EXECUTIVE SUMMARY
PERIODIC PROGRAM REVIEW
BACHELOR OF SCIENCE, COMPUTER SCIENCE

The Department of Computer Science aims to promote and advance all phases of computer and information science education. Key objectives are to further improve the quality of the academic program in Computer Science, to train both academic and industrial leaders who strive for excellence in Computer Science at the undergraduate, graduate and professional levels, and to guarantee that faculty members realize their maximum academic potential in contributing to teaching, research and service. The mission of the Department of Computer Science encompasses theory (providing the highest quality undergraduate and graduate education within the rapidly evolving fields of computer science), discovery (promoting basic and applied research in computer science), application (providing computer science expertise to the society), and partnership (using principles of computing to other disciplines and supporting multi-disciplinary efforts).

The Computer Science Program (CSP) offers a 40-course degree program with the designation Bachelor of Science (Computer Science). This program is offered in full-time and part-time formats. The Department also offers an optional Co-op program whereby a student may work for sixteen to twenty months (four or five work terms), typically for a software company, outside of the university.

All versions of the program are designed to produce graduates who can work effectively as software practitioners in a wide variety of professional areas in the computing industry. Theory forms the foundation for an understanding of the complexity of problems and algorithms, while practice prepares students for the development of applications. Students learn programming languages and they are trained to be multilingual in the programming areas that are currently in demand. They are also given a practical treatment of both systems programming and applications programming. This combination will satisfy future career requirements in areas where a technical knowledge of all phases of software in a given application is a major advantage. An optional thesis in fourth year allows academically stronger students the opportunity to work on projects representative of assignments encountered in industry. Students in the Computer Science program become experienced with networked environments, web-based applications, client-server applications, database design and software engineering.

The BSc (Computer Science) program was accredited by the Computer Science Accreditation Council in 2007. The current faculty complement within the Department stands at 19 tenure-stream/tenured faculty. The total program enrolment (all years, full-time and part-time) averages 448 students.

The program curriculum conforms to the Ryerson tripartite curriculum structure, providing students with a balance of professional (i.e. discipline specific), professionally related (supporting the core discipline) and liberal studies (breadth requirement) courses. Courses are offered through in-class lectures supplemented by laboratories. All but four of the compulsory courses involve laboratory work. The number of students in each lab varies from 15 to 40 and they are usually supervised by a graduate assistant.

Admission requirements for the full-time program include O.S.S.D. with six Grade 12 U/M courses, including Grade 12 U courses in: English, Advanced Functions (MHF4U), one of Physics (SPH4U), or Chemistry (SCH4U), or Biology (SBI4U), and either Calculus and Vectors (MCV4U) or Mathematics of Data Management (MDM4U). Calculus and Vectors (MCV4U) is the preferred mathematics course.

ENG4U/EAE4U is the preferred English. Physics is the recommended Grade 12 U Science. Subject to competition, candidates may be required to present averages/grades above the minimum.

The Periodic Program Review identifies a number of strengths of the Computer Science program. The curriculum covers all requisite core areas in computer science and math, while providing students with breadth in engineering, science and business, liberal studies and communication. The curriculum is regularly modified to cover emerging areas such as data mining, information retrieval and extreme programming. Societal relevance of computer science is high and employment demand in computer science is expected to increase by ten to twenty percent in the coming decade. Feedback from employer surveys indicates that Ryerson computer science graduates are ready to be productive from day one on the job. They particularly value graduates with co-op experience. Nearly 88% of the surveyed employers intend to hire more Ryerson computer science graduates. The PPR data (e.g. NSSE) indicates a high level of student satisfaction with many areas of the program. Respondents rate their "entire educational experience" as either good or excellent and indicate that they would attend Ryerson again if they were to start over. Upper year students state that the program is academically challenging (91% of respondents), is good preparation for a career (86%), is well-organized (76%) and is of high quality (90%). Students value the practical focus of many of the courses. The faculty view the Department and University as a positive working environment where younger faculty are supported in various ways. Students consider faculty to be caring and responsible and most are responsive to student needs. Teaching loads are viewed as reasonable. There is a dedicated technical support team who enjoy their work and are well respected by faculty members.

