305 - Introduction to Biostatistical Methods for Health Sciences (3)

STAT 350 - Linear Models in Applied Statistics (3) *

~~and both of~~

~~STAT 403 - Intermediate Sampling and Experimental Design (3)~~

~~STAT 452 - Statistical Learning and Prediction (3)~~

~~and one of~~

~~STAT 445 - Applied Multivariate Analysis (3)~~

~~STAT 475 - Applied Discrete Data Analysis (3)~~

~~STAT 485 - Applied Time Series Analysis (3)~~

Students complete at least 8 courses from List 1 and 2, including a minimum of 4 courses from List 1 (which must include at least one STAT course and one CMPT course)

List 1

STAT 403 - Intermediate Sampling and Experimental Design (3)

STAT 452 - Statistical Learning and Prediction (3)

STAT 445 - Applied Multivariate Analysis (3)

STAT 475 - Applied Discrete Data Analysis (3)

STAT 485 - Applied Time Series Analysis (3)

CMPT 310 - Introduction to Artificial Intelligence (3)

CMPT 353 - Computational Data Science (3)

CMPT 459 - Special Topics in Database Systems (3)

CMPT 307 - Data Structures and Algorithms (3)

BUS 439 - Analytics Project (3) ***

BUS 445 - Customer Analytics (3) ***

MATH 309 - Continuous Optimization (3)

List 2

BUS 345 - Marketing Research (3)

BUS 362 - Business Process Analysis (4)

BUS 437 - Decision Analysis in Business (3) ***



BUS 440 - Simulation in Management Decision-making (4) ***
BUS 441 - Web Analytics (3) ***
CMPT 363 - User Interface Design (3)
CMPT 371 - Data Communications and Networking (3)
CMPT 340 - Biomedical Computing (3)
CMPT 419 - Special Topics in Artificial Intelligence (3)
CMPT 456 – Information Retrieval and Web Search (3)
CMPT 372 - Web II – Service-side Development (3) **
CMPT 373 - Software Development Methods (3) **
CMPT 410 - Machine Learning (3) **
CMPT 420 - Deep Learning (3) **
CMPT 454 - Database Systems II (3) **
CMPT 467 – Visualization (3) **
MATH 343 - Applied Discrete Mathematics (3)
MATH 345 - Introduction to Graph Theory (3)
MATH 348 - Introduction to Probabilistic Models (3)
MATH 408 - Discrete Optimization (3)
MATH 448 - Network Flows (3)
STAT 342 - Introduction to Statistical Computing and Exploratory Data Analysis - SAS (2)
STAT 360 - Advanced R for Data Science (2)
STAT 440 - Learning from Big Data (3) **
STAT 410 - Statistical Analysis of Sample Surveys (3) **
STAT 450 - Statistical Theory (3) **
STAT 460 – Bayesian Statistics (3) **

*** Recommended**

**** Course has extra prerequisite(s) (i.e. beyond what is required for the Data Science program)**

***** BUS 360W is recommended but not required. BUS 360W will be waived as a prerequisite for 400 division business courses for those in the Data Science Major, provided that an alternative approved upper division W course is in progress, or has been completed. Students should consult with a Department of Statistics and Actuarial Science Academic Advisor for further information on obtaining a waiver.**

Open Concentration Requirements

Lower Division Requirements

~~Business Administration~~

Students complete all of

~~BUS 200 – Business Fundamentals (3)~~
~~BUS 217W – Critical Thinking in Business (3)~~
~~BUS 251 – Financial Accounting I (3)~~
 BUS 272 - Behaviour in Organizations (3)

~~Computing Science~~

~~Students complete all of~~

~~CMPT 120 - Introduction to Computing Science and Programming I (3)~~
~~CMPT 125 - Introduction to Computing Science and Programming II (3)~~
~~CMPT 225 - Data Structures and Programming (3)~~
~~CMPT 276 – Introduction to Software Engineering (3)~~

~~Mathematics and Computing Science~~

~~Students complete both of~~

~~MACM 101 - Discrete Mathematics I (3)~~
~~MACM 201 - Discrete Mathematics II (3)~~

~~Data Science~~

~~Students complete~~

~~DATA 180 - Undergraduate Seminar in Data Science (1)~~
STAT 240 - Introduction to Data Science (3)
STAT 260 - Introductory R for Data Science (2)
STAT 261 - Laboratory for Introductory R for Data Science (1)
MATH 152 - Calculus II (3)

~~Mathematics~~

~~Students complete and one of~~

~~MATH 150 - Calculus I with Review (4) *~~
~~MATH 151 - Calculus I (3) *~~
~~MATH 154 - Mathematics for the Life Sciences I (3)~~
~~MATH 157 - Calculus I for the Social Sciences (3)~~

