FOR APPROVAL   **PUBLIC**   **OPEN SESSION**

TO: UTSC Academic Affairs Committee

SPONSOR: Prof. William Gough, Vice-Principal Academic and Dean
CONTACT INFO: 416-208-7027, vpdean.utsc@utoronto.ca

PRESENTER: Prof. Katherine Larson: Vice-Dean Teaching, Learning & Undergraduate Programs
CONTACT INFO: 416-208-2978, vdundergrad.utsc@utoronto.ca

DATE: April 20, 2021 for April 27, 2021

AGENDA ITEM: 5

ITEM IDENTIFICATION:

Minor Modification: New Category 2 Certificate in Computational Social Science, UTSC

JURISDICTIONAL INFORMATION:

University of Toronto Scarborough Academic Affairs Committee (AAC) "is concerned with matters affecting the teaching, learning and research functions of the Campus" (*AAC Terms of Reference, Section 4*). Under section 5.6 of its terms of reference, the Committee is responsible for approval of "Major and minor modifications to existing degree programs." The AAC has responsibility for the approval of Major and Minor modifications to existing programs as defined by the University of Toronto Quality Assurance Process (*UTQAP, Section 3.1*).

GOVERNANCE PATH:

1. **UTSC Academic Affairs Committee [For Approval] (April 27, 2021)**

PREVIOUS ACTION TAKEN:

No previous action in governance has been taken on this item.

HIGHLIGHTS:

The Department of Sociology at the University of Toronto Scarborough (UTSC) is proposing to introduce a new Category 2 Certificate in Computational Social Science. Category 2 Certificates are for-credit and are offered in conjunction with an existing undergraduate degree program(s).

The proposed Certificate examines how theory and data working together can help solve some of the most pressing challenges facing human societies in the 21st Century, and prepares students to take advantage of opportunities as researchers and confront challenges as citizens.

The Certificate leverages expertise and existing course offerings from multiple UTSC academic units, and particularly those focused on the social sciences, to structure a sequence of courses aimed at developing the cumulative skills required for collecting, structuring, analyzing and making sense of the many different kinds of information available in digitized machine-readable formats. Using these data requires considerable computational skills which have not been areas of focus in social science curricula. As a result, social students are too often graduating from their university programs without the requisite skills to apply their considerable expertise in social science to the many new research and employment opportunities that technology has generated.

The Certificate fits well with the academic goals of the Department of Sociology, including fostering methodological training with a view toward preparing students for careers in a labour market increasingly requiring computational and quantitative skills, and the ability to communicate and interpret quantitative information.

It is anticipated that the proposed Certificate will be attractive to students at UTSC that are interested in computation and qualitative analysis, but that do not have the necessary high school mathematics background for programs in mathematics and statistics. In this way the proposed Certificate will provide new opportunities for students and support equity, diversity and inclusion.

There has been extensive consultation within the Department of Sociology. There has also been consultation with the UTSC Departments of Computer and Mathematical Sciences, Human Geography, Political Science and Health and Society, as well as the Office of the Registrar, and Admissions. The proposal has been reviewed by the Dean's Office at UTSC, and by the Office of the Vice-Provost, Academic. Feedback from all stakeholder groups has been incorporated into the proposal.

FINANCIAL IMPLICATIONS:

There are no net implications to the campus operating budget.

RECOMMENDATION:

Be It Resolved,

THAT the proposed Certificate in Computational Social Science (Category 2), offered by the Department of Sociology, and as described in the proposal dated March 17, 2021, be approved, effective for the 2021-2022 academic year.

DOCUMENTATION PROVIDED:

1. New Category 2 Certificate in Computational Social Science, dated March 17, 2021.

University of Toronto Proposal to Create a Certificate in Conjunction With an Undergraduate Program

Certificates offered in conjunction with an undergraduate program are for-credit undergraduate certificates governed by the *Policy for Certificates (For-Credit and Not-For-Credit)*.

