



**FOR APPROVAL**

**PUBLIC**

**OPEN SESSION**

**TO:** UTSC Academic Affairs Committee

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

**PRESENTER:** Prof. Mark Schmuckler, Vice-Dean, Undergraduate  
**CONTACT INFO:** 416-208-2978, vicedean@utsc.utoronto.ca

**DATE:** Wednesday, January 27, 2016

**AGENDA ITEM:** 4b

**ITEM IDENTIFICATION:**

Major modification to introduce a new stream in Entrepreneurship to the Specialist and Specialist Co-op programs in Computer Science (BSc).

**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] (January 27, 2016)**

**PREVIOUS ACTION TAKEN:**

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

## **HIGHLIGHTS:**

The Department of Computer and Mathematical Science (CMS) is proposing to introduce a new stream in Entrepreneurship to both the Specialist and Specialist Co-op programs in Computer Science (BSc).

The Specialist/Specialist Co-op programs in Computer Science are long-standing programs with four streams – Comprehensive, Software Engineering, Information Systems, and Health Informatics. All streams (non Co-op and Co-op) share a common core of essential computer science courses, corresponding to topics that every graduating student must have been exposed to as they complete their undergraduate degree. However, each stream has a different emphasis, to allow students with different interests to pursue specific areas of computer science in greater depth – typically those areas in which they will pursue further education or careers within industry. With the addition of a stream in Entrepreneurship, both the Specialist/Specialist Co-op programs in Computer Science become programs with five streams.

The overarching goal of the Specialist/Specialist Co-op programs is to provide students with a working knowledge of the foundations of computer science, including: modern computer software and hardware, theoretical aspects of computer science, and relevant areas of mathematics and statistics. It also imparts an appreciation of the discipline's transformative impact on science and society. The programs prepare students for further study at the graduate level and for careers in the computing industry.

The proposed streams (non Co-op and Co-op) in Entrepreneurship will provide students with a solid foundation in computer science as well as the tools and practical experience that will allow them to develop their ideas into viable commercial ventures. Moreover, they address the strong need within computer science programs to better prepare students for a possible career as innovators and entrepreneurs. Students graduating from a leading program in computer science expect to be able to turn innovative ideas into products. At the same time, our society needs innovation to provide much needed growth. Indeed, the social impact of high-tech innovation is impossible to ignore.

Student demand for such a program is very high, as demonstrated by the success of ongoing entrepreneurship related courses at UT St. George. The University itself has made entrepreneurship, and the development of viable start-up companies, a priority by establishing several innovation labs or incubators across its campuses (including The HUB at UTSC).

CMS is well positioned to support the proposed streams because it already offers a strong series of software engineering courses, and because, through the Co-op program, they are able to place over 100 students each year in internship positions with diverse industry partners. Consequently, the proposed streams (non Co-op and Co-op) in Entrepreneurship are key ingredients of the CMS 5-year academic plan, through which the Department will contribute to the development of a strong culture of high-tech innovation in Canada.

This proposal has been approved by the CMS Departmental Curriculum Committee. There has been extensive consultation within CMS, with the UTSC Department of Management to determine how the two academic units can collaborate on their respective entrepreneurship-focused offerings, with the Director of the UTSC HUB, and with the Director of the Arts and Science Co-op Office at UTSC. Externally, there has also been extensive consultation with the UT St. George Department of Computer Science, including their Innovation Lab. Finally, the proposal has been reviewed by the Dean's Office, the Decanal Undergraduate Curriculum Committee and the Provost's Office.

**FINANCIAL IMPLICATIONS:**

There are no net financial implications to the campus' operating budget.

**RECOMMENDATION:**

Be It Resolved,

THAT the Entrepreneurship stream of the Specialist in Computer Science (BSc), as described in the proposal dated November 26, 2015 and recommended by the Interim Vice-Principal Academic and Dean, Professor William Gough, be approved effective April 1, 2016 for the academic year 2016-17; and

THAT the Entrepreneurship stream of the Specialist (Co-operative) in Computer Science (BSc), as described in the proposal dated November 26, 2015 and recommended by the Interim Vice-Principal Academic and Dean, Professor William Gough, be approved effective April 1, 2016 for the academic year 2016-17.

**DOCUMENTATION PROVIDED:**

1. Major Modification to introduce a new stream in Entrepreneurship to the Specialist and Specialist Co-op programs in Management (BBA) dated November 26, 2015.



## University of Toronto Major Modification Proposal: Significant Modifications to Existing Graduate and Undergraduate Programs

<b>Program being modified:</b>	Specialist in Computer Science (BSc) Specialist (Co-operative) in Computer Science (BSc)
<b>Proposed Major Modification:</b>	Introduce a new stream in <i>Entrepreneurship</i> to both programs
<b>Effective Date of Change:</b>	April 1, 2016
<b>Department / Unit where the program resides:</b>	Computer and Mathematical Sciences
<b>Faculty / Academic Division:</b>	University of Toronto Scarborough
<b>Faculty / Academic Division contact:</b>	Annette Knott, Academic Programs Officer aknott@utsc.utoronto.ca
<b>Department / Unit contact:</b>	Bianca Schroeder, bianca@cs.utoronto.ca
<b>Date of this version of the proposal:</b>	November 26, 2015

# 1 Summary

This is a proposal to introduce a new stream in Entrepreneurship to both the Specialist and Specialist Co-op programs in Computer Science (BSc).

The Specialist/Specialist Co-op programs in Computer Science are long-standing programs housed in the Department of Computer and Mathematical Sciences (CMS) at the University of Toronto Scarborough (UTSC). These programs currently have four streams – Comprehensive, Software Engineering, Information Systems, and Health Informatics. With the addition of a stream in Entrepreneurship, both the Specialist/Specialist Co-op programs in Computer Science become programs with five streams.

The overarching goal of the Specialist/Specialist Co-op programs is to provide students with a working knowledge of the foundations of computer science, including: modern computer software and hardware, theoretical aspects of computer science, and relevant areas of mathematics and statistics. It also imparts an appreciation of the discipline's transformative impact on science and society. The programs prepare students for further study at the graduate level and for careers in the computing industry.

