AGENDA ITEM NO: 13.1

UNIVERSITY COUNCIL

ACADEMIC PROGRAMS COMMITTEE

REQUEST FOR DECISION

PRESENTED BY: Susan Detmer, Chair, Academic Programs Committee

DATE OF MEETING: June 17, 2021

SUBJECT: **Graduate programs in Applied Computing**

DECISIONS REQUESTED:

It is recommended:

That Council approve the Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.) degree programs in Applied Computing, effective May 2022.

PURPOSE:

University Council has the authority to approve degree-level programs.

CONTEXT AND BACKGROUND:

The College of Graduate and Postdoctoral Studies is proposing Applied Computing as a new field of specialization for the Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.) programs. The programs will build upon expertise in the Department of Computer Science and are interdisciplinary.

These new programs will ensure that graduates have both the requisite knowledge in computing and in their domains of application. Students' programs will link computer science concepts with a cognate area. The thesis-based M.Sc. program will prepare students further study at the Ph.D. level, or for a career in industry. These programs will complement the existing Computer Science graduate programming and will ensure that students are able to pursue interdisciplinary interests.

Supervision for students in the MSc program will require an advisory committee of no less than three people: the supervisor, a committee member from Computer Science and another member from either Computer Science or relevant cognate discipline. Because course selection in an interdisciplinary program can be especially challenging, this committee's role and guidance for the student will be particularly important. Students in the Ph.D. program will have an advisory committee of no less than five people with representation from Computer Science and the student's cognate discipline.

These programs require no additional courses to be developed, as students will take courses both in Computer Science and in the cognate discipline.

CONSULTATION:
The academic programs committee reviewed the proposal for this program at its May 26, 2021 meeting. The committee was impressed with the detail of the report and anticipate that this program will help students seeking graduate training in applied computing without potentially compromising the content or quality of the existing computer science programs.

This programs was also reviewed and approved by the CGPS Programs committee on March 22, 2021 and by the CGPS Executive Committee on April 15, 2021.

ATTACHMENTS:

1. **Proposals for the new Master of Science and Doctor of Philosophy in Applied Computing**

UNIVERSITY OF SASKATCHEWAN
College of Graduate and Postdoctoral Studies
GRAD.USASK.CA

116, 110 Science Place
Saskatoon SK S7N 5C9 Canada
Telephone: **306-966-5751**
Email: **grad.studies@usask.ca**

M E M O R A N D U M

To: Academic Programs Committee of University Council

Copy: Dr. Ian McQuillan, Graduate Chair, Department of Computer Science

From: Office of the Associate Dean, College of Graduate and Postdoctoral Studies

Date: May 19, 2021

Re: New Master of Science and Doctor of Philosophy in Applied Computing

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Applied Computing is proposed as a new field of specialization for the Master of Science (MSc) and Doctor of Philosophy (PhD) degrees. The field would be an appropriate fit for an existing cohort of students in the department of computer science. The programming is interdisciplinary, which is timely as programming is being challenged to incorporate interdisciplinarity. The new programming would require completion of 12 credit units of coursework for the MSc and 6 credit units of coursework for the PhD. The programming would not include specific course requirements, which is common in science disciplines where course requirements are determined based on the research to be conducted. The new programming could have a positive impact on faculty collaboration, and the new programming is responsive to an existing and growing trend. As the proposal represents formalization of existing practices, no additional resources are required beyond in-kind contributions for program implementation.

The Graduate Programs Committee recommended approval of the programming on March 22, 2021, and the Executive Committee supported the new programming on April 15, 2021.

Attached please find support from the review committees, the MSc proposal, PhD proposal, Notice of Intent, and Consultation with the Registrar documents.

If you have any questions, please contact Kelly Clement at kelly.clement@usask.ca

:kc

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M E M O R A N D U M

To: Graduate Programs Committee (GPC)

From: Debby Burshtyn, Chair - Executive Committee

Date: April 15, 2021

Re: 1) Master of Science in Applied Computing
2) Doctor of Philosophy in Applied Computing

On April 15, 2021, the Executive Committee (EC) considered the noted proposals.

1) The EC approved the Master of Science in Applied Computing.
Roesler/Simonson 1 abstention: motion carried unanimously.

2) *The EC approved the Doctor of Philosophy in Applied Computing.*
Roesler/Simonson 1 abstention: motion carried unanimously.

Heather Heavin (GPC chair) introduced the proposal. It was clear from the proposal that it was appropriate and a great addition for the department to engage in both a master's and PhD in applied computing.

It was shared with the EC that from the department's perspective, the applied computing stream will be under the purview under the computer sciences graduate student committee. The department will fund them the same as computer science students. The overall intent is to remove barriers for students wanting to get into applied computing who do not have an B.Sc. from within the computer science discipline.

No further discussion was heard.

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M E M O R A N D U M

To: Executive Committee of CGPS

Copy: Dr. Ian McQuillan, Graduate Chair, Department of Computer Science

From: Graduate Programs Committee

Date: April 8, 2021

Re: New Master of Science and Doctor of Philosophy in Applied Computing

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On March 22, 2021, the Graduate Programs Committee considered proposals for a new Master of Science (MSc) and Doctor of Philosophy (PhD) in Applied Computing.

Committee members noted that the new field of specialization seemed to be an appropriate fit for an existing cohort of students in the department. It was noted that the programming was interdisciplinary, which was timely as programming was being challenged to incorporate interdisciplinarity. The new programming would require completion of 12 credit units of coursework for the MSc and 6 credit units of coursework for the PhD. The programming would not include specific course requirements, which was common in science disciplines where course requirements were determined based on the research to be conducted. Committee members noted that the new programming could have a positive impact on faculty collaboration, and the new programming was responsive to an existing and growing trend. As the proposal represents formalization of existing practices, no additional resources are required beyond in-kind contributions for program implementation.

The Graduate Programs Committee passed the following motions:

To recommend approval of the Master of Science in Applied Computing. Labrecque/Morrison
CARRIED unanimous

To recommend approval of the Doctor of Philosophy in Applied Computing.
Tanaka/Morrison CARRIED unanimous

Attached please find the complete MSc proposal followed by the complete PhD proposal.

If you have any questions, please contact Kelly Clement at kelly.clement@usask.ca

:kc

UNIVERSITY OF SASKATCHEWAN	**Proposal for Academic or Curricular Change**

PROPOSAL IDENTIFICATION

Title of proposal: MSc in Applied Computing

Degree(s): MSc

Field(s) of Specialization: Applied Computing

Level(s) of Concentration: N/A

Option(s): N/A

Degree College: CGPS

Contact person(s) (name, telephone, fax, e-mail): Ryan Walker, Associate Dean, CGPS; 306-966-2229; kelly.clement@usask.ca

Proposed date of implementation: May 2022

Proposal Document

Please provide information which covers the following sub topics. The length and detail should reflect the scale or importance of the program or revision. Documents prepared for your college may be used. Please expand this document as needed to embrace all your information.

1. **Academic justification:**
   a. *Describe why the program would be a useful addition to the university, from an academic programming perspective.*

   Computing is permeating modern life. When applied to a particular problem or domain, knowledge of computing and the domain itself are required to effectively achieve insight. Traditional industries such as mining and agriculture have joined the ranks of more established technology users in IT, medicine, business and design. There is a clear need for graduates with knowledge in both computing and domains of application.

At the graduate level, interdisciplinary graduate work is becoming significantly more common in the Department of Computer Science at the University of Saskatchewan. In the past year alone, 23 students in the thesis-based MSc and PhD programs in Computer Science either have been co-supervised by faculty from other departments, or have been partially co-funded by a researcher in another department. This points to the interdisciplinary research currently being conducted within our department. However, students with a strong background in a relevant cognate area are prevented from pursuing graduate studies within the department by substantial remedial Computer Science course requirements, putting unnecessary strain on students transferring in from other disciplines. While students could conduct meaningful research at the graduate level on interdisciplinary projects under the supervision of a faculty member in Computer Science, they are prevented from doing so by the Department's need to maintain the brand integrity of the MSc and PhD in Computer Science. Indeed, given that a PhD graduate in Computer Science could reasonably be expected to teach in an accredited computer science program, they should have a sufficient depth and breadth of knowledge in the discipline.

Despite this requirement, faculty members in Computer Science have identified supervising students with stronger backgrounds in cognate areas as being key to addressing their research goals. Also, collaborators in cognate areas have identified computing as being a requirement for their research programs; and students in these areas have expressed a desire to improve their computer science training and to apply computation towards their background area of expertise. Creating a new graduate degree program to accommodate students with interdisciplinary interests provides a path to graduation without impacting the existing graduate programs in Computer Science. The program would also be appropriate for students in the undergraduate program in Applied Computing, which is also being proposed by the Department of Computer Science.

A Master's of Science in Applied Computing is a research intensive and thesis-based program (as opposed to course-based or project-based degree) linking computer science concepts with a cognate area. Students completing this degree could be targeting a PhD in a related area, or advanced knowledge for a career in industry.

b. *Giving consideration to strategic objectives, specify how the new program fits the university signature areas and/or integrated plan areas, and/or the college/school, and/or department plans.*

The proposed program is intrinsically aligned with the University and College strategic priority for interdisciplinarity. While this program is aligned with strategic goals, it did not arise from their calls to action. This program does align with elements of the Computer Science strategic plan, articulated at the June 2017 departmental retreat, which called for a greater impact of computer science as a department and discipline across campus to reflect its growing importance to society.

We currently have the largest research-intensive thesis-based graduate program at the university. Almost all our graduate students are funded, and the majority through

grants held by professors. Our current program is also characterized by substantial interdisciplinary research. For example, our world leading Human Computer Interaction and Software Engineering groups have substantial collaborations across the university (Social Sciences and SENS) and with industry. Members of our Bioinformatics group collaborate with life scientists in Health, Biology, and Agriculture. Image processing and data analytics research is core to the Plant Phenotyping and Imaging Research Centre. Because of the scope of our collaborative activities, we attract a diverse group of graduate students. Instead of greatly increasing the number of graduate students in our graduate programs, the proposed program will allow us to more adroitly accommodate students from non-traditional computer science backgrounds.

c. *Is there a particular student demographic this program is targeted towards and, if so, what is that target? (e.g., Aboriginal, mature, international, returning)*

This program does not explicitly address internationalization. However, there are aspects of it within the programs. The student body of the graduate program in Computer Science is predominantly international. We expect this trend to continue in the graduate level Applied Computing program. At the undergraduate level, Computer Science has a disproportionate number of international students compared to other units, particularly from East Asia and South Asia.

Indigenization within this program, and Computer Science in general, will focus on access and impact. Aspects of Applied Computing would be of potential interest to indigenous students as data sovereignty is a core component of many issues facing indigenous communities including land claims, environmental assessments, and water rights. Training indigenous students in these disciplines would allow them to perform their own analysis of data collected on their traditional territories, enabling more fulsome participation in conversations about land use and impact.

Like their undergraduate counterparts, there is high demand for graduate level training in areas such as interactive systems or user experience, bioinformatics, health informatics and epidemiology, and data analytics as evidenced by the success of graduates in these areas from our current MSc in Computer Science.

d. *What are the most similar competing programs in Saskatchewan, and in Canada? How is this program different?*

In addition to the graduate programs, we are also separately proposing an undergraduate program in Applied Computing. There are some institutions in Canada with a similar undergraduate program (most notably Dalhousie). However, at the graduate level, the proposed MSc program is more unique. There are some MSc programs in Canada in Applied Computing, most notably at the University of Toronto, Wilfrid Laurier, Concordia, Dalhousie, and Windsor. However, these programs all focus on industry, and some have a built-in internship. We believe that there is not a PhD program in Applied Computing in Canada.

In contrast, the proposed program is entirely research focussed, and thesis based. We expect it to be a novel program across Canada, and it will encourage excellent students with degrees in cognate disciplines who wish to apply computational techniques to their undergraduate area.

2. Admissions

a. *What are the admissions requirements of this program?*

Students entering the MSc in Applied Computing must have a 4-year BSc degree in Applied Computing, or Computer Science (or equivalent), or a 4-year undergraduate degree in a cognate discipline from a recognized institution, with a minimum overall average of 70%. If the student is entering with a degree in a cognate discipline, the proposed faculty advisor must submit a short letter to the Computer Science Graduate Committee (less than 250 words) justifying why the student's background qualifies the student for the intended area of research. This justification will serve as part of the admission record, but will also serve to educate graduate committee members as to the types of qualifications and reputable institutions that match well with different research groups.

Admitted students under either of those conditions will not be required to do any remedial undergraduate computer science courses unless recommended as part of the course of study for an individual graduate student by their advisory committee. English requirements will be identical to the Computer Science graduate programs. All students must meet the CGPS English requirements, with higher minimum testing scores. This can be done by demonstrating an aggregate TOEFL score of at least 94, with no individual score below 20; or an aggregate IELTS (Academic Module) score of at least 7.0, with no individual score below 6.5. Students also must submit a statement of research interest, a resume, and three reference letters.

3. Description of the program

a. *What are the curricular objectives, and how are these accomplished?*

The curricular objectives will ensure that graduates are highly qualified researchers that are able to apply computational techniques to some cognate research area. The program will be ideally suited for students wishing to become senior professionals in the technology industry or applying computation to a cognate industry. Graduates will become project leaders at companies and research labs. For example, students with an undergraduate degree in bioinformatics, biology, or plant science, could gain the skills needed to apply data analytics techniques and computational modelling to address biological hypotheses, and to draw biological conclusions. As another example, students with a psychology background could become able to combine the principles of human computer interaction and visualization with psychology.

Graduates of the MSc program will be able to:

- *demonstrate expertise in applying computational techniques and research methodology to problems and data from a cognate discipline*
- *critically evaluate literature and research techniques from both their cognate discipline and from computer science*
- *work independently towards their research, and execute their research plan*
- *communicate and interpret requirements with researchers in both computer science and their cognate disciplines*
- *collaborate and participate in a cutting-edge research group*
- *write a rigorous scientific document for academic audiences*
- *communicate and defend their research through oral presentations*

b. *Describe the modes of delivery, experiential learning opportunities, and general teaching philosophy relevant to the programming. Where appropriate, include information about whether this program is being delivered in a distributed format.*

Students will be required to attend presentations in seminar series both within Computer Science and in cognate disciplines, and will participate in presentations and discussions in lab meetings. While individual projects will vary, Applied Computing will also allow for potential experiential learning opportunities that are less natural within the Computer Science MSc program, such as wet lab or field work, or data gathering for a health science project. Computer programming experience and data analysis experience will be common, as will be the experience of dealing with large amounts of data. The required coursework will provide further background for being able to address the required components depending on the project.

