THE UNIVERSITY OF WISCONSIN-MILWAUKEE
College of Engineering and Applied Science

F A C U L T Y M E E T I N G

Friday, November 8, 2019 10:30 A.M. EMS E180

A G E N D A

I. DEAN UPDATE

II. ANNOUNCEMENTS

A. Associate Dean Munson: Academic Affairs: Characteristics of CEAS's BS graduates and possible implications for our programs.

III. INFORMAL REPORTS – See Attachment 1

A. Opportunity for questions regarding Informal Reports

IV. DETERMINATION OF THE PRESENCE OF A QUORUM FOR FACULTY MEETING

V. AUTOMATIC CONSENT BUSINESS

A. Minutes of the October 4, 2019 meeting

B. New Courses and Course Changes – See Attachment 2

VI. NEW BUSINESS

A. Changes to MS in Computer Science – See Attachment 3

B. Electrical Engineering Ph.D. Notice of Intent – See Attachment 4

C. B.S. in Data Science Notice of Intent – See Attachment 5

D. Proposal for Transformation of Center for By-Products Utilization (CBU) into Concrete Sustainability and Resilience Center (CSRC) – See Attachment 6

E. B.A. in Computer Science Authorization to Implement – See Attachment 7

F. Presentation by Jessica Silvaggi, UWM Research Foundation

VII. GENERAL DISCUSSION

VIII. ADJOURNMENT

John R. Reisel, Secretary
CEAS Faculty

JRR
Attachments

ATTACHMENT 1

INFORMAL REPORTS

Office of Student Services – Todd Johnson

CEAS Enrollment Summary – Fall 2019

	2018	2019	Dif
Bachelors	1868	1752	-116
UG Special	3	6	+3
Masters	195	197	+2
Doctoral	200	181	-19
Non-Degree	13	10	-1
Total	2276	2140	-136

Career Services – Juli Pickering
No Report

Curriculum Committee – Prof. A. Rahman
No Report

Graduate Program Subcommittee – Prof. Suzuki
No Report

Academic Planning Committee – Prof. Patrick
No Report

Faculty Senate – Prof. Reisel

In the October meeting, the Faculty Senate approved changes to the Graduate School's Admission, Continuation, and Dismissal policies.

ATTACHMENT 2

NEW COURSES

COMPSCI 411 MACHINE LEARNING AND APPLICATIONS, U/G, 3 cr.
The course will cover some of the most important topics in machine learning, including deep learning. It will also include applications and provide hands-on experience with machine learning software and libraries.
Prereq: CompSci 202 (P) or CompSci 241 (P) or CompSci 250 (P) or cons instr.

COURSE CHANGES (changes indicated in red)

COMPSCI 535 ALGORITHM DESIGN AND ANALYSIS, U/G, 3 cr.
Introduction to abstract data structures, analysis of time and space requirements of numerical and non-numerical algorithms methods for data manipulation.
Prereq: jr st; Math 211(P), 213(P), 221(P) or 231(P); C or better in ~~both~~ CompSci 351(P) and either CompSci 317(P) or both of Math 341(P) and MthStat 361(P). ~~& 351(P).~~

COMPSCI 732 TYPE SYSTEMS FOR PROGRAMMING LANGUAGES, G, 3 cr.
Lambda calculus, simple types, record types, subtypes, polymorphic types, type reconstruction, universal types, bounded quantification, higher-order types.
Prereq: grad st; CompSci 431(P) ~~& 654(P).~~

COMPSCI 759 DATA SECURITY, G, 3 cr.
Protection of data in computer and communication systems, cryptography, classical one key and public key cryptosystems, database protection, operating system security.
Prereq: grad st; CompSci 317(P). ~~217(P) & 536(P).~~

COMPST 701 ~~MATHEMATICAL &~~ COMPUTING FUNDAMENTALS FOR IT PROFESSIONALS, G, 3 cr.
A survey of computer science fundamentals. Topics include data storage and manipulation, operating systems and networks, algorithms and data structures, programming languages, artificial intelligence, parallel computing, and computability. ~~Introductory discussion of logic and reasoning techniques, discrete structures, combinatorics, probability, and their applications to IT.~~
Prereq: grad st.