The proposed streams (non Co-op and Co-op) in Entrepreneurship will provide students with a solid foundation in computer science as well as the tools and practical experience that will allow them to develop their ideas into viable commercial ventures. Moreover, they address the strong need within computer science programs to better prepare students for a possible career as innovators and entrepreneurs. Students graduating from a leading program in computer science expect to be able to turn innovative ideas into products. At the same time, our society needs innovation to provide much needed growth. Indeed, the social impact of high-tech innovation is impossible to ignore.

Student demand for such a program is very high, as demonstrated by the success of ongoing entrepreneurship related courses at UT St. George. The University itself has made entrepreneurship, and the development of viable start-up companies, a priority by establishing several innovation labs or incubators across its campuses (including The HUB at UTSC).

The proposed streams (non Co-op and Co-op) in Entrepreneurship are key ingredients of the CMS 5-year academic plan. Through them, the Department will contribute to the development of a strong culture of high-tech innovation in Canada. There is no equivalent offering at the University of Toronto, and within Canada only the University of Ottawa provides an entrepreneurship option within their computer science program.

Two new courses are associated with this proposal: CSCD54H3 (Technology Innovation and Entrepreneurship) and CSCD90H3 (The Startup Sandbox).

## 2 Academic Rationale

This is a proposal to introduce a new stream in Entrepreneurship to both the Specialist and Specialist Co-op programs in Computer Science (BSc).

The Specialist/Specialist Co-op programs in Computer Science are long-standing programs housed in the Department of Computer and Mathematical Sciences (CMS) at the University of Toronto Scarborough (UTSC). These programs currently have four streams – Comprehensive, Software Engineering, Information Systems, and Health Informatics.

All streams (non Co-op and Co-op) share a common core of essential computer science courses, corresponding to topics that every graduating student must have been exposed to as they complete their undergraduate degree. However, each stream has a different emphasis, to allow students with different interests to pursue specific areas of computer science in greater depth – typically those areas in which they will pursue further education or careers within industry.

Hence, among our existing streams (non-Co-op and Co-op):

- The Comprehensive streams provide a broad and balanced exposure to computer science as a discipline;
- The Software Engineering streams place a greater emphasis on the topics within computer science that are involved in the design and implementation of large software-based systems, this includes software design, computer systems, and core applications;
- The Information Systems streams provide a core of computer science courses with an emphasis on enterprise software systems, and also exposes students to the principles of business management;
- The Health Informatics streams provide exposure to statistics and social sciences, subjects useful for a career as a computer scientist in the health sector.

The proposed streams (non Co-op and Co-op) in Entrepreneurship will provide students with a solid foundation in computer science as well as the tools and practical experience needed to allow them to develop their ideas into viable commercial ventures.

The development of the proposed streams is timely, given the strong and fast growing global interest in high-tech innovation, the companies that drive it, and the individuals that generate and implement innovative ideas. Innovation is in the minds of our students. Those arriving fresh from high-school have grown up in a world characterized by fast-paced technological change, and they have seen small groups of highly motivated computer scientists go on to build large and successful companies. At the same time, their lives have been transformed by the products and services that many of these innovative companies create. As a consequence, students today view computer science as a promising path to a career as innovators.

The social impact of having a strong culture of innovation cannot be overstated. Innovation drives the creation of new products, jobs, markets, and in remarkable instances entire

economies, as an example, consider the rise of on-line retail and its impact on our economy and daily lives. It is therefore of the utmost importance that Universities provide students with every opportunity to learn and develop a mindset appropriate for innovation to occur.

Despite a strong interest in innovation from students, and despite the obvious benefits to society of having a strong culture of innovation and entrepreneurship, neither innovation nor entrepreneurship is currently well represented in most computer science programs around the world. Large universities with strong computer science programs are only just beginning to explore the inclusion of business topics into their programs to better prepare graduates for industry work and founding technology start-ups.

The development of the proposed streams (non Co-op and Co-op) in Entrepreneurship is inspired, in part, by the recent evolution of a course specifically geared toward entrepreneurship at UT St. George – CSC454H1 The Business of Software. This course runs in parallel with a practical project course, which has already produced a number of exciting and innovative ideas. In fact, the University of Toronto was one of only 10 universities worldwide, and the only Canadian university, invited to participate in the inaugural IBM Watson Cognitive Computing Competition, which combines computing with entrepreneurship: US participants included Carnegie Mellon University, University of California at Berkeley, and Stanford University. In this competition, teams of students were asked to design and implement new services via IBM's Watson platform. The top local team went on to compete in New York and placed second in the final round against teams from the other nine universities with their system to help lawyers carry out background research (see <http://news.utoronto.ca/u-t-team-takes-second-place-ibm-watson-challenge>).

Course offerings such as CSC454H1 prove not only that the potential exists for bringing entrepreneurship into the core of a computer science program, but also have shown that student interest and motivation for participating in such efforts is very strong.

The current climate within computer science as a discipline is ripe for the introduction of the proposed streams in Entrepreneurship (non Co-op and Co-op), and it will bring UTSC to the front line of computer science education within Canada. At the present time, only the University of Ottawa offers an established program combining computer science and entrepreneurship (Honours BSc with specialization in Computer Science, Management, and Entrepreneurship).

CMS at UTSC is well positioned to support the proposed streams (non Co-op and Co-op) for the following key reasons: first, we offer a strong series of software engineering courses including CSCB07H3 Software Design, CSCC01H3 Introduction to Software Engineering, and CSCD01H3 Engineering Large Software Systems; second, through our Co-Op program we are able to place over one hundred computer science students each year in internship positions with diverse industry partners; third, our students have access to extra-curricular activities and opportunities through the HUB, which provides entrepreneurship-related workshops and mentoring for students interested in the development and commercialization of their ideas; and finally, with the recent establishment of streams in Entrepreneurship in the Specialist and

Specialist Co-op programs in Management (BBA), UTSC has already begun to distinguish itself as an entrepreneur-friendly campus.

For all the above reasons, the creation of the proposed streams (non Co-op and Co-op) in Entrepreneurship within our Specialist/Specialist Co-op programs in Computer Science is a key component of the Department's 5-year academic plan. We expect this stream to be populated with highly motivated, creative, and capable students. The success of these streams and their students will greatly increase the visibility of CMS, and contribute in a meaningful way toward making CMS and UTSC destinations of choice for talented students interested in computer science.

The proposed streams (non Co-op and Co-op) are aimed at students with a passion for innovation and entrepreneurship, Although it is not designed solely for Co-Op students, we anticipate that students in the Co-Op program will be especially interested in the Co-op stream because of its direct relationship with small, fast evolving companies. At the same time, enrolment in the Co-op program will be an asset since these students are more likely to have been involved at some level with the process of high-tech innovation, and will already have hands-on experience developing software products.