There are no plans for explicit delivery in a distributed format.

c. *Provide an overview of the curriculum mapping.*

The program requirements include completing the CMPT 990 seminar series, CMPT 994 MSc thesis, and GSR 960 Ethics. Students in the MSc in Applied Computing must complete 12 credit units worth of courses. Three credit units may be taken at the 300 level or 400 level at the discretion of the advisory committee. Six credits worth of graduate-level coursework must be from the Department of Computer Science (CMPT prefix). The current offerings (not including CMPT 898s) are:

CMPT 810	*Algorithms*
CMPT 811	*Advanced Human Computer Interaction*
CMPT 815	*Computer Systems and Performance Evaluation*
CMPT 816	*Advanced Software Engineering*
CMPT 817	*Usability Engineering*
CMPT 819	*Advanced Image Processing and Computer Vision*
CMPT 820	*Topics in Learning and Intelligence Systems*
CMPT 821	*Advanced Topics in Programming Languages*
CMPT 823	*Compilers*

CMPT 824	*Graph Drawing and Network Visualization*
CMPT 826	*Data and Process Modeling and Analytics*
CMPT 829	*Computer Graphics*
CMPT 830	*Bioinformatics and Computational Biology*
CMPT 832	*Advanced Operating Systems*
CMPT 835	*Foundations of Concurrent Programming*
CMPT 840	*Accessible Computing*
CMPT 842	*Mobile and Cloud Computing*
CMPT 846	*Software Maintenance and Evolution*
CMPT 851	*Parallel Programming for Scientific Computing*
CMPT 856	*Topics in Software Engineering*
CMPT 857	*Readings in Bioinformatics*
CMPT 858	*Topics in Modeling and Operations Research*
CMPT 865	*Advanced Parallel and Distributed Systems*
CMPT 866	*Topics in Human Computer Interaction*
CMPT 867	*Affective Computing*
CMPT 868	*Social Computing*
CMPT 873	*Adaptive Systems and Personalization*
CMPT 874	*Construction of Computational Casual Models*
CMPT 876	*Image and Animation Synthesis*

The remaining courses can be from the cognate discipline(s), as approved by the Advisory Committee.

The MSc program requires an advisory committee of no less than three people: the supervisor(s), a committee member from Computer Science, and a committee member from Computer Science or relevant cognate discipline. When there are two committee members from Computer Science, one can be chosen to serve as the Graduate Chair's designate; when only one committee member is from Computer Science, that member is always the Chair's designate, unless the Graduate Chair opts to attend in person. The committee is expected to meet with the student once per academic year, on average, over the course of their degree. The committee must approve the course of study for the student, and this cannot be approved by the supervisor alone. Because the curation of interdisciplinary course selection can be more challenging than disciplinary course selection, this role of the committee has special importance. While it is preferable that the committee approve the course of study in a meeting with the student, emailed agreement is sufficient. Either an email chain from the committee or minutes of the meeting where the course of study is approved must be included in the student's file. The supervisor must complete an annual review of student progress that is endorsed by the committee every academic year. The committee must approve a thesis document as suitable for defence. There is no formal requirement for a thesis proposal at the MSc level; however, the committee is encouraged to perform an informal proposal prior to the defence.

The written thesis/dissertation will involve original research that contributes new knowledge to the cognate area by including the application of computation. Students are expected to obtain ethics approvals if needed. The defence will involve a 15-20 minute presentation summarizing the research, followed by a rigorous questioning from the examining committee.

d. *Identify where the opportunities for synthesis, analysis, application, critical thinking, problem solving are, and other relevant identifiers.*

Students will explicitly be involved in the ***application*** *of computing towards a cognate area. This will involve reading publications from both computing and the cognate area and then to* ***synthesize*** *the various connections required. During the course of the research, a plan will be developed, and* ***problem solving*** *will be required to address hypotheses in an appropriate fashion. As roadblocks are inevitably reached during the progression of their research, the student will need to critically evaluate appropriate techniques to solve their problems, or to alter their hypotheses.*

e. *Explain the comprehensive breadth of the program.*

Students entering the MSc in Applied Computing must have a 4-year BSc degree in Applied Computing, or Computer Science (or equivalent), or a 4-year undergraduate degree in a cognate discipline from a recognized institution. Even without a degree in Computer Science, they will still need to take at least 6 graduate level CUs from Computer Science. This still might require some additional relevant undergraduate background courses, but it will focus on what is needed for their research area rather than enough to justify the Computer Science name at the graduate level. Commonly, graduate courses in the cognate discipline will be taken as well as deemed appropriate by the graduate committee. Similarly, the thesis itself will cross multiple areas. We therefore expect a significant breadth from students in the program.

f. *Referring to the university "Learning Charter", explain how the 5 learning goals are addressed, and what degree attributes and skills will be acquired by graduates of the program.*

Truth and understanding *The Applied Computing program will follow the scientific principles of analysis and evaluation. Computation can be applied to almost every other discipline, as it provides techniques to make sense of and analyse data from any area, through e.g. models, simulation, and machine learning. Through coursework and supervision, students will be encouraged to be creative with their solutions, and to employ critical thinking.*

Pursuit of knowledge *Students in the Applied Computing program will undertake the largely interdisciplinary work of applying computation to a cognate area,*

which will involve the intersection of related disciplines. This enables the synthesis and pursuit of knowledge across related disciplines.

Pursuit of integrity and respect *There will be an emphasis placed on professionalism and integrity. Scientific integrity is crucial, and will be emphasized within coursework, and throughout their program. As an example, the Department of Computer Science often provides a seminar on Academic Integrity to our graduate students (which will be shared with Applied Computing).*

Pursuit of skills and practices *The Applied Computing program will provide the skills required to conduct research both individually and in teams, through collaboration and communication with those from different disciplines. Communication will also be required through research presentations, presentations in courses, and also possibly at international conferences. Applied Computing will provide students with the computational tools and disciplinary breadth to impact diverse industrial and social areas after graduation.*

Individual and community pursuits *Throughout their program, students will develop their leadership skills within interdisciplinary teams, as they will serve as a key bridge of expertise between computation and the cognate area. Largely, these projects will enable students to explicitly make positive contributions to society, and it will allow them to use these skills and gained responsibility in other areas of community.*

g. *Describe how students can enter this program from other programs (program transferability).*

Students who wish to transfer from other programs will be considered if they meet the minimum criteria. As with the Computer Science program, admission only occurs if a faculty member(s) agree to supervise the student, and admission is approved by the Computer Science Graduate Committee, along with the justification from the supervisor(s) as with the standard admission procedure.

h. *Specify the criteria that will be used to evaluate whether the program is a success within a timeframe clearly specified by the proponents in the proposal.*

Five years will be enough time to evaluate the success of the Applied Computing MSc program. By that time, there should have been multiple strong MSc graduates from Applied Computing for the program to be deemed a success.

i. *If applicable, is accreditation or certification available, and if so how will the program meet professional standard criteria. Specify in the budget below any costs that may be associated.*

There is not any accreditation available for this program.

4. Consultation

a. *Describe how the program relates to existing programs in the department, in the college or school, and with other colleges. Establish where students from other programs may benefit from courses in this program. Does the proposed program lead into other programs offered at the university or elsewhere?*

There is a substantial overlap with the Computer Science MSc program also run within the Department of Computer Science. Courses and administration will both be completely shared between the two programs. It will likely be significantly more practical for a student whose undergraduate degree is in another discipline to do a MSc in Applied Computing vs a MSc in Computer Science. Furthermore, the program could lead to either (the proposed) PhD in Applied Computing, or a PhD in their cognate discipline. A PhD in Computer Science might also be possible after a MSc in Applied Computing if the minimum breadth requirements are obtained by that stage. There are no new courses to be setup for this program, although many students in other graduate programs take Computer Science graduate courses as part of their program.

b. *List units that were consulted formally, and provide a summary of how consultation was conducted and how concerns that were raised in consultations have been addressed. Attach the relevant communication in an appendix.*

Faculty in the Department of Computer Science will be a beneficiary of the MSc in Applied Computing. But, in the past, we have had many students co-supervised by faculty members in other departments. For example, in the last year, we have had co-supervisors of Computer Science students within the Department of Biochemistry, Microbiology and Immunology, Department of Anatomy, Physiology and Pharmacology, Department of Plant Sciences, Department of Geography and Planning, Department of Large Animal Clinical Sciences, amongst others, and we had 23 graduate students that were either co-supervised with faculty from other departments, or co-funded by a researcher in another department. We expect that other faculty in other departments interested in applying computation to their own research areas to be significant beneficiaries of the Applied Computing program. These students will have the resources within the Applied Computing program to gain a substantial amount of relevant computer science knowledge, within both courses, and within the appropriate research groups.

Letters of support are attached from the Department of Biochemistry, Microbiology and Immunology, the Department of Anatomy, Physiology and Pharmacology, and from the College of Dentistry.

c. *Proposals that involve courses or other resources from colleges outside the sponsoring unit should include evidence of consultation and approval. Please give special consideration to pre- and co-requisite requires when including courses from other colleges.*

There are no predetermined required courses for Applied Computing either inside Computer Science, or outside Computer Science. The courses to be taken outside of Computer Science will completely depend on the student, their cognate area, the decisions of the Advisory Committee, the courses that are being taught at that time, and the prerequisites for those courses.

d. *Provide evidence of consultation with the University Library to ensure that appropriate library resources are available.*

Since no new courses are being created, no additional resources are required.

e. *List other pertinent consultations and evidence of support, if applicable (e.g., professional associations, accreditation bodies, potential employers, etc.)*

A letter of support has been provided from sasktech, which represents the interests of Saskatchewan technology companies with the goal of making Saskatchewan a key technology centre in Canada.

5. Budget

a. *How many instructors will participate in teaching, advising and other activities related to core program delivery (not including distribution/ breadth requirements or electives)? (estimate the percentage time for each person).*

We already have a substantial number of Computer Science courses being taught by faculty in the Department of Computer Science each year (roughly each faculty member teaches one grad course per year). No new courses will be created for this program, nor are there any special requirements in terms of courses that need to be taught in any given year. We also do not anticipate a large change in terms of the number of graduate students that are supervised per faculty member in the department, as we already have a very large graduate program. The main method of advising will be the student Advisory Committees, which is already a large responsibility, and so little will change in this regard. The Department of Computer Science Graduate Committee will also oversee the Applied Computing program. The Graduate Administrative Assistant will also oversee administrative issues for the program.

b. *What courses or programs are being eliminated in order to provide time to teach the additional courses?*

No new courses are being created, and none are being deleted.

c. *How are the teaching assignments of each unit and instructor affected by this proposal?*

There will be no change to teaching assignments, and we will continue with our practice of offering a substantial number of graduate courses each year (roughly one per faculty member), and there are no required courses as part of this program.

d. *Describe budget allocations and how the unit resources are reallocated to accommodate this proposal. (Unit administrative support, space issues, classroom availability, studio/practice rooms laboratory/clinical or other instructional space requirements).*

There are no new resources required to accommodate this proposal. No new courses will be taught. It is possible there will be a slight increase in the number of applications to graduate school in our department which will cause an increase in the amount of communication with the graduate administrative assistant and the number of applications that need to be evaluated by the Computer Science Graduate Committee.

e. *If this program is to be offered in a distributed context, please describe the costs associated with this approach of delivery and how these costs will be covered.*

We will operate this program exactly like the Computer Science program, where it is primarily non-distributed and there is an 8-month residency requirement as part of the MSc program.

f. *If this is an interdisciplinary program, please indicate whether there is a pool of resources available from other colleges involved in the program.*

There are no resources available from other colleges to support this program. However, it is common for faculty members in other departments to co-supervise students within Computer Science while helping with the funding of the student. In the past year, 23 graduate students within the Department of Computer Science have either been co-supervised with a member of another department, or have been co-funded by a member of another department. We expect this practice to be common for students in Applied Computing.

g. *What scholarships will students be able to apply for, and how many? What other provisions are being provided for student financial aid and to promote accessibility of the program?*

We will operate the Applied Computing program with the existing funding model and pool used by the Department of Computer Science. The Department of Computer Science receives certain funding amounts from CGPS and the College of Arts and Science. When students apply to Computer Science and faculty members request to supervise those students, funds from both faculty members and from other University sources are used to pay scholarships/stipends. We will continue to allocate these funds, but now to students within both the Computer Science program and the Applied Computing program. No preference will be given to students in Computer Science, or in Applied Computing. Funding and admission decisions will continue to be made by the Computer Science Graduate Committee. We have a standard funding amount of $21,500/year for two years for MSc students, and $24,500/year for four years for PhD students (we also have a policy of this funding amount being required for all international students except in extraordinary circumstances, and it is strongly recommended for all graduate students). These amounts will continue for the Applied Computing program as well. Students will be encouraged to apply for other scholarships such as NSERC CGS scholarships, SK Innovation and Opportunity Scholarships, and Dean's Scholarships.

h. *What is the program tuition? Will the program utilize a special tuition model or standard tuition categories? (The approval authority for tuition is the Board of Governors).*

We will use the same standard tuition funding amounts as the Computer Science program.