COMPST 703 SOFTWARE DEVELOPMENT LIFE CYCLE ~~SOFTWARE ENGINEERING PRINCIPLES~~, G, 3 cr.
Introduction to core topics of the software development life cycle ~~engineering~~ including requirements analysis, object-oriented design, testing, maintenance and project management. Overview of ethical and social issues in computing.
Prereq: CompSt 701 ~~702~~, or equiv

ATTACHMENT 3

Program Changes to the M.S. in Computer Science

The proposed program changes to the M.S. in Computer Science can be found on the following pages.

COMPUTER SCIENCE, MS

History

1. Aug 18, 2018 by clmig-jwehrheim
2. Feb 28, 2019 by Emily Kuhnen (ebilicki)

Changes saved but not submitted

Viewing: Computer Science, MS

Last approved: Thu, 28 Feb 2019 20:15:05 GMT

Last edit: Tue, 04 Jun 2019 19:56:12 GMT

Reviewer Comments

Todd Johnson (johnsont) (Tue, 04 Jun 2019 16:27:55 GMT): Rollback: Department request

Is this a proposal to create a new submajor or concentration?

No

Title of program:

Computer Science, MS

Program Level:

Graduate Only

Program Type:

Master's

Is this a coordinated degree program proposal?

No

Department or Functional Equivalent

Units:
Computer Science

College, School, or Functional Equivalent

Units:
College of Engineering and Applied Science

Proposed Effective Catalog:

2019-2020

Proposed Effective Term:

2199

Summary of proposed changes or request:

Lower grade requirements on undergraduate requirements, to match the regular track. Provide alternative to CompSci 537 which has too deep a pre-req stream.
Disallow use of extra CompSci 700 credits or of multiple credits in CompSci 870.

Program Curriculum (for the Catalog)

Credits and Courses

MSCS Regular Track

An applicant must meet Graduate School requirements to be considered for admission. Additionally, the applicants must meet either of the following program requirements:

- Undergraduate major in Computer Science.
- Satisfactory completion of two programming courses (such as COMPSCI 250 and COMPSCI 251); at least 6 additional credits of coursework in CS; and one course in calculus (such as MATH 211 or MATH 231).

Applicants without sufficient Computer Science background are encouraged to apply to the professional track. Applicants not admitted to the regular track may be offered admission to the professional track instead. Applicants may be admitted with specific program-defined course deficiencies provided that the deficiencies amount to no more than two courses. The student is expected

to satisfy deficiency requirements within three enrolled semesters. The deficiencies are monitored by the Graduate School and the individual graduate program unit. No course credits earned in making up deficiencies may be counted as program credits required for the degree.

The student must have taken six Computer Science courses (specified below) or their equivalents prior to completion of the MS Program. Appropriate courses taken by a student in another program that are considered equivalent to the courses below can be used to satisfy this requirement with the approval of the Department. The six courses are:

Code	Title	Credits
COMPSCI 315	Introduction to Computer Organization and Assembly Language Programming	3
COMPSCI 317	Discrete Information Structures	3
COMPSCI 351	Data Structures and Algorithms	3
COMPSCI 458	Computer Architecture	3
COMPSCI 535	Algorithm Design and Analysis	3
COMPSCI 537	Introduction to Operating Systems	3
Total Credits		18

At most six credits of the courses used to satisfy this requirement (excluding COMPSCI 315, COMPSCI 317 and COMPSCI 351) and taken as a graduate student may be used in either option of the program. All students must submit an approved Undergraduate Requirements Assessment (which explains how the requirement will be met) prior to registering for any courses.