We will work closely with the Arts and Science Co-Op Office to support students in the Co-op stream to join small companies and start-ups so that they become familiar with the atmosphere and pace of high-tech start-ups. Such co-op placements should be available as early as 2017. We will also look at different ways to enable students with extremely promising project ideas to find entrepreneurial co-op placements so that they can truly pursue their entrepreneurial aspirations in the HUB at UTSC.

The proposed streams (non Co-op and Co-op) call for extensive mentoring and faculty interaction, and suitable placements during co-op terms. Because of the resource demands entailed, we intend to keep enrolments in the Entrepreneurship streams relatively small; aiming to have no more than 15 to 20 students per year initially.

### **3 Description of the Proposed Major Modification(s)**

#### Admission Requirements:

Enrolment into the existing Specialist/Specialist Co-op programs in Computer Science, including the four existing streams, is limited. Students may apply to their desired stream after they have passed all of the first-year computer science and mathematics courses, as follows:

- CSCA08H3 Introduction to Computer Science I
- CSCA48H3 Introduction to Computer Science II
- CSCA67H3 Discrete Mathematics
- MATA23H3 Linear Algebra I
- MATA31H3 Calculus I for Mathematical Sciences



- MATA37H3 Calculus II for Mathematical Sciences

CGPA admission requirements for the proposed streams in Entrepreneurship are identical to those of the other streams of the Specialist/ Specialist Co-op programs in Computer Science:

- The CGPA admission requirement for entry after first year for the stream in Entrepreneurship in the non Co-op program is 2.5;
- The CGPA admission requirement for entry after first year for the stream in Entrepreneurship in the Co-op program is 2.75;
- In addition, students wishing to apply to either of the proposed streams in Entrepreneurship (non Co-op and Co-op) will be required to submit a Supplementary Application (SAP) form that asks them to describe their motivation, and their views on innovation and entrepreneurship. The SAP will allow us to determine whether the stream in Entrepreneurship is a good fit for the student. A draft version of this form is given in Appendix C.

Program Requirements:

The course requirements for the Specialist/Specialist Co-op programs in Computer Science consist of a common core (9.0 credits) that all students must take, plus an additional 4.5 to 6.0 credits, depending upon the stream.

Students in the proposed streams in Entrepreneurship (non Co-op and Co-op) must complete a total of 27 courses (13.5 credits), including the 9.0 credits from the common core (requirements 1-5 of the Specialist/Specialist Co-op programs in Computer Science), plus an additional 9 courses (4.5 credits) as follows:

#### **6. Additional required courses (3.0 credits)**

CSCC01H3 Introduction to Software Engineering

CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics

CSCC63H3 Computability and Computational Complexity

CSCD01H3 Engineering Large Software Systems

CSCD54H3 Technology Innovation and Entrepreneurship (*new*)

CSCD90H3 The Startup Sandbox (*new*)

#### **7. Electives from courses in computer science, mathematics, and statistics (1.5 credits)**

**Three of:**

MATB41H3 Techniques of the Calculus of Several Variables I

STAB57H3 Introduction to Statistics

CSCC09H3 Programming on the Web

CSCC11H3 Introduction to Machine Learning and Data Mining

CSCC24H3 Principles of Programming Languages

CSCC85H3 Introduction to Embedded Systems

CSCD18H3 Computer Graphics

CSCD27H3 Computer and Network Security

CSCD43H3 Database System Technology  
CSCD58H3 Computer Networks  
CSCD84H3 Artificial Intelligence  
CSC318H Design of Interactive Computational Media  
CSC320H Visual Computing  
CSC321H Introduction to Neural Networks and Machine Learning  
CSC401H Natural Language Computing  
CSC469H Operating Systems Design and Implementation  
CSC485H Computational Linguistics  
CSC488H Compilers and Interpreters

Unique to the proposed streams in Entrepreneurship (non Co-op and Co-op) are two new D-level (capstone) courses, focused on Entrepreneurship:

- CSCD54H3 Technology Innovation and Entrepreneurship
- CSCD90H3 The Startup Sandbox

CSCD54H3 introduces the landscape of technology innovation and entrepreneurship, and provides a thorough and up-to-date study of the methodologies and processes involved in developing a start-up company.

CSCD90H3 is an experiential project course in which students attempt to develop a new technology-based business venture. It functions as the capstone course in both the non Co-op and Co-op streams, and is designed as an immersive, experiential component that cannot be taken in isolation as an elective. It is intended to allow students to build a product to the point where it is ready for a potential round of seed funding, and it does not work outside the context of the larger effort to provide students with the technical knowledge, methodologies, and skills that are part of a mindset centered on innovation.

With these two courses, students will gain a deep understanding of the process of transforming an idea into a viable product, bringing together their technical knowledge of computer science, and in particular software engineering, and their knowledge of the methodologies and process of starting a high-tech venture.

These new courses will be offered concurrently to give students the opportunity to put conceptual material and their own ideas directly into practice; thus, ensuring their fourth year is both engaging and immersive. These D-level courses form the core of the entrepreneurship component of the proposed streams (non Co-op and Co-op), however, we also recognize the desirability of introducing innovation and entrepreneurship at an even earlier stage in a student's education; as such, long-term plans for these streams include the introduction of a C-level course, which will foster the skills and mindset that put students in tune with the culture of technology innovation.

A complete Calendar entry for the Specialist/Specialist Co-op programs in Computer Science, showing the changes associated with the proposed streams in Entrepreneurship (non Co-op

and Co-op), is given in Appendix A.

#### Learning Outcomes:

A detailed description of the learning outcomes for the proposed streams in Entrepreneurship (non Co-op and Co-op) is given in Appendix B.

## **4 Impact of the Change on Students**

Incoming students, starting their University program in Sept 2015, will be eligible to join the new streams in the Fall of 2016 provided they meet the requirements and qualifications necessary to do so. Similarly qualified students already in one of our other streams will be able to apply for transfer to the new streams should they wish to do so.

We anticipate that a proportion of the students who are currently choosing the Software Engineering streams of the Specialist/Specialist Co-op programs in Computer Science, will be interested in the proposed streams in Entrepreneurship (non Co-op and Co-op). We therefore may see a decline in enrolments in the Software Engineering streams, but no decline in enrolments in the Specialist/Specialist Co-op programs in Computer Science overall.

