SoCS 2020/21 Undergrad Curriculum Mapping Report

Oct. 12, 2021

Contents

1 Context of Undergrad Curriculum Mapping

As part of Cyclic Program Review (CPR), the Bachelor of Computing (BComp) program at SoCS is subject to review in the 2021/22 academic year. The BComp degree program consists of a Computer Science Major, a Software Engineering Major, and a General Program. Since each of them is subject to review separately, we refer to each of them below as a *program*, abbreviated as CS (for the Computer Science Major), SENG (for the Software Engineering Major), and General (for the General Program). Without a better choice and with a slight possibility of confusion, we refer to the the BComp *degree program* as consisting of a CS program, a SENG program, and a General program.

The Institutional Quality Assurance Process (IQAP) requires CPR to include a self-study and an external evaluation. The self-study "discussion should include consideration of the learning outcomes for the program(s) in relation to the University's learning outcomes, and how these outcomes are realized by the program(s)." Based on these requirements and the 3 programs to review, the following self-study tasks are identified, where the University's learning outcomes are referred to as ULOs, and the program learning outcomes are referred to as PLOs.

Task 1 For each of the 3 programs, specify PLOs and map them to ULOs.

Task 2 For each of the 3 programs, map its courses to PLOs of the program.

Task 3 For each of the 3 programs, if it has a capstone course, map the course to assessment of PLOs of the program.

How these self-study tasks are carried out at SoCS is described in the following sections.

2 Task 1: PLO Specification and ULO Mapping

2.1 PLO Documents

Out of the 3 programs to be reviewed, SoCS has specified PLOs for the CS and SENG programs and mapped them to ULOs (around year 2012). These specifications and mappings are considered sufficiently up to date. The PLO specification and ULO mapping for these two programs are listed in Appendixes A and B.

PLOs for the General program have not been previously specified. In carrying out Task 1, SoCS Undergraduate Curriculum Committee worked on the specification of PLOs for the General program and their mapping to ULOs. The PLO specification and ULO mapping for the General program were approved by the SoCS Council in Nov. 2020 (see Appendix C). However, as SoCS proceeded into Task 2, some limitation of this 1st version of PLO specification and ULO mapping for the General program was recognized, which led to its updating described in Section 3.6.

2.2   Format of PLO Documents

Next, we describe the documents on PLO specification and ULO mapping for the 3 programs. As shown in Appendixes A, B, and C, the document for each program is organized into 5 tables, where each table corresponds to one of the 5 ULO categories (Critical and Creative Thinking, Literacy, Global Understanding, Communicating, Professional and Ethical Behaviour). Each ULO category contains 4 ULOs. For instance, ULOs under the category of Critical and Creative Thinking are: Inquiry and Analysis, Problem Solving, Creativity, and Depth and Breadth of Understanding. Hence, 5 ULO categories contain a total of 20 ULOs.

Each table is organized into a 4 columns. Its ULO category is identified in the 1st column. The specific ULOs under the category are identified in the 2nd column. The 3rd column identifies generic PLOs for the BComp degree. Each degree PLO maps to a particular ULO (indicated by the same table row).

The 4th column identifies PLOs for the program (CS, SENG, or General). Each PLO maps to a particular ULO (indicated by the same table row). If a ULO is not applicable to the program, the cell at the 4th column of the row is empty.

In summary, the documents on PLO specification and ULO mapping specify 14 PLOs for the CS program, 17 PLOs for the SENG program, and 20 PLOs for the General program (updated to 18 PLOs as described in Section 3.6).

3   Task 2: Mapping Courses to PLOs

3.1   The Scope of Curriculum Mapping

To carry out Task 2 and map courses of each program to its PLOs, the administrative team of SoCS (Director, Associate Director for Undergraduate Studies, Associate Director for Graduate Studies, Assistant Director, and Chair of Undergraduate Curriculum Committee) discussed possible scope of this task in Oct.

2020:

There are 47 undergraduate CIS courses, and most of them support each of the 3 programs either as required courses or as electives. To make the course-PLO mapping process efficient, the admin team made the decision to map all required courses for each of the 3 programs. There are 14 required courses for the CS program:

1. CIS*1300: Programming

2. CIS*1910: Discrete Structures in Computing I

3. CIS*2030: Structure and Application of Microcomputers

4. CIS*2430: Object Oriented Programming

5. CIS*2500: Intermediate Programming

6. CIS*2520: Data Structures

7. CIS*2750: Software Systems Development and Integration

8. CIS*2910: Discrete Structures in Computing II

9. CIS*3110: Operating Systems I

10. CIS*3490: The Analysis and Design of Computer Algorithms

11. CIS*3150: Theory of Computation

12. CIS*3750: System Analysis and Design in Applications

13. CIS*3760: Software Engineering

14. CIS*4650: Compilers

There are 18 required courses for the SENG program:

1. CIS*1250: Software Design I

2. CIS*1300: Programming

3. CIS*1910: Discrete Structures in Computing I

4. CIS*2030: Structure and Application of Microcomputers

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5. CIS*2250: Software Design II

6. CIS*2430: Object Oriented Programming

7. CIS*2500: Intermediate Programming

8. CIS*2520: Data Structures

9. CIS*2750: Software Systems Development and Integration

10. CIS*3110: Operating Systems I

11. CIS*3250: Software Design III

12. CIS*3260: Software Design IV

13. CIS*3490: The Analysis and Design of Computer Algorithms

14. CIS*3750: System Analysis and Design in Applications

15. CIS*3760: Software Engineering

16. CIS*4150: Software Reliability and Testing

17. CIS*4250: Software Design V

18. CIS*4300: Human Computer Interaction

There are 8 required courses for the General program:

1. CIS*1300: Programming

2. CIS*1910: Discrete Structures in Computing I

3. CIS*2430: Object Oriented Programming

4. CIS*2500: Intermediate Programming

5. CIS*2520: Data Structures

6. CIS*2750: Software Systems Development and Integration

7. CIS*2910: Discrete Structures in Computing II

8. CIS*3530: Data Base Systems and Concepts

The above required courses for the 3 programs count a total of 24 courses. The executive decision made by the admin team is to focus Task 2 on these 24 courses, which amount to about half of all CIS courses for the BComp degree program.

3.2 PLO Teaching and Assessment Options

In addition to the scope of the courses for PLO mapping, to gather info on how each PLO is taught in a course, the alternative teaching methodologies (referred to as *teaching options* below) need to be specified. To gather info on how each PLO is accessed in a course, the alternative evaluation methods (referred to as *assessment options* below) also need to be specified. In specifying these options, the admin team applied the following criteria:

1. The options collectively cover the teaching and evaluation practice of CIS courses at SoCS.

2. An option should not be included if it is unlikely to be practiced at SoCS.

3. Each option needs to be sufficiently specific, so that whether the option is applied in a course can be reasonably clearly identified by an instructor of the course.