The Program Review Self Study also identifies a number of weakness and challenges of the Computer Science program. The Computer Science program experienced a temporary three-year (2005-2007) dip in first year retention. Some of the contributing factors may have been a "bursting of the technology bubble" in 2001, which led to a decline in applications and a consequent decline in grades of the average student accepted to the program, removal of Grade 13 (OAC) in 2003 which led to decreased skills in mathematics (particularly calculus) for incoming students, and possible misdirection of high school students seeking education in computer and information technology. One of the strengths of the program is that it is essentially an Honours program with a specialization in Computer Science; however, some students might be better suited to a less rigorous program with less compulsory math courses and more elective computer science courses. The program has improved access to minors by increasing the number of electives; however, in order to obtain a minor in a subject other than Mathematics a student must take additional courses to the 40 course curriculum. Another perceived weakness is that with Computer Science being a part of a predominantly Engineering Faculty this potentially has a negative influence on profile and visibility. Other challenges identified include the lack of a formal mentoring program, the number of faculty required to balance the teaching loads for the undergraduate and graduate programs, the number of support staff for both the undergraduate and graduate programs, students' requests for more flexibility with electives and minors, and the availability of senior courses and summer session courses for co-op students.

The Peer Review Team (PRT) included Dr. Peter R. King (Professor Emeritus, University of Manitoba) and Dr. Sylvia Osborn (Associate Professor, University of Western Ontario). Overall, the PRT judged the program to be of high quality and well-rounded, if somewhat conventional. Students are engaged, proud of the program and successful at obtaining employment and admission to graduate school upon graduation. The program is well aligned with Ryerson's academic plan, although more effort could be spent in achieving societal relevance, recognition of teaching excellence and building reputation.

The Peer Review Team recognized that the overall the curriculum is clearly and carefully designed. The learning goals and objectives of the courses are generally well delineated and clear. The CSAC-accredited curriculum covers the core areas of the discipline and its main areas of application. Courses are, by-in-large, taught at an appropriate level and build expertise year-over-year. The PRT identified the liberal studies and science electives as a positive feature providing students with additional breadth. Required communication and management courses were also identified as positive features. The PRT noted some weaknesses with the curriculum. For instance, the PRT felt that the amount of mathematic content and the order in which it is presented was problematic, that in year three there was an excessive emphasis on programming languages and parsing which may need not be required of all students, and that there was a large table of upper year electives but many are not offered in a given year.

Within the overall program the PRT felt that the program meets its stated goals in general and its graduates are "industry-ready". The PRT questioned why the goal of producing graduates acceptable to graduate computer science programs is not more at centre stage as a key program goal. The PRT also recommended a restructuring of the curriculum to allow greater choice earlier in the program and, given the large number of elective CSP courses, the program may wish to identify streams within the overall program. The PRT encouraged the department to continue to work to improve the image of its undergraduate program while recognizing the need to have that image align with Ryerson's traditions and culture.

When reviewing the program's resources the PRT indicated that while the faculty-base is sufficient to offer a strong core program, there is little capacity to offer new, cutting edge courses and insufficient capacity to offer the full-range of fourth year elective courses. The launch of the PhD will place additional pressures on the current faculty demands. Administrative support was deemed to be adequate but the PRT was concerned how the current technical staff would cope with the additional demands brought by the PhD program launch. The graduate TA system seems to be working well and both faculty and students seemed satisfied with the level of support provided.

The PRT noted that the average entering grades of applicants to the program were below the average of the Faculty and that this might contribute to the observed drop off rate. It also was concerned that the rate of students with clear standing after year one was approximately 50%.

The PRT attributed the positive student experience results to hard work by the department to meets student needs. It was noted that students have a great affinity to the institution and to the department and they felt their professors were providing quality instruction in an enthusiastic fashion on up-to-date and relevant material. Students who met with the PRT did not comment on class size as an issue of concern. The PRT also noted that graduates from the program become employed or admitted to graduate students with rates comparable to other programs in the province.