Creation and closure of these certificates follow the protocols for minor modifications; are reviewed with the relevant undergraduate program; and are reported to the Provost through the Office of the Vice-Dean, Academic Programs. Successful completion of the certificate is recorded on the academic transcript. Students must be enrolled in a specific undergraduate program.

This template should be used to bring forward all proposals for new undergraduate, for-credit, certificates that will be offered in conjunction with an existing undergraduate degree program. The creation of the certificate follows a minor modification process and is reported to the VPAP office after approval.

Proposed certificate name: **E.g., Certificate in Human Resources Management (Faculty of Arts & Science)**	**Certificate in….. (Faculty name)** Certificate in Computational Social Science
Undergraduate degree(s) the certificate will be offered in conjuction with:	HBA HBSc
Academic unit:	Department of Sociology
Faculty/academic division:	University of Toronto Scarborough
Dean's office contact:	Annette Knott, Academic Programs Officer, annette.knott@utoronto.ca
Version date: (Please change as you edit this proposal.)	March 17, 2021

1 Summary

- Please provide a brief summary of the certificate, including:
    - academic rationale for certificate
    - impetus for its development (including interest and demand)
    - how the certificate fits with unit/division's academic plans
    - any important or distinctive elements

The Department of Sociology at the University of Toronto Scarborough (UTSC) is proposing a new Category 2 Certificate, titled: Certificate in Computational Social Science.

The proposed Certificate leverages expertise and existing course offerings from multiple UTSC academic units, and particularly those focused on the social sciences, to structure a sequence of courses aimed at developing the cumulative skills required for collecting, structuring, analyzing and making sense of the many different kinds of information (text, image, network, quantitative) increasingly available in digitized machine-readable formats. The proliferation of these data offers a remarkable opportunity for social science researchers, but using these data requires considerable computational skills which have not been, traditionally, areas of focus in social science curricula. As a result, social students are too often graduating from their university programs without the requisite skills to apply their considerable expertise in social science to the many new research and employment opportunities that technology has generated.

Although all of the social science academic units at UTSC have quantitative reasoning as a core pedagogical objective, and although many social science academic units (esp. the Departments of Sociology and Human Geography) have, in recent years, increased their complement of faculty with expertise in these areas, there is currently no single department with the capacity to devote faculty to a full sequence of courses aimed at curating the skills students need to take advantage of the full range of opportunities in computational social science. Moreover, there is currently considerable duplication across programs, especially at the foundational levels of quantitative reasoning. The proposed Certificate aims to coordinate teaching resources across departments and thereby make it possible to expand the sequence of courses at upper levels. To this end, the proposed certificate builds upward from foundational courses in quantitative and theoretical reasoning to more advanced and focused treatments of statistical, spatial, textual and mathematical analysis of social science data.

2 Effective Date

September 2021, for the 2021-22 academic year.

3 Academic Rationale

What are the academic reasons for the certificate, and how does it fit with the unit/division's academic plans?

The proposed Certificate in Computational Social Science examines how theory and data working together can help solve some of the most pressing challenges facing human societies in the 21st Century. The volume and accessibility of information is unprecedented and the rate of growth is accelerating. This creates many opportunities but also many challenges for democratic countries. The proposed Certificate prepares students to take advantage of opportunities as researchers and confront challenges as citizens.

The Certificate course requirements, which are drawn from existing courses in the Departments of Sociology, Computer and Mathematical Sciences, Health and Society, Human Geography, and Political Science will equip students with the programming, reasoning, and communication skills needed for career and research opportunities in the computational analysis of social science data. Students gain basic competencies through the completion of the first component of the course requirements – [SOCB35H3 Numeracy and Society or STAB23H3, Introduction to Statistics for the Social Sciences]. Then, in SOCC70H3 Models of the Social World, students will develop an understanding of a range of approaches to building quantitative models of social phenomena, while also learning how to implement these models in the R programming language. The remaining elective requirements (1.0 credits) provide students opportunities to apply their skills in a substantive research area (such as community health or politics) and/or acquire more advanced training in key computational social science methodologies (such as GIS or multivariate analysis).