4. Each option needs to be sufficiently general, so that the total number of options is not too large.

By referencing options used by other colleges (provided by Jennifer Reniers from Office of Teaching and Learning) and consultation with multiple admin team members and faculty members, the following teaching options and assessment options are compiled. There are 13 teaching options that are practiced in CIS courses, each code-named by *Tmd* (for Teach method) and an index:

Tmd1 Lecture;

Tmd2 Discussions / exercises / activities (e.g. think-pair-share);

Tmd3 In-lab or assignment activities (active, hands-on, or experiential learning opportunities);

Tmd4 Community engaged design or development;

Tmd5 E-portfolios;

Tmd6 Guest lectures;

Tmd7 Clicker questions / responses;

Tmd8 Multimedia presentations (e.g. video, film, YouTube);

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Tmd9 Assigned readings;

Tmd10 Reflective writing / journaling;

Tmd11 Research Projects (proposals, literature reviews, data collection & analysis, reports);

Tmd12 Self-assessment (student compares own progress toward intended learning goal);

Tmd13 Workshop sessions (e.g. writing, peer-review, time management sessions);

There are 20 assessment options that are practiced in CIS courses, each code-named by *Amd* (for Assignment method) and an index:

Amd1 Exam or quiz;

Amd2 Lab exam or quiz with hands-on components;

Amd3 Assignment> Written> Literature review;

Amd4 Assignment> Written> Research proposal;

Amd5 Assignment> Written> Case study analysis;

Amd6 Assignment> Written> Laboratory project / report;

Amd7 Assignment> Written> Media / content analysis;

Amd8 Assignment> Written> Reflective writing / journaling;

Amd9 Assignment> Problem solving> Questions and answers;

Amd10 Assignment> Problem solving> Design and/or implementation;

Amd11 Learning portfolio (e.g. ePortfolio, LinkedIn account);

Amd12 Oral exam;

Amd13 Oral presentation (excluding poster);

Amd14 Poster presentation;

Amd15 Multimedia presentation (e.g. creating video, podcast);

Amd16 Participation / Engagement> Discussion;

Amd17 Participation / Engagement> Peer evaluation;

Amd18 Participation / Engagement> Self-assessment;

Amd19 Practicum;

Amd20 Community engagement;

In addition to teaching options and assessment options, at what depth is a PLO evaluated in a course is also a relevant piece of info, which is referred to below as assessment level options. We applied the standard options from the University, which consist of 3 level options: Introduce, Reinforce, and Master.

3.3 Curriculum Mapping Survey for Broad Faculty Input

With the specification of PLOs for each program, teaching options on how a PLO is taught in a course, assessment options on how a PLO is evaluated in a course, and assessment level options, the Task 2 proceeded to faculty consultation on course-to-PLO mapping. As faculty members who taught a specific course frequently have the best perspective on how program PLOs are taught and assessed in the course, their direct inputs are solicited, through a curriculum mapping survey programmed (in Qualtrics) by SoCS admin team.

The curriculum mapping survey questions are shown in Appendix D. Each survey is to be completed by a faculty member who has been assigned a CIS course that they have taught frequently before. The 1st question Q1 introduces the survey to the faculty member on the purpose of the survey, the natures of questions in the survey, and technical issues to be careful about in completing the survey. Q2 identifies the faculty member for verification against the assignment mentioned above. Q3 identifies the course assigned to the faculty member.

The remaining 15 questions (Q4 through Q18) are divided into 3 groups. Each group contains 5 questions targeted at a particular program (CS, SENG, or General). The 5 questions are on which PLOs are taught in the course, how they are taught, which PLOs are assessed, how they are assessed, and at what depth students are assessed. Depending on whether the assigned course is required by each of the 3 programs (CS, SENG, and General), the faculty member will be presented with one, or two, or all three groups of questions.

If a course is only required by CS program, Q4 through Q8 will be asked. When Q4 (Which BComp-CS PLOs are taught in this course?) is asked, the 14

PLOs for CS program will be presented, including their ULO mapping. For instance, the 1st PLO for CS program is presented as follows:

> Problem Solving: Develop, test, document, deploy, and maintain secure program code to meet given specifications.

After the faculty member specified PLOs taught in the course, say, 5 of the 14, Q5 (How BComp-CS PLOs are taught in this course?) will be presented with a table of 5 rows (one per PLO) and 13 columns (one per teaching option). This allows the faculty member to specify their answer by selecting cells from the table as they apply.

Q6 (How BComp-CS PLOs are taught in this course?) has the similar format as Q4. Q7 (How BComp-CS PLOs are assessed?) has the similar format as Q5, except the table has 20 columns (one per assessment option). Q8 (At what depth are students assessed for each of the BComp-CS PLOs?) has the similar format as Q5, except the table has 3 columns (one per assessment level option).

3.4 Conducting the Curriculum Mapping Survey

The curriculum mapping survey was conducted on the 24 required courses of CS, SENG and General. For efficiency, a survey is completed for each course by one faculty member. A total of 22 faculty members are selected, who have been instructors of these 24 courses in past 10 years. Each faculty member is assigned with one or two courses that they offered frequently in past 10 years (with preference in past 5 years), subject to balancing of survey workload (no more than two courses per faculty member). The faculty member to course assignment for curriculum mapping survey is shown in Appendix E.

The curriculum mapping survey was opened for faculty completion on Dec 15, 2021, and the last of the 24 surveys (one per required course) was completed on Jan 29, 2021.

3.5 Compiling Curriculum Mapping Survey Outcomes

During the period from Feb 3 to Mar 1, 2021 (after completion of curriculum mapping survey), the survey responses from faculty members were compiled from lengthy, hard to read data records to a compact, user-friendly format. The compiled curriculum mapping outcomes for CS, SENG, and General programs are shown in Appendixes F, G, and H (ignore highlighting in red for now).

Consider the curriculum mapping for CS program in Appendix F: The CS program has 14 PLOs. The mapping consists of 4 tables, covering 3, 3, 4, 4 PLOs, respectively. As each PLO uniquely maps to a ULO, for compactness in presentation, each PLO is indicated in the table using its corresponding ULO. For instance, in the 1st table, the three PLOs covered are indicated by corresponding ULOs: Problem Solving, Creativity, and Dep(th and)-Breadth (of) Underst(anding).

The rows of the tables are labeled by the 14 required courses of the CS program. For instance, PLO mapping for CIS*1300 is shown in the 3rd row in each table.

Mapping for each of the 14 PLOs occupies 3 columns, reflecting how the PLO was taught (indicated by column heading *Teach*), how the PLO was assessed (indicated by column heading *Assess*), and the level of assessment (indicated by column heading *lv*).

For each course and each PLO, the cell in column *Teach* contains indexes of the Tmd teaching options specified by the faculty member through the survey. For instance, the column *Teach* for CIS*1300 shows "1,2,3", which correspond to the following teaching options:

Tmd1 Lecture;

Tmd2 Discussions / exercises / activities (e.g. think-pair-share);

Tmd3 In-lab or assignment activities (active, hands-on, or experiential learning opportunities);

They indicate that the Problem Solving PLO was taught in CIS*1300 through Lecture, Discussions / exercises / activities, and In-lab or assignment activities.

Similarly, for each course and each PLO, the cell in column *Assess* contains indexes of the Amd assessment options specified by the faculty member surveyed. The cell in column *Lv* indicates the level of assessment by letter I, R, or M, for Introduce, Reinforce, or Master, respectively.

The curriculum mapping outcomes for the SENG and General programs are formatted similarly as shown in Appendixes G and H.

3.6 Reflecting on Curriculum Mapping Survey Outcomes

The compiled curriculum mapping survey outcomes allow some immediately analysis and reflection:

For each of the 3 programs, most PLOs are well taught and assessed. The extent that they are taught and assessed are consistent with the program. For

instance, the Problem Solving PLO is taught and assessed in almost all required courses in each program, reflecting the nature of BComp as an intensely technical degree. The Leadership PLO is covered in 2 out of the 14 courses (14%) in CS program, reflecting its lesser career importance. The same PLO is covered in 6 out of 18 courses (33%) in SENG program, reflecting its significantly more career importance, as team work is essential in building non-trivial software systems.