The Department has held consultation with the student body through AMACSS, the Association of Mathematics and Computer Science Students. The result is overwhelming support among our student body for the creation of the new streams in Entrepreneurship. Many of our students are already involved in entrepreneurship-related activities through The Hub, and have signalled strong interest in having access to the opportunities provided by computer science streams with a focus on entrepreneurship. At the same time, strong and continued interest in the entrepreneurship courses at St. George shows that such interest in entrepreneurship is widespread and increasing over time.

## **5 Consultation**

Within CMS, consultation on the plan for the proposed streams (non Co-op and Co-op) has taken place over an extended period. The general structure of the streams was discussed during the development of our 5-year plan, and received strong support from all computer science faculty. The faculty has had ample opportunity to provide feedback, express their views on the proposal, and request changes or improvements to the proposal. The full body of this proposal was approved by the Department's Curriculum Committee on Oct. 2, 2015.

Extensive consultation has occurred with Mario Grech and Helen Kontozopoulos, Co-Directors of the Department of Computer Science Innovation Lab at UT St. George, as well as with the instructors of Computer Science courses focused on entrepreneurship at UT St. George. Our goal is to build a strong, coherent tri-campus culture of innovation and entrepreneurship in computer science at the University of Toronto. The collaboration with DCS and DCSIL will immediately benefit our students by allowing them to have access to the weekly invited

lectures on entrepreneurship offered at St. George as part of their Business of Software course.

We have discussed this proposal at length with Gray Graffam, Director of The HUB. The capstone elements of the proposed streams may be well suited to making use of HUB facilities, for instruction, team project work, and invited speakers that contribute to the capstone courses.

We have discussed the proposed Co-op stream in Entrepreneurship with Roger Francis, Director of the Arts & Science Co-op Office. We agree that the Co-op stream will benefit from a more flexible co-op model, and greater co-op contacts in smaller companies.

Because of the close relationship between entrepreneurship and all aspects of business management, consultations with the Department of Management are ongoing to determine to what degree we can collaborate within our respective Entrepreneurship-oriented efforts. Given that streams in Entrepreneurship already exist within the Specialist/Specialist Co-op programs In Management, one clear possibility for collaboration involves coordinating a joint capstone project, bringing together computer science and management students enrolled in the corresponding entrepreneurship streams (non Co-op and Co-op). The current consensus is that close collaboration and any efforts to allow computer sciences and management students to interact within the scope of entrepreneurship are welcome and should be pursued seriously.

## 6 Resources

This is a proposal to introduce new streams in Entrepreneurship to already existing Specialist and Specialist Co-op programs in Computer Science. As such faculty resources sufficient to support the proposed streams (non Co-op and Co-op) already exist in CMS. Most of the course requirements associated with the proposed streams are drawn from courses that are already being offered on a regular basis, and the expertise required to teach the two associated new courses – CSCD54H3 and CSCD90H3 – also already exists among current CMS faculty.

In addition, we have held close consultation with the instructors who coordinate the entrepreneurship courses offered by the Department of Computer Science at UT St. George. Both Mario Grech and Helen Kontozopoulos have been very outspoken in their willingness to share their experience with their courses, and to collaborate with CMS once our streams in Entrepreneurship (non Co-op and Co-op) are up and running. Further to this, Helen Kontozopoulos will be conducting a trial run of CSCD54H3 (Technology Innovation and Entrepreneurship) as a topics course during the Winter term of 2016. There are many good reasons for doing this, including allowing current CMS faculty to closely observe how the course develops, allowing CMS to measure student interest in such a course, and identifying potential challenges so they can be addressed well before the stream launches.

The only resource implications associated with this proposal are tied to the new courses, and are discussed in the new course proposals. They consist of requests for some additional stipend support for CSCD90H3 as well as 65 hours of TA support for CSCD54H3 and 130 hours of TA support for CSCD90H3. We are currently working with the Dean's Office to increase our stipend

and TA support budgets.

We foresee the use of The HUB as a meeting space for students to exchange ideas and work on their projects; and, for those teams who generate promising innovations, a home from which they can continue to develop their start-up company until it is ready to be launched. Indeed, this will both enhance students' experiences and help the HUB achieve its mission. Students will also have access to programming in DCSIL, the Department of Computer Science Innovation Lab on the St. George campus.

We are looking for potential sources of additional funding so that teams with promising product ideas will have the opportunity to continue to develop them; one possibility includes co-op placements within The HUB, but we are looking for an on-going source of outside funding so that promising teams can be encouraged to work on their products year after year.

## 7 Governance Process

<b>Levels of Approval Required</b>	<b>Date</b>
<b>Academic Unit Curriculum Committee</b>	Approved on Oct. 2, 2015
<b>Decanal Sign-Off</b>	November 9, 2015
<b>DUCC (Undergraduate)</b>	December 21, 2015
<b>UTSC Academic Affairs Committee</b>	January 27, 2016
<b>Submission to Provost's Office</b>	
<b>AP&amp;P – reported annually</b>	
<b>Ontario Quality Council – reported annually</b>	

# Appendix A: Calendar Copy [showing changes]

## SPECIALIST PROGRAM IN COMPUTER SCIENCE (SCIENCE)

*Supervisor of Studies:* R. Pancer (416-287-7679) *Email:* [pancer@utsc.utoronto.ca](mailto:pancer@utsc.utoronto.ca)

### Program Objectives

This program provides a working knowledge of the foundations of computer science: modern computer software and hardware, theoretical aspects of computer science, and relevant areas of mathematics and statistics. It also imparts an appreciation of the discipline's transformative impact on science and society. The program prepares students for further study and for careers in the computing industry. It comprises ~~four~~ **five** streams with different emphases:

**The Comprehensive Stream** provides a broad and balanced exposure to the discipline. It is the stream best-suited for students planning to pursue graduate study in computer science, but it is also suitable for other career paths.

**The Software Engineering Stream** places a greater emphasis on the engineering side of the discipline, including computer systems and core applications.

**The Information Systems Stream** has a similar focus as the Software Engineering Stream, but it provides additional exposure to certain aspects of business management. It is of special interest to students wishing to pursue careers in technical management but who have a deep interest in the technology.