What are the estimated costs of program delivery, based on the total time commitment estimates provided? (Use TABBS information, as provided by the College/School financial officer)

Supervision of graduate students is constrained by faculty time and their grants, and not by the programs offered. We receive well over ten times more graduate applications than graduate students we accept. The purpose of this new graduate program is to address the interdisciplinary research needs and interests of our faculty members, to improve collaboration with the university at large, and to accommodate students with other backgrounds. Therefore, this program will cost nothing more in terms of program delivery or in terms of time commitments.

i. *What is the enrolment target for the program? How many years to reach this target? What is the minimum enrolment, below which the program ceases to be feasible? What is the maximum enrolment, given the limitations of the resources allocated to the program?*

There is no difference in terms of cost or resources whether or not students are in Computer Science or Applied Computing once in the program. There might be a small administrative burden in terms of number of applications to our program. If we consistently maintain some students in the program, it should be maintained, given its negligible incremental cost. We would expect that 5-10 graduate students would enter the proposed program in any given year, but this amount could change based on the research interests of the faculty in Computer Science and their collaborators. There is no explicit maximum, but in practice, faculty members will only accept students if they have the time and funding to support them. We do not expect significant changes in the total number of graduate students supervised (per faculty member) in Computer Science.

j. *What are the total expected revenues at the target enrolment level, separated into core program delivery and distribution/breadth requirements or electives? What portion of this expected revenue can be thought of as incremental (or new) revenue?*

We do not expect any changes in expected revenues as there are no specialized courses in Applied Computing, and we do not expect any substantial changes to enrolment in our department.

k. *At what enrolment number will this program be independently sustainable? If this enrolment number is higher than the enrolment target, where will the resources come from to sustain the program, and what commitments define the supply of those resources?*

No additional resources are required beyond those already available to our Computer Science graduate program, which is the largest thesis-based graduate program at the U of S.

l. *Proponents are required to clearly explain the total incremental costs of the program. This is to be expressed as: (i) total cost of resources needed to deliver the program: (ii) existing resources (including in-kind and tagged as such) applied against the total cost: and (iii) a listing of those resource costs that will require additional funding (including new in-kind support).*

The additional cost of resources needed to deliver the program above the computer science program is negligible. No courses are needed to be taught in any given year beyond what are offered as part of the computer science graduate program, and no special arrangements will need to be made to accommodate the applied computing program.

m. *List all new funding sources and amounts (including in-kind) and the anticipated contribution of each to offsetting increment program costs. Please identify if any indicated funding is contingent on subsequent approval by a funding authority*

and/or future conditions. Also indicate under what conditions the program is expected to be cost neutral. The proponents should also indicated any anticipated surpluses/deficits associated with the new program

No new funding sources have been obtained, although no additional resources are required.

College Statement

Please provide here or attach to the online portal, a statement from the College which contains the following:

- Recommendation from the College regarding the program
- Description of the College process used to arrive at that recommendation
- Summary of issues that the College discussed and how they were resolved

Related Documentation

At the online portal, attach any related documentation which is relevant to this proposal to the online portal, such as:

- Excerpts from the College Plan and Planning Parameters
- SPR recommendations
- Relevant sections of the College plan
- Accreditation review recommendations
- Letters of support
- Memos of consultation

It is particularly important for Council committees to know if a curriculum changes are being made in response to College Plans and Planning Parameters, review recommendations or accreditation recommendations.

Consultation Forms At the online portal, attach the following forms, as required

<u>Required for all submissions:</u>

- Consultation with the Registrar form
- Complete Catalogue entry, if proposing a new program, or excerpt of existing of existing program with proposed changes marked in red

<u>Required for all new courses:</u>

- New Course Proposal forms
- Calendar-draft list of new and revised courses

<u>Required if resources needed</u>:

- Information Technology Requirements form
- Library Requirements form
- Physical Resource Requirements form

- Budget Consultation form

March 12, 2021

To Whom It May Concern:

RE: University of Saskatchewan, Dept. of Computer Science, Applied Computing Proposal

We are writing on behalf of SaskTech to express our support of the proposal being submitted by the University of Saskatchewan's Department of Computer Science for a graduate level applied computing program.

The rapid digitization of almost every discipline of human endeavour is the root cause of one of the most significant labour shortages our country has ever experienced. The next several decades will be critical for Saskatchewan, as our historically strong and innovative core economic engines reimagine themselves in a world economy driven by data science, robotics, and AI; agriculture, mining, and energy companies are following the lead of commerce, finance, and health with reimagined workforces, workplaces, and tools & technologies.

There are two ways to address this shortage in the training of local labour: massively increase the pipeline of computer science and computer engineering graduates, then train them with the necessary domain knowledge to take their place in new industries; or acknowledge that a combination of domain knowledge and technical skills are needed in every field and educate students of those fields appropriately. It is this second approach that the applied computing programs developed by the Department of Computer Science fills. It's imaginative, scalable, and has the potential to solve the problem effectively.

We are fully in support of the undergraduate programs currently proposed, but feel that the graduate programs, as described to us in detail, are potentially even more critical for the success of the innovation economy in Saskatchewan and Canada. A key gap at the head of every innovative company in Saskatchewan, Canada, and beyond is the technical lead with the skills to navigate the domain (be it ethics, biochemistry, or engineering) and the technological intersection with that domain. Graduates of the proposed program will be among the most sought after to be employed in start-ups, established companies (tech or otherwise), and as key research leads for multidisciplinary projects.

SaskTech is pleased to strongly support the M.Sc and Ph.D. Applied Computing program proposal.

Best regards,

Aaron Genest
President, SaskTech
On behalf of the Board and Members
www.sasktech.org/members

UNIVERSITY OF SASKATCHEWAN

March 12, 2021

To: Ian McQuillan, Department of Computer Sciences

REF: Graduate Programs in Applied Computing

This note is to confirm the College of Dentistry enthusiastic support for the new proposed MSc and PhD programs in Applied Computing. There is an emerging need for graduate students from disciplines outside Computer Sciences to get experiential training in Applied Computing including Applied Bioinformatics. We see these new programs as outstanding opportunities for further collaborations between Health Sciences and Computer Sciences that will imply collaborative projects and co-supervision of graduate students. We, therefore, as a College, strongly support these new programs.

Sincerely,

Petros Papagerakis, BSc, MS, PhD
Associate Dean for Research
College of Dentistry
Centennial Enhancement Chair in One Health
Professor
University of Saskatchewan
Canada
Phone: 306-966-5116
Email: petros.papagerakis@usask.ca

UNIVERSITY OF SASKATCHEWAN

Department of Anatomy,
Physiology, and Pharmacology
College of Medicine

3D01-107 Wiggins Road, Saskatoon, SK S7N 5E5
Eames office telephone: (306) 966-6534

RE: establishing Applied Computing grad programs

CGPS Programs Committee
University of Saskatchewan

12Mar2021

Dear Committee Members,

As a Grad Chair (and perhaps more importantly, a research faculty) in Anatomy, Physiology, and Pharmacology in the College of Medicine at the UofS, I ***strongly support*** establishment of graduate programs in Applied Computing through the Department of Computer Science.

When my lab's research entered the 'omics' era in 2013, I sought out a collaboration with Ian McQuillan, and we have since co-supervised four students in Computer Science. Our collaboration has been productive recently, with a number of publications now coming out and many more on the way. However, one of the main impediments to earlier productivity was an inability to find students with the biological background required to perform the necessary applied bioinformatics analyses. As a result, I spend a lot of time meeting with each student in our collaboration, teaching them the basics of biology that would drive the decisions on which bioinformatic algorithms to apply to the data and why.

An Applied Computing grad program would solve this impediment, enabling a massive increase in research productivity to the many research faculty, like myself, whose research programs now require bioinformatics after just starting to employ 'omics' techniques. I am very excited about the idea that I can co-supervise a student who has an undergrad in another area, such as Biology or Health Sciences, in the Applied Computing program. Again, as a Grad Chair in APP, I also recognize the importance of establishing this program in order to attract an entirely new cadre of grad students. By the nature of an Applied Computing program, these students will not only increase recognition of the UofS as a new Canadian research powerhouse, but will also have the applied training that is sought by employers in many biotechnology and pharmaceutical companies.

Please don't hesitate to contact me to follow up on any points that I've raised above.

Brian F. Eames, PhD
Grad Chair and Associate Professor
Anatomy, Physiology, and Pharmacology
b.frank@usask.ca

UNIVERSITY OF SASKATCHEWAN
College of Medicine
MEDICINE.USASK.CA

Department of Biochemistry, Microbiology, and Immunology
GA20 – 107 Wiggins Road, Saskatoon, SK Canada S7N 5E5
Phone: 306-966-6538 Fax: 306-966-4298

To: Ian McQuillan
Department of Computer Science

From: Bill Roesler, Head
Department of Biochemistry, Microbiology & Immunology

Date: March 3, 2021

RE: Graduate programs in Applied Computing

Our department has discussed the proposal for graduate degrees in Applied Computing that you provided. There was broad and enthusiastic support for these new programs. It was felt that these programs will open up doors for our biomedical science students to get advanced training in applied computing, skills and knowledge that our students often lack but need. It was also felt that it could pave the way for more research collaboration between our two departments as well. Thus we give our strong support for these proposed programs.

William (Bill) J. Roesler, Professor and Head
Department of Biochemistry, Microbiology, and Immunology, University of Saskatchewan
107 Wiggins Road, Saskatoon, SK S7N 5E5 Canada
Telephone: 306-966-4375 Email: bill.roesler@usask.ca

UNIVERSITY OF SASKATCHEWAN	**Proposal for Academic or Curricular Change**

PROPOSAL IDENTIFICATION

Title of proposal: PhD in Applied Computing

Degree(s): PhD

Field(s) of Specialization: Applied Computing

Level(s) of Concentration: N/A

Option(s): N/A

Degree College: CGPS

Contact person(s) (name, telephone, fax, e-mail): Ryan Walker, Associate Dean, CGPS; 306-966-2229; kelly.clement@usask.ca

Proposed date of implementation: May 2022

Proposal Document

Please provide information which covers the following sub topics. The length and detail should reflect the scale or importance of the program or revision. Documents prepared for your college may be used. Please expand this document as needed to embrace all your information.

1. **Academic justification:**
   a. *Describe why the program would be a useful addition to the university, from an academic programming perspective.*

Computing is permeating modern life. When applied to a particular problem or domain, knowledge of computing and the domain itself are required to effectively achieve insight. Traditional industries such as mining and agriculture have joined the ranks of more established technology users in IT, medicine, business and design. There is a clear need for graduates with knowledge in both computing and domains of application.

At the graduate level, interdisciplinary graduate work is becoming significantly more common in the Department of Computer Science at the University of Saskatchewan. In the past year alone, 23 students in the thesis-based MSc and PhD programs in Computer Science either have been co-supervised by faculty from other departments, or have been partially co-funded by a researcher in another department. This points to the interdisciplinary research currently being conducted within our department. However, students with a strong background in a relevant cognate area are prevented from pursuing graduate studies within the department by substantial remedial Computer Science course requirements, putting unnecessary strain on students transferring in from other disciplines. While students could conduct meaningful research at the graduate level on interdisciplinary projects under the supervision of a faculty member in Computer Science, they are prevented from doing so by the Department's need to maintain the brand integrity of the MSc and PhD in Computer Science. Indeed, given that a PhD graduate in Computer Science could reasonably be expected to teach in an accredited computer science program, they should have a sufficient depth and breadth of knowledge in the discipline.

Despite this requirement, faculty members in Computer Science have identified supervising students with stronger backgrounds in cognate areas as being key to addressing their research goals. Also, collaborators in cognate areas have identified computing as being a requirement for their research programs; and students in these areas have expressed a desire to improve their computer science training and to apply computation towards their background area of expertise. Creating a new graduate degree program to accommodate students with interdisciplinary interests provides a path to graduation without impacting the existing graduate programs in Computer Science. The program would also be appropriate for students in the undergraduate program in Applied Computing, which is also being proposed by the Department of Computer Science.

A PhD in Applied Computing implies a commitment to research on the part of the applicant. While classically PhD recipients in Computer Science would target a faculty position, there are substantial opportunities for PhD candidates in large firms such as Google or Microsoft who have in-house research programs or leading-edge development efforts. Opportunities in government research labs and as consultants also exist. The same is true of recipients of a PhD in Applied Computing. For example, a PhD candidate with a background in computer models of contagious disease might target academia in either Computer Science or Medicine, or could work for a government agency such as the Saskatchewan Health Quality Council. Similarly, a student with a PhD in User Experience (UX) in games could target a faculty position or become a development lead in the game industry. Both of these examples have been realized by interdisciplinary students who have successfully navigated our PhD in Computer Science. The PhD in Applied Computing is meant to facilitate the research and mentoring of these kinds of students.

b. *Giving consideration to strategic objectives, specify how the new program fits the university signature areas and/or integrated plan areas, and/or the college/school, and/or department plans.*

The proposed program is intrinsically aligned with the University and College strategic priority for interdisciplinarity. While this program is aligned with strategic goals, it did not arise from their calls to action. This program does align with elements of the Computer Science strategic plan, articulated at the June 2017 departmental retreat, which called for a greater impact of computer science as a department and discipline across campus to reflect its growing importance to society.

We currently have the largest research-intensive thesis-based graduate program at the university. Almost all our graduate students are funded, and the majority through grants held by professors. Our current program is also characterized by substantial interdisciplinary research. For example, our world leading Human Computer Interaction and Software Engineering groups have substantial collaborations across the university (Social Sciences and SENS) and with industry. Members of our Bioinformatics group collaborate with life scientists in Health, Biology, and Agriculture. Image processing and data analytics research is core to the Plant Phenotyping and Imaging Research Centre. Because of the scope of our collaborative activities, we attract a diverse group of graduate students. Instead of greatly increasing the number of graduate students in our graduate programs, the proposed program will allow us to more adroitly accommodate students from non-traditional computer science backgrounds.

c. *Is there a particular student demographic this program is targeted towards and, if so, what is that target? (e.g., Aboriginal, mature, international, returning)*

This program does not explicitly address internationalization. However, there are aspects of it within the programs. The student body of the graduate program in Computer Science is predominantly international. We expect this trend to continue in the graduate level Applied Computing program. At the undergraduate level, Computer Science has a disproportionate number of international students compared to other units, particularly from East Asia and South Asia.

Indigenization within this program, and Computer Science in general, will focus on access and impact. Aspects of Applied Computing would be of potential interest to indigenous students as data sovereignty is a core component of many issues facing indigenous communities including land claims, environmental assessments, and water rights. Training indigenous students in these disciplines would allow them to perform their own analysis of data collected on their traditional territories, enabling more fulsome participation in conversations about land use and impact.

Like their undergraduate counterparts, there is high demand for graduate level training in areas such as interactive systems or user experience, bioinformatics, health informatics and epidemiology, and data analytics as evidenced by the success of graduates in these areas from our current PhD in Computer Science.

d. *What are the most similar competing programs in Saskatchewan, and in Canada? How is this program different?*

In addition to the graduate programs, we are also separately proposing an undergraduate program in Applied Computing. There are some institutions in Canada with a similar undergraduate program (most notably Dalhousie). However, at the graduate level, the proposed PhD program is unique. There are some MSc programs in Canada in Applied Computing, most notably at the University of Toronto, Wilfrid Laurier, Concordia, Dalhousie, and Windsor. However, these programs all focus on industry, and some have a built-in internship. We believe that there is not a PhD program in Applied Computing in Canada.