The proposed Certificate fits well with the academic goals of the Department of Sociology, including fostering methodological training with a view toward preparing students for careers in a labour market increasingly requiring computational and quantitative skills, and the ability to communicate and interpret quantitative information. To support these academic goals, the Department recently hired a new colleague in computational social science (Fosse). It should also be noted that other departments at the wider University are expanding research and teaching capacity in this area; for example, the St George Department of Sociology is searching in the area of applications of computational methods to urban sociology. These are growth areas of study, with interdisciplinary and labour-force applications, and academic units at the University are very interested in providing students with the tools they need to participate.

Opportunities for the skills that students will gain upon completing the proposed Certificate include the growing interdisciplinary domain of data and computational

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sciences – for example, the University's current commitment to an institutionalized strategic initiative in data sciences. This Certificate will lay the ground for social science students to participate in this growth initiative. In the non-academic labour force, computational social science is a growth area in the technology sector, government, non-profit research organizations, management consulting, and banking and finance. The proposed certificate will equip students with some of the key skills crucial to success in these fields.

4 Need and Demand

- Provide a brief description of the projected interest in and demand for the proposed certificate.

- Provide details regarding the anticipated yearly in-take.

The general field of computational social science is expanding because of strong student interest, and it is anticipated that there will be substantial interest and demand for the proposed Certificate. Programs and certificates at other institutions such as the University of Chicago (MA in Computational Social Science), Dalhousie (undergraduate certificate in "Computing in Arts and Social Science"), Northeastern University (Minor in Computational Science), University College Dublin (Major in Computational Social Science) indicate movement toward dedicated computational social science programs in peer institutions. Enrollments in the existing courses from which the new certificate will draw are consistent, and it is expected that the opportunity to combine them into a certificate will only increase their attractiveness.

It is anticipated that the proposed Certificate will be attractive to students at UTSC that are interested in computation and qualitative analysis, but that do not have the necessary high school mathematics background for programs in mathematics and statistics. In this way the proposed Certificate will provide new opportunities for students and support equity, diversity and inclusion.

It is anticipated that there will be initial cohorts of 10-20 students, growing over the next 4-5 years to 40-50 students each year.

5 Admission Requirements

Provide the admission requirements for the certificate.

The proposed Certificate will be open to all students in all Honours Bachelor of Arts (HBA) and Honours Bachelor of Science (HBSc) degree programs. Students will be able to apply after completing 4.0 credits.

Developed by the Office of the Vice-Provost, Academic Programs

The Certificate will be supplementary and concurrent; it cannot be taken on its own and cannot replace any degree-required program (i.e., one Specialist; two Majors; or one Major and two Minors).

6 Certificate Requirements

This certificate will consist of a coherent sequence of for-credit undergraduate courses related to an identified topic or theme that may complement the degree program.

- Describe the academic requirements of the certificate and mechanism for the assessment of student performance.
- Clarify the certificate program length.
- Is this certificate linked to a particular undergraduate program or degree? Please explain the relationship.

Students must complete a minimum of 2.0 credits.

1. Students will select either SOCB35H3 Numeracy and Society or STAB23H3 Introduction to Statistics for the Social Sciences. This requirement ensures students attain basic quantitative competencies necessary for computational social science.

2. Students must complete SOCC70H3 Models of the Social World. This requirement ensures students acquire facility in conceptualizing and implementing a range of models of social phenomena, as well the ability to implement these models programmatically.

3. Students will select At least 1.0 credit from a list of electives:
CSCA20H3 Introduction to Programming or equivalent
GGRB30H3 Fundamentals of GIS I
GGRB32H3 Fundamentals of GIS II
GGRC30H3 Advanced GIS
GGRC32H3 Essential Spatial Analysis
GGRC42H3 Making Sense of Data: Applied Multivariate Analysis
HLTC27H3 Community Health and Epidemiology
POLD56H3 Politics and Computational Social Science
POLD87H3 Rational Choice and International Cooperation Essential Spatial Analysis

This requirement ensures students have opportunities to apply the skills they are developing to a substantive research domain and/or to deepen their understanding of a particular methodology.