The students in the regular track must write a thesis or complete a capstone project.

Thesis Option

The minimum credit requirement is 30, comprising:

Code	Title	Credits
COMPSCI 700	CEAS Graduate Seminar	3
COMPSCI 704	Analysis of Algorithms	3
Select 12 additional credits of 700 or higher level courses, including the following: [1]		12
Select 6 credits of additional courses that carry graduate credit		6
COMPSCI 990	Masters Thesis	6
Total Credits		30

[1] Excluding COMPSCI 990.

All courses must be approved in the Program of Study, which must not include any more than one credit of COMPSCI 870. The student must not register for more than 4 credits of COMPSCI 990 in any one semester. The student must write an acceptable thesis under the supervision of a faculty advisor and pass a final comprehensive examination, which will normally focus on the thesis. Once a student begins a thesis under the supervision of an advisor, the graduate program director must approve any change to a new thesis advisor.

Capstone Option

The minimum credit requirement is 31, comprising:

Code	Title	Credits
COMPSCI 700	CEAS Graduate Seminar	1
COMPSCI 704	Analysis of Algorithms	3
COMPSCI 995	Master's Capstone Project	3
Select 15 additional credits of 700 or higher level courses		15
Select 9 credits of additional courses that carry graduate credit		9
Total Credits		31

The student must complete a capstone project under the supervision of a faculty advisor and pass COMPSCI 995 with a grade of B or better. No more than one credit each of COMPSCI 700 or COMPSCI 870 can be used to satisfy program requirements.

The Professional Track

An applicant must meet Graduate School requirements to be considered for admission. We expect that students admitted to the professional track will have knowledge of computer programming to the extent of COMPSCI 250 and COMPSCI 251. Applicants can demonstrate this knowledge via academic coursework or online courses. Applicants can also explain in their Statement of Purpose if they gained this knowledge via work experience. All admitted students are assigned a placement level concerning their knowledge of computer programming. The students may be required to take COMPSCI 250 and/or COMPSCI 251 (or equivalents) based on their placement level.

The student must demonstrate knowledge equivalent to the following four Computer Science courses prior to completion of the MS Program:

Code	Title	Credits
COMPSCI 317	Discrete Information Structures	3
COMPSCI 351	Data Structures and Algorithms	3

COMPSCI 535	Algorithm Design and Analysis	3
COMPSCI 537	Introduction to Operating Systems	3
or COMPSCI 431	Programming Languages Concepts	
Total Credits		12

This requirement can be met in one of the following ways:

- A grade of "C-" or better in these courses or equivalent CompSt courses.
- Passing the sufficiency exams offered by the department.
- Prior academic coursework approved by the academic advisor.

Graduate credits earned while taking these courses as a graduate student may be used to meet the credit requirements of the program. All students must submit an approved Undergraduate Requirements Assessment (which explains how the requirement will be met) prior to registering for any courses.

The minimum credit requirement is 31 graduate credits, comprising:

Code	Title	Credits
COMPSCI 700	CEAS Graduate Seminar	1
Select at least 15 credits of 700-level CompSci courses [1]		15
Select up to 9 graduate credits of courses from a pre-approved list of non-CompSci courses considered useful for professionals in CompSci-related industries		9
Select the remaining credits from graduate-level or U/G-level CompSci courses		6
Total Credits		31

[1] These 15 credits may include COMPSCI 995, which is required for those students who fulfill the Capstone Requirement by completing a capstone project.

Up to 12 credits of prior graduate-level course work (including up to 6 credits of prior graduate-level Computer Science courses) can be used to meet the credit requirements. No more than one credit each in COMPSCI 700 or COMPSCI 870 may be used to meet the requirements. All courses must be approved in the Program of Study. Any non-CompSci courses must be approved prior to registration.