In contrast, the proposed program is entirely research focussed, and thesis based. We expect it to be a novel program across Canada, and it will encourage excellent students with degrees in cognate disciplines who wish to apply computational techniques to their undergraduate area.

2. Admissions

a. *What are the admissions requirements of this program?*

Similar to the MSc in Applied Computing, applicants to the PhD in Applied Computing must have a MSc in Applied Computing, Computer Science or equivalent, or a thesis-based Masters-level credential in a relevant cognate area with a minimum overall average of 80%. If the student is entering with a degree in a cognate discipline, the proposed faculty advisor must submit a short letter to the Computer Science Graduate Committee (less than 250 words) justifying why the student's background qualifies the student for the intended area of research. This justification will serve as part of the admission record, but will also serve to educate graduate committee members as to the types of qualifications and reputable institutions that match well with different research groups.

Admitted students under either of those conditions will not be required to do any remedial undergraduate computer science courses unless recommended as part of the course of study for an individual graduate student by their advisory committee, or as part of their Qualifying Examination (described below). English requirements will be identical to the Computer Science graduate programs. All students must meet the CGPS English requirements, with higher minimum testing scores. This can be done by demonstrating an aggregate TOEFL score of at least 94, with no individual score below 20; or an aggregate IELTS (Academic Module) score of at least 7.0, with no individual score below 6.5. Students also must submit a statement of research interest, a resume, and three reference letters.

3. Description of the program

a. *What are the curricular objectives, and how are these accomplished?*

The curricular objectives will ensure that graduates are highly qualified researchers that are able to apply computational techniques to some cognate research area. The program will be ideally suited for students wishing to become senior professionals in the technology industry or applying computation to a cognate industry. Graduates will become project leaders at companies and research labs. For example, students with an MSc degree in bioinformatics, biology, or plant science, could gain the skills needed to apply data analytics techniques and computational modelling to address biological hypotheses, and to draw biological conclusions. As another example, students with a psychology background could become able to combine the principles of human computer interaction and visualization with psychology.

Graduates of the PhD program will be able to:

- *demonstrate expertise in applying computational techniques and research methodology to problems and data from a cognate discipline*
- *critically evaluate literature and research techniques from both their cognate discipline and from computer science*
- *work independently towards their research, and execute their research plan*
- *communicate and interpret requirements with researchers in both computer science and their cognate disciplines*
- *collaborate and participate in a cutting-edge research group*
- *write rigorous scientific documents and publish refereed papers for academic audiences*
- *communicate and defend their research through oral presentations*

b. *Describe the modes of delivery, experiential learning opportunities, and general teaching philosophy relevant to the programming. Where appropriate, include information about whether this program is being delivered in a distributed format.*

Students will be required to attend presentations in seminar series both within Computer Science and in cognate disciplines, and will participate in presentations and discussions in lab meetings. While individual projects will vary, Applied Computing will also allow for potential experiential learning opportunities that are less natural within the Computer Science PhD program, such as wet lab or field work, or data gathering for a health science project. Computer programming experience and data analysis experience will be common, as will be the experience of dealing with large amounts of data. The required coursework will provide further background for being able to address the required components depending on the project.

There are no plans for explicit delivery in a distributed format.

c. *Provide an overview of the curriculum mapping.*

The program requirements include completing the CMPT 990 seminar series, CMPT 996 PhD thesis, and GSR 960 Ethics. Students in the PhD in Applied Computing must complete 6 credit units worth of courses at the graduate level. Three credits worth

of graduate-level coursework must be from the Department of Computer Science (CMPT prefix). The current offerings (not including CMPT 898s) are:

CMPT 810	*Algorithms*
CMPT 811	*Advanced Human Computer Interaction*
CMPT 815	*Computer Systems and Performance Evaluation*
CMPT 816	*Advanced Software Engineering*
CMPT 817	*Usability Engineering*
CMPT 819	*Advanced Image Processing and Computer Vision*
CMPT 820	*Topics in Learning and Intelligence Systems*
CMPT 821	*Advanced Topics in Programming Languages*
CMPT 823	*Compilers*
CMPT 824	*Graph Drawing and Network Visualization*
CMPT 826	*Data and Process Modeling and Analytics*
CMPT 829	*Computer Graphics*
CMPT 830	*Bioinformatics and Computational Biology*
CMPT 832	*Advanced Operating Systems*
CMPT 835	*Foundations of Concurrent Programming*
CMPT 840	*Accessible Computing*
CMPT 842	*Mobile and Cloud Computing*
CMPT 846	*Software Maintenance and Evolution*
CMPT 851	*Parallel Programming for Scientific Computing*
CMPT 856	*Topics in Software Engineering*
CMPT 857	*Readings in Bioinformatics*
CMPT 858	*Topics in Modeling and Operations Research*
CMPT 865	*Advanced Parallel and Distributed Systems*
CMPT 866	*Topics in Human Computer Interaction*
CMPT 867	*Affective Computing*
CMPT 868	*Social Computing*
CMPT 873	*Adaptive Systems and Personalization*
CMPT 874	*Construction of Computational Casual Models*
CMPT 876	*Image and Animation Synthesis*

The remaining courses can be from the cognate discipline(s), as approved by the Advisory Committee.

***Advisory Committee**: The PhD program requires an advisory committee of no less than five people: the supervisor(s), the graduate chair (or designate), a committee member from Computer Science, and a committee member from Computer Science or relevant cognate discipline, and a cognate member who must be from outside Computer Science or a department of the supervisor(s). The committee is expected to meet with the student once per academic year, on average, over the course of their degree. The committee must approve the course of study for the student, this cannot be approved by the supervisor alone. Because the curation of interdisciplinary course selection can be more challenging than disciplinary course selection, this role of the committee has*

special importance. While it is preferable that the committee approve the course of study in a meeting with the student, emailed agreement is sufficient. Either an email chain from the committee or minutes of the meeting must where the course of study is approved must be included in the student's file. The supervisor must complete an annual review of student progress that is endorsed by the committee every academic year.

PhD students in Applied Computing must complete a Qualifying Exam, a Comprehensive Exam, a Thesis Proposal, and a Thesis.

***Qualifying Exam**: The PhD in Computer Science requires advanced courses at either the senior undergraduate or graduate levels in five distinct areas (an area is approved by the advisory committee) with a minimum GPA of 70% for a graduate course, or 80% for an undergraduate course to satisfy the breadth requirement or qualifying exam. Non-U of S course grades will be converted using established grade conversions (e.g. those used to determine admission averages) and judged according to the U of S grade equivalent. This requirement will be similar for the PhD in Applied Computing. Because it is possible that many of the areas of a student's breadth will lie outside of Computer Science, the student is not required to constrain their breadth to within Computer Science. Students completing the Qualifying Exam must complete or have previously completed courses in five distinct areas at the senior undergraduate or graduate level. At least two areas must be within Computer Science. Up to three courses may be at the senior undergraduate (3rd or 4th year) level. The student is required to provide a document including a table detailing the courses they took and why they constitute different cognate areas, as well as a short (< 1000 word) description on how the courses prepare them for the research area they are planning to enter. The qualifying exam is approved first by the advisory committee, then ratified by the graduate committee. The candidate is expected to complete this examination at the beginning of the Ph.D. program, normally within the first 12 months of entering the program.*

***Comprehensive Exam**: For the Comprehensive Exam, the student will prepare a full literature review of the state of the art in the field they are planning to do their thesis in. The main deliverable of the comprehensive exam is a survey paper which comprises a thorough review of the chosen topic area in terms of both breadth and depth. The paper is evaluated against the standard of quality for a publishable survey paper in a reputable refereed journal or conference proceedings in the area. There will be an oral examination conducted by the advisory committee. During this examination, the student gives a 15-20 minute presentation based on their paper, and then answers questions regarding their paper and presentation. The purpose of the questions is to establish that the student has gained a sufficient breadth and depth of the area. To pass the Comprehensive Examination, a pass in both the oral examination and the paper are required. The Comprehensive Examination should be completed within the first 18 months of entering the PhD program. The candidate's supervisor(s) and advisory committee are not permitted to provide significant editorial assistance in the preparation of the comprehensive exam paper. This paper should be representative of the student's*

own independent writing ability. Students may fail the Comprehensive exam in accordance with CGPS policies.

***Thesis Proposal**: For the Thesis Proposal, the candidate will prepare a document describing the work done to date, and provide an overview and plan for the completion of the work. If the student is planning a manuscript-based thesis, the thesis proposal may be one or more papers, accompanied by a general introduction motivating and identifying the overall problem for the thesis, as well as individual introductions for each paper describing how that contribution addresses the overall question, and the role of any of the paper's co-authors.*

***Thesis and Defence**: The written thesis/dissertation will involve original research that contributes new and significant knowledge to the cognate area by including the application of computation. The defence will involve a 15-20 minute presentation summarizing the research, followed by a rigorous questioning from the examining committee.*

d. *Identify where the opportunities for synthesis, analysis, application, critical thinking, problem solving are, and other relevant identifiers.*

*Students will explicitly be involved in the **application** of computing towards a cognate area. This will involve reading publications from both computing and the cognate area and then to **synthesize** the various connections required. During the course of the research, a plan will be developed, and **problem solving** will be required to address hypotheses in an appropriate fashion. As roadblocks are inevitably reached during the progression of their research, the student will need to critically evaluate appropriate techniques to solve their problems, or to alter their hypotheses.*

e. *Explain the comprehensive breadth of the program.*

Students entering the PhD in Applied Computing must have a MSc degree in Applied Computing, or Computer Science (or equivalent), or a MSc degree in a cognate discipline from a recognized institution. Breadth is required within both the cognate discipline and in applied computation. This will be evaluated through the Qualifying Examination, which still might require some additional relevant background courses be taken, but it will focus on what is needed for their research area rather than enough to justify the Computer Science name at the graduate level. Commonly, graduate courses in the cognate discipline will be taken as well as deemed appropriate by the graduate committee. Similarly, the thesis itself will cross multiple areas. We therefore expect a significant breadth from students in the program.

f. *Referring to the university "Learning Charter", explain how the 5 learning goals are addressed, and what degree attributes and skills will be acquired by graduates of the program.*

Truth and understanding *The Applied Computing program will follow the scientific principles of analysis and evaluation. Computation can be applied to almost every other discipline, as it provides techniques to make sense of and analyse data from any area, through e.g. models, simulation, and machine learning. Through coursework and supervision, students will be encouraged to be creative with their solutions, and to employ critical thinking.*

Pursuit of knowledge *Students in the Applied Computing program will undertake the largely interdisciplinary work of applying computation to a cognate area, which will involve the intersection of related disciplines. This enables the synthesis and pursuit of knowledge across related disciplines.*

Pursuit of integrity and respect *There will be an emphasis placed on professionalism and integrity. Scientific integrity is crucial, and will be emphasized within coursework, and throughout their program. As an example, the Department of Computer Science often provides a seminar on Academic Integrity to our graduate students (which will be shared with Applied Computing).*

Pursuit of skills and practices *The Applied Computing program will provide the skills required to conduct research both individually and in teams, through collaboration and communication with those from different disciplines. Communication will also be required through research presentations, presentations in courses, and also possibly at international conferences. Applied Computing will provide students with the computational tools and disciplinary breadth to impact diverse industrial and social areas after graduation.*

Individual and community pursuits *Throughout their program, students will develop their leadership skills within interdisciplinary teams, as they will serve as a key bridge of expertise between computation and the cognate area. Largely, these projects will enable students to explicitly make positive contributions to society, and it will allow them to use these skills and gained responsibility in other areas of community.*

g. *Describe how students can enter this program from other programs (program transferability).*

Students who wish to transfer from other programs will be considered if they meet the minimum criteria. As with the Computer Science program, admission only occurs if a faculty member(s) agree to supervise the student, and admission is approved

by the Computer Science Graduate Committee, along with the justification from the supervisor(s) as with the standard admission procedure.

h. *Specify the criteria that will be used to evaluate whether the program is a success within a timeframe clearly specified by the proponents in the proposal.*

Seven years will be enough time to evaluate the success of the Applied Computing PhD program. By that time, there should have been multiple strong PhD graduates from Applied Computing for the program to be deemed a success.

i. *If applicable, is accreditation or certification available, and if so how will the program meet professional standard criteria. Specify in the budget below any costs that may be associated.*

There is not any accreditation available for this program.

4. Consultation

a. *Describe how the program relates to existing programs in the department, in the college or school, and with other colleges. Establish where students from other programs may benefit from courses in this program. Does the proposed program lead into other programs offered at the university or elsewhere?*

There is a substantial overlap with the Computer Science PhD program also run within the Department of Computer Science. Courses and administration will both be completely shared between the two programs. It will likely be significantly more practical for a student who does not have a prior degree in Computer Science to do a PhD in Applied Computing vs a PhD in Computer Science. There are no new courses to be setup for this program, although many students in other graduate programs take Computer Science graduate courses as part of their program.

b. *List units that were consulted formally, and provide a summary of how consultation was conducted and how concerns that were raised in consultations have been addressed. Attach the relevant communication in an appendix.*

Faculty in the Department of Computer Science will be a beneficiary of the PhD in Applied Computing. But, in the past, we have had many students co-supervised by faculty members in other departments. For example, in the last year, we have had co-supervisors of Computer Science students within the Department of Biochemistry, Microbiology and Immunology, Department of Anatomy, Physiology and Pharmacology, Department of Plant Sciences, Department of Geography and Planning, Department of Large Animal Clinical Sciences, amongst others, and we had 23 graduate students that were either co-supervised with faculty from other departments, or co-funded by a researcher in another department. We expect that other faculty in other departments

interested in applying computation to their own research areas to be significant beneficiaries of the Applied Computing program. These students will have the resources within the Applied Computing program to gain a substantial amount of relevant computer science knowledge, within both courses, and within the appropriate research groups.