Students will complete the Certificate as part of their four-year undergraduate degree. The courses taken to complete the Certificate are not subject to the 12

distinct credits rule that applies to credits within programs; students can count the courses towards the completion of the Certificate and their program(s) of study (POSt).

7 Calendar Copy

CERTIFICATE IN COMPUTATIONAL SOCIAL SCIENCE

Computational social science extends theories and analyses from the social science by leveraging tools and techniques from scientific computing and data science. The Certificate in computational social science provides students with training in statistics, modeling, and programming approaches to the analysis of social problems using data, and fosters critical thinking and communication skills crucial to social science research.

Certificate Requirements

Students must complete a minimum of 2.0 credits as follows:

1. 0.5 credit from the following:
SOCB35H3 Numeracy and Society
STAB23H3 Introduction to Statistics for the Social Sciences

2. SOCC70H3 Models of the Social World

3. At least 1.0 credit from the following:
CSCA20H3 Introduction to Programming or equivalent
GGRB30H3 Fundamentals of GIS I
GGRB32H3 Fundamentals of GIS II
GGRC30H3 Advanced GIS
GGRC32H3 Essential Spatial Analysis
GGRC42H3 Making Sense of Data: Applied Multivariate Analysis
HLTC27H3 Community Health and Epidemiology
POLD56H3 Politics and Computational Social Science
POLD87H3 Rational Choice and International Cooperation Essential Spatial Analysis

8 Consultation

Outline any consultation undertaken with the Dean and chair/director of the relevant academic units and relevant programs.

Consultation within the Department of Sociology:

There has been extensive consultation within the Department of Sociology, including the Chair and faculty; all have signalled their support of the Certificate (faculty meeting, Dec 15 2021). Student interest in and demand for the program has been expressed in dozens of student advising interactions with Department faculty.

Consultation with other academic units at UTSC:
Consultation has occurred with several faculty members and Chairs/Directors of the following units with approval of courses included in the certificate requirements:
Department of Computer and Mathematical Sciences (September 22 2020)
Department of Human Geography (October 2 2020)
Department of Political Science (September 24, 2020)
Department of Health and Society (September 29 2020)

Additional Consultation:
The Department of Sociology has consulted with the Office of the Dean at UTSC, the Registrar's Office, and Admissions, who indicated support for the proposal. The proposal has been shared with the Office of the Vice-Provost, Academic Programs, and their feedback has been incorporated.

9 Resources

Describe any resource requirements including, but not limited to, faculty complement, space, libraries and enrolment/admissions.

Indicate if the certificate will affect any existing agreements with other institutions, or will require the creation of a new agreement to facilitate the certificate (e.g., Memorandum of Understanding, Memorandum of Agreement, etc). Please consult with the Provost's office (vp.academicprograms@utoronto.ca) regarding any implications to existing or new agreements.

The proposed certificate will not require any additional resources. Existing courses will be utilized by students to fulfill the requirements. There is no impact on libraries, or enrolment/admissions.

The proposed Certificate will not affect any existing agreements with other institutions. It does not require the creation of any new agreements, but should this change, the appropriate process will be followed.

10   Oversight and Accountability: Review

- Category 2 certificates are subject to periodic reviews with the relevant undergraduate program. Please provide details. This will be tracked by the VPAP office.

The proposed Certificate will be housed in the Department of Sociology, and will be aligned to its cyclical review process. The next review of the Department of Sociology is scheduled for 2021-22. The first review of the Certificate will therefore take place with the following review of the Department – this review will be scheduled to take place by no later than 2029-30.

11   UTSC Administrative Steps

Administrative Steps Required	Date
Departmental Curriculum Committee	December 15, 2021

12   Process Steps and Approvals

The pathway is summarized in the table below.