~~and both of~~

~~MATH 152 – Calculus II (3)~~
~~MATH 208W – Introduction to Operations Research (3)~~



and one of

MATH 208W - Introduction to Operations Research (3)

MACM 203 - Computing with Linear Algebra (2)

and one of

MATH 232 - Applied Linear Algebra (3)

MATH 240 - Algebra I: Linear Algebra (3) *

~~Statistics~~

~~Students complete all of~~

~~STAT 240 - Introduction to Data Science (3)~~

~~STAT 260 - Introductory R for Data Science (2)~~

~~STAT 261 - Laboratory for Introductory R for Data Science (1)~~

and one of

BUS 232 - Business Statistics (3)

STAT 201 - Statistics for the Life Sciences (3)

STAT 203 - Introduction to Statistics for the Social Sciences (3)

STAT 205 - Introduction to Statistics (3)

STAT 270 - Introduction to Probability and Statistics (3) *

* Recommended

Lower Division Recommended Courses

BUS 217W - Critical Thinking in Business (3)

CMPT 276 - Introduction to Software Engineering (3)

STAT 285 - Intermediate Probability and Statistics (3)

Upper Division Requirements

~~Business Administration~~

Students complete all of

BUS 343 - Introduction to Marketing (3)

~~BUS 360W - Business Communication (4)~~

BUS 439 - Analytics Project (3) ***

BUS 445 - Customer Analytics (3) ***

CMPT 354 - Database Systems I (3)

MATH 308 - Linear Optimization (3)

and one of

STAT 302 - Analysis of Experimental and Observational Data (3)

STAT 305 - Introduction to Biostatistical Methods for Health Sciences (3)

STAT 350 - Linear Models in Applied Statistics (3) ****

and one of

BUS 360W - Business Communication (4) ****

MATH 402W - Operations Research Clinic (4)

CMPT 376W - Technical Writing and Group Dynamics (3) **

STAT 300W - Statistics Communication (3) **

and at least 9 courses from List 1 and 2, including a minimum of 5 courses from List 1 (which must include at least two STAT courses and two CMPT courses)

List 1

STAT 403 - Intermediate Sampling and Experimental Design (3)

STAT 452 - Statistical Learning and Prediction (3)

STAT 445 - Applied Multivariate Analysis (3)

STAT 475 - Applied Discrete Data Analysis (3)

STAT 485 - Applied Time Series Analysis (3)

CMPT 310 - Introduction to Artificial Intelligence (3)

CMPT 353 - Computational Data Science (3)

CMPT 459 - Special Topics in Database Systems (3)

CMPT 307 - Data Structures and Algorithms (3)

MATH 309 - Continuous Optimization (3) **

List 2

BUS 345 - Marketing Research (3)

BUS 362 - Business Process Analysis (4)

BUS 437 - Decision Analysis in Business (3) ***

BUS 440 - Simulation in Management Decision-making (4) ***

BUS 441 - Web Analytics (3) ***

CMPT 363 - User Interface Design (3)

CMPT 371 - Data Communications and Networking (3)

CMPT 340 - Biomedical Computing (3)

CMPT 419 - Special Topics in Artificial Intelligence (3)

CMPT 456 - Information Retrieval and Web Search (3)

CMPT 372 - Web II - Service-side Development (3) **

CMPT 373 - Software Development Methods (3) **

CMPT 410 - Machine Learning (3) **
CMPT 420 - Deep Learning (3) **
CMPT 454 - Database Systems II (3) **
CMPT 467 – Visualization (3) **
MACM 316 - Numerical Analysis I (3)
MATH 343 - Applied Discrete Mathematics (3)
MATH 345 - Introduction to Graph Theory (3)
MATH 348 - Introduction to Probabilistic Models (3)
MATH 408 - Discrete Optimization (3)
MATH 448 - Network Flows (3)
STAT 342 - Introduction to Statistical Computing and Exploratory Data Analysis - SAS (2)
STAT 360 - Advanced R for Data Science (2)
STAT 440 - Learning from Big Data (3) **
STAT 410 - Statistical Analysis of Sample Surveys (3) **
STAT 450 - Statistical Theory (3) **
STAT 460 – Bayesian Statistics (3) **

**** Course has extra prerequisite(s) (i.e. beyond what is required for the Data Science program)**

***** BUS 360W is recommended but not required. BUS 360W will be waived as a prerequisite for 400 division business courses for those in the Data Science Major, provided that an alternative approved upper division W course is in progress, or has been completed. Students should consult with a Department of Statistics and Actuarial Science Academic Advisor for further information on obtaining a waiver.**