Letters of support are attached from the Department of Biochemistry, Microbiology and Immunology, the Department of Anatomy, Physiology and Pharmacology, and from the College of Dentistry.

c. *Proposals that involve courses or other resources from colleges outside the sponsoring unit should include evidence of consultation and approval. Please give special consideration to pre- and co-requisite requires when including courses from other colleges.*

There are no predetermined required courses for Applied Computing either inside Computer Science, or outside Computer Science. The courses to be taken outside of Computer Science will completely depend on the student, their cognate area, the decisions of the Advisory Committee, the courses that are being taught at that time, and the prerequisites for those courses.

d. *Provide evidence of consultation with the University Library to ensure that appropriate library resources are available.*

Since no new courses are being created, no additional resources are required.

e. *List other pertinent consultations and evidence of support, if applicable (e.g., professional associations, accreditation bodies, potential employers, etc.)*

A letter of support has been provided from sasktech, which represents the interests of Saskatchewan technology companies with the goal of making Saskatchewan a key technology centre in Canada.

5. Budget

a. *How many instructors will participate in teaching, advising and other activities related to core program delivery (not including distribution/ breadth requirements or electives)? (estimate the percentage time for each person).*

We already have a substantial number of Computer Science courses being taught by faculty in the Department of Computer Science each year (roughly each faculty member teaches one grad course per year). No new courses will be created for this program, nor are there any special requirements in terms of courses that need to be taught in any given year. We also do not anticipate a large change in terms of the number of graduate students that are supervised per faculty member in the department, as we already have a very large graduate program. The main method of advising will be

the student Advisory Committees, which is already a large responsibility, and so little will change in this regard. The Department of Computer Science Graduate Committee will also oversee the Applied Computing program. The Graduate Administrative Assistant will also oversee administrative issues for the program.

b. *What courses or programs are being eliminated in order to provide time to teach the additional courses?*

   No new courses are being created, and none are being deleted.

c. *How are the teaching assignments of each unit and instructor affected by this proposal?*

There will be no change to teaching assignments, and we will continue with our practice of offering a substantial number of graduate courses each year (roughly one per faculty member), and there are no required courses as part of this program.

d. *Describe budget allocations and how the unit resources are reallocated to accommodate this proposal. (Unit administrative support, space issues, classroom availability, studio/practice rooms laboratory/clinical or other instructional space requirements).*

There are no new resources required to accommodate this proposal. No new courses will be taught. It is possible there will be a slight increase in the number of applications to graduate school in our department which will cause an increase in the amount of communication with the graduate administrative assistant and the number of applications that need to be evaluated by the Computer Science Graduate Committee.

e. *If this program is to be offered in a distributed context, please describe the costs associated with this approach of delivery and how these costs will be covered.*

We will operate this program exactly like the Computer Science program, where it is primarily non-distributed and there is a 18-month residency requirement as part of the PhD program.

f. *If this is an interdisciplinary program, please indicate whether there is a pool of resources available from other colleges involved in the program.*

There are no resources available from other colleges to support this program. However, it is common for faculty members in other departments to co-supervise students within Computer Science while helping with the funding of the student. In the past year, 23 graduate students within the Department of Computer Science have either been co-supervised with a member of another department, or have been co-funded by a

member of another department. We expect this practice to be common for students in Applied Computing.

g. *What scholarships will students be able to apply for, and how many? What other provisions are being provided for student financial aid and to promote accessibility of the program?*

We will operate the Applied Computing program with the existing funding model and pool used by the Department of Computer Science. The Department of Computer Science receives certain funding amounts from CGPS and the College of Arts and Science. When students apply to Computer Science and faculty members request to supervise those students, funds from both faculty members and from other University sources are used to pay scholarships/stipends. We will continue to allocate these funds, but now to students within both the Computer Science program and the Applied Computing program. No preference will be given to students in Computer Science, or in Applied Computing. Funding and admission decisions will continue to be made by the Computer Science Graduate Committee. We have a standard funding amount of $21,500/year for two years for MSc students, and $24,500/year for four years for PhD students (we also have a policy of this funding amount being required for all international students except in extraordinary circumstances, and it is strongly recommended for all graduate students). These amounts will continue for the Applied Computing program as well. Students will be encouraged to apply for other scholarships such as NSERC CGS scholarships, SK Innovation and Opportunity Scholarships, and Dean's Scholarships.

h. *What is the program tuition? Will the program utilize a special tuition model or standard tuition categories? (The approval authority for tuition is the Board of Governors).*

We will use the same standard tuition funding amounts as the Computer Science program.

What are the estimated costs of program delivery, based on the total time commitment estimates provided? (Use TABBS information, as provided by the College/School financial officer)

Supervision of graduate students is constrained by faculty time and their grants, and not by the programs offered. We receive well over ten times more graduate applications than graduate students we accept. The purpose of this new graduate program is to address the interdisciplinary research needs and interests of our faculty members, to improve collaboration with the university at large, and to accommodate students with other backgrounds. Therefore, this program will cost nothing more in terms of program delivery or in terms of time commitments.

i. *What is the enrolment target for the program? How many years to reach this target? What is the minimum enrolment, below which the program ceases to be feasible? What is the maximum enrolment, given the limitations of the resources allocated to the program?*

There is no difference in terms of cost or resources whether or not students are in Computer Science or Applied Computing once in the program. There might be a small administrative burden in terms of number of applications to our program. If we consistently maintain some students in the program, it should be maintained, given its negligible incremental cost. We would expect that 3-5 graduate students would enter the proposed program in any given year, but this amount could change based on the research interests of the faculty in Computer Science and their collaborators. There is no explicit maximum, but in practice, faculty members will only accept students if they have the time and funding to support them. We do not expect significant changes in the total number of graduate students supervised (per faculty member) in Computer Science.

j. *What are the total expected revenues at the target enrolment level, separated into core program delivery and distribution/breadth requirements or electives? What portion of this expected revenue can be thought of as incremental (or new) revenue?*

We do not expect any changes in expected revenues as there are no specialized courses in Applied Computing, and we do not expect any substantial changes to enrolment in our department.

k. *At what enrolment number will this program be independently sustainable? If this enrolment number is higher than the enrolment target, where will the resources come from to sustain the program, and what commitments define the supply of those resources?*

No additional resources are required beyond those already available to our Computer Science graduate program, which is the largest thesis-based graduate program at the U of S.

l. *Proponents are required to clearly explain the total incremental costs of the program. This is to be expressed as: (i) total cost of resources needed to deliver the program: (ii) existing resources (including in-kind and tagged as such) applied against the total cost: and (iii) a listing of those resource costs that will require additional funding (including new in-kind support).*

The additional cost of resources needed to deliver the program above the computer science program is negligible. No courses are needed to be taught in any given year beyond what are offered as part of the computer science graduate program,

and no special arrangements will need to be made to accommodate the applied computing program.

m. *List all new funding sources and amounts (including in-kind) and the anticipated contribution of each to offsetting increment program costs. Please identify if any indicated funding is contingent on subsequent approval by a funding authority and/or future conditions. Also indicate under what conditions the program is expected to be cost neutral. The proponents should also indicated any anticipated surpluses/deficits associated with the new program*

No new funding sources have been obtained, although no additional resources are required.

College Statement

Please provide here or attach to the online portal, a statement from the College which contains the following:

- Recommendation from the College regarding the program
- Description of the College process used to arrive at that recommendation
- Summary of issues that the College discussed and how they were resolved

Related Documentation

At the online portal, attach any related documentation which is relevant to this proposal to the online portal, such as:

- Excerpts from the College Plan and Planning Parameters
- SPR recommendations
- Relevant sections of the College plan
- Accreditation review recommendations
- Letters of support
- Memos of consultation

It is particularly important for Council committees to know if a curriculum changes are being made in response to College Plans and Planning Parameters, review recommendations or accreditation recommendations.

Consultation Forms At the online portal, attach the following forms, as required

<u>Required for all submissions:</u>

- Consultation with the Registrar form
- Complete Catalogue entry, if proposing a new program, or excerpt of existing of existing program with proposed changes marked in red

<u>Required for all new courses:</u>

- New Course Proposal forms
- Calendar-draft list of new and revised courses

Required if resources needed:

- Information Technology Requirements form
- Library Requirements form
- Physical Resource Requirements form
- Budget Consultation form

March 12, 2021

To Whom It May Concern:

RE: University of Saskatchewan, Dept. of Computer Science, Applied Computing Proposal

We are writing on behalf of SaskTech to express our support of the proposal being submitted by the University of Saskatchewan's Department of Computer Science for a graduate level applied computing program.

The rapid digitization of almost every discipline of human endeavour is the root cause of one of the most significant labour shortages our country has ever experienced. The next several decades will be critical for Saskatchewan, as our historically strong and innovative core economic engines reimagine themselves in a world economy driven by data science, robotics, and AI; agriculture, mining, and energy companies are following the lead of commerce, finance, and health with reimagined workforces, workplaces, and tools & technologies.

There are two ways to address this shortage in the training of local labour: massively increase the pipeline of computer science and computer engineering graduates, then train them with the necessary domain knowledge to take their place in new industries; or acknowledge that a combination of domain knowledge and technical skills are needed in every field and educate students of those fields appropriately. It is this second approach that the applied computing programs developed by the Department of Computer Science fills. It's imaginative, scalable, and has the potential to solve the problem effectively.

We are fully in support of the undergraduate programs currently proposed, but feel that the graduate programs, as described to us in detail, are potentially even more critical for the success of the innovation economy in Saskatchewan and Canada. A key gap at the head of every innovative company in Saskatchewan, Canada, and beyond is the technical lead with the skills to navigate the domain (be it ethics, biochemistry, or engineering) and the technological intersection with that domain. Graduates of the proposed program will be among the most sought after to be employed in start-ups, established companies (tech or otherwise), and as key research leads for multidisciplinary projects.

SaskTech is pleased to strongly support the M.Sc and Ph.D. Applied Computing program proposal.

Best regards,

Aaron Genest
President, SaskTech
On behalf of the Board and Members
www.sasktech.org/members

UNIVERSITY OF SASKATCHEWAN

March 12, 2021

To: Ian McQuillan, Department of Computer Sciences

REF: Graduate Programs in Applied Computing

This note is to confirm the College of Dentistry enthusiastic support for the new proposed MSc and PhD programs in Applied Computing. There is an emerging need for graduate students from disciplines outside Computer Sciences to get experiential training in Applied Computing including Applied Bioinformatics. We see these new programs as outstanding opportunities for further collaborations between Health Sciences and Computer Sciences that will imply collaborative projects and co-supervision of graduate students. We, therefore, as a College, strongly support these new programs.

Sincerely,

Petros Papagerakis, BSc, MS, PhD
Associate Dean for Research
College of Dentistry
Centennial Enhancement Chair in One Health
Professor
University of Saskatchewan
Canada
Phone: 306-966-5116
Email: petros.papagerakis@usask.ca

UNIVERSITY OF SASKATCHEWAN

Department of Anatomy,
Physiology, and Pharmacology
College of Medicine

3D01-107 Wiggins Road, Saskatoon, SK S7N 5E5
Eames office telephone: (306) 966-6534

RE: establishing Applied Computing grad programs

CGPS Programs Committee
University of Saskatchewan

12Mar2021

Dear Committee Members,

As a Grad Chair (and perhaps more importantly, a research faculty) in Anatomy, Physiology, and Pharmacology in the College of Medicine at the UofS, I ***strongly support*** establishment of graduate programs in Applied Computing through the Department of Computer Science.

When my lab's research entered the 'omics' era in 2013, I sought out a collaboration with Ian McQuillan, and we have since co-supervised four students in Computer Science. Our collaboration has been productive recently, with a number of publications now coming out and many more on the way. However, one of the main impediments to earlier productivity was an inability to find students with the biological background required to perform the necessary applied bioinformatics analyses. As a result, I spend a lot of time meeting with each student in our collaboration, teaching them the basics of biology that would drive the decisions on which bioinformatic algorithms to apply to the data and why.

An Applied Computing grad program would solve this impediment, enabling a massive increase in research productivity to the many research faculty, like myself, whose research programs now require bioinformatics after just starting to employ 'omics' techniques. I am very excited about the idea that I can co-supervise a student who has an undergrad in another area, such as Biology or Health Sciences, in the Applied Computing program. Again, as a Grad Chair in APP, I also recognize the importance of establishing this program in order to attract an entirely new cadre of grad students. By the nature of an Applied Computing program, these students will not only increase recognition of the UofS as a new Canadian research powerhouse, but will also have the applied training that is sought by employers in many biotechnology and pharmaceutical companies.

Please don't hesitate to contact me to follow up on any points that I've raised above.

Brian F. Eames, PhD
Grad Chair and Associate Professor
Anatomy, Physiology, and Pharmacology
b.frank@usask.ca

UNIVERSITY OF SASKATCHEWAN
College of Medicine
MEDICINE.USASK.CA

Department of Biochemistry, Microbiology, and Immunology
GA20 – 107 Wiggins Road, Saskatoon, SK Canada S7N 5E5
Phone: 306-966-6538 Fax: 306-966-4298

To: Ian McQuillan
Department of Computer Science

From: Bill Roesler, Head
Department of Biochemistry, Microbiology & Immunology

Date: March 3, 2021

RE: Graduate programs in Applied Computing

Our department has discussed the proposal for graduate degrees in Applied Computing that you provided. There was broad and enthusiastic support for these new programs. It was felt that these programs will open up doors for our biomedical science students to get advanced training in applied computing, skills and knowledge that our students often lack but need. It was also felt that it could pave the way for more research collaboration between our two departments as well. Thus we give our strong support for these proposed programs.

William (Bill) J. Roesler, Professor and Head
Department of Biochemistry, Microbiology, and Immunology, University of Saskatchewan
107 Wiggins Road, Saskatoon, SK S7N 5E5 Canada
Telephone: 306-966-4375 Email: bill.roesler@usask.ca

Applied Computing

Master of Science (M.Sc.) - Thesis-based

Admission Requirements

- Language Proficiency Requirements: Proof of English proficiency may be required for international applicants and for applicants whose first language is not English. Requirements are as follows: a minimum TOEFL score of 94, with no minimum score below 20; or a minimum IELTS score of 7.0, with no minimum score below 6.5.
- a cumulative weighted average of at least a 70% (U of S grade system equivalent) in the last two years of study (e.g. 60 credit units)
- a four-year honours degree, or equivalent, from a recognized college or university in an academic discipline relevant to the proposed field of study
    - Additional selection criteria includes a statement of research interest, a resume, and three letters of reference

Degree Requirements

Students must maintain continuous registration in the 994 course.