**The Health Informatics Stream** provides a broad perspective of the discipline and exposure to additional subjects, including statistics and social sciences, that are useful for a career as a computer scientist in the health sector.

**The Entrepreneurship Stream** includes a solid core of computer science and software engineering, while exposing students to the framework and methodologies that underlie the development of innovative technology ideas into viable commercial opportunities. Enrolment into the Entrepreneurship stream will be limited to highly qualified and motivated students, and preference will be given to students enrolled in the Specialist (Co-operative) program.

The structure of the program requirements allows one to easily switch streams until relatively late in the program. Consequently, these streams should not be viewed as rigidly separated channels feeding students to different career paths, but as a flexible structure that provides computer science students guidance in their course selection based on their broad (but possibly fluid) interests.

### Program Admission

Students may apply to a Computer Science Specialist stream after completing first year. An

applicant must have passed all of the first-year computer science and mathematics courses required for their program.

**For the Comprehensive, Software Engineering, Information Systems and Health Informatics streams, a CGPA of 2.5 or greater guarantees admission. Admission for students with a CGPA less than 2.5 will depend on their CGPA and the available space in the program.**

**For the Entrepreneurship stream, students must have a minimum CGPA of 2.5 and submit a completed Supplementary Application form available at the CMS website <http://www.utsc.utoronto.ca/cms/>**

### **Program Requirements**

To remain in the program, a student must maintain a CGPA of 2.0 or higher throughout the program. To complete the program, a student must meet the course requirements described below. (One credit is equivalent to two courses). The program requirements comprise a core of 18 courses (9.0 credits), common to all streams and additional requirements which depend on the stream, for a total of 27 courses (13.5 credits) for the Comprehensive, ~~and~~ Software Engineering, **and Entrepreneurship** Streams, 29 courses (14.5 credits) for the Information Systems Stream, ~~and~~ 30 courses (15.0 credits) for the Health Informatics Stream.

**Note:** Many Computer Science courses are offered both at U of T Scarborough and at the St. George campus. When a course is offered at both campuses in a given session, U of T Scarborough students are expected to take that course at U of T Scarborough. The Department of Computer Science at the St. George campus cannot guarantee space for U of T Scarborough students in their courses, especially those offered at both campuses.

### **Core (9.0 credits)**

#### **1. Writing Requirement (0.5 credit) (\*)**

**One of:** ANTA01H3, ANTA02H3, (CLAA02H3), (CTLA19H3), CTLA01H3, ENGA10H3, ENGA11H3, ENGB06H3, ENGB07H3, ENGB08H3, ENGB09H3, ENGB17H3, ENGB19H3, ENGB50H3, (ENGB51H3), GGRA02H3, GGRA03H3, GGRB05H3, (GGRB06H3), (HISA01H3), (HLTA01H3), ACMA01H3, (HUMA01H3), (HUMA11H3), (HUMA17H3), (LGGA99H3), LINA01H3, PHLA10H3, PHLA11H3, WSTA01H3.

(\*) It is recommended that this requirement be satisfied by the end of the second year.

#### **2. A-level courses (3.0 credits)**

CSCA08H3 Introduction to Computer Science I  
CSCA48H3 Introduction to Computer Science II  
CSCA67H3 Discrete Mathematics  
MATA23H3 Linear Algebra I  
MATA31H3 Calculus I for Mathematical Sciences  
MATA37H3 Calculus II for Mathematical Sciences

### **3. B-level courses (3.5 credits)**

CSCB07H3 Software Design  
CSCB09H3 Software Tools and Systems Programming  
CSCB36H3 Introduction to the Theory of Computation  
CSCB58H3 Computer Organization  
CSCB63H3 Design and Analysis of Data Structures  
MATB24H3 Linear Algebra II  
STAB52H3 Introduction to Probability

### **4. C-level courses (1.5 credits)**

CSCC43H3 Introduction to Databases  
CSCC69H3 Operating Systems  
CSCC73H3 Algorithm Design and Analysis

### **5. D-level courses (0.5 credit)**

CSCD03H3 Social Impact of Information Technology

### **A. Comprehensive Stream**

This stream requires a total of 27 courses (13.5 credits). In addition to the core requirements 1-5 common to all streams, 9 other distinct courses (4.5 credits) must be chosen satisfying all of the following requirements:

### **6. Additional required courses (2.5 credits)**

MATB41H3 Techniques of the Calculus of Several Variables I  
CSCC24H3 Principles of Programming Languages  
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics  
CSCC63H3 Computability and Computational Complexity  
CSCD37H3 Analysis of Numerical Algorithms for Computational Mathematics

### **7. Electives from courses on computers systems and applications (1.0 credit)**

#### **Two of:**

CSCC01H3 Introduction to Software Engineering  
CSCC09H3 Programming on the Web  
CSCC11H3 Introduction to Machine Learning and Data Mining  
CSCC85H3 Introduction to Embedded Systems  
CSCD01H3 Engineering Large Software Systems  
CSCD18H3 Computer Graphics  
CSCD27H3 Computer and Network Security  
CSCD43H3 Database System Technology  
CSCD58H3 Computer Networks  
CSCD84H3 Artificial Intelligence  
CSC318H Design of Interactive Computational Media  
CSC320H Visual Computing  
CSC321H Introduction to Neural Networks and Machine Learning



CSC401H Natural Language Computing  
CSC469H Operating Systems Design and Implementation  
CSC485H Computational Linguistics  
CSC488H Compilers and Interpreters

**8. Electives from courses related to the theory of computing (0.5 credit)**

**One of:**

MATC09H3 Introduction to Mathematical Logic  
MATC16H3 Coding Theory and Cryptography  
MATC32H3 Graph Theory and Algorithms for its Applications  
MATC44H3 Introduction to Combinatorics  
CSC438H Computability and Logic  
CSC448H Formal Languages and Automata  
CSC465H Formal Methods in Software Design

**9. CSC, MAT, or STA elective (0.5 credit)**

**One of:**

Any C- or D-level CSC, MAT, or STA course, excluding MATC82H3, MATC90H3, and STAD29H3.

