I L L I N O I S
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE: Establish a New Major in Computer Science and Crop Sciences for the Bachelor of Science in the Department of Crop Sciences in the College of Agricultural, Consumer and Environmental Sciences.

SPONSOR: Frederic L. Kolb, Cavanah Professor of Plant Breeding and Genetics, Crop Sciences Teaching Coordinator, 333-9485, f-kolb@illinois.edu, and Leonard B. Pitt, Professor and Associate Head, Computer Science, 333-7505, pitt@illinois.edu

COLLEGE CONTACT: Mary Lowry, Assistant Dean, Academic Programs, 333-9391, lowry@illinois.edu

BRIEF DESCRIPTION: This collaborative program in Computer Science and Crop Sciences is for undergraduate students who plan to pursue careers in the agriculture field with a technology and data handling and management focus. This degree will prepare students for advanced study at a graduate level, as well as immediate entry into the workforce.

JUSTIFICATION: The Department of Crop Sciences and the Department of Computer Science propose a new major that is a combination of Crop Sciences and Computer Science. This proposed new curriculum is in response to the growing demands in the agriculture industry for students who have a foundation in agriculture combined with a background in computer science and data analysis and management. The Crop Sciences Department already has several faculty members who are conducting research in this area of bioinformatics, and we believe that the demand for students with this combination of backgrounds is expected to grow in the future. The agricultural industry is looking for students who have skills in precision agriculture, bioinformatics, web programming, and data analysis. Through cooperation between the Computer Science and Crop Sciences Departments, we plan to provide a program for students who are interested in these career fields. This proposed curriculum follows the precedent already established through the CS + X programs offered in Computer Science + Anthropology, Computer Science + Astronomy, Computer Science + Chemistry, and Computer Science + Linguistics. This program would provide students who are interested in computer applications in Crop Sciences with that opportunity.

The Crop Sciences Department has developed a new course to help educate students on big data and its importance in the fields of biology and agriculture, and show how it can solve problems in research. Both departments will continue to update course offerings based on what is needed in the industry to provide the best possible education for the students.

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources

How does the unit intend to financially support this proposal?

As is the case for the existing CS + X majors, students enrolled in this program will pay the same differential tuition as the current College of Engineering Computer Science students. Differential tuition will be shared equally by the College of Engineering and the College of ACES.

How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?

The need for new resources is not anticipated as both the Computer Science degree and Crop Sciences degree already exist on campus, and both departments are prepared with the resources needed for regular growth of the programs. Any additional resources that are needed in the future can be covered by the use of the differential tuition. A request for a differential tuition rate has been submitted by the College for BOT approval in January 2017.

Will the unit need to seek campus or other external resources? If so, please provide a summary of the sources and an indication of the approved support.

Additional support will not be requested. Letters of support from the College of ACES and the Department of Computer Science are attached.

2) Resource Implications

Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.

The Computer Science and Crop Sciences courses that are required for the major have the capacity or can be expanded through the use of differential tuition to accommodate new students. The Departments will work jointly to advise students, and ensure a timely graduation rate. The Departments do not believe that an additional 15-20 students/year in this major will exceed capacity in courses in either Computer Science or Crop Sciences. The Departments will be working together to advertise the major and keep advising channels open so students receive the best education possible. The students in this major will be

primarily advised in Crop Sciences. The Department of Crop Sciences has capacity to advise these additional students and several new faculty advisors who work in this topic area will be assigned to advise these students.

Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units.

It is not anticipated that an additional 15-20 students/year in the CS+CPSC concentration will impact course enrollment in classes outside of Computer Science or Crop Sciences Departments. No significant changes in class enrollment outside of the Departments are anticipated.

Please address the impact on the University Library

No impact is expected since both the Computer Science and Crop Sciences degrees already exist. Please see attached letter.

Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)

No impact is expected on computer or teaching spaces. Turner Hall will under-go remodeling starting in Summer 2017 to update teaching spaces and the computer lab housed in the building. The construction will be completed by Fall 2018; these facilities will then be available to use as the new major grows in student numbers. New technology and additional lab sections will be added to courses as required to meet demand.

For new degree programs only:

Briefly describe how this program will support the University's mission, focus, and/or current priorities. Include specific objectives and measurable outcomes that demonstrate the program's consistency with and centrality to that mission.