The Computer Science Developmental Plan is structured around the articulation of a number of objectives: enhancing staffing by recruiting high quality faculty, including senior appointments, to replace retiring personnel; enhancing and strengthening the Department's research activities and knowledge creation endeavours through establishment of a new research intensive graduate program; enhancing the quality of the undergraduate program in Computer Science by offering relevant curriculum which is accredited by CIPS and that covers the fundamental principles and state-of the-art tools technologies; improvement and expansion of the research infrastructure to support improved research publications, external funding and graduate student research participation; enhancing research capabilities and bringing the amount of external funding to that of the provincial norm; improving

retention and enrolment; and improving the learning experience, student engagement and student satisfaction.

The Dean's response to the Self Study and the report from the Peer Review Team considers four broad categories: student retention; societal relevance and distinctiveness of the program; resources; and degree level expectations/curriculum mapping.

The Dean supports the early intervention efforts of the program and endorses the inclusion of computer science students under the umbrella of the First Year and Common Science Office. There is no requirement for the Computer Science program to align its first-year curriculum with the common science first-year platform. The Dean advocates the Office of Science Outreach and Enrichment (OSOE) which promotes Ryerson as a university with a variety of strong Science programs, including Computer Science. With some financial support from the Dean the Department of Computer Science has purchased a fleet of robots, which will be used for these outreach activities. The Dean also notes that the program has adopted the PRT recommendation to modify the math content in its curriculum which should support improvement in student retention.

The Dean supports incorporating elements of faculty research into the undergraduate curriculum as a way of giving the program a distinctive flavour along with interdisciplinary programming initiatives. The gaming degree in partnership with Radio and Television Arts is noted in particular. The Dean recognizes several constraints around the faculty complement and how this impacts program delivery and performance. While technical support within the department is currently adequate, the launch of the PhD in Fall 2011 adds additional demand which will increase as that program grows. It is expected that the increased revenue from joint programming (e.g., with Radio and Television Arts) will provide additional funding for technical staff. The department should also benefit from efficiencies due to overlap in the needs of the two undergraduate programs (current and proposed) and the graduate program. The Computer Science program curriculum is heavily dependent on access to up-to-the-minute computer and peripheral technology as well as software. The Dean recommends a renewal cycle with one-third of the equipment being replaced on an annual basis.

The Dean points out that having the Computer Science program undertake an analysis of its curriculum and UDLEs over the next year is timely as it will coincide with program reviews in a number of the other undergraduate science programs.

The Academic Standards Committee's (ASC) assessment of the Periodic Program Review of the Bachelor Science (Computer Science) and its recommendations indicates that the self study does not contain an analysis of the curriculum in light of the degree level expectations expressed in Ryerson's IQAP. Given the concerns expressed by the Peer Review Team about curriculum inflexibility and limited student choice, the ASC recommends that a full curriculum mapping of the program be completed and presented in a follow-up report. It is also important that the program review its curriculum in light of the new curriculum framework. The ASC recommends that the curriculum mapping process be used to seek additional flexibility in the curriculum with the goal of making it consistent with the new framework.

The ASC is supportive of the developmental plan which provides a number of suggestions on ways to improve student academic performance, particularly the early intervention and transition program efforts. The ASC is also endorses of the idea of specialized support for first year students; however, the ASC recommends that first-year student support be provided through the currently existing First Year and Common Science Office, as proposed by the Faculty Dean, rather than a program-specific First Year

Office. The ASC also questioned a move towards a higher entry level average for admission. The self-study data supports the view that current interventions have been effective in enhancing student academic performance; it is not clear that raising the admission bar will be a more effective approach than excellent support for admitted students. The ASC recommends that the department take steps to establish whether there is a realistic demand for the part-time program and, if there is, to discuss strategies (e.g. partnership with the Chang School) to make the program attractive to students.

The ASC supports the suggestion from the Peer Review Team that the program seek ways to incorporate faculty research themes into undergraduate curriculum and indicates that the curriculum mapping may be helpful in this context. In addition, the ASC recommends that the department draw on the expertise of the Science Teaching Chair for advice on strategies to integrate research themes into undergraduate courses in an effective way. The ACS supports the program's strategies to encourage graduates of the BSc to attend Ryerson graduate programs, but some thought should be given to promoting the BSc as a route to graduate studies in computer science at any university.

The Computer Science Periodic Program Review was approved by Ryerson University's Senate on March 6, 2012. A response to the Academic Standards Committee recommendations is due June, 2013.