Furthermore, the mapping shows that a variety of teaching methods and assessment methods are being used in delivering each of the programs, indicated by the wide ranging Tmd and Amd indexes in the *Teach* and *Assess* columns on different PLOs.

Analysis of the mapping outcomes also reveals some limitations of the PLO documents as well as of the mapping process:

The survey outcomes did not indicate coverage for the PLO on Global Understanding in any required course for the CS program. For the General program, the survey outcomes did not indicate coverage for 5 PLOs: Global Understanding, Historic Development, Intercultural Competence, Teamwork, and Leadership.

The absence of these PLOs in the curriculum mapping for CS and General program may originate from the following reasons: First, a missing PLO in the survey outcome may indicate that it was truly not covered in the required courses of the program. In that case, the question arises whether the PLO is essential and should remain, or it is non-essential and should be removed from the PLOs of the program. Second, a missing PLO in the survey outcome may indicate that it was not stated in the survey even though it was actually covered by the required courses. In that case, its missing reflects the imperfection of data collection process (a single instructor per course for survey efficiency, the compact expressions of PLO, teaching options, and assessment options, which are subject to instructor's subjective interpretation, the limited number of teaching and assessment options used in the survey versus the unlimited number of their variations, etc.).

To resolve the above issue, the matter was discussed by the Undergrad Curriculum Committee in March 2021. The Committee members concluded that the PLO on Global Understanding should and has been covered by required courses for the CS program. Based on experience and perspectives of Committee members, the PLO on Global Understanding was added to the mappings of CIS*2500, CIS*2520, CIS*2750, CIS*3750, and CIS*3760 (taught and assessed). This is shown in Appendix F with highlighting in red.

Similarly, the Committee members concluded that the PLOs on Global Understanding, Historic Development, and Intercultural Competence should and have been covered by required courses for the General program. These 3 PLOs were added to the mappings of CIS*1050, CIS*1300, CIS*2170, CIS*2500, CIS*2520,

and CIS*3530 (taught, but some were not assessed). This is shown in Appendix H with highlighting in red.

As a subset of the above-mentioned courses, in particular, CIS*2500, CIS*2520, CIS*2750, CIS*3750, and CIS*3760, are also required by the SENG program, their mapping under the SENG program were updated accordingly (see highlighting in red in Appendix G).

For the remaining two PLOs on Teamwork and Leadership that were missing in mapping outcomes of the General program, the Undergrad Curriculum Committee decided that they were non-essential for the program. As the General program is a 3-year program, it is impractical to cover these 2 PLOs adequately. A proposal to remove these 2 PLOs from the General program was approved by SoCS Council on Apr 27, 2021. As the result, the PLO document for the General program was updated accordingly (see Appendix I).

4   Task 3: PLO Mapping for Capstone

Based on IQAP requirement,

> the self-study "discussion should include consideration of the learning outcomes for the program(s) in relation to the University's learning outcomes, and **how these outcomes are realized by the program(s)**"

the issue of capstone PLO mapping was discussed in the SoCS Undergrad Program Implementation Committee in Nov 2020. The focus of discussion was whether capstone projects/courses or signature assessments can be identified from each of the 3 programs (CS, SENG, and General) for evaluation of how PLOs are realized.

For the SENG program, CIS*4250 (Software Design V) was identified as the capstone course. It was clearly intended from the SENG program design, as indicated by the calendar description of CIS*4250:

> "This is a capstone course which applies the knowledge gained from the previous Software Design courses to a large team project."

For the General program, a negative conclusion is also clear: It is a 3-year program, and does not have a clearly designated capstone project/course or signature assessment.

The issue is less clear for the CS program, and hence there has been much discussion. Historically, there was a course intended as the capstone for the CS

program: CIS*4000 (Applications of Computing Seminar). It did not work well and had low enrolment (on average about 10 students per semester). Hence, it was deleted in W2013, with the following rationale:

> "The experience provided by this course can be received through the existing project and thesis courses CIS*4900 and CIS*4910. The course material is not recognized as integral to a computer science education and there is no clear reason to require all majors take this course."

Should CIS*4900 (Computer Science Project) and CIS*4910 (Computer Science Thesis) be regarded as the capstone instead? Although they are intended for and typically taken in senior years, they have not always been taken by students in senior years. Since each offer is based on topic interests of individual instructors and students, the focus differs widely and may not be sufficiently broad as expected from a program capstone. It is also not taken by every student in the CS program. Hence, the two courses are not sufficiently justified to serve as the capstone.

Another course, CIS4650 (Compilers), was also discussed as alternative candidate capstone. It has direct prerequisites CIS*2030, CIS*3110, and CIS*3150. There courses have prerequisites CIS*1910, CIS*2500, CIS*2520, CIS*2750, and CIS*3490, which in turn have the next level prerequisites CIS*1300 and CIS*2430. Hence, completion of CIS4650 requires the completion of 10 CIS courses out of the total 14 courses required by the CS program. It can be viewed as combining skills developed in the CS program and applying to the practice of compilers. As a required course, it is taken by every student in the CS program.

The discussion at the Undergrad Program Implementation Committee ended with the recommendations of CIS*4250 as capstone for the SENG program, no capstone for the General program, and CIS*4650 as preferred capstone option for the CS program. The recommendations were brought to SoCS Council on Feb. 2, 2021 for further consideration. Although the first two recommendations are generally agreeable, most faculty members do not favor the idea of treating the compiler course CIS*4650 as the capstone. Hence, it was decided that no capstone curriculum mapping will be performed for the CS program.

Based on the decision, PLO mapping of CIS*4250 (Software Design V) was conducted from the capstone perspective in late Feb 2021. The outcome is shown in Appendix J. It is formatted differently from the earlier curriculum mapping so that how PLOs are assessed can be presented directly (rather than through code indexes) and clearly.

The mapping outcome is organized into 17 sections, each corresponds to one of the 17 PLOs of the SENG program. Out of the 17 PLOs, the capstone course taught and assessed 12 PLOs, and the teaching methods, assessment methods, and assessment levels for these PLOs are indicated. The PLOs that were not covered include Global Understanding, Civic Knowledge and Engagement, Intercultural Knowledge and Competence Integrative Communication, and Ethical Reasoning. These PLOs are arguably harder to cover in an in-house course, but future improvement is desirable.

5 Appendixes

A PLO specification and ULO mapping for CS Program

Undergraduate Degree Learning Outcomes Alignment Template
2012 University of Guelph Undergraduate Degree Learning Outcomes and Associated Skills
reviewed for alignment with Degree Program and/or Specialization Outcomes (BComp:CS)

Critical and Creative Thinking	*Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome shows evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome.*	*BComp Honours*	*Computer Science Major*
	Learning Outcomes and Associated Skills (2013)	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Inquiry and Analysis	Analyze complex real-world problems. Devise efficient, well-documented computer-based solutions for those problems.	
	2. Problem Solving	Analyze a software development problem. Consider a range of possible approaches to its solution and identify the most promising approaches.	Develop, test, document, deploy, and maintain secure program code to meet given specifications.
	3. Creativity	Apply a knowledge of fundamental algorithms, programming techniques, and design to create software systems.	Design, implement, and evaluate computer-based solutions to meet the needs and constraints of the client.
	4. Depth and Breadth of Understanding	Design, correctly implement and document solutions to significant computational problems. Explain advanced, contemporary concepts related to software development.	Apply knowledge of computing and mathematics to a discipline outside of computing.