The generation of huge data sets in several areas of agriculture, such as genomic selection and prediction through molecular genetics, high through-put phenotyping systems, data from unmanned aerial vehicles (drones), collection of extensive weather and climate data, and multiple layers of GIS based data, are creating a growing requirement for people with backgrounds and skills combining agriculture and computer science. These individuals are essential for management, analysis, and interpretation and analysis of the data generated. The proposed cooperative program between two departments in different colleges provides unique opportunities for students to obtain a background that will provide them with an exceptional blend of skills needed to meet this demand which already exists and is expected to grow significantly in the coming years. This program will serve the industry by educating students who will be highly sought after and will provide exceptional opportunities for students. As evident

from the large grant just announced by NSF to establish a Midwest Big Data Hub at UIUC, this is an area that impacts many field of study and is becoming increasingly important.

Please provide an analysis of the market demand for this degree program. What market indicators are driving this proposal? What type of employment outlook should these graduates expect? What resources will be provided to assist students with job placement?

This proposed program is in response to the growing agriculture and technology industries. Jobs are readily available to students with this distinctive combination of skills and backgrounds. Some of the job opportunities that have increased in availability in recent years include: precision agriculture, agriculture IT, bioinformatics, computational biology, and web programming for agriculture companies. These career opportunities are certain to continue growing as the agriculture companies continue to advance and bring more technology into their practices. According to projections from the U.S. Department of Agriculture, there will be 60,000 job openings annually in the agriculture industry through 2020; with only 35,000 students graduating each year to fill these positions. Of these available job opportunities in the next five years, it is estimated that 27% will be in the technology, science, engineering, and mathematics areas of agriculture. "Agriculture is going through a transformation itself into more of that digital space," said Melissa Harper, vice president of global talent acquisition at Monsanto. "Many of the roles that we need-and those in agriculture need - didn't exist just five years ago."

The students graduating from this program will receive support from both Computer Science and Crop Sciences advisors, as well as the career services resources for students at the University of Illinois.

DESIRED EFFECTIVE DATE:

We would like to implement this major as soon as possible, following approval at the appropriate levels. Our hope is to allow on-campus ICTs (Inter/Intra College Transfers) in AY 2017-18, and new freshman in fall 2018.

STATEMENT FOR PROGRAMS OF STUDY CATALOG:

See attached appendix

CLEARANCES: *(Clearances should include signatures and dates of approval. **These signatures must appear on a separate sheet.** If multiple departments or colleges are sponsoring the proposal, please add the appropriate signature lines below.)*


Signatures:
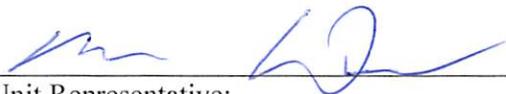
_____   11/17/2016
Unit Representative: Date:

_____   _____
Unit Representative: Date:
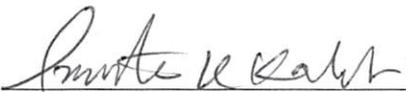
_____   11/17/2016
College Representative: Date:

_____   _____
College Representative: Date:

_____   _____
Graduate College Representative: Date:

_____   _____
Council on Teacher Education Representative: Date:

Crop Sciences

Computer Science

Curriculum in Computer Science and Crop Sciences

www.cs.illinois.edu/ or www.cropsci.illinois.edu/

This major is sponsored jointly by the Departments of Computer Science and Crop Sciences. The major in Computer Science and Crop Sciences is a flexible program for undergraduate students who plan to pursue careers in the agricultural field that have a technology focus. The degree will prepare students for advanced study at the graduate level, as well as immediate entry into the workforce.

E-mail: academic@cs.illinois.edu or cropsci@illinois.edu

Degree title: Bachelor of Science in Computer Science and Crop Sciences

Minimum required major and supporting course work equates to 74-77 hours. All Campus General Education and College of ACES foreign language requirements must be met. The minimum hours required for graduation is 126. At least twenty-one hours of 300- and 400-level coursework must be taken on this campus

A Major Plan of Study Form must be completed and submitted to the Department of Computer Science office of undergraduate affairs and to the Undergraduate Teaching Office in Crop Sciences by the beginning of the fifth semester (60-75 hours). Please see the Computer Science advisor in 1210 Siebel Center, as well as the Crop Sciences Teaching Coordinator in Turner Hall AE-120.

To graduate from the Computer Science and Crop Sciences curriculum, a student must complete the following courses, all of which must be taken for a traditional letter grade.