Levels of Approval Required	Date
Decanal Sign-Off	March 19, 2021
UTSC Academic Affairs Committee	April 27, 2021
Submission to Provost's Office	
AP&P – reported annually	

Developed by the Office of the Vice-Provost, Academic Programs

Appendix A: Proposed Learning Outcomes

Certificates offered in conjunction with an undergraduate program will have a sub-set of complementary learning outcomes in relation to the program. Divisions are responsible for developing the outcomes and expectations for certificates in the context of divisional norms. Please outline in the table below how the design, structure, requirements and delivery of the certificate support the certificate learning outcomes and expectations.

Certificate Expectations	Certificate Learning Outcomes	How the Design/Structure Supports the Certificate Expectations
1. Depth and Breadth of Knowledge Depth of Knowledge: is attained through a progression of introductory, core and specialized courses. Specialized courses will normally be at the C and D levels. Breadth of Knowledge: students will gain an appreciation of the variety of modes of thinking, methods of inquiry and analysis, and ways of understanding the world that underpin different intellectual fields.	Depth and breadth of knowledge is understood in the Certificate in Computational Social Science as an ability to represent understandings of social phenomena as models and then test these models using data and computation. This is reflected in students who are able to: (1) express social theories as models; (2) identify appropriate measures for the variables in these models; (3) identify and/or collect and structure relevant data for measuring these variables; (4) identify or create computational tools for running these models; (5) interpret the output of these models, including the level of uncertainty and any assumptions embedded in the models.	The design and requirement elements that ensure these student outcomes for depth and breadth of knowledge are: (1) A core course on Models of the Social World (SOCC70H3), and additional optional courses for learning how to model social phenomena (HLTC27H3, POLD87H3) support learning outcome 1. (2) A battery of courses about available tools for measurement, data analysis, and modelling (SOCB35H3, STAB23H3, GGRB30H3, GGRB32H3, GGRC30H3, GGRC32H3, GGRC42H3) support learning outcomes #2, #3, #4, and #5. (3) Courses on computation and programming (CSCA20H3, POLD56H3), support learning outcomes #3, #4, and #5.
2. Knowledge of Methodologies Students have a working knowledge of different methodologies and approaches relevant to their area of study. They are able to evaluate the efficacy of different methodologies in addressing questions that	Knowledge of methodologies is understood in the Certificate in Computational Social Science as an ability to apply appropriate methods to a given type of data, to qualify the outputs of those methods with quantitative measures of uncertainty, and to understand the limitations arising from those methods for making inferences about social phenomena. This is reflected in students who are able to: (1) identify and correctly	The design and requirement elements that ensure these student outcomes for knowledge of methodologies are: (1) Introductory courses in statistics and numeracy (SOCB35H3 or STAB23H3); (2) A core course introducing different models of social phenomena and the data/tools most appropriate for each model (SOC70H3); (3) A suite of electives in third- and fourth year focused on a

arise in their area of study.	employ measures, statistical models, and/or other computational methods appropriate to different types of data; (2) express the results of their analysis along with measures of uncertainty; and (3) recognize limitations in their own work and in the work of other scholars.	wide range of different methodologies, including multivariate statistical analysis, geographic analysis, computing, and formal modelling and mathematical analysis.
3. Application of Knowledge Students are able to frame relevant questions for further inquiry. They are familiar with, or will be able to seek the tools with which, they can address such questions effectively.	Application of Knowledge is understood in the Certificate in Computational Social Science as the ability to manage project workflows, specify the understanding of a problem as a model, specify that model as a program, apply that program to data, interpret and explain the results. This is reflected in students that are able to: (1) complete research using interactive workbooks or integrated development environments for managing, explaining and disseminating their project workflow; (2) express their arguments as formal models, gather appropriate data, and apply their models to these data; and (3) present their analysis and results in a clear and accessible manner.	SOCC70H3 introduces students to modelling social problems; and HLTC27H3 develops advanced capacities for modelling different understandings of social problems; POLD87H3 gives students the opportunity to uses formal models to understand social problems; GGRC42H3 and POLD56H3 involve applying those models to data and explaining the results.
4. Awareness of Limits of Knowledge Students demonstrate an awareness of the limits of their own knowledge and their appreciation of the uncertainty, ambiguity, and limits to our collective knowledge and how these might influence analyses and interpretations.	N/A	N/A
5. Communication Skills Students are able to communicate information, arguments	Communication skills are understood in the Certificate in computational Social Science as an ability to write and speak about data, as well as visualize, using graphs, the results of analysis.	SOCC70H3, GGRB32H3, GGRC30H3, GGRC32H3, GGRC42H3, HLTC27H3, and POLD56H3 all involve writing about data and producing graphs