University of Guelph, Undergraduate Degree Learning Outcomes Alignment Template
November 2012

Literacy	Literacy is the ability to extract material from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.		
	Learning Outcomes and Associated Skills (2013)	Degree Program Outcomes	Specialization (Major/Minor) Outcomes
	1. Information Literacy	Apply the core areas of software development. (data structures, theory of computation, operating systems, compilers, programming languages, computer architecture).	Apply knowledge from at least one specialized area of computer science (Human Factors, Security, Graphics, Networks, Databases) to the design/development of software.
	2. Quantitative Literacy	Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems.	Understand the use and structure of the common mechanisms for formally describing software and algorithms. Execute standard measuring and analysis techniques in the evaluation of computing algorithms.
	3. Technological Literacy	Evaluate current techniques, hardware, software, and tools required for the production of software systems. Select the most appropriate tools for the task.	Demonstrate technological fluency. Evaluate and test new technologies systematically.
	4. Visual Literacy	Understand the use and structure of the common mechanisms for formally describing software and hardware structures and graphical user interfaces.	

	Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.		
Global Understanding			
	Learning Outcomes and Associated Skills (2013)	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Global Understanding	Explain how technical constraints limit solutions desired by society in both local and global contexts.	Analyze the local and global impact of computing on individuals, organizations, the environment, and society.
	2. Sense of Historical Development	Summarize the evolution of communication and information technologies, the history of software and the evolution of computer technology.	
	3. Civic Knowledge and Engagement	Analyze the local and global impact of computing on individuals, organizations, and society.	Enumerate common workplace expectations found in information technology (IT) environments.
	4. Intercultural Knowledge and Competence	Recognize the social and cultural responsibilities of a professional working in the discipline of computer science.	

University of Guelph, Undergraduate Degree Learning Outcomes Alignment Template
November 2012

Communicating	Communicating is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communicating also comprises attentiveness and listening, as well as reading comprehension. It is the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.		
	Learning Outcomes and Associated Skills (2013)	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Oral Communication	Negotiate, clarify, and document software requirements. Communicate effectively and professionally using audience appropriate technical language.	Communicate confidently and effectively to audiences of a varying technological ability.
	2. Written Communication	Compose written reports to convey technical material meeting accepted standards for writing style.	Produce high quality programming documentation for libraries and reusable code modules.
	3. Reading Comprehension	Locate and evaluate relevant written information related to a software development project, evaluate the contents, and judge the relative importance of the information.	Interpret and use written documentation and programming interface specifications.
	4. Integrative Communication	Communicate effectively with a range of audiences. Present ideas at multiple levels of abstraction and from multiple perspectives.	Interpret, produce, and present work-related documents and information effectively and accurately.

Professional and Ethical Behaviour	Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organizational and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome.		
	Learning Outcomes and Associated Skills (2013)	Degree Program Outcomes	Specialization (Major/Minor) Outcomes
	1. Teamwork	Work effectively as a team, managing conflicts, to accomplish a common goal. Recognize the different roles and responsibilities within a team.	
	2. Ethical Reasoning	Interpret the professional and ethical responsibilities surrounding software development. Demonstrate ethical practises.	Explain the legal and security-related issues arising from design choices for a software system.
	3. Leadership	Generate goals and milestones and recommend task breakdowns for software projects.	Provide technical leadership to software teams.
	4. Personal Organization / Time Management	Recognize the need for, and have the ability to engage in, life-long learning. Consistently organize time and committments to ensure success.	

B   PLO specification and ULO mapping for SENG Program

Undergraduate Degree Learning Outcomes Alignment Template

2012 University of Guelph Undergraduate Degree Learning Outcomes and Associated Skills

reviewed for alignment with Degree Program and/or Specialization Outcomes (BComp:SoftEng)

	Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome shows evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome.	*BComp Honours*	*Software Engineering Major*
Critical and Creative Thinking			
	Learning Outcomes and Associated Skills (2013)	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Inquiry and Analysis	Analyze complex real-world problems. Devise efficient, well-documented computer-based solutions for those problems.	Use a variety of proven techniques when analysing software development problems.
	2. Problem Solving	Analyze a software development problem. Consider a range of possible approaches to its solution and identify the most promising approaches.	Evaluate possible approaches to solving a problem and explain the benefits and drawbacks to each approach.
	3. Creativity	Apply a knowledge of fundamental algorithms, programming techniques, and design to create software systems.	
	4. Depth and Breadth of Understanding	Design, correctly implement and document solutions to significant computational problems. Explain advanced, contemporary concepts related to software development.	Describe the broad engineering considerations that are the background for developing complex, software-intensive systems.

University of Guelph, Undergraduate Degree Learning Outcomes Alignment Template
November 2012

Literacy	Literacy is the ability to extract material from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.		
	Learning Outcomes and Associated Skills (2013)	Degree Program Outcomes	Specialization (Major/Minor) Outcomes
	1. Information Literacy	Apply the core areas of software development. (data structures, theory of computation, operating systems, compilers, programming languages, computer architecture).	Translate software specifications into well-documented designs.
	2. Quantitative Literacy	Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems.	Collect, analyse and interpret metrics for software and software development teams.
	3. Technological Literacy	Evaluate current techniques, hardware, software, and tools required for the production of software systems. Select the most appropriate tools for the task.	Plan and execute software engineering processes that effectively use available technology and tools.
	4. Visual Literacy	Understand the use and structure of the common mechanisms for formally describing software and hardware structures and graphical user interfaces.	Produce and interpret a variety of diagrams to represent beginning, middle and final stages of software projects.

University of Guelph, Undergraduate Degree Learning Outcomes Alignment Template
November 2012

	Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.		
Global Understanding			
	Learning Outcomes and Associated Skills (2013)	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Global Understanding	Explain how technical constraints limit solutions desired by society in both local and global contexts.	Identify ways in which advances in software development pose new ethical questions, require new standards, and introduces moral problems and dilemmas.
	2. Sense of Historical Development	Summarize the evolution of communication and information technologies, the history of software and the evolution of computer technology.	Reflect on the appropriateness of different software engineering methodologies for different contexts.
	3. Civic Knowledge and Engagement	Analyze the local and global impact of computing on individuals, organizations, and society.	Describe the additional design considerations required for critical software systems.
	4. Intercultural Knowledge and Competence	Recognize the social and cultural responsibilities of a professional working in the discipline of computer science.	Work effectively on multidisciplinary teams.

Communicating	Communicating is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communicating also comprises attentiveness and listening, as well as reading comprehension. It is the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.		
	Learning Outcomes and Associated Skills (2013)	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Oral Communication	Negotiate, clarify, and document software requirements. Communicate effectively and professionally using audience appropriate technical language.	Interact with a project client to elicit input and communicate project progress.
	2. Written Communication	Compose written reports to convey technical material meeting accepted standards for writing style.	Produce written documentation for the design, development, and testing of a complex software project.
	3. Reading Comprehension	Locate and evaluate relevant written information related to a software development project, evaluate the contents, and judge the relative importance of the information.	
	4. Integrative Communication	Communicate effectively with a range of audiences. Present ideas at multiple levels of abstraction and from multiple perspectives.	Create and present software project proposals for clients and funding agencies who may not be software professionals.

	Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organizational and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome.		
Professional and Ethical Behaviour	**Learning Outcomes and Associated Skills (2013)**	**Degree Program Outcomes**	**Specialization (Major/Minor) Outcomes**
	1. Teamwork	Work effectively as a team, managing conflicts, to accomplish a common goal. Recognize the different roles and responsibilities within a team.	Employ group-working skills to provide leadership and mentoring to teamates.
	2. Ethical Reasoning	Interpret the professional and ethical responsibilities surrounding software development. Demonstrate ethical practises.	Make defensible judgements about actions and policies when presented with competing ethical perspectives.
	3. Leadership	Generate goals and milestones and recommend task breakdowns for software projects.	Manage a software project including planning, scheduling, and risk assessment/management.
	4. Personal Organization / Time Management	Recognize the need for, and have the ability to engage in, life-long learning. Consistently organize time and committments to ensure success.	

C PLO specification and ULO mapping for General Program (1st Version)

Critical and Creative Thinking	Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome show evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome. At the graduate level, originality in the application of knowledge is expected.	
	University of Guelph Learning Outcomes and Associated Skills	**B.Comp. CS Honours Degree Program Outcomes**	**B.Comp. General Degree Program Outcomes**
	Independent Inquiry and Analysis	Analyze complex real-world problems. Devise efficient, well-documented computer-based solutions for those problems.	Examine complex real-world problems. Devise efficient, well-documented computer-based solutions for those problems.
	Problem Solving	Analyze a software development problem. Consider a range of possible approaches to its solution and identify the most promising approaches.	Analyze a software development problem. Consider a range of possible approaches to its solution and identify the most promising approaches.
	Creativity	Apply a knowledge of fundamental algorithms, programming techniques, and design to create software systems.	Apply a knowledge of fundamental algorithms, programming techniques, and design to create software systems.
	Depth and Breadth of Understanding	Design, correctly implement and document solutions to significant computational problems. Explain advanced, contemporary concepts related to software development.	Design, correctly implement, and document solutions to significant computational problems.

Literacy	Literacy is the ability to extract information from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.	

University of Guelph Learning Outcomes and Associated Skills	B.Comp. CS Honours Degree Program Outcomes	B.Comp. General Degree Program Outcomes
Information Literacy	Apply the core areas of software development. (data structures, theory of computation, operating systems, compilers, programming languages, computer architecture).	Apply the core areas of software development. (data structures, programming languages, computer architecture).
Quantitative Literacy	Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems.	Apply mathematical foundations, algorithmic principles, design of computer-based systems.
Technological Literacy	Evaluate current techniques, hardware, software, and tools required for the production of software systems. Select the most appropriate tools for the task.	Evaluate current techniques, hardware, software, and tools required for the production of software systems.
Visual Literacy	Understand the use and structure of the common mechanisms for formally describing software and hardware structures and graphical user interfaces.	Understand the use and structure of the common mechanisms for formally describing software and hardware structures and graphical user interfaces.

Global Understanding	Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.	
	University of Guelph Learning Outcomes and Associated Skills	**B.Comp. CS Honours Degree Program Outcomes**	**B.Comp. General Degree Program Outcomes**
	Global Understanding	Explain how technical constraints limit solutions desired by society in both local and global contexts.	Explain how technical constraints limit solutions desired by society in both local and global contexts.
	Sense of Historical Development	Summarize the evolution of communication and information technologies, the history of software and the evolution of computer technology.	Discuss the history of software and the evolution of computer technology.
	Civic Knowledge and Engagement	Analyze the local and global impact of computing on individuals, organizations, and society.	Describe the local and global impact of computing on individuals, organizations, and society.
	Intercultural Competence	Recognize the social and cultural responsibilities of a professional working in the discipline of computer science.	Relate the social and cultural responsibilities of a professional working in the discipline of computer science.

Communication	Communication is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communication also comprises attentiveness and listening, as well as reading comprehension. It includes the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.	
	University of Guelph Learning Outcomes and Associated Skills	**B.Comp. CS Honours Degree Program Outcomes**	**B.Comp. General Degree Program Outcomes**
	Oral Communication	Negotiate, clarify, and document software requirements. Communicate effectively and professionally using audience appropriate technical language.	Explain software requirements using appropriate technical language.
	Written Communication	Compose written reports to convey technical material meeting accepted standards for writing style.	Compose written reports to convey technical material meeting accepted standards for writing style.
	Reading Comprehension	Locate and evaluate relevant written information related to a software development project, evaluate the contents, and judge the relative importance of the information.	Locate and evaluate relevant written information related to a software development project.
	Integrative Communication	Communicate effectively with a range of audiences. Present ideas at multiple levels of abstraction and from multiple perspectives.	Apply appropriate user interface techniques to design systems that are usable by people.

Professional and Ethical Behaviour	Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organization and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome. At the graduate level, intellectual independence is needed for professional and academic development and engagement.	

	University of Guelph Learning Outcomes and Associated Skills	B.Comp. CS Honours Degree Program Outcomes	B.Comp. General Degree Program Outcomes
	Teamwork	Work effectively as a team, managing conflicts, to accomplish a common goal. Recognize the different roles and responsibilities within a team.	Recognize the different roles and responsibilities within a team.
	Ethical Reasoning	Interpret the professional and ethical responsibilities surrounding software development. Demonstrate ethical practises.	Explain the professional and ethical responsibilities surrounding software development.
	Leadership	Generate goals and milestones and recommend task breakdowns for software projects.	Use goals and milestones and recommend task breakdowns for software projects.
	Personal Organization/Time Management	Recognize the need for, and have the ability to engage in, life-long learning. Consistently organize time and commitments to ensure success.	Recognize the need for, and have the ability to engage in, life-long learning. Consistently organize time and commitments to ensure success.

D The Undergrad Curriculum Mapping Survey

Q1 Introduction to survey

Thank you for completing this curriculum mapping survey. The data collected will be used in the 2020-2021 Cyclical Program Review of 3 SoCS undergrad programs: BComp CS major, BComp SENG major, and BComp General, referred to below as BComp-CS, BComp-SENG, and BComp-General.

What does the survey include? You will identify a course that you teach from a list of CIS courses. You will then indicate how program learning outcomes (PLOs) are taught and assessed in the course, relative to each program where the course is required. For any PLO assessed, you will indicate the level of assessment using a 3-point scale (Introduce, Reinforce, or Master). The survey takes about 15 minutes to complete. If you are responsible for more than one course being mapped, please complete a separate survey for each course.

PLOs are broad. Please select PLOs that you teach some aspects of. It may not be that the course addresses all aspects of the PLO. The degree to which you assess the PLO will be gauged in the question on level of assessment.

Information to gather before beginning the survey Before you start the survey, it will be beneficial to gather reference documents such as course outline, lecture plans, assignments, assessment measures, lab manuals, etc.

Note: Please complete this survey on a computer. Although the survey can be viewed and answered on a mobile device, many tables require a bigger screen, and using a computer enhances your experience.

Q2 Please identify you from the SoCS faculty list:

Q3 Please select a CIS course you are responsible to map:

Q4 Which BComp-CS PLOs are taught in this course?

Q5 How BComp-CS PLOs are taught in this course?

Q6 Which BComp-CS PLOs are assessed in this course?

Q7 How BComp-CS PLOs are assessed?

Q8 At what depth are students assessed for each of the BComp-CS PLOs?

Q9 Which BComp-SENG PLOs are taught in this course?

Q10 How BComp-SENG PLOs are taught in this course?

Q11 Which BComp-SENG PLOs are assessed in this course?

Q12 How BComp-SENG PLOs are assessed?

Q13 At what depth are students assessed for each of the BComp-SENG PLOs?

Q14 Which BComp-General PLOs are taught in this course?

Q15 How BComp-General PLOs are taught in this course?

Q16 Which BComp-General PLOs are assessed in this course?

Q17 How BComp-General PLOs are assessed?