- GPS 960.0 Introduction to Ethics and Integrity
- GPS 961.0 Ethics and Integrity in Human Research, if research involves human subjects
- GPS 962.0 Ethics and Integrity in Animal Research, if research involves animal subjects
- A minimum of 12 credit units
- CMPT 990.0 Seminar
- CMPT 994.0 Research

Doctor of Philosophy (Ph.D.)

Admission Requirements

- Language Proficiency Requirements: Proof of English proficiency may be required for international applicants and for applicants whose first language is not English. Requirements are as follows: a minimum TOEFL score of 94, with no minimum score below 20; or a minimum IELTS score of 7.0, with no minimum score below 6.5.
- Master's degree, or equivalent, from a recognized university in an academic discipline relevant to the proposed field of study
- a cumulative weighted average of at least a 80% (U of S grade system equivalent) in the last two years of full-time study (e.g. 60 credit units)
    - Additional selection criteria includes a statement of research interest, a resume, and three letters of reference

Degree Requirements

Students must maintain continuous registration in the 996 course.

- GPS 960.0 Introduction to Ethics and Integrity
- GPS 961.0 Ethics and Integrity in Human Research, if research involves human subjects
- GPS 962.0 Ethics and Integrity in Animal Research, if research involves animal subjects
- CMPT 990.0 Seminar
- CMPT 996.0 Research
- a minimum of 6 credit units
- comprehensive examination
- qualifying examination

Transfer from Master's to Ph.D.

Degree Requirements

Students must maintain continuous registration in the 996 course.

- GPS 960.0 Introduction to Ethics and Integrity
- GPS 961.0 Ethics and Integrity in Human Research, if research involves human subjects
- GPS 962.0 Ethics and Integrity in Animal Research, if research involves animal subjects
- comprehensive exam
- A minimum of 18 credit units
- CMPT 990.0 Seminar
- CMPT 996.0 Research

Introduction and Program Description

Traditionally, computer science was taught as a single discipline, producing experts in creating software, who then worked with domain experts to craft solutions to particular problems. However, as computer science has become more sophisticated and widespread there is increasing demand within industry for graduates who have knowledge of computer science and a domain area. Traditional industries such as mining and agriculture have joined the ranks of more established technology users in IT, alongside medicine, business and design. There is a need for graduates with knowledge in both computing and domains of application.

Offering interdisciplinary degrees is a reoccurring challenge for universities. Degree stewardship and administration can be hard to assign, classes difficult to schedule, and faculty resourcing uncertain. This has led to interdisciplinary programs languishing. It is even more difficult to offer interdisciplinary programming in the context of an accredited program like Computer Science, where external agencies constrain potential choices and require more depth in the primary subject than might be required for an interdisciplinary practitioner. While students have some freedom to form an ad hoc interdisciplinary study plan by combining an existing majors program with a selection of courses from other field, such ad hoc combinations create challenges for students who must understand not only the content of individual courses, but also how that content meshes with other disciplines.

To address stakeholders' need for graduates with both computing and domain expertise while operating under the constraints of university structure and governance, we propose a new model for interdisciplinary programming, which we term the skinny major. In a skinny major model, a primary unit composes a core major program requiring the minimum number of disciplinary credit units for that college (in Arts and Science 36), leaving space in standard 120cu degree programs for minor-like ensembles of courses in cognate disciplines. This space is filled with carefully curated combinations of courses, in collaboration with colleagues from cognate disciplines, leading students away from ad hoc interdisciplinary choices. To avoid credential bloat and associated administrative cost, these curated packages of courses can be instantiated as named streams within an overarching degree, for example a Degree in Applied Computing in Bioinformatics, or a Degree in Applied Computing in Geomatics. Because these streams are curated, scheduling conflicts can be encoded and avoided using established software. Similarly, credentialing can happen automatically, as there are clear course packages required to graduate.

Computer Science is willing to take the lead in developing skinny major interdisciplinary programming. This proposal identifies a core program of existing courses from the Computer Science degree programs (with courses from Computer Science, Math and Philosophy) that would form the basis of a skinny major. When combined with carefully chosen courses from other fields, this degree program can form synthesized knowledge directly applicable to stakeholders in the community. By employing a skinny major, we obtain the flexibility to grow programming to meet the needs of local stakeholders with reduced overhead.

Proposed Undergraduate Applied Computing Streams

We propose to terminate two existing programs and replace with streams within the Applied Computing degree. We further propose to instantiate three additional programs in areas of Applied Computing which meet emerging needs and opportunities. Students would receive either four-year Bachelor of Science (BSc) or Bachelor of Science Honours (BSc Hon) credentials.

Bioinformatics (Cognate areas: Biology, Biochemistry) Bioinformatics is an established, but niche, program in the college. Adding this program to Applied Computing would allow for a reimagining of content and broader reach.

Interactive System Design (Cognate areas: Art, Psychology) The ISD program is an established BASc program with solid enrolments, which trains graduates to work on front end computing and interactive system design.

Data Analytics (Cognate areas: Mathematics, Statistics) This program would focus on training general purpose data scientists, without a specific application domain. What they would lose in domain knowledge they would gain in mathematical rigor. This degree would be of interest to those who have a cognate degree already, as well as those interested in analytical mechanics.

Geomatics (Cognate area: Geography) Understanding geographically anchored data is important in areas such as mining, agriculture, and city planning. This program would focus on the programmatic use of GIS and satellite-based systems and data in water management, agriculture, mining and civic planning.

Business (Cognate areas: General Business and Marketing) There is a significant industrial demand for graduates who understand computing, data, and business processes. We anticipate that this will be a popular stream.

Graduate Degrees in Applied Computing

Interdisciplinary graduate work is becoming more common in the Department of Computer Science at the University of Saskatchewan. However, students receiving graduate degrees in Computer Science are expected to be able to teach in accredited Computer Science programs, putting additional strain on students transferring in from other disciplines. A program that would allow students to receive interdisciplinary training with fewer disciplinary constraints would remove this strain. Our current plan for MSc and PhD in Applied Computing follows our current graduate program structure at the MSc and PhD levels, but relaxes entry requirements, allows up to half the committee members to be from outside Computer Science, and permits up to half of the courses to be from outside of Computer Science.

Demand and Enrolment

Predicting demand for new programs is problematic, as student program intentions exist in an intersection of economic conditions, university marketing, and cultural zeitgeist, all of which are volatile on the timescale of degree approval. However, potentially actionable insight may be inferred from existing programs, industrial demand, and similar offerings at comparator institutions. Bioinformatics and Interactive System Designs are existing interdisciplinary degree programs within the College of Arts and Science and are meeting established needs. Geomatics meets a need for students to support the research and industrial development around remote monitoring, particularly for water and food security, and was discussed as a potential strategic area at the 2019 College of Arts and Science retreat. The business stream meets a clear need as articulated by our industrial stakeholders. Data analytics is a rapidly growing industry touching not just the IT sector, but traditional economic sectors like mining and agriculture, and is common in some form at our comparator institutions. We are already training interdisciplinary students at the graduate level and struggling to adapt their needs to existing degree programs. All elements of this program are inherently needs-driven.

Computer Science has seen a dramatic year on year increase in enrollments, echoed by Bioinformatics and Interactive System Design. This increase in enrolments is happening worldwide, and is driven by a societal perception, largely born out in practice, that jobs in the twenty-first century will involve the application of information technology to many fields. The last four years of enrolment data for Bioinformatics, Computer Science, and Interactive System Design are shown in Table 1. These numbers are underestimates of the totals for the programs, as approximately half the students in Arts and Science do not declare a major for a significant portion of their degree. However, in this case the trend is more important than the absolute numbers.

Table 1: Student demand for the last five years for Computer Science, Bioinformatics and Interactive Systems Design.

	2016	*2017*	*2018*	*2019*	*2020*
Bioinformatics	9	13	16	20	20
Computer Science	533	638	734	806	862
Interactive Systems Design	61	66	68	70	72

Dalhousie is the comparator institution with the closest program. Their Bachelor of Applied Computer Science program has a similar intent and scope, but slightly different specializations. Dalhousie's Computer Science program is approximately the same size as ours. When they introduced their Bachelor of Applied Computer Science, their existing interdisciplinary degree programs accounted for 10% of their total enrollments, approximately the same in our department. After adding the BACS degree four years ago, their enrollments in the core Computer Science programming grew at the same rate as ours, but their BACS enrollments grew faster, reaching 20% of total enrollments and 250 students. Given the comparable sizes, and programs, we hope to experience the same growth as Dalhousie.

Explicit projections for the three new streams – Geomatics, Data Analytics, and Business – have not been performed. As these programs are based to a large extent on industry pull rather than student or academic push, we anticipate that they will be as popular as the ISD program once students recognize their post-graduation potential.

Graduate program

We currently have the largest research-intensive graduate program at the university. Almost all our graduate students are funded, and the majority through grants held by professors. Our current program is limited by faculty time and financial resources, and we are near capacity now. Adding an MSc and PhD in Applied Computing will not change this fundamental calculus. Our current program is also characterized by substantial interdisciplinary research. For example, our world leading Human Computer Interaction and Software Engineering groups have substantial collaborations across the university (Social Sciences and SENS) and with industry. Our Bioinformatics group collaborate with life scientists in Health, Biology and Agriculture. Image processing and data analytics research is core to P2IRC. Because of the scope of our collaborative activities, we attract a diverse group of graduate students. Instead of changing the number of graduate students in the program, the changes will allow us to more adroitly accommodate students from non-traditional computing backgrounds. We anticipate that the proposed degree will change the disciplinary breadth and diversity of our graduate program, rather than the overall numbers.

Strategic Alignment

The proposed program is intrinsically aligned with the University and College strategic priority for interdisciplinarity. While this program is aligned with strategic goals, it did not arise from their calls to action. This program does align with elements of the Computer Science strategic plan, articulated at the June 2017 departmental retreat, which called for a greater impact of computer science as a department and discipline across campus to reflect its growing importance to society.

Undergraduate Program Interdisciplinarity

The undergraduate proposal clearly addresses the interdisciplinary component of the university and college plans. By creating interdisciplinary programs within the context of existing course offerings and

degree frameworks, we can move the interdisciplinary vision of the university and college forward with limited risk. This program provides clear ownership of degrees (the Department of Computer Science within the College of Arts and Science), clear paths to graduation though stream-specific curation of synergistic courses, and limited cost growth through the leveraging of existing course offerings. This program makes high-demand interdisciplinary degrees possible and provides graduates with appropriately named degrees by curating existing courses and expertise in interesting and useful ways.

Each program was either reviewed (ISD, Bioinformatics), or created (Geomatics, Data Analytics, Business) by a joint committee consisting of the Computer Science Undergraduate Committee, and ad-hoc committee members proposed by the collaborating departments (Math and Stats, Geography, Art and Art History, Biology, and Edwards). These programs are not only interdisciplinary but were created by interdisciplinary teams. As the primary collaborators were involved in crafting the programs, the consultation with them is explicit. The Department Head of Computer Science also met with representatives from Plant Science, Geology, Public Health, and Economics to discuss the potential for inclusion, and the impact of the program.

Graduate Program Interdisciplinarity

At the graduate level, the simple relaxation of the requirement that graduates must be able to teach an accredited program in computer science removes many of the issues facing interdisciplinary graduate students. The further relaxation of course requirements (up to half outside Computer Science), and committee membership (the committee may be composed of the supervisor, a Computer Science faculty member and a faculty member from outside the department) removes barriers to effective interdisciplinary program creation. Unlike the undergraduate degrees, which have a number of self-directed streams with proscribed programming, research intensive graduate degrees are curated at the individual student level by the supervisory committee. This curation is already part of most research-intensive degrees, although typically within a discipline. In many ways the program is catching up with the reality of the research we are doing, particularly in collaboration with industry (SOAR CREATE), the social sciences (SWaGUR CREATE), agriculture and biosciences (P2IRC) and water security (GIWS), to name just the major collaborative grants. Many smaller, but still significant, collaborations exist between faculty in the department and industry, branches of government, health authorities and other departments on campus. The breadth of collaboration has attracted graduate students with more diverse backgrounds to our department. Because this program would be unique nationally – other Applied Computing programs are not research based – we have an excellent opportunity to attract strong interdisciplinary students from across Canada and around the world.

Internationalization

This program does not explicitly address internationalization; however, there are aspects within the programs. The student body of the graduate program in Computer Science is predominantly international. We expect this trend to continue in the graduate level Applied Computing program. At the undergraduate level, Computer Science has a disproportionate number of international students compared to other units, particularly from East Asia and South Asia.

Indigenization

Indigenization within this program, and Computer Science in general will focus on access and impact. The Data Analytics and Geomatics streams would be of potential interest to indigenous students as they speak directly to data sovereignty, which is a core component of many issues facing indigenous communities including land claims, environmental assessments and water rights. Training indigenous students in these disciplines would allow them to perform their own analysis of data collected on their traditional territories, enabling more fulsome participation in conversations about land use and impact.

Indigenization is a college-level priority in Arts and Science, and we intend to leverage existing College programs. STEM education in remote communities and on reserve is a concern, limiting Indigenous students' access to careers in Information Technology. This problem is common across rural Saskatchewan, and the Department of Computer Science has already created a course -- CMPT140:

Creative Computing – to act as a bridge for students entering our program with limited Computer Science background. CMPT140 is a course designed to introduce coding concepts gradually, as there is limited opportunity for students outside of the major urban centers to take either grade 11 or 12 Computer Science in high school. Indigenous students will have the option of entering the undergraduate degree through the Arts and Science Indigenous Student Achievement Pathways program. We will work with the College to include CMPT140: Creative Computing in this program, and will allocate a specific tutorial section for ISAP students within that program.

Relationships to Other Programs

Undergraduate Program

Programs in Bioinformatics and Interactive System Design are already offered by the College of Arts and Science. These programs will be deleted and brought into Applied Computing. There are no similar programs on campus for the Geomatics, Data Analytics and Business streams; however, the non-Computer Science portion of these streams closely mirrors the minor in Geographic Information Systems, and the Certificate in Business. Enrollments may shift subtly, but it is difficult to accurately predict. The most likely short-term outcome is an increase in CS headcount, but a decrease in relative CS 3CUEs, as we will attract and retain additional students, but those students will take fewer Computer Science classes than their peers in the existing BSc in Computer Science.