and analyses clearly, both orally and in writing.	This is reflected in students who are able to write effectively about data, develop table and graphs to summarize analyses in clear and concise ways, and effectively write about these tables and graphs.	to summarize data and the results of analysis.
6. Autonomy and Professional Capacity Students demonstrate an awareness of the limits of their own knowledge and their appreciation of the uncertainty, ambiguity, and limits to our collective knowledge and how these might influence analyses and interpretations.	N/A	N/A

Appendix B: List of Courses

CSCA20H3 - Introduction to Programming
An introduction to computer programming, with an emphasis on gaining practical skills. Introduction to programming, software tools, database manipulation. This course is appropriate for students with an interest in programming and computers who do not plan to pursue a Computer Science program.
Exclusion: CSCA08H3, CSC108H, CSC120H
Breadth Requirements: Quantitative Reasoning
Note:
This course does not require any prior exposure to computer programming.

SOCB35H3 - Numeracy and Society
This course introduces the basic concepts and assumptions of quantitative reasoning, with a focus on using modern data science techniques and real-world data to answer key questions in sociology. It examines how numbers, counting, and statistics produce expertise, authority, and the social categories through which we define social reality. This course avoids advanced mathematical concepts and proofs.
Corequisite: [SOCA03Y3 or [(SOCA01H3) and (SOCA02H3)]] or enrolment in the Certificate in Computational Social Science **Enrolment Limits:** 150
Breadth Requirements: Quantitative Reasoning

SOCC70H3 - Models of the Social World
This course examines how quantitative models can be used to understand the social world with a focus on social inequality and social change. Students will learn the fundamentals of modern computational techniques and data analysis, including how to effectively communicate findings using narratives and visualizations. Topics covered include data wrangling, graphic design, regression analysis, interactive modelling, and categorical data analysis. Methods will be taught using real-world examples in sociology with an emphasis on understanding key concepts rather than mathematical formulas.
Prerequisite: SOCB35H3 or [completion of 8.0 credits, including component 1 of the course requirements for the Certificate in Computational Social Science]
Enrolment Limits: 60
Breadth Requirements: Social & Behavioural Sciences

STAB23H3 - Introduction to Statistics for the Social Sciences
This course covers the basic concepts of statistics and the statistical methods most commonly used in the social sciences. The first half of the course introduces descriptive statistics, contingency tables, normal probability distribution, and sampling distributions. The second half of the course introduces inferential statistical methods. These topics include significance test for a mean (t-test), significance test for a proportion, comparing two groups (e.g., comparing two proportions, comparing two means), associations between categorical variables (e.g., Chi-square test of independence), and simple linear regression.
Exclusion: ANTC35H3, MGEB11H3/(ECMB11H3), (POLB11H3), PSYB07H3, (SOCB06H3), STAB22H3, STAB52H3, STAB57H3, STA220H, STA250H
Breadth Requirements: Quantitative Reasoning