Q18 At what depth are students assessed for each of the BComp-General PLOs?

E Faculty Assignment in Curriculum Mapping Survey

Name	1st	2nd
Antonie	1250	
Bruce	4300	
Calvert	3250	
Chaturvedi	1300	3530
Dara	2500	
Flatla	2170	
Gillis	3750	
Grewal	2030	
Hamilt-Wright	2250	
Kremer	2520	
Lin	3110	
Matsakis	1910	
McCuaig	2430	
Nikitenko	2750	4250
Obimbo	3150	
Sawada	2910	
Scott	3760	
Song	4650	
Stacey	4250	
Wang	3490	
Wineberg	3260	4150
Wirth	1050	

F   Curriculum Mapping for BComp CS program

Curriculum Mapping for BComp CS Major (May 2021)
Red: amendment by Undergrad Curriculum Cmt

	Problem Solving			Creativity			Dep-Breadth Underst		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1300	1,2,3	1,2,10	I	1,2,3	1,2,10	I			
CIS*1910									
CIS*2030	1,3,9	1,2,6,7,10,13,17	R	1,3,9	1,2,6,7,10,13,17	R	1,3,9	1,2,6,7,10,17	R
CIS*2430	1,2,3,7	1,2,9,10	I	1,2,3,7,12	2,10	I		1,2,10	I
CIS*2500	1,2,3	1,2,10	I						
CIS*2520	1,2,3,9	1,2,9,10,18	R				1,2,3,9	1,2,9,10,18	R
CIS*2750	1,7,9	1,10	M				1,7,9	1,10	M
CIS*2910	1,2,3,9	1,9,10	I				1,2,3,9	1,9,10	I
CIS*3110	1,2,3	1,2,6,9	M	1,2,3	2,9	R			
CIS*3150	1,2,3,7,9	2,9,16	R	1,2,3			1,2,3,7,9	1,9,16	M
CIS*3490	1,2,3	1,2,9,10	I	1,2,3	1,9,10	I			
CIS*3750	1,2,3,4,6,9	1,9,10,13,15,16,20	R	1,2,3,4,6,10	6,8,10,13,16,20	M	1,2,3,4,6,9	6,10,13,16,20	I
CIS*3760	1,3,9	1,9,10,17,18	M	1,2,3,8,9	1,10,13,17,18	R			
CIS*4650	1,2,3	1,10,13	M						

	Information Lit			Quantitative Lit			Techno Lit		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1300									
CIS*1910									
CIS*2030				1,3,9	1,2,6,7,10,13,17	R			
CIS*2430				1,2,3,7	1,2,10,18	I	1,2,3,12		
CIS*2500									
CIS*2520	1,2,3,9	1,2,9,10,18	I	1,2,3,9	1,2,9,10,18	R	1,2,3,9	1,2,9,10,18	R
CIS*2750	1,7,9	1,10	M				1,7,9	1,10	R
CIS*2910				1,2,3,9	1,9,10	I			
CIS*3110	1,2,3	1,2,9	I	1,2,3	1,2,9	R			
CIS*3150				1,3,9	1,2,9,16	M			
CIS*3490									
CIS*3750									
CIS*3760							1,2,8,9	1,10,13,17,18	R
CIS*4650									

Curriculum Mapping for BComp CS Major (May 2021)

	Global Understan			Civic Knowl & Engag			Oral Communication			Written Commu		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1300												
CIS*1910												
CIS*2030										3	1,6,7,10,13,17	R
CIS*2430										3	1,2,10,17	I
CIS*2500	1	1	I									
CIS*2520	1	1	I									
CIS*2750	1	1	I									
CIS*2910												
CIS*3110				1,2,3								
CIS*3150												
CIS*3490												
CIS*3750	1,3	1,4,10	R	1,2,3,4,6,9,10	6,10,13,16,20	R	2,3,4,8	8,10,13,16,20	R	1,2,3,4,9	1,6,13,16,20	R
CIS*3760	1,3	1,4,10	M	1,3,9						3,9	10,17,18	M
CIS*4650										2,3	10	R

	Reading Comprehens			Integrative Commu			Ethical Reasoning			Leadership		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1300	2,3	2,10	I				1,3	10	I			
CIS*1910				1,3,7,9	1,9	I						
CIS*2030	3,10	1,2,6,7,17	R									
CIS*2430	1,2,3,9	1,2,10,17	R				1,2,7					
CIS*2500												
CIS*2520	1,2,3,9	1,2,9,10,18	M									
CIS*2750		10	R									
CIS*2910												
CIS*3110				2,3	2,9	R						
CIS*3150												
CIS*3490												
CIS*3750	1,2,3,4,6	1,6,9,10,20	R	2,3,4								
CIS*3760	3,9	10,17,18	R	1,3,9	1,10,13,15,17,18	M				1,3,9	1,10,17,18	R
CIS*4650	2,3,9	10,13	R							2,3	10,16	I

G   Curriculum Mapping for BComp SENG program

BComp SENG

	Inquiry & Analysis			Problem Solving			Dep-Breadth Underst			Information Lit		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1250	1,3,9	1,2,10	I	1,3,9	1,2,10	I				1,3	2,10	I
CIS*1300				1,2,3	1,2,10	I						
CIS*1910				1,3,7,9	1,9	I						
CIS*2030				1,3,9	1,2,6,9,13,18	R	1,3,9	1,2,6,9,13,18	R			
CIS*2250	1,2,3,9,10,11,12,13	1,6	I	2,3,9,10,11,12,13	6,16	I		6,16,17,18	I	1,2,12,13		
CIS*2430	1,2,3,7	1,2,10	I	1,2,3,7	1,2,10	I				1,2,3,7	1,2,10	R
CIS*2500	1,2,3	1,2,10	I	1,2,3	1,2,10	I						
CIS*2520	1,2,3,9,12	1,2,9,10,18	M	1,2,3,9,12	1,2,9,10,18	M	1,2,3,9,12	1,2,9,10,18	R	1,2,3,9,12	1,2,9,10,18	R
CIS*2750	1,7	1,10	R									
CIS*3110	1,2,3	1,2,9	R	1,2,3	1,2,9	M	1,2,3					
CIS*3250	1,2,3,11	1,2,4,6,9,10	R	1,2,3,11	4,9,10	R	1,2,3,11	4,6,10	R	1,2,3,11	4,10	R
CIS*3260		1,6,9,10,13,17	M	1,3,9,13	1,6,9,10,13,17	M	1,2,3,9,13	1,9,13	R	1,2,3,13	1,6,10,13	M
CIS*3490	1,2,3	1,9,10	I	1,2,3	1,9,10	I						
CIS*3750	1,2,3,4	1,6,9,10,13,15	R	1,2,3,4,9	1,8,9,10	R	1,2,3,9	2,10,13,20	R	2,3,4,6,10	6,9,13,16,20	M
CIS*3760	1,2,3,8,9	1,10,13,17,18	M	1,2,3,8,9	1,10,13,17,18	M	1,2,3,8,9	1	R			
CIS*4150	1,9	1,9,10	M	1,3	1,9,10	M	1	1,9,10	R	1	1	M
CIS*4250	2,3,12	5,8,9,10,16	M	2,3,12	5,8,9,10,16	M	2,3,12	5,8,9,10,16	M	2,3,12	5,8,9,10,16	M
CIS*4300	1,2,3,11	1,4,7,9,10,16	M	1,2,3,11	4,10	M	1,2,3,11	4,10,13	M		4,9,10	M