The undergraduate program described here is innovative within Arts and Science and the University of Saskatchewan, in that it embeds interdisciplinary programming within disciplinary oversight. We are willing to develop this kind of programming, so that other units can follow suit. Computer Science remains open to similar programming from other departments incorporating computer science as a cognate topic. For example, a skinny major in Commerce, with Computer Science as a cognate area, could be useful for someone wishing to work in IT Marketing; similarly, a skinny major in Plant Science with Computer Science and Geography as cognate areas could provide an agriculturist with some geomatics training.

Graduate Program

The graduate program is most related to the MSc and PhD programs in Computer Science. Introducing the new program will benefit the existing programs by creating separate entry and degree requirements for disciplinary and interdisciplinary students in our programs. This will allow us to maintain our current degree programs and their existing entry requirements for disciplinary students, while offering more appropriate requirements for interdisciplinary students. This will be better for students and take pressure off our departmental graduate committee who must make difficult decisions when admitting students with a non-traditional background, who would undoubtably be able to undertake research in the department.

Resource Requirements

One of the elegant properties of this proposal is the way it leverages existing resources in new ways to create cohesive and impactful programs. There is only one totally new course proposed in this program: Data Analytics. The Dean has expressed that this topic is a priority for the college, and Computer Science likely would have offered a course regardless. Bioinformatics will technically offer four new courses, but four courses in the BINF program will be removed to make way. We will create a new honors thesis for Applied Computing, but it will be offered in conjunction with our current honors thesis and will only have separate numbering to accommodate different evaluation criteria for interdisciplinary projects. No new courses are required at the graduate level.

We have received commitments from all involved departments that spaces in required classes outside of Computer Science are available for students in this program. Computer Science did a strategic review of undergraduate programming two years ago and streamlined the BSc degree to allow double sectioning of upper year courses. This streamlining, combined with additional resources provided by the Dean and Provost, have provided us with a window of opportunity to entertain new programs. If the Computer Science growth rate continues as it has over the last decade, or potentially even accelerates following the

Dalhousie example, Computer Science would be projected to run out of capacity again in 3-8 years. Growth may also create issues in other popular courses and program such as first year Biology, core Commerce courses and senior Planning courses. Similar to Computer Science, we anticipate sufficient initial capacity in these disciplines, which will have to be re-evaluated as numbers increase. When enrolments reach saturation, the Provost and affected Deans will have to make a strategic decision to invest in additional growth or to cap enrollments.

Computer Science manages its own IT assets and has its own IT support. As such the impact on institutional ICT should be low for most of the offerings. There could be some impact on centrally administered products such as ArcGIS in the Geomatics stream. This proposal does assume that the College continues to support Computer Science's computer renewal plans at the current level, and the university continues to support the renewal of licenses for software assets used in the Business and Geomatics streams. Computer Science has used innovative approaches to leverage its existing infrastructure to accommodate its expansion and will continue to do so. As classes continue to grow, Computer Science will continue to have to compete for the larger classrooms on campus. If this program increases the growth rate, as in the Dalhousie example, then this competition will become acute earlier. The competition for larger classroom spaces continues to be an issue across campus and is not unique to this program. Computer Science has recently completed an extensive set of renovations and a space reallocation exercise to accommodate its large thesis-based graduate program. As the graduate program is not expected to impact enrolments, it is not expected to create additional demands on the space.

Risks

At the graduate level there are limited institutional risks, as the graduate program is largely based on our existing programming, streamlined for collaboration and interdisciplinarity. Some care will have to be taken with communications, particularly for PhD graduates seeking academic appointments. Future employers will have to understand the interdisciplinary nature of the degrees. Participants' breadth will likely extend beyond computer science, making graduates more specialized within computer science than their colleagues with a graduate degree in Computer Science. This specialization within computer science, and breadth outside will need to be accurately rendered in communications with other institutions and employers. Our experience with communications around the Bioinformatics and ISD programs gives us confidence we will be able to successfully manage communications regarding Applied Computing.

The undergraduate program was driven by demand from industry and other units on campus. Expectations for growth in the program are predicated on industry demand for graduates creating desirable employment opportunities, and by extension driving student uptake. It is a risk that the anticipated demand might fail to materialize or might disappear due to external economic drivers. However, given that the anticipated start date is September 2022, the first full undergraduate cohort from this program would not be expected until May 2027. People with the ability to accurately predict economic conditions seven years in the future tend to be employed in more lucrative professions than academia. This risk will have to be actively measured and managed as the program rolls out.

Although we have received assurances from all impacted Dean's offices that spaces will be made available for this program, those assurances are not necessarily binding, and could be withdrawn at some point in the future. This risk exists for all interdisciplinary undergraduate programs, and will have to be actively managed by senior academic leadership if the University's goal of interdisciplinarity is to be achieved.

The fiscal risk associated with the project is limited. If the program proves too popular, this could put strain on some courses, in particular the cognate courses in Edwards, and second and third year Computer Science courses which are required in the BSc in Computer Science. Given growth projections, we would not expect this to be an issue until 2025 at the earliest. This could be managed through either additional investment in faculty positions, justified by the enrollments, through expanded use of sessional lecturers, or through capping enrollments in the program. Strain on first and second year Computer Science classes that all Computer Science and Applied Computing streams share could be managed by adding additional sections of those classes taught by sessional lecturers, at a substantially lower cost than the additional

revenues driving the multiple sections. In a related vein, this program has the potential benefit of directing more students into Geography and senior Math and Statistics classes, which do have capacity.

The fiscal risk associated with support is also limited. Course scheduling will be somewhat more complex, as cross departmental class schedule coordination will be required. For students entering a stream in first year, and progressing through the recommended course progression, this should be solvable and maintainable. For students transferring into a stream from another stream or degree, who might be taking some courses outside the proscribed sequence, this will be more complex, and may require additional administrative support and software assistance. However, this risk is not unique to this program and will have to be adequately addressed, regardless, if the university is serious about its interdisciplinary vision.

There is some risk in not offering this program at this time. Most of our Canadian comparator institutions have a form of Data Analytics programming. Failing to implement our own puts us at a competitive disadvantage. We are already engaged in substantial collaborative and interdisciplinary research at the graduate level. Failing to create the graduate level Applied Computing degrees will place an unnecessary impediment on the functioning and growth of the department's research effort.

Timing

This program is anticipated to start September, 2022. This is the earliest feasible start date given the many levels of approval that this program needs to navigate. The current timeline provides for PPC/IPC approval in November, submission to the Arts and Science APC in December, submission to University APC in February, and final approval at University Council in the Spring. Although it is feasible to approve the program for March, assuming the smooth passage through all stage gates, this will miss the cut off for inclusion in the University Calendar, forcing a start date of September 2022. This will provide ample time for Student Information Services and other support organizations a year to prepare for the launch. It will similarly allow sufficient time to advertise the new program to existing and entering students.

Clement, Kelly

From: Warrington, Seanine
Sent: Wednesday, April 14, 2021 10:52 AM
To: Isinger, Russ; Vuong, Lucy; Walker, Ryan; Clement, Kelly
Cc: Zagiel, Eileen; Doell, Jason
Subject: RE: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

Thanks, Russ!

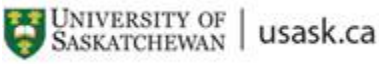
Kelly, I will wait to see the proposal come through APC,

Seanine

From: Isinger, Russ <russell.isinger@usask.ca>
Sent: Wednesday, April 14, 2021 10:50 AM
To: Warrington, Seanine <seanine.warrington@usask.ca>; Vuong, Lucy <lucy.vuong@usask.ca>; Walker, Ryan <ryan.walker@usask.ca>; Clement, Kelly <kelly.clement@usask.ca>
Cc: Zagiel, Eileen <eileen.zagiel@usask.ca>; Doell, Jason <jason.doell@usask.ca>
Subject: RE: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

Approved.

Russell Isinger, BA, MA
University Registrar
Professional Affiliate, Department of Political Studies, College of Arts and Science
University Registrar's Office
Teaching, Learning and Student Experience
Room E-34, 105 Administration Place
University of Saskatchewan
Saskatoon, Saskatchewan, Canada
S7N 5A2
Office: 306-966-6723
Cell: 306-280-6178
Fax: 306-966-6730



From: Warrington, Seanine <seanine.warrington@usask.ca>
Sent: April 13, 2021 4:57 PM
To: Vuong, Lucy <lucy.vuong@usask.ca>; Walker, Ryan <ryan.walker@usask.ca>; Clement, Kelly <kelly.clement@usask.ca>; Isinger, Russ <russell.isinger@usask.ca>

Cc: Zagiel, Eileen <eileen.zagiel@usask.ca>; Doell, Jason <jason.doell@usask.ca>
Subject: RE: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

Thank you, Kelly, for fixing that!

Thank you, Ryan and Lucy - we will wait for Russ's final approval.

Seanine

From: Vuong, Lucy <lucy.vuong@usask.ca>
Sent: Tuesday, April 13, 2021 4:52 PM
To: Walker, Ryan <ryan.walker@usask.ca>; Clement, Kelly <kelly.clement@usask.ca>; Isinger, Russ <russell.isinger@usask.ca>
Cc: Zagiel, Eileen <eileen.zagiel@usask.ca>; Warrington, Seanine <seanine.warrington@usask.ca>; Doell, Jason <jason.doell@usask.ca>
Subject: Re: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

Approved

From: Walker, Ryan <ryan.walker@usask.ca>
Sent: April 13, 2021 4:51 PM
To: Clement, Kelly <kelly.clement@usask.ca>; Isinger, Russ <russell.isinger@usask.ca>; Vuong, Lucy <lucy.vuong@usask.ca>
Cc: Zagiel, Eileen <eileen.zagiel@usask.ca>; Warrington, Seanine <seanine.warrington@usask.ca>; Doell, Jason <jason.doell@usask.ca>
Subject: RE: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

I confirm the details are correct and I'm happy to approve.
Ryan

Ryan Walker, Ph.D. RPP MCIP
Associate Dean, Policy and Programming Innovation
College of Graduate and Postdoctoral Studies
Thorvaldson Bldg. University of Saskatchewan
116-110 Science Place
Saskatoon, SK S7N 5C9
Tel: (306) 966-2229
http://artsandscience.usask.ca/profile/RWalker/

I acknowledge that I live and work on Treaty 6 Territory and the Homeland of the Métis. We pay our respect to the First Nations and Métis ancestors of this place and reaffirm our relationship with one another.

From: Clement, Kelly <kelly.clement@usask.ca>
Sent: Tuesday, April 13, 2021 4:41 PM
To: Isinger, Russ <russell.isinger@usask.ca>; Walker, Ryan <ryan.walker@usask.ca>; Vuong, Lucy <lucy.vuong@usask.ca>
Cc: Zagiel, Eileen <eileen.zagiel@usask.ca>; Warrington, Seanine <seanine.warrington@usask.ca>; Doell, Jason <jason.doell@usask.ca>
Subject: FW: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

Oops, sorry folks – please use this CWR. We accidentally had listed the info in Section 4 (undergrad) rather than Section 5 (grad), so I fixed that!

Kelly Clement
Committee and Programs Administrator
College of Graduate and Postdoctoral Studies
Thorvaldson Bldg. University of Saskatchewan
116-110 Science Place
Saskatoon, SK S7N 5C9
Tel: (306) 966-2229

From: Warrington, Seanine <seanine.warrington@usask.ca>
Sent: Tuesday, April 13, 2021 10:31 AM
To: Isinger, Russ <russell.isinger@usask.ca>; Walker, Ryan <ryan.walker@usask.ca>; Vuong, Lucy <lucy.vuong@usask.ca>
Cc: Doell, Jason <jason.doell@usask.ca>; Clement, Kelly <kelly.clement@usask.ca>; Zagiel, Eileen <eileen.zagiel@usask.ca>
Subject: CWR Form - New Field of Study in Applied Computing for M.Sc. and Ph.D. Programs

Dear Russ, Ryan, and Lucy,

Please see the completed Consultation with the Registrar Form that proposes a new Field of Study in Applied Computing for the M.Sc. Thesis program and the Ph.D. and Ph.D. Transfer programs, to be effective May 2022.

These programs follow standard M.Sc. Thesis and Ph.D. templates, there are no new courses, and tuition is proposed as the standard graduate per term amount and method of assessment. As such, it was decided that no in-person meeting was necessary, but please do let me know if you wish to meet.

Please “reply-all” with your confirmation that the details in the forms are correct. Your confirmation email will replace a signature of approval in the midst of the coronavirus pandemic (COVID-19) disruptions.

Thank you,

Seanine

Seanine Warrington, M.A.
Senior Editor and Coordinator
Catalogue and Academic Programs
Registrarial Services
University of Saskatchewan
Teaching, Learning and Student Experience
Ph: 306-966-1874

Consultation with the Registrar Form

This form is to be completed by the Registrar (or his/her designate) during an in-person consultation with the faculty member responsible for the proposal. Please consider the questions on this form prior to the meeting.

Section 1: New Degree / Diploma / Certificate Information or Renaming of Existing

1 Is this a new degree, diploma, or certificate? Yes [ ] No [X]

Is an existing degree, diploma, or certificate being renamed? Yes [ ] No [X]

If you've answered NO to each of the previous two questions, please continue on to the next section.

2 What is the name of the new degree, diploma, or certificate?

3 What is the credential of this new degree, diploma, or certificate? [Example - D.M.D. = Doctor of Dental Medicine]

4 If you have renamed an existing degree, diploma, or certificate, what is the current name?

5 Does this new or renamed degree / diploma / certificate require completion of degree level courses or non-degree level courses, thus implying the attainment of either a degree level or non-degree level standard of achievement?

6 If this is a new degree level certificate, can a student take it at the same time as pursuing another degree level program? Yes [ ] No [ ]

7 If YES, a student attribute will be created and used to track students who are in this certificate alongside another program. The attribute code will be:

8 Which College is responsible for the awarding of this degree, diploma, or certificate?

9 Is there more than one program to fulfill the requirements for this degree, diploma, or certificate? If yes, please list these programs.

10 Are there any new majors, minors, or concentrations associated with this new degree / diploma / certificate? Please list the name(s) and whether it is a major, minor, or concentration, along with the sponsoring department.