****** Recommended; course has extra prerequisite(s) (i.e. beyond what is required for the Data Science program)**

~~Computing Science~~

~~Students complete all of~~

~~CMPT 307 – Data Structures and Algorithms (3)~~
~~CMPT 310 – Introduction to Artificial Intelligence (3)~~
~~CMPT 353 – Computational Data Science (3)~~
~~CMPT 354 – Database Systems I (3)~~
~~CMPT 370 – Information System Design (3)~~

~~Mathematics~~

~~Students complete one of~~

~~MATH 308 – Linear Optimization (3)~~

~~MATH 309 – Continuous Optimization (3)~~

Statistics

Students complete one of

~~ECON 333 – Statistical Analysis of Economic Data (4)~~

~~STAT 302 – Analysis of Experimental and Observational Data (3)~~

~~STAT 305 – Introduction to Biostatistical Methods for Health Sciences (3)~~

~~STAT 350 – Linear Models in Applied Statistics (3)~~

and both of

~~STAT 403 – Intermediate Sampling and Experimental Design (3)~~

~~STAT 452 – Statistical Learning and Prediction (3)~~

and one of

~~STAT 445 – Applied Multivariate Analysis (3)~~

~~STAT 475 – Applied Discrete Data Analysis (3)~~

~~STAT 485 – Applied Time Series Analysis (3)~~

Students must complete 9 additional units from this list

~~BUS 345 – Marketing Research (3)~~

~~BUS 362 – Business Process Analysis (4)~~

~~BUS 437 – Decision Analysis in Business (3)~~

~~BUS 440 – Simulation in Management Decision-making (4)~~

~~CMPT 308 – Computability and Complexity (3)~~

~~CMPT 322W – Professional Responsibility and Ethics (3)~~

~~CMPT 373 – Software Development Methods (3)~~

~~CMPT 376W – Technical Writing and Group Dynamics (3)~~

~~CMPT 405 – Design and Analysis of Computing Algorithms (3)~~

~~CMPT 417 – Intelligent Systems (3)~~

~~CMPT 419 – Special Topics in Artificial Intelligence (3)~~

~~CMPT 470 – Web-based Information Systems (3)~~

~~MACM 316 – Numerical Analysis I (3)~~

~~MATH 343 – Applied Discrete Mathematics (3)~~

~~MATH 345 – Introduction to Graph Theory (3)~~

~~STAT 342 – Introduction to Statistical Computing and Exploratory Data Analysis – SAS (2)~~

~~STAT 445 – Applied Multivariate Analysis (3)~~

~~STAT 475 – Applied Discrete Data Analysis (3)~~

~~STAT 485 – Applied Time Series Analysis (3)~~

Statistics Concentration Requirements

Lower Division Requirements

~~Business Administration~~

Students complete all of

- ~~BUS 200 – Business Fundamentals (3)~~
- ~~BUS 217W – Critical Thinking in Business (3)~~
- ~~BUS 251 – Financial Accounting I (3)~~
- BUS 272 - Behaviour in Organizations (3)

Computing Science

Students complete all of

- CMPT 120 - Introduction to Computing Science and Programming I (3)
- CMPT 125 - Introduction to Computing Science and Programming II (3)
- CMPT 225 - Data Structures and Programming (3)
- ~~CMPT 276 – Introduction to Software Engineering (3)~~

~~Mathematics and Computing Science~~

Students complete both of

- MACM 101 - Discrete Mathematics I (3)
- ~~MACM 201 – Discrete Mathematics II (3)~~

Data Science

Students complete

- DATA 180 - Undergraduate Seminar in Data Science (1)
- STAT 240 - Introduction to Data Science (3)**
- STAT 260 - Introductory R for Data Science (2)**
- STAT 261 - Laboratory for Introductory R for Data Science (1)**
- STAT 270 - Introduction to Probability and Statistics (3)**
- STAT 285 - Intermediate Probability and Statistics (3)**

Mathematics

Students complete **and** one of



MATH 150 - Calculus I with Review (4) *

MATH 151 - Calculus I (3) *

MATH 154 - Mathematics for the Life Sciences I (3)

MATH 157 - Calculus I for the Social Sciences (3)

and ~~all~~ **both** of

MATH 152 - Calculus II (3)

~~MATH 208W - Introduction to Operations Research (3)~~

MATH 251 - Calculus III (3)

and one of

MATH 208W - Introduction to Operations Research (3)

MACM 203 - Computing with Linear Algebra (2)

and one of

MATH 232 - Applied Linear Algebra (3)