BComp SENG

	Quantitative Lit			Techno Lit			Visual Lit			Global Understan		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1250										1		
CIS*1300												
CIS*1910												
CIS*2030	1,3,9	1,2,6,9,13,18	R									
CIS*2250	1,2,9,10			1,2,10	6,16,17,18	R				1,2,9,11,13	5,16,17,18	I
CIS*2430				1,2,3,7	1,2,10,17	I						
CIS*2500										1	1	I
CIS*2520	1,2,3,9,12	1,2,9,10,18	R	1,2,3,9,12	1,2,9,10,18	R	1,2,3,9,12			1	1	I
CIS*2750										1	1	I
CIS*3110	1,2,3	2	M									
CIS*3250				2,3,11	10	R	3,11	1,3,10	R			
CIS*3260				1,3,9,13	6,10,13	M	1,2,3,13	1,6,10,13,17	M			
CIS*3490												
CIS*3750	1,2,9	1,6,9	I	1,2,3,9	2,10,13,20	R	1,2,3,9	2,6,9,10	I	1,3	1,4,10	R
CIS*3760	1,2,3,8,9	1,10,13,17,18	R	1,2,3,8,9	1,10,13,15,17,18	R	1,3,8,9	1,10,13,17,18	R	1,3	1,4,10	M
CIS*4150	1,3	1,9,10	M	1	1	R	1,3	1,9,10	M			
CIS*4250	2,3,12			2,3,12	5,8,9,10,16	M	2,3,12	5,8,9,10,16	R			
CIS*4300				1,2,3,11	4,10,13	M	1,2,3,11	4,9,10,13	M	1,2,3,11	4,9,10,13	R

Red: amendment by Undergrad Curriculum Cmt

BComp SENG

	Historic Dev			Civic Knowl & Engag			Intcul Knowl & Compe			Oral Communication			Written Communicatn		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1250										1,3,9	2,9,10	I	1,3	2,6,10	I
CIS*1300	1														
CIS*1910															
CIS*2030		1	R										1,3,9	2,6,9,17	R
CIS*2250				1,2,3,9,10	5,16,17,18	R	3,12,13	1,16,17,18	R				11,12	6	I
CIS*2430															
CIS*2500	1	1	I				1								
CIS*2520	1	1	I				1								
CIS*2750															
CIS*3110	1,2,3	1,2,9	R	1,2,3	1,9	I									
CIS*3250										2,3,11	4,5,10	R	11	4,10	R
CIS*3260										1,3,13	1,6	M			
CIS*3490															
CIS*3750							3,4,6,9,10	13,20	R	2,3,4,6,10	13,15,20	R	1,2,3,9	1,6,8,9,10,20	R
CIS*3760	1,2,9	1	R					1,10,17,18	R	1,2,9			1,3,9	1,10,13,17,18	M
CIS*4150				1	1	R							1	1,10	R
CIS*4250	2,3,12	5,8,9,10,16	R							2,3,12	9,16	R	2,3,12	5,8,10	M
CIS*4300		4,9,10	R							1,2,3,11			1,2,3,11	4,9,10	M

BComp SENG

	Integrative Commu			Teamwork			Ethical Reasoning			Leadership		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1250				1,3								
CIS*1300							1,3	10	I			
CIS*1910												
CIS*2030												
CIS*2250	11			2,3,9,12,13	6,13,16,17,18	R	2,9,10,11,12,13	1,5,16,17,18	R	3,12,13	6,16,17,18	R
CIS*2430												
CIS*2500												
CIS*2520												
CIS*2750												
CIS*3110												
CIS*3250				2,3,11	4,10,17,18	R	1	1	R			
CIS*3260				3,12	17	M				3,12	17	R
CIS*3490												
CIS*3750	2,3,4	6,13,15,20	R	1,2,3,4,10	6,13,15	R				1,2,3,4,9	1,6,13,15,20	R
CIS*3760	1,2,3,9	1,10,13,17,18	R	1,2,3,9	1,10,13,17,18	M				1,2,3,8,9	1,10,17,18	R
CIS*4150												
CIS*4250				2,3,12	8,9,10,16	R				2,3,12	8,9,10,16	R
CIS*4300							1,2,3,11	4,9,10,13	M		4,9,10,13	M

H   Curriculum Mapping for BComp General program

Bcomp General

	Inquiry & Analysis			Problem Solving			Creativity			Dep-Breadth Underst			Information Lit		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1050	3,9,10	5,8,10,17	R	3,9,10	5,6,8,10,17	R									
CIS*1300				1,2,3	1,2,10	I	1,2,3	1,2,10	I						
CIS*1910															
CIS*2170							1,2,3,8,9	1,5,6,13	I						
CIS*2430	1,2,3,7			1,2,3,7	1,2,10	I	1,2,3,7	1,2,10	I				1,2,3,7	1,2,10	R
CIS*2500				1,2,3	1,2,10	I									
CIS*2520	1,2,3,9,12	1,2,9,10,18	M	1,2,3,9,12	1,2,10,18	M	1,2,3,9,12	1,2,10,18	M	1,2,3,9,12	1,2,10,18	M	1,2,3,9,12	1,2,10,18	M
CIS*3530	1,2,3	1,10	I	1,2,3	10	I									

	Quantitative Lit			Techno Lit			Visual Lit			Global Understan			Historic Dev		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1050										1					
CIS*1300													1		
CIS*1910	1,3,7,9	1,9	I												
CIS*2170							1,2,3,8,9	1,5,6,13	R	1	1	I			
CIS*2430				1,2,3,7	1,2,10,17	I									
CIS*2500										1	1	I	1	1	I
CIS*2520	1,2,3,9,12	1,2,10,18	R	1,2,3,9,12	1,2,10,18	R				1	1	I	1	1	I
CIS*3530										1			1	1	R

Red: amendment by Undergrad Curriculum Cmt

Bcomp General

	Civic Knowl & Engag			Intercul Competence			Oral Commu			Written Commu			Reading Comprehensn		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1050	3,9,10						3			3,9,10	5,6,7,10,17	R	3,9	7,8	R
CIS*1300													3	2,10	I
CIS*1910															
CIS*2170															
CIS*2430															
CIS*2500				1											
CIS*2520				1									1,2,3,9,12	1,2,10,18	M
CIS*3530				1									1,2,3	1,10	I

	Integrative Commu			Ethical Reasoning			Pers Org/Time Manag		
	Teach	Assess	Lv	Teach	Assess	Lv	Teach	Assess	Lv
CIS*1050	3,10	7,8,10,15	I						
CIS*1300				1,3	10	I			
CIS*1910									
CIS*2170	1,2,3,8,9	1,5,6,13	M						
CIS*2430							1,2,3,7		
CIS*2500									
CIS*2520							1,2,3,9,12		
CIS*3530									

I PLO specification and ULO mapping for General Program (Updated)

Critical and Creative Thinking	Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome show evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome. At the graduate level, originality in the application of knowledge is expected.	

University of Guelph Learning Outcomes and Associated Skills	B.Comp. CS Honours Degree Program Outcomes	B.Comp. General Degree Program Outcomes
Independent Inquiry and Analysis	Analyze complex real-world problems. Devise efficient, well-documented computer-based solutions for those problems.	Examine complex real-world problems. Devise efficient, well-documented computer-based solutions for those problems.
Problem Solving	Analyze a software development problem. Consider a range of possible approaches to its solution and identify the most promising approaches.	Analyze a software development problem. Consider a range of possible approaches to its solution and identify the most promising approaches.
Creativity	Apply a knowledge of fundamental algorithms, programming techniques, and design to create software systems.	Apply a knowledge of fundamental algorithms, programming techniques, and design to create software systems.
Depth and Breadth of Understanding	Design, correctly implement and document solutions to significant computational problems. Explain advanced, contemporary concepts related to software development.	Design, correctly implement, and document solutions to significant computational problems.

