Connecting with Computer Science: Course Overview

Computational ways of thinking, as well as computational tools, are tremendously useful in informing the ways we create, collaborate, learn, and otherwise interact with our world. In this course you will learn about the computation and the field of computer science through connections with biology, psychology and the arts. No prior computing background is required, although some familiarity with using computers for tasks such as browsing the web and document formatting will be very helpful. In a nutshell, you’ll have opportunities to *understand*, *design*, *connect*, *analyze*, and *reflect*. The next five paragraphs elaborate a little on what these five words connote in the context of this course.

**Understand.** Computing concepts are organized along three themes: data, interfaces, and processes. Data is the *raison d’être* of computing technologies, whether it be messages you want to share, photos, videos or music, books or articles, personal or work-related data. Interfaces, such as the graphical window-based interfaces provided by web browsers, image processing and document formatting tools, are our means for interacting with digital technologies. Processes are the underlying mechanisms (such as programs, algorithms or protocols) that enable us to do creative and useful things with data. A central goal for this course is to help you understand the ways that data is organized on a computer, the factors that make user interfaces easy or hard to use, and how computer processes work behind the scenes.

**Design.** Labs and a class project will provide you with hands-on experience in applying your understanding. You can be creative in designing artifacts such as web pages and computer-generated art on the computer. You will get a little exposure to the art of computer programming, but this is not a core programming course and most
of the course material focuses on topics other than programming per se. Course labs cover HTML (a markup language for design of web pages), GIMP (an image creation and editing tool), Scratch (a programming environment with a visual interface) and Javascript (a programming language that can be embedded in web pages).

Connect. Much of your learning will be in the context of connections with other disciplines. These connections provide a rich context in which to apply and enrich your understanding of computing concepts. By comparing the way computers work with “computations” that happen in the brain, the cell, and in everyday life, you will gain insight as to why computers work the way they do, why they are a remarkably effective tool in some applications (such as sequencing in the human genome) while still poor at other tasks (such as natural language recognition). You will learn how fundamental computing concepts provide an interesting lens for viewing central problems in biology and psychology.

Analyze. Throughout, you can build valuable problem-solving and analysis skills that will help you navigate unfamiliar interfaces or figure out why computer programs behave the way they do (often in unexpected ways!). Three examples of such skills are: building and refining conceptual models that provide a framework for predicting how things work, experimenting and comparing what you see with your conceptual models, and using resources available to you (people and information) effectively.

Reflect. Computing today suffers from an image problem which (among other factors) deters many talented young people from entering the field. To counter this image, we will illustrate throughout the course the ways in which computing offers tremendous scope for creativity, for bringing many different experiences and insights to bear on the development of computing technologies, and for making a positive difference in our world. You will have opportunities to reflect on factors that influence who does or does not participate in computing— with a particular focus on women who currently comprise just 11% computer science graduates at research institutions in Canada and North America. It’s important to have some perspective on these issues because computing is having a huge impact in our world. Broad participation in the development of computing technologies can enhance the quality and reach of computing technologies and can help change the culture in and perceptions of the field. Perhaps most importantly, perspective on the larger picture can be helpful to you personally as you explore your own interest in and aptitude for computer science during this course.
Course Learning Goals

To summarize, there are five key learning goals for this course, listed below. Each course module will also list learning goals; all of the later goals will relate to one of the five below within a specific theme or connection area.

0.1 *Understand* how data structures, interfaces and processes on computers are designed.

0.2 *Design* your own digital artifacts using computer applications and programs, by applying your understanding of data, interfaces, and processes and using other resources available to you.

0.3 *Connect* your computing knowledge with your knowledge and interest in other disciplines.

0.4 *Analyze* artifacts and concepts to infer what they do or what they mean, and debug errors, using experimentation and conceptual models.

0.5 *Reflect* on the factors that influence participation in the field of computing and assess your own interest in and aptitude for further computing education.