GGRB30H3 - Fundamentals of GIS I
This course provides a practical introduction to digital mapping and spatial analysis using a geographic information system (GIS). The course is designed to provide hands-on experience using GIS to analyse spatial data, and create maps that effectively communicate data meanings. Students are instructed in GIS methods and approaches that are relevant not only to Geography but also to many other disciplines. In the lectures, we discuss mapping and analysis concepts and how you can apply them using GIS software. In the practice exercises and assignments, you then learn how to do your own data analysis and mapping, gaining hands-on experience with ArcGIS software, the most widely used GIS software.
Exclusion: GGR272H, GGR278H
Recommended Preparation: GGRA30H3
Enrolment Limits: 150
Breadth Requirements: Quantitative Reasoning

GGRB32H3 - Fundamentals of GIS II
This course builds on GGRB30 Fundamentals of GIS, continuing the examination of theoretical and analytical components of GIS and spatial analysis, and their application through lab assignments. The course covers digitizing, topology, vector data models, remote sensing and raster data models and analysis, geoprocessing, map design and cartography, data acquisition, metadata, and data management, and web mapping.
Prerequisite: GGRB30H3
Enrolment Limits: 150
Breadth Requirements: Quantitative Reasoning

GGRC30H3 - Advanced GIS
This course covers advanced theoretical and practical issues of using GIS systems for research and spatial analysis. Students will learn how to develop and manage GIS research projects, create and analyze three-dimensional surfaces, build geospatial models, visualize geospatial data, and perform advanced spatial analysis. Lectures introduce concepts and labs implement them.
Prerequisite: GGRB32H3
Exclusion: GGR373H
Enrolment Limits: 60
Breadth Requirements: Quantitative Reasoning

GGRC32H3 - Essential Spatial Analysis
This course builds on introductory statistics and GIS courses by introducing students to the core concepts and methods of spatial analysis. With an emphasis on spatial thinking in an urban context, topics such as distance decay, distance metrics, spatial interaction, spatial distributions, and spatial autocorrelation will be used to quantify spatial patterns and identify spatial processes. These tools are the essential building blocks for the quantitative analysis of urban spatial data.
Area of focus: Urban Geography
Prerequisite: Any 8.0 credits including [STAB23H3 and GGRB30H3]
Exclusion: GGR276H

Enrolment Limits: 60
Breadth Requirements: Quantitative Reasoning

GGRC42H3 - Making Sense of Data: Applied Multivariate Analysis
This course introduces students to the main methods of multivariate analysis in the social sciences, with an emphasis on applications incorporating spatial thinking and geographic data. Students will learn how to evaluate data quality, construct analysis datasets, and perform and interpret multivariate analyses using the R statistical programming language.
Prerequisite: STAB22H3 or equivalent
Exclusion: GGRC41H3 (if taken in the 2019 Fall session)
Breadth Requirements: Quantitative Reasoning

HLTC27H3 - Community Health and Epidemiology
Epidemiology is the study or the pattern and causes of health-related outcomes and the application of findings to improvement of public health. This course will examine the history of epidemiology and its principles and terminology, measures of disease occurrence, study design, and application of concepts to specific research areas.
Prerequisite: [HLTB15H3 and HLTB16H3 and any statistics course] or [enrolment in the Certificate in Computational Social Science]
Exclusion: ANTC67H3
Breadth Requirements: Quantitative Reasoning
Note:
Priority will be given to students enrolled in the Major/Major Co-op programs in Health Studies.

POLD56H3 - Politics and Computational Social Science
This course applies tools from computational social science to the collection and analysis of political data, with a particular focus on the computational analysis of text. Students are expected to propose, develop, carry out, and present a research project in the field of computational social science.
Prerequisite: STAB23H3 or equivalent and 1.5 credit at the C-level
Breadth Requirements: Quantitative Reasoning

POLD87H3 - Rational Choice and International Cooperation
This course is an introduction to rational choice theories with applications to the international realm. A main goal is to introduce analytical constructs frequently used in the political science and political economy literature to understand strategic interaction among states.
Area of Focus: International Relations
Prerequisite: POLB80H3 and POLB81H3 and [1.5 credits at the C-level in POL courses]
Enrolment Limits: 25
Breadth Requirements: Social & Behavioural Sciences