Literacy	Literacy is the ability to extract information from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.	

University of Guelph Learning Outcomes and Associated Skills	B.Comp. CS Honours Degree Program Outcomes	B.Comp. General Degree Program Outcomes
Information Literacy	Apply the core areas of software development. (data structures, theory of computation, operating systems, compilers, programming languages, computer architecture).	Apply the core areas of software development. (data structures, programming languages, computer architecture).
Quantitative Literacy	Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems.	Apply mathematical foundations, algorithmic principles, design of computer-based systems.
Technological Literacy	Evaluate current techniques, hardware, software, and tools required for the production of software systems. Select the most appropriate tools for the task.	Evaluate current techniques, hardware, software, and tools required for the production of software systems.
Visual Literacy	Understand the use and structure of the common mechanisms for formally describing software and hardware structures and graphical user interfaces.	Understand the use and structure of the common mechanisms for formally describing software and hardware structures and graphical user interfaces.

Global Understanding	Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.	
University of Guelph Learning Outcomes and Associated Skills	**B.Comp. CS Honours Degree Program Outcomes**	**B.Comp. General Degree Program Outcomes**
Global Understanding	Explain how technical constraints limit solutions desired by society in both local and global contexts.	Explain how technical constraints limit solutions desired by society in both local and global contexts.
Sense of Historical Development	Summarize the evolution of communication and information technologies, the history of software and the evolution of computer technology.	Discuss the history of software and the evolution of computer technology.
Civic Knowledge and Engagement	Analyze the local and global impact of computing on individuals, organizations, and society.	Describe the local and global impact of computing on individuals, organizations, and society.
Intercultural Competence	Recognize the social and cultural responsibilities of a professional working in the discipline of computer science.	Relate the social and cultural responsibilities of a professional working in the discipline of computer science.

Communication	Communication is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communication also comprises attentiveness and listening, as well as reading comprehension. It includes the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.	
	University of Guelph Learning Outcomes and Associated Skills	**B.Comp. CS Honours Degree Program Outcomes**	**B.Comp. General Degree Program Outcomes**
	Oral Communication	Negotiate, clarify, and document software requirements. Communicate effectively and professionally using audience appropriate technical language.	Explain software requirements using appropriate technical language.
	Written Communication	Compose written reports to convey technical material meeting accepted standards for writing style.	Compose written reports to convey technical material meeting accepted standards for writing style.
	Reading Comprehension	Locate and evaluate relevant written information related to a software development project, evaluate the contents, and judge the relative importance of the information.	Locate and evaluate relevant written information related to a software development project.
	Integrative Communication	Communicate effectively with a range of audiences. Present ideas at multiple levels of abstraction and from multiple perspectives.	Apply appropriate user interface techniques to design systems that are usable by people.

Professional and Ethical Behaviour	Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organization and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome. At the graduate level, intellectual independence is needed for professional and academic development and engagement.	
	University of Guelph Learning Outcomes and Associated Skills	**B.Comp. CS Honours Degree Program Outcomes**	**B.Comp. General Degree Program Outcomes**
Teamwork	Work effectively as a team, managing conflicts, to accomplish a common goal. Recognize the different roles and responsibilities within a team.	
Ethical Reasoning	Interpret the professional and ethical responsibilities surrounding software development. Demonstrate ethical practises.	Explain the professional and ethical responsibilities surrounding software development.
Leadership	Generate goals and milestones and recommend task breakdowns for software projects.	
Personal Organization/Time Management	Recognize the need for, and have the ability to engage in, life-long learning. Consistently organize time and commitments to ensure success.	Recognize the need for, and have the ability to engage in, life-long learning. Consistently organize time and commitments to ensure success.

J Curriculum Mapping for BComp SENG Capstone Course CIS*4250

Curriculum Mapping for BComp SENG Major Capstone CIS*4250 (May 2021)

PLO 1	Inquiry and Analysis	
	Teaching methods	
		In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
		Community engaged design or development
		Workshop sessions (e.g. writing; peer-review; time management sessions)
	Assessment methods	
		Assignment> Written> Case study analysis
		Assignment> Written> Reflective writing / journaling
		Assignment> Problem solving> Questions and answers
		Assignment> Problem solving> Design and/or implementation
		Participation / Engagement> Discussion
	Assessment level	Master
PLO 2	Problem Solving	
	Teaching methods	
		In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
		Community engaged design or development
		Workshop sessions (e.g. writing; peer-review; time management sessions)
	Assessment methods	
		Assignment> Written> Case study analysis
		Assignment> Written> Reflective writing / journaling
		Assignment> Problem solving> Questions and answers
		Assignment> Problem solving> Design and/or implementation
		Participation / Engagement> Discussion
	Assessment level	Master
PLO 3	Depth & Breadth of Understanding	
	Teaching methods	
		In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
		Community engaged design or development
		Workshop sessions (e.g. writing; peer-review; time management sessions)
	Assessment methods	
		Assignment> Written> Case study analysis
		Assignment> Written> Reflective writing / journaling
		Assignment> Problem solving> Questions and answers
		Assignment> Problem solving> Design and/or implementation
		Participation / Engagement> Discussion
	Assessment level	Master

PLO 4	Information Literacy		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Case study analysis
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Questions and answers
			Assignment> Problem solving> Design and/or implementation
			Participation / Engagement> Discussion
		Assessment level	Master
PLO 5	Quantitative Literacy		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Not assessed	
PLO 6	Technological Literacy		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Case study analysis
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Questions and answers
			Assignment> Problem solving> Design and/or implementation
			Participation / Engagement> Discussion
		Assessment level	Master
PLO 7	Visual Literacy		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Case study analysis
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Questions and answers
			Assignment> Problem solving> Design and/or implementation
			Participation / Engagement> Discussion
		Assessment level	Reinforce
PLO 8	Global Understanding		
		Not taught	
		Not assessed	

PLO 9	Sense of Historical Development		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Case study analysis
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Questions and answers
			Assignment> Problem solving> Design and/or implementation
			Participation / Engagement> Discussion
		Assessment level	Reinforce
PLO 10	Civic Knowledge and Engagement		
		Not taught	
		Not assessed	
PLO 11	Intercultural Knowledge and Competence		
		Not taught	
		Not assessed	
PLO 12	Oral Communication		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Problem solving> Questions and answers
			Participation / Engagement> Discussion
		Assessment level	Reinforce
PLO 13	Written Communication		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Case study analysis
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Design and/or implementation
		Assessment level	Master
PLO 14	Integrative Communication		
		Not taught	
		Not assessed	

PLO 15	Teamwork		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Questions and answers
			Assignment> Problem solving> Design and/or implementation
			Participation / Engagement> Discussion
		Assessment level	Reinforce
PLO 16	Ethical Reasoning		
		Not taught	
		Not assessed	
PLO 17	Leadership		
		Teaching methods	
			In-lab or assignment activities (active; hands-on; or experiential learning opportunities)
			Community engaged design or development
			Workshop sessions (e.g. writing; peer-review; time management sessions)
		Assessment methods	
			Assignment> Written> Reflective writing / journaling
			Assignment> Problem solving> Questions and answers
			Assignment> Problem solving> Design and/or implementation
			Participation / Engagement> Discussion
		Assessment level	Reinforce