Capstone Requirement

The student must demonstrate the ability to integrate the knowledge of the discipline in one of the following ways:

- A capstone project completed under faculty supervision by completing the 3-credit COMPSCI 995 course with a B or better grade. These credits can be applied towards the requirement regarding 700-level CompSci courses.
- An oral exam based on a prior open-source or professional project completed by the student. The student must ensure that faculty can review the actual implementation of the project.

Industrial Internship

With faculty advisor's approval, one credit per semester of COMPSCI 990 or COMPSCI 995 may be satisfied with a supervised industrial internship for a maximum of two credits.

Key: 199

ATTACHMENT 4

Notice of Intent, PhD in Electrical Engineering
University of Wisconsin-Milwaukee

Degree: Doctor of Philosophy
Major: Electrical Engineering
Department: Electrical Engineering (EE)
School/College: College of Engineering and Applied Science (CEAS)
Mode of Delivery: Face to face
Institutional Contact: Devarajan Venugopalan, Associate Vice Chancellor, Academic Affairs, dv@uwm.edu

Program Description

Electrical engineering is concerned with the application of physical principles to the analysis, design, and development of electrical technologies. It includes power systems, communications, photonics and optics, controls, signal processing, instrumentation, sensors, and electronics, among other areas. Electrical engineering is one of the fundamental engineering disciplines, and electrical engineer careers take on a diversity of forms.

The undergraduate electrical engineering program at UWM has been present (with some early changes in name) since the inception of the College of Engineering in the 1960s. The undergraduate electrical engineering program has the third highest enrollment of the seven engineering programs at UWM (Biomedical, Civil, Computer Science, Electrical, Materials, Industrial, and Mechanical), and graduates approximately 40 students each year. The department plays a key role in the college's mission to educate students to become creative problem solvers, and to act as a catalyst for improved economic development and quality of life in Wisconsin. With the fast-paced changes in electrical technology, the department is critical to the college and university to achieve the strategic goal of anticipating and responding to market demands in order to produce graduates who are prepared to address and adapt to the changing needs of the marketplace and society.

At the graduate level, currently there is a long-standing, college-wide PhD program, spanning the various engineering disciplines of the college. Each engineering discipline functions, essentially, as its own individual program. With this Notice of Intent, we plan to separate the EE portion of the college-wide PhD program into its own program. The need for this action is detailed in the following section.

The proposed PhD Program in Electrical Engineering will essentially be the same as the EE portion of the existing college-wide PhD program. Curricular areas will be unchanged (covering typical graduate-level electrical engineering content). There is no planned change in research focus – current areas of strength include power systems and components, bio-optical imaging, and nanotechnology.

Our program serves graduate students that work full or part time in the Milwaukee area (place-bound), those that come to work with specific faculty on research, and those have a desire to be in the Milwaukee area, as well as foreign students. The PhD enrollment in the EE portion of the current college-wide PhD program for years 2015-2018 was 38, 43, 44, and 40, for an average of 41 PhD students in the EE portion of the program.
Anticipated Program Outcomes: Typically, 2-3 PhD students graduate from the EE portion of the CEAS PhD program. We do not expect any significant changes in that number after the EE PhD

program becomes a stand-along program. As stated below, the goal of this endeavor is to be able to higher-caliber students, and to greatly assist in data collection about the EE PhD.
Learning Outcomes of the EE PhD Program (same as the current college-wide PhD Program):

a. Apply advanced knowledge of mathematics, science, and engineering to solve complex problems.
b. Use modern tools or techniques to solve complex problems, conduct research, and analyze and interpret data.
c. Demonstrate proficiency and competency in the area of specialization.
d. Identify, formulate, and solve complex problems with an original and/or significant contribution to the field.
e. Demonstrate a familiarity with research in a related or complementary discipline.
f. Use quantitative methods appropriate to the field of research.
g. Understand academic, professional and ethical responsibility.
h. Communicate effectively via technical writing and oral presentations.