**B. Software Engineering Stream**

This stream requires a total of 27 courses (13.5 credits). In addition to the core requirements 1-5 common to all streams, 9 other distinct courses (4.5 credits) must be chosen satisfying all of the following requirements:

**6. Additional required courses (3.0 credits)**

MATB41H3 Techniques of the Calculus of Several Variables I  
CSCC01H3 Introduction to Software Engineering  
CSCC24H3 Principles of Programming Languages  
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics  
CSCC63H3 Computability and Computational Complexity  
CSCD01H3 Engineering Large Software Systems

**7. Electives from courses on computer systems and applications (1.5 credits)**

**Three of:**

CSCC09H3 Programming on the Web  
CSCC11H3 Introduction to Machine Learning and Data Mining  
CSCC85H3 Introduction to Embedded Systems  
CSCD18H3 Computer Graphics  
CSCD27H3 Computer and Network Security  
CSCD43H3 Database System Technology  
CSCD58H3 Computer Networks  
CSCD84H3 Artificial Intelligence  
CSC318H Design of Interactive Computational Media  
CSC320H Visual Computing

CSC321H Introduction to Neural Networks and Machine Learning  
CSC401H Natural Language Computing  
CSC469H Operating Systems Design and Implementation  
CSC485H Computational Linguistics  
CSC488H Compilers and Interpreters

### **C. Information Systems Stream**

This stream requires a total of 29 courses (14.5 credits). In addition to the core requirements 1-5 common to all streams, 11 other distinct courses (5.5 credits) must be chosen satisfying all of the following requirements:

#### **6. Required management courses (1.5 credits)**

MGTA01H3/(MGTA03H3) Introduction to Management I  
MGTA02H3/(MGTA04H3) Introduction to Management II  
MGHB02H3 Managing People and Groups in Organizations

#### **7. Additional required mathematics and computer science courses (3.0 credits)**

MATB41H3 Techniques of the Calculus of Several Variables I  
CSCC01H3 Introduction to Software Engineering  
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics  
CSCC63H3 Computability and Computational Complexity  
CSCD01H3 Engineering Large Software Systems  
CSCD43H3 Database System Technology

#### **8. Electives from courses on computer systems and applications (1.0 credit)**

##### **Two of:**

CSCC09H3 Programming on the Web  
CSCC11H3 Introduction to Machine Learning and Data Mining  
CSCC85H3 Introduction to Embedded Systems  
CSCD18H3 Computer Graphics  
CSCD27H3 Computer and Network Security  
CSCD58H3 Computer Networks  
CSCD84H3 Artificial Intelligence  
CSC318H Design of Interactive Computational Media  
CSC320H Visual Computing  
CSC321H Introduction to Neural Networks and Machine Learning  
CSC401H Natural Language Computing  
CSC469H Operating Systems Design and Implementation  
CSC485H Computational Linguistics  
CSC488H Compilers and Interpreters

### **D. Health Informatics Stream**

This stream requires a total of 30 courses (15.0 credits). In addition to the core requirements 1-

5 common to all streams, 12 other distinct courses (6.0 credits) must be chosen satisfying all of the following requirements:

**6. Additional courses related to health studies (2 credits)**

PHLB09H3 Biomedical Ethics

MGTA06H3 Introduction to Health Management\*

**One of:** (courses on health policy and politics)

HLTB16H3 Introduction to Public Health

HLTB17H3 Conceptual Models of Health

HLTB40H3 Health Policy and Health Systems

HLTC40H3 Introduction to Health Economics

**One of:** (other courses on health studies)

HLTB22H3 Biological Determinants of Health

HLTC05H3 Social Determinants of Health\*

(\*) These courses have prerequisites not included in this program's requirements.

**7. Additional required computer science and statistics courses (1.5 credits)**

CSCC01H3 Introduction to Software Engineering

STAB57H3 Introduction to Statistics

STAC50H3 Data Collection

**8. Additional CSC, MAT and STA courses (2.5 credits)**

MATB41H3 Techniques of the Calculus of Several Variables I

Four of:

any other C- or D-level CSC or STA courses, excluding STAD29H3 \*\*†

**NOTE:** Of the five courses taken to satisfy this requirement, at least one must be a D-level course, and at least three must be CSC courses.

\*\* Some C- and D-level CSC and STA courses have prerequisites that are not included among the required courses for this stream. Review the prerequisites carefully before selecting courses for this requirement. One or more courses taken to satisfy this requirement can be prerequisites for other courses also taken to satisfy this requirement.

† Among the CSC courses that can be used to satisfy this requirement there are two categories of courses that are particularly well aligned with the goals of the Health Informatics stream: software engineering and systems, and computer science applications. Courses in the category of software engineering and systems include: CSCC09H3, CSCC85H3, CSCD01H3, CSCD43H3, and CSCD58H3. Courses in the category of computer science applications include: CSCC11H3, CSCD18H3, and CSCD84H3.

**E. Entrepreneurship Stream**

This stream requires a total of 27 courses (13.5 credits). In addition to the core requirements 1-5 common to all streams, 9 other distinct courses (4.5 credits) must be chosen satisfying all of the following requirements:

## 6. Additional required courses (3.0 credits)

CSCC01H3 Introduction to Software Engineering  
CSCC37H3 Introduction to Numerical Algorithms for Computational Mathematics  
CSCC63H3 Computability and Computational Complexity  
CSCD01H3 Engineering Large Software Systems  
CSCD54H3 Technology Innovation and Entrepreneurship (new)  
CSCD90H3 The Startup Sandbox (new)

## 7. Electives from courses in computer science, mathematics, and statistics (1.5 credits)

### Three of:

MATB41H3 Techniques of the Calculus of Several Variables I  
STAB57H3 Introduction to Statistics  
CSCC09H3 Programming on the Web  
CSCC11H3 Introduction to Machine Learning and Data Mining  
CSCC24H3 Principles of Programming Languages  
CSCC85H3 Introduction to Embedded Systems  
CSCD18H3 Computer Graphics  
CSCD27H3 Computer and Network Security  
CSCD43H3 Database System Technology  
CSCD58H3 Computer Networks  
CSCD84H3 Artificial Intelligence  
CSC318H Design of Interactive Computational Media  
CSC320H Visual Computing  
CSC321H Introduction to Neural Networks and Machine Learning  
CSC401H Natural Language Computing  
CSC469H Operating Systems Design and Implementation  
CSC485H Computational Linguistics  
CSC488H Compilers and Interpreters

## SPECIALIST (CO-OPERATIVE) PROGRAM IN COMPUTER SCIENCE (SCIENCE)

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### Program Objectives

This program combines the coursework of the Specialist Program in Computer Science described above with paid work terms in public and private enterprises. It shares the goals and structure of the Specialist Program in Computer Science, including its ~~four~~ **five** streams (Comprehensive, Software Engineering, Information Systems, ~~and~~ Health Informatics, **and Entrepreneurship**), but complements study of the subject with considerable work experience.