One major is required on all programs [4 characters for code and 30 characters for description]

11 If this is a new graduate degree, is it thesis-based, course-based, or project-based?

Section 2: New / Revised Program for Existing or New Degree / Diploma / Certificate Information

1 Is this a new program? Yes [ ] No [X]
Is an existing program being revised? Yes [ ] No [X]
If you've answered NO to each of the previous two questions, please continue on to the next section.

2 If YES, what degree, diploma, or certificate does this new/revised program meet requirements for?

3 What is the name of this new/revised program?

4 What other program(s) currently exist that will also meet the requirements for this same degree(s)?

5 What College/Department is the academic authority for this program?

6 Is this a replacement for a current program? Yes [ ] No [ ]

7 If YES, will students in the current program complete that program or be grandfathered?

8 If this is a new graduate program, is it thesis-based, course-based, or project-based?

9 If this is a new non-degree or undergraduate level program, what is the expected completion time?

Section 3: Mobility

Mobility is the ability to move freely from one jurisdiction to another and to gain entry into an academic institution or to participate in a learning experience without undue obstacles or hindrances.

1 Does the proposed degree, program, major, minor, concentration, or course involve mobility? Yes [ ] No [X]

If yes, choose one of the following?

- Domestic Mobility (both jurisdictions are within Canada) [ ]
- International Mobility (one jurisdiction is outside of Canada) [ ]

2 Please indicate the mobility type (refer to Nomenclature for definitions).

- Joint Program [ ]
- Joint Degree [ ]
- Dual Degree [ ]
- Professional Internship Program [ ]
- Faculty-Led Course Abroad [ ]
- Term Abroad Program [ ]

3 The U of S enters into partnerships or agreements with external partners for the above mobility types in order to allow students collaborative opportunities for research, studies, or activities. Has an agreement been signed? Yes [ ] No [ ]

4 Please state the full name of the agreement that the U of S is entering into.

5 What is the name of the external partner?

6 What is the jurisdiction for the external partner?

Section 4: New / Revised Major, Minor, or Concentration for Existing Degree Information (Undergraduate)

1 Is this a new or revised major, minor, or concentration attached to an existing degree program? Yes [ ] No [X] Revised [ ]
If you've answered NO, please continue on to the next section.

2 If YES, please specify whether it is a major, minor, or concentration. If it is more than one, please fill out a separate form for each.

3 What is the name of this new / revised major, minor, or concentration?

4 Which department is the authority for this major, minor, or concentration? If this is a cross-College relationship, please state the Jurisdictional College and the Adopting College.

5 Which current program(s), degree(s), and/or program type(s) is this new / revised major, minor, or concentration attached to?

Section 5: New / Revised Disciplinary Area for Existing Degree Information (Graduate)

1 Is this a new or revised disciplinary area attached to an existing graduate degree program? Yes [X] No [ ] Revised [ ]
If you've answered NO, please continue on to the next section.

2 If YES, what is the name of this new / revised disciplinary area?
Applied Computing (ACPG) - this information is included in the undergraduate submission for the new major - same code and description being used

3 Which Department / School is the authority for this new / revised disciplinary area? (NOTE - if this disciplinary area is being offered by multiple departments see question below.)
Computer Science (CMPT)

4 Which **multiple** Departments / Schools are the authority for this new / revised disciplinary area?

4a Of the **multiple** Departments / Schools who are the authority for this new / revised disciplinary area and what allocation percentage is assigned to each? (Note - must be whole numbers and must equal 100.)

4b Of the **multiple** Departments / Schools who is the primary department? The primary department specifies which department / school policies will be followed in academic matters (ex. late adds, re-read policies, or academic misconduct). If no department / school is considered the primary, please indicate that. (In normal circumstances, a department / school with a greater percentage of responsibility - see question above - will be designated the primary department.)

5 Which current program(s) and / or degree(s) is this new / revised disciplinary area attached to?
MSC-T-GP Master of Science-Thesis; PHD-GP Doctor of Philosophy; PHD-TRANS-GP Doctor of Philosophy(Transfer)

Section 6: New College / School / Center / Department or Renaming of Existing

1	Is this a new college, school, center, or department?	Yes		No	X
	Is an existing college, school, center, or department being renamed?	Yes		No	X
	Is an existing college, school, center, or department being deleted?	Yes		No	X

If you've answered NO to each of the previous two questions, please continue on to the next section.

2 What is the name of the new (or renamed or deleted) college, school, center, or department?

3 If you have renamed an existing college, school, center, or department, what is the current name?

4 What is the effective term of this new (renamed or deleted) college, school, center, or department?

5 Will any programs be created, changed, or moved to a new authority, removed, relabelled?

6 Will any courses be created, changed, or moved to a new authority, removed, relabelled?

7 Are there any ceremonial consequences for Convocation (ie. New degree hood, adjustment to parchments, etc.)?

Section 7: Course Information - SAME AS CURRENT SET-UP

1 Is there a new subject area(s) of course offering proposed for this new degree? If so, what is the subject area(s) and the suggested four (4) character abbreviation(s) to be used in course listings?

2 If there is a new subject area(s) of offerings what College / Department is the academic authority for this new subject area?

3 Have the subject area identifier and course number(s) for new and revised courses been cleared by the Registrar?

4 Does the program timetable use standard class time slots, terms, and sessions? Yes No

If NO, please describe.

5 Does this program, due to pedagogical reasons, require any special space or type or rooms? Yes No

If YES, please describe.

NOTE: Please remember to submit a new "Course Creation Form" for every new course required for this new program / major. Attached completed "Course Creation Forms" to this document would be helpful.

Section 8: Admissions, Recruitment, and Quota Information - AS PER CURRENT SET-UP FOR COMPUTER SCIENCE FOR QUESTIONS NOT ANSWERED

1 Will students apply on-line? If not, how will they apply?

2 What term(s) can students be admitted to?

3 What is the application deadline for each term(s) students can be admitted to?

4 For undergraduate programs, will students be admitted to one of the approved majors or an undeclared major?

n/a

5 For undergraduate programs, if there's more than one degree proposed (ex. 3Y and 4Y), which program/degree will students be admitted to?

n/a

6 Does this impact enrollment?

Expect 5-10 students entering each program in any given year

7 How should Marketing and Student Recruitment handle initial inquiries about this proposal before official approval?

Department of Computer Science

8 Can classes towards this program be taken at the same time as another program?

9 What is the application deadline?

10 What are the admission qualifications? (IE. High school transcript required, grade 12 standing, minimum average, any required courses, etc.)

- 4 year BSc degree in Applied Computing or Computer Science (or equivalent) or a 4 year undergraduate degree in a cognate discipline from a recognized institution with a minimum overall average of 70% for MSc program
- MSc in Applied Computing, Computer Science, or equivalent, or a thesis-based Masters-level credential in a relevant cognate area with a nimum overall average of 80% for PhD program
- if student entering with degree in a cognate discipline, the proposed faculty advisor must submit a short letter to the Computer Science Graduate Committee justifying why the student's background qualifies the student for the intended area of research for both MSc and PhD programs
- English requirements identical to the Computer Science graduate programs for both MSc and PhD programs
- All students must meet the CGPS English requirements with higher minimum testing scores; aggregate TOEFL score of at least 94 with no individual score below 20; or an aggregate IELTS (Academic Module) score of at least 7.0 with no individual score below 6.5 for both MSc and PhD programs
- Students must submit a statement of research interest, a resume, and 3 references for both MSc and PhD programs

11 What is the selection criteria? (IE. If only average then 100% weighting; if other factors such as interview, essay, etc. what is the weighting of each of these in the admission decision.)

12 What are the admission categories and admit types? (IE. High school students and transfer students or one group? Special admission? Aboriginal equity program?)

13 What is the application process? (IE. Online application and supplemental information (required checklist items) through the Admissions Office or sent to the College/Department?)

14 Who makes the admission decision? (IE. Admissions Office or College/Department/Other?)

15 Letter of acceptance - are there any special requirements for communication to newly admitted students?

16 Will the standard application fee apply?

17 Will all applicants be charged the fee or will current, active students be exempt?

18 Are international students admissible to this program? Yes [X] No [ ]

If YES, what is the tuition amount for the first 12 months for a full-time international student? This information is required for the Immigration, Refugees and Citizenship Canada [IRCC] form (this form is for students who need to get a visa to study here).

$6,731.00 (based on 2020-2021 rates as new rates not yet available)

Section 9: Government Loan Information - NOT APPLICABLE

NOTE: Federal / provincial government loan programs require students to be full-time in order to be eligible for funding. The University of Saskatchewan defines full-time as enrollment in a minimum of 9 credit units (operational) in the fall and/or winter term(s) depending on the length of the loan.

1 If this is a change to an existing program, will the program change have any impact on student loan eligibility?

2 If this is a new program, do you intend that students be eligible for student loans?

Section 10: Convocation Information (only for new degrees) - NOT APPLICABLE

1 Are there any 'ceremonial consequences' of this proposal (ie. New degree hood, special convocation, etc.)?

2 If YES, has the Office of the University Secretary been notified?

3 When is the first class expected to graduate?

4 What is the maximum number of students you anticipate/project will graduate per year (please consider the next 5-10 years)?

Section 11: Schedule of Implementation Information

1 What is the start term?

202205 (May 2022)

2 Are students required to do anything prior to the above date (in addition to applying for admission)? Yes [ ] No [X]

If YES, what and by what date?

Section 12: Registration Information - AS PER CURRENT SET-UP

1 What year in program is appropriate for this program (NA or a numeric year)?
(General rule = NA for programs and categories of students not working toward a degree level qualification; undergraduate degree level certificates will use numeric year.)

2 Will students register themselves? Yes No
If YES, what priority group should they be in?

Section 13: Academic History Information - AS PER CURRENT SET-UP

1 Will instructors submit grades through self-serve? Yes No
2 Who will approve grades (Department Head, Assistant Dean, etc.)?

Section 14: T2202 Information (tax form) - AS PER CURRENT SET-UP

1 Should classes count towards T2202s? Yes No

Section 15: Awards Information

1 Will terms of reference for existing awards need to be amended? Yes No
2 If this is a new undergraduate program, will students in this program be eligible for College-specific awards?

Section 16: Government of Saskatchewan Graduate Retention (Tax) Program - AS PER CURRENT SET-UP

1 Will this program qualify for the Government of Saskatchewan graduate retention (tax) program? Yes No
To qualify the program must meet the following requirements:
- be equivalent to at least 6 months of full-time study, and
- result in a certificate, diploma, or undergraduate degree.

Section 17: Program Termination

1 Is this a program termination? Yes [ ] No [X]

If yes, what is the name of the program?

2 What is the effective date of this termination?

3 Will there be any courses closed as a result of this termination? Yes [ ] No [ ]

If yes, what courses?

4 Are there currently any students enrolled in the program? Yes [ ] No [ ]

If yes, will they be able to complete the program?

5 If not, what alternate arrangements are being made for these students?

6 When do you expect the last student to complete this program?

7 Is there mobility associated with this program termination? Yes [ ] No [ ]

If yes, please select one of the following mobility activity types.

- [ ] Dual Degree Program
- [ ] Joint Degree Program
- [ ] Internship Abroad Program
- [ ] Term Abroad Program
- [ ] Taught Abroad Course
- [ ] Student Exchange Program

Partnership agreements, coordinated by the International Office, are signed for these types of mobility activities. Has the International Office been informed of this program termination? Yes [ ] No [ ]

Section 18: Proposed Tuition and Student Fees Information - SAME AS COMPUTER SCIENCE PROGRAM for both MSc and PhD Programs

1 How will tuition be assessed?

Standard Undergraduate per credit ☐
Standard Graduate per credit ☐
Standard Graduate per term ☐
Non standard per credit* ☐
Non standard per term* ☐
Other * ☐
Program Based* ☐
* See attached documents for further details

2 If fees are per credit, do they conform to existing categories for per credit tuition? If YES, what category or rate?

3 If program based tuition, how will it be assessed? By credit unit? By term? Elsehow?

4 Does proponent's proposal contain detailed information regarding requested tuition? Yes ☐ No ☐
If NO, please describe.

5 What is IPA's recommendation regarding tuition assessment? When is it expected to receive approval?

6 IPA Additional comments?

7 Will students outside the program be allowed to take the classes?

8 If YES, what should they be assessed? (This is especially important for program based.)

9 Do standard student fee assessment criteria apply (full-time, part-time, on-campus versus off-campus)?

10 Do standard cancellation fee rules apply?

11 Are there any additional fees (e.g. materials, excursion)? If yes, see NOTE below.

12 Are you moving from one tuition code (TC) to another tuition code? Yes ☐ No ☐
If YES, from which tuition code to which tuition code?

13 Are international students admissible to the program? If yes, will they pay the international tuition differential?

NOTE: Please remember to submit a completed "Application for New Fee or Fee Change Form" for every new course with additional fees.

Section 19: TLSE - Information Dissemination (internal for TLSE use only)

1	Has TLSE, Marketing and Student Recruitment, been informed about this new / revised program?	Yes		No
2	Has TLSE, Admissions, been informed about this new / revised program?	Yes		No
3	Has TLSE, Student Finance and Awards, been informed about this new / revised program?	Yes		No
4	Has CGPS been informed about this new / revised program?	Yes		No
5	Has TLSE, Transfer Credit, been informed about any new / revised courses?	Yes		No
6	Has ICT-Data Services been informed about this new or revised degree / program / major / minor / concentration?	Yes		No
7	Has the Library been informed about this new / revised program?	Yes		No
8	Has ISA been informed of the CIP code for new degree / program / major?	Yes		No
9	Has Room Scheduling/Scheduling Hub/Senior Coordinator of Scheduling been informed of unique space requirements for the new courses and/or informed of program, course, college, and department changes?	Yes		No
10	Has the Convocation Coordinator been notified of a new degree?	Yes		No

11 What is the highest level of financial approval required for this submission? Check all that apply.

- a. None - as it has no financial implications

OR

- b. Fee Review Committee
- c. Institutional Planning and Assessment (IPA)
- d. Provost's Committee on Integrated Planning (PCIP)
- e. Board of Governors
- f. Other

SIGNED

Date:

Registrar (Russell Isinger):

College Representative(s):

IPA Representative(s):