MATH 240 - Algebra I: Linear Algebra (3) *

~~Statistics~~

~~Students complete all of~~

~~STAT 240 - Introduction to Data Science (3)~~

~~STAT 260 - Introductory R for Data Science (2)~~

~~STAT 261 - Laboratory for Introductory R for Data Science (1)~~

~~STAT 270 - Introduction to Probability and Statistics (3)~~

~~STAT 285 - Intermediate Probability and Statistics (3)~~

* Recommended

Lower Division Recommended Courses

CMPT 276 - Introduction to Software Engineering (3)

MACM 201 - Discrete Mathematics II (3) OR CMPT 210 - Probability and Computing (3)

Upper Division Requirements

~~Business Administration~~

Students complete all of

BUS 343 - Introduction to Marketing (3)
~~BUS 360W - Business Communication (4)~~
 BUS 439 - Analytics Project (3) *
 BUS 445 - Customer Analytics (3) *
CMPT 354 - Database Systems I (3)
MATH 308 - Linear Optimization (3)

~~Computing Science~~

~~Students complete all of~~

~~CMPT 307 - Data Structures and Algorithms (3)~~
~~CMPT 310 - Introduction to Artificial Intelligence (3)~~
~~CMPT 353 - Computational Data Science (3)~~
~~CMPT 354 - Database Systems I (3)~~

~~Mathematics~~

~~Students complete one of~~

~~MATH 308 - Linear Optimization (3)~~
~~MATH 309 - Continuous Optimization (3)~~

~~Statistics~~

~~Students complete all of~~

STAT 330 - Introduction to Mathematical Statistics (3)
 STAT 350 - Linear Models in Applied Statistics (3)
 STAT 403 - Intermediate Sampling and Experimental Design (3)
 STAT 440 - Learning from Big Data (3)
 STAT 450 - Statistical Theory (3)
 STAT 452 - Statistical Learning and Prediction (3)
STAT 300W - Statistics Communication (3) **

and at least 4 courses from the List 1 and 2, including a minimum of 2 CMPT courses.

List 1

STAT 445 - Applied Multivariate Analysis (3)
STAT 475 - Applied Discrete Data Analysis (3)
STAT 485 - Applied Time Series Analysis (3)
CMPT 310 - Introduction to Artificial Intelligence (3)
CMPT 353 - Computational Data Science (3)
CMPT 459 - Special Topics in Database Systems (3)

CMPT 307 - Data Structures and Algorithms (3) **
MATH 309 - Continuous Optimization (3) **

List 2

BUS 345 - Marketing Research (3)
BUS 362 - Business Process Analysis (4)
BUS 437 - Decision Analysis in Business (3) *
BUS 440 - Simulation in Management Decision-making (4) *
BUS 441 - Web Analytics (3) *
CMPT 363 - User Interface Design (3)
CMPT 371 - Data Communications and Networking (3)
CMPT 340 - Biomedical Computing (3)
CMPT 419 - Special Topics in Artificial Intelligence (3)
CMPT 456 – Information Retrieval and Web Search (3)
CMPT 372 - Web II – Service-side Development (3) **
CMPT 373 - Software Development Methods (3) **
CMPT 410 - Machine Learning (3) **
CMPT 420 - Deep Learning (3) **
CMPT 454 - Database Systems II (3) **
CMPT 467 – Visualization (3) **
MACM 316 - Numerical Analysis I (3)
MATH 343 - Applied Discrete Mathematics (3) **
MATH 345 - Introduction to Graph Theory (3) **
MATH 348 - Introduction to Probabilistic Models (3)
MATH 408 - Discrete Optimization (3)
MATH 448 - Network Flows (3)
STAT 342 - Introduction to Statistical Computing and Exploratory Data Analysis - SAS (2)
STAT 360 - Advanced R for Data Science (2)
STAT 410 - Statistical Analysis of Sample Surveys (3)
STAT 460 – Bayesian Statistics (3)

*** BUS 360W is recommended but not required. BUS 360W will be waived as a prerequisite for 400 division business courses for those in the Data Science Major, provided that an alternative approved upper division W course is in progress, or has been completed. Students should consult with a Department of Statistics and Actuarial Science Academic Advisor for further information on obtaining a waiver.**

**** Course has extra prerequisite(s) (i.e. beyond what is required for the Data Science program)**

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~~Double Majors and Minors~~



~~Students wishing to complete a second major or a minor in addition to a Data Science (DATA) major must satisfy all DATA requirements. At least 34 upper division units must be allocated exclusively to the DATA major.~~

~~This includes at least nine units from each of the lists under the sub-headings Business Administration, Computing Science, Mathematics and Statistics. Units used to satisfy DATA upper division requirements beyond these 34 can be applied simultaneously to the other major, minor or honours.~~