### Program Admission

Refer to the Program Admission requirements for the Specialist Program in Computer Science described above and the [Co-operative Programs](#) section in this *Calendar*. Students entering this

program after first year must have a CGPA of at least 2.75. Admission to the Entrepreneurship Stream also requires the submission of a Supplementary Application form available from the CMS website: <http://www.utoronto.ca/cms/>

### **Program Requirements**

To remain in the program, a student must maintain a CGPA of 2.5 or higher throughout the program. To complete the program, a student must meet the work term and course requirements described below.

### **Work Term Requirements**

Students must successfully complete three work terms, at most one of which can be during the summer. In addition, prior to their first work term, students must successfully complete the Arts & Science Co-op Work Term Preparation Activities. These include networking sessions, speaker panels and industry tours along with seminars covering resumes, cover letters, job interviews and work term expectations.

### **Course Requirements**

The Co-operative Program can be taken in conjunction with any of the streams in the Specialist Program in Computer Science. For the course requirements of each stream, please refer to the description of the Specialist Program in Computer Science.

## Appendix B: New Learning Outcomes, and Degree Level Expectations [Undergraduate Programs]

Degree Level Expectations	Clearly describe the new Program Learning Outcomes.	Clearly describe how the revised program design/structure will support the program learning outcomes.
<p><b>1. Depth and Breadth of Knowledge</b></p> <p>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.</p> <p>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.</p>	<p>Within all streams of our Specialist/Specialist Co-Op programs in Computer Science, depth and breadth of knowledge is understood as the acquisition of a strong foundation on the core computer science areas including, but not restricted to theory, systems and software engineering, algorithms and data structures, and applications. Such foundations require in-depth knowledge of related mathematics and statistics topics including calculus, linear algebra, and probability.</p> <p>In the proposed streams in Entrepreneurship (non Co-op and Co-op), students will be expected, in addition to the above, to learn the techniques and methodologies involved in developing an innovative high-tech idea into a viable product. Students in this stream will acquire a solid background in entrepreneurship, including practical experience developing their own innovative idea.</p> <p>Mastery of the above will be reflected in students who are able to handle a wide range of theoretical as well as practical problems in computer science, and who have the skills to become software developers or graduate students in the field, at the same time, they will be capable of developing a high-tech innovation, identifying the potential market, and creating a viable business plan and product prototype that can be presented to potential investors.</p> <p>Graduating students will be able to</p>	<p>The program design and requirement elements in all streams of our Specialist/Specialist Co-op programs that ensure these student outcomes for depth and breadth of knowledge are:</p> <p>The course sequence and progression from A- to D-level courses is designed to provide increasing depth and sophistication. At each level, students are expected to engage the material with greater understanding and improved techniques of reasoning.</p> <p>Breadth is provided by ensuring students take courses in a broad spectrum of computer science courses as well as in neighbouring disciplines. In particular, our students are required to cover a minimum of 2.5 credits worth of Mathematics and Statistics courses, including Calculus, Linear Algebra, and Probability and Statistics.</p> <p>A carefully prepared combination of theory and practical, experiential learning provides students with an opportunity to learn, apply, and strengthen their mastery of core computer science topics along with their mathematical and statistical foundations.</p> <p>Additionally, and specific to the Entrepreneurship streams (non Co-op and Co-op), they will develop maturity and technical depth enabling them to integrate their computer science knowledge with the product development process to turn innovative ideas into viable potential products.</p> <p>Students in the Entrepreneurship streams (non Co-op and Co-op) will be required to</p>

	<p>pursue a career as innovators and entrepreneurs, or to follow more traditional paths toward a career in the software industry or graduate-level studies in computer science.</p>	<p>write reports for different audiences, and to present verbally their ideas, innovations, and technical solutions in an articulate and concise manner. The progression of courses provides them with opportunities to practice and develop their writing and oral presentation skills under the mentorship of qualified TAs and faculty.</p>
<p><b>2. Knowledge of Methodologies</b></p> <p>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 arise in their area of study.</p>	<p>Students in all streams of our Specialist/Specialist Co-op programs in Computer Science, are taught the methodologies in all core areas of Computer Science as well as closely related areas in Mathematics and Statistics</p> <p>Within the proposed streams in Entrepreneurship (non Co-op and Co-op) they will also be taught current methodologies and topics in Entrepreneurship.</p> <p>Students are expected to master these methodologies and accompanying tools through exercises, problem solving, and guided project work.</p>	<p>Each sequence of courses in the Specialist/Specialist Co-op programs in Computer Science is structured so that students learn and apply the relevant methodologies in the corresponding area of knowledge with increasing depth. For instance, the course sequence: CSCB07H3 Software Design, CSCC01H3 Introduction to Software Engineering, and CSCD01H3 Engineering Large Software Systems, provides students with increasing depth and mastery of material related to software engineering theory and practice. Similar sequences exist for computational theory, databases, machine learning and artificial intelligence, algorithms, and the Mathematics and Statistics components of the program.</p> <p>For the Entrepreneurship streams (non Co-op and Co-op), the concurrent entrepreneurship course (CSCD54H3 Technology, Innovation and Entrepreneurship) and capstone project (CSCD90H3 The Startup Sandbox) build upon each other to develop the student's understanding of the process of bringing an innovation to market.</p> <p>The sequence of courses is geared toward building maturity and developing a sound understanding of each of the areas of study; developing the skills that will allow students to choose between possible career paths in computer science, or as technology innovators.</p>
<p><b>3. Application of Knowledge</b></p> <p>Students are able to frame relevant questions for further inquiry. They are familiar with, or will be able</p>	<p>Students in all streams of the Specialist/Specialist Co-op programs in Computer Science are expected to have the ability to apply their technical knowledge of a wide range of topics within computer science towards</p>	<p>The Specialist/Specialist Co-op programs in Computer Science, and the proposed streams in Entrepreneurship (non Co-op and Co-op) will provide a sequence of courses designed to help students develop their critical thinking skills.</p>