For the Degree of Bachelor of Science in Computer Science and Crop Sciences

Prescribed Courses including Campus General Education

Composition I and Speech

RHET 105 & CMN 101	Writing and Research and Public Speaking (or equivalent - see College Composition I requirement)	6-7

Advanced Composition

Select from campus approved list.		3-4

Cultural Studies

Select one course from Western culture and one from non-Western/U.S. minority culture from campus approved list.		6

Foreign Language

Coursework at or above the third level is required for graduation.		

Quantitative Reasoning I

See Mathematical Foundations for specific requirement		3

Quantitative Reasoning II

See Mathematical Foundations for specific requirement		3

Natural Sciences and Technology

See Crop Sciences Core for specific requirement		6

Humanities and the Arts

Select from campus approved list		6

Social and Behavioral Sciences

Select from campus approved list.		6

ACES required

ACES 101	Contemporary Issues in ACES	2

Computer Science Core		**22**
CS 100	Freshman Orientation (recommended)	1
CS 125	Intro to Computer Science	4
CS 126	Software Design Studio	3
CS 173	Discrete Structures	3
CS 225	Data Structures	4
CS 374	Introduction to Algorithms & Models of Computation	4
CS 421	Programming Languages & Compilers	3
Computer Science Technical Track		**9-11**

To include either CS 240, or CS 233 and CS 241, plus up to two CS 400-level classes per approved list and constraints maintained on Computer Science department website.

Mathematical Foundations (fulfills Quantitative Reasoning I and II)		12-13
CS 361	Probability & Statistics for Computer Science	3

MATH 220
   Or MATH 221
	Calculus
	      Calculus I
		4-5

MATH 225	Introductory Matrix Theory	2
MATH 231	Calculus II	3
Crop Sciences Core		**33-35**
CPSC 112	Introduction to Crop Sciences	4
Select two of the following:		6
CPSC 226	Introduction to Weed Science	
CPSC 270	Applied Entomology	
PLPA 204	Introductory Plant Pathology	
CPSC 266	Data in Biology and Agriculture (course approved by ACES C and C)	3
CPSC 261	Biotechnology in Agriculture	3
CPSC 265	Genetic Engineering Lab	3
CPSC 352	Plant Genetics	4
CPSC 440	Applied Stats Methods I	4
Select two of the following:		5-7
CPSC 418	Crop Growth and Management	
CPSC 452	Advanced Plant Genetics	
CPSC 453	Principles of Plant Breeding	
CPSC 466	Genomics for Plant Improvement	
CPSC 498	Crop Sci Professional Develpmt	1
Prescribed Courses Including Campus General Education		**29-31**
Computer Science and Crop Sciences Required Hours		**76-81**
Open Electives		**14-21**
Total Hours		**126**

Appendix A:

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

University Library
Office of Dean of Libraries
and University Librarian
230 Main Library, MC-522
1408 West Gregory Drive
Urbana, IL 61801

September 2, 2016

Frederic L. Kolb
Cavanah Professor of Plant Breeding and Genetics
Crop Sciences Teaching Coordinator
Department of Crop Sciences University of Illinois
AE-120 Turner Hall
M/C 046

Dear Professor Kolb:

Thank you for providing the University Library with the opportunity to review the Department of Crop Science's proposal to the Senate Committee on Educational Policy to establish a Bachelor of Science in Computer Science and Crop Sciences administered by the College of Agriculture and Consumer Economics.

Based upon the proposal submitted to the Library on August 30, 2016 and the reviews conducted by Profs. Bill Mischo and Sarah Williams, we do not believe that there will be any substantial, immediate impact on the Library's materials or operations. Indeed, there was excitement expressed about the new program and its ability to fill a demonstrated need in the field.

We appreciate your providing us with the proposals as such contact does help ensure that our services are in line with the programs developing in the College.

Sincerely,

John P. Wilkin
Juanita J. and Robert E. Simpson
Dean of Libraries and University Librarian

e-c: Bill Mischo
        Leonard Pitt
        Thomas Teper
        Sarah Williams

October 7, 2016

To Whom it May Concern:

I write to convey enthusiastic support of the College of ACES for the new major in Computer Science and Crop Science as proposed by the Department of Crop Science. Although no funding from the college is being requested, we are prepared to support this additional major, as we do for all our programs and students, with academic and administrative support, career services, and scholarships where students are eligible. This program will prepare our students to work at the forefront of agricultural technology. Big data has the potential to impact every subject on our campus, and agriculture is no exception.