<p>to seek the tools with which, they can address such questions effectively.</p>	<p>solving a problem; be it a research question, an industry need, or a technical issue arising from a novel application of computer science.</p> <p>In addition to the above, students in the proposed streams in Entrepreneurship (non Co-op and Co-op) will be able to carry out the process of product development including building a product prototype within any of the major areas of application of computer science.</p>	<p>Students are able to enrol in faculty-supervised study projects such as CSCD94H3/D95H3 Computer Science Project, and will also have the opportunity to apply their knowledge toward implementing software products for the consumer market or for industry through CSCC01H3 Introduction to Software Engineering, CSCD01H3 Engineering Large Software Systems, and CSCD90H3 The Startup Sandbox.</p>
<p><b>4. Awareness of Limits of Knowledge</b></p> <p>Students gain an understanding of the limits of their own knowledge and an appreciation of the uncertainty, ambiguity, and limits to our collective knowledge and how these might influence analyses and interpretations.</p>	<p>Students in all streams of the Specialist/Specialist Co-op programs in Computer Science will, through practical experience in software projects and guided study courses, develop an understanding of the limits of technical solutions. They will be exposed to open problems in multiple areas of computer science.</p> <p>In addition, for the proposed streams in Entrepreneurship (non Co-op and Co-op), students will develop an awareness of the uncertainties associated with working with customers and/or users in the software industry, and learn to handle the uncertainties and risk inherent in the process of developing a new product.</p>	<p>The program includes a number of experiential components allowing students to see and experience within a project course the limitations of their knowledge. This is especially evident in project courses such as CSCD94H3, Computer Science Project, which typically involve exposing students to cutting-edge research and open problems. Students will thus learn to identify opportunities for further learning. Software development projects in CSCC01H3 Introduction to Software Engineering and CSCD01H3 Engineering Large Software Systems will provide them with tools to manage inherent uncertainties where customers are involved.</p> <p>Within the proposed streams in Entrepreneurship (non Co-op and Co-op), exposure to the world of high-tech entrepreneurship via CSCD54H3 Technology, Innovation and Entrepreneurship and CSCD90H3 the Startup Sandbox, combined with the extra curricular activities and content provided by high-tech accelerators and incubators across the University (in particular, The HUB at UTSC), will allow students to identify novel ideas with potential market value, and to be aware of the risks inherent in any new technology venture.</p>
<p><b>5. Communication Skills</b></p> <p>Students are able to communicate information, arguments, and analyses accurately and reliably,</p>	<p>Students in all streams of the Specialist/Specialist Co-op program in Computer Science are expected to develop excellent written and oral presentation skills. They are able to present their ideas concisely and at</p>	<p>All students in all streams of the Specialist/Specialist Co-op programs in Computer Science are presented with multiple opportunities to develop their written and presentation skills. Examples include project reports, software</p>



<p>both orally and in writing. They learn to read and to listen critically.</p>	<p>the right level of technical detail depending on their audience, and can work effectively and productively as part of a team to develop an idea.</p> <p>Additionally, for the proposed streams in Entrepreneurship (non Co-op and Co-op), students are expected to be able to present an innovative high-tech idea in a format suitable for potential investors, and to prepare and present a convincing pitch for their prototype product.</p>	<p>documentation, and pitches for commercial ventures. Together with the need to work in groups for their course projects, all these factors contribute to developing solid written and oral presentation skills.</p> <p>For students in the proposed streams in Entrepreneurship (non Co-op and Co-op), the capstone project CSCD90H3 The Startup Sandbox further develops these skills by allowing students to gain experience <i>pitching</i> an idea effectively to audiences with different backgrounds.</p>
<p><b>6. Autonomy and Professional Capacity</b></p> <p>The education students receive achieves the following broad goals:</p> <ul style="list-style-type: none"> <li>• It gives students the skills and knowledge they need to become informed, independent and creative thinkers</li> <li>• It instils the awareness that knowledge and its applications are influenced by, and contribute to, society</li> <li>• It lays the foundation for learning as a life-long endeavour</li> </ul>	<p>Students in all streams of the Specialist/Specialist Co-Op programs in Computer Science will have acquired the foundations in computer science that will allow them to pursue a career of their choice within the field. They can, for example, become software developers; or they can choose instead to pursue graduate studies in a computer science topic they find exciting.</p> <p>The proposed streams in Entrepreneurship (non Co-op and Co-op) will further enable our students to choose a path toward a career in high-tech innovation and entrepreneurship; either as founders of high-tech startup companies, or as members of a highly motivated team working to bring new products to market.</p> <p>The course structure, the qualifications of our faculty, the focus of our Department, and the atmosphere within the student body all contribute toward instilling the desire for learning and for further refinement of student skills.</p> <p>Students will have observed the impact that innovation can have in society, and will have had opportunity to reflect and consider their role as computer science professionals, no matter what career path they ultimately choose to pursue.</p>	<p>All streams of the Specialist/Specialist Co-Op programs in Computer Science allow students to achieve these learning outcomes by providing them with an education that is thorough, carefully planned, and carried out by outstanding research and teaching stream faculty. Moreover, research faculty, working at the frontiers their field, will expose students to cutting-edge research, thus providing them with opportunities to learn the research process.</p> <p>All, students in the proposed streams in Entrepreneurship (non Co-op and Co-op) will, through the capstone project in CSCD90H3 The Startup Sandbox, have concrete experience developing a novel product, but students in Co-op stream will also have the opportunity to experience the impact of computer science outside university, and to bring that experience back to students in the non Co-op stream through their interactions within team projects. In this way, students in both the Co-op and non Co-op streams in Entrepreneurship are advantaged.</p>

# Appendix C: Draft Supplementary Application Form

**To apply for admission to the Entrepreneurship stream please submit the following:**

- A .pdf of your current CV
- A .pdf of your current un-official transcript from ROSI
- A .pdf with your answers to the following questions:
  1. What is your University of Toronto email address?
  2. What field or topic within computer science do you find most exciting?
  3. What project courses have you taken at the U of T?
  4. What entrepreneurial projects or ventures have you been involved in, and in what role?
  5. What app development or design have you been involved in, if any, and were they successfully launched?
  6. List one or two of your major failures and lessons from each.
  7. List clubs or organizations in which you actively participate that are relevant to this course.
  8. Briefly describe any other qualifications that you bring to the table other than those mentioned above.
  9. List 2 innovative ideas you have for a project and why you think they solve problems that are significant and might foster disruptive change on an industry and user level.

**Please limit your responses to a maximum of 4 pages, with 11 point text and 1 inch margins.**