Our leading employers are already seeking team members with skills in data management and analysis to advance their companies, their technologies, and their products. Big data on agriculture and nutrition and IT are global emerging topics these days, as evidenced by the recent GODAN (Global Open Data on Agriculture and Nutrition) held in New York City last month. The ability of career seekers to analyze large data sets, be it from multiple environmental factors interacting in a single field to weather patterns over entire regions, to gene sequencing for improved crop performance, is critical. Rising costs paired with rising demand makes the best and most efficient use of our limited resources the goal of all agricultural production related sectors. And analysis of data is another tool that will help to do this. This major will also allow technologically savvy students not familiar with crop sciences a new outlet to apply their talents to take on the very real challenge of continuing to feed an ever-expanding population. Crop experts with the ability to manage and analyze multiple types of data related to production of food are a needed asset, and this program will prepare students to do that, be it through employment or graduate research. In addition, this would be the first program of this type in the nations among our peer institutions and will keep the College of ACES at leading edge of preparing our students. If you have any questions about the program or the College of ACES commitment to it, please feel free to contact me.

Sincerely,

Prasanta Kalita

Associate Dean

Department of Computer Science
201 North Goodwin Avenue
Urbana, IL 61801-2302 USA

November 8, 2016

Professor Germán Bollero
Head, Dept. of Crop Sciences
University of Illinois

Dear Professor Bollero,

I am pleased to let you know that the Computer Science faculty enthusiastically approved the CS + Crop Sciences proposal that we have been jointly working on during the last several months, and is in full support of the new program. Based on the many overlaps outlined in the proposal we think that this is a very natural fit and an excellent opportunity for both departments, as well as for future students whose interests align with the program.

Sincerely,

Leonard Pitt
Professor and Associate Head
Director of Undergraduate Programs
Department of Computer Science
University of Illinois, Urbana, IL 61801
Ph: 217-333-7505. Email pitt@illinois.edu

University of Illinois
AT URBANA-CHAMPAIGN

Department of Computer Science
201 North Goodwin Avenue
Urbana, IL 61801-2302 USA

January 31, 2017

Professor Germán Bollero
Head, Dept. of Crop Sciences
University of Illinois

Dear Professor Bollero,

I am pleased to let you know that the Computer Science faculty enthusiastically approved the CS + Crop Sciences proposal that we have been jointly working on during the last several months, and is in full support of the new program. Based on the many overlaps outlined in the proposal we think that this is a very natural fit and an excellent opportunity for both departments, as well as for future students whose interests align with the program.

We have evaluated our current course offerings and how they might be affected by the influx of the anticipated CS+CPSC majors, and do not anticipate any problems in ensuring that they will have access. Moreover, the impact on course enrollments should be minimal, as these new majors will represent only a very small fraction relative to the current size of those courses. Finally, tbe CS department is in a growth phase, having added nine faculty (tenure track plus instructional) last year, and plan to hire another eight this year. The addition of these faculty should allow us to grow our course offerings where most needed.

Sincerely,

Leonard Pitt
Professor and Associate Head
Director of Undergraduate Programs
Department of Computer Science
University of Illinois. Urbana, IL 61801
Ph: 217-333-7505. Email pitt@illinois.edu

November 18, 2016

Bettina Francis, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Francis:

Enclosed is a copy of a proposal from the College of Agricultural, Consumer and Environmental Sciences to establish a Bachelor of Science in Computer Science and Crop Sciences.

Sincerely,

Kathryn A. Martensen
Assistant Provost

Enclosures

c: R. Chappell
    M. Lowry
    F. Kolb
    A. Edwards

College of Agricultural, Consumer and Environmental Sciences

Academic Programs
128 Mumford Hall, MC-710
1301 West Gregory Drive
Urbana, IL 61801

November 15, 2016

Kathy Martensen, Assistant Provost
Office of the Provost
207 Swanlund Administration Building
Campus MC-304

Dear Kathy:

I am writing to request campus-level review and approval for a new undergraduate major in Crop Sciences and Computer Science, which would be offered through the Department of Crop Sciences and the Department of Computer Science. A proposal (attached in Senate format) to establish this major has been reviewed and approved by the College of ACES Courses and Curricula Committee and has also been endorsed by the College of Engineering.

Thank you for your consideration. I look forward to receiving your reply.

Sincerely,
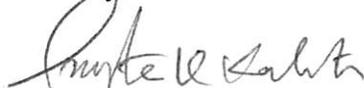
Prasanta K. Kalita
Associate Dean
ACES Academic Programs

PKK/rhc

cc: G. A. Bollero
       M. L. Harmon
       F. L. Kolb
       S.-Y. Lee
       M. K. Lowry
       M. M. Ward
       CPSC C&C Binder