METHODS OF ASSESSMENT OF OUTCOMES

i. Outcome (a) is assessed through achievement of the Ph.D. Qualifying Examination.
ii. Outcome (b) is assessed through the dissertation proposal hearing.
iii. Outcome (c) is assessed through the Qualifying Examination and achieving a grade of B or higher in program of study.
iv. Outcome (d) is assessed in the preliminary examination (identify and formulate), in the thesis (solve) and in any published results.
v. Outcome (e) is assessed through achieving required B or higher average in selected course work (9 minor credits) and in the preliminary examination.
vi. Outcome (f) is assessed in the program of study's inclusion of appropriate course work with a grade of B or higher.
vii. Outcome (g) is assessed in the required ethics and communication course(s) being developed with a grade of B or higher.
viii. Outcome (h) is assessed in the Dissertation Proposal hearing and the Dissertation Defense.

The minimum degree requirement is 66 graduate credits beyond the Bachelor's degree with minimum credit distribution as follows: 21 credits in the major area; 9 credits in an approved minor area; 6 credits in mathematics and/or quantitative methods; 9 credits of approved electives; 3 credit CEAS Graduate Seminar (Ethics and Engineering Communication); A minimum of 26 credits, excluding dissertation, must be at the 700 level or higher; 18 credits of doctoral thesis. A minimum of 33 credits (including thesis) must be completed in the Ph.D. program at UWM.

A maximum of 33 credits may be considered for transfer from prior graduate work, including a Master's degree earned at UWM or elsewhere provided the course work taken falls within the appropriate areas and has earned a grade of "B" or better. Students entering the program without an applicable Master's degree are limited to a maximum transfer of 9 credits for courses taken elsewhere.

Existing or anticipated resources required to deliver the program
Since this is essentially a splitting-off of an existing program, no additional resources are required. The college will still manage admissions processing, as occurs currently. Currently, there are 15 faculty members supporting the program.

Alignment with Institutional Mission, Strategic Plan, and Existing Program Array
The current joint program, being focused on research and advanced education, clearly serves the broad UW–Milwaukee mission for discovery, research, and education, and supports the generation of new knowledge for the development and betterment of society. The new, split-off EE program will serve the same purpose.

Need for the Program, and Relationship to Existing Programs
As discussed above, at present there is a college-wide PhD program in Engineering and Applied Science. The electrical engineering portion of that program has approximately 100 graduate students, divided roughly in half between Master of Science (MS) and Doctor of Philosophy (PhD) students. The proposed program is simply to split off the electrical engineering portion of that existing program, to become a PhD in Electrical Engineering. Department faculty feel that this is an appropriate move for several reasons. First, there is some student reluctance to have a PhD degree that is, officially, in Engineering, rather than in Electrical Engineering. We feel that a more specific degree name would aid in attracting top PhD student candidates to the program. Second, department faculty would like more autonomy in administering the program, including scheduling and evaluation of the PhD Qualifying Exam. Third, having a combined college-wide program makes it difficult to collect data on our (EE) students and graduates, as all PhD students in the college are, officially, in Engineering rather than Electrical Engineering. Related to data collection for our own internal purposes, the presence of a college-wide PhD program adversely affects us in rankings, such as US News and World Reports and similar venues. We do not appear in these rankings of electrical engineering PhD programs simply because we do not have a PhD in electrical engineering (despite the fact that we, essentially, do have such a program of longstanding nature).

Impact on Madison's EE PhD Program: We do not expect that this program will have any effect on the EE PhD program in Madison. Our student pool is largely drawn from two groups. One is engineers working in industry in Milwaukee. They choose UWM because it is convenient, and for them, Madison is too far to commute. The creation of a stand-along EE PhD program will not affect these students. The other main group is foreign students, but our program and the program at Madison have different admission criteria (which is the current situation, and which will not change in the proposed program). As such, it is clear that the proposed program will neither produce unnecessary duplication within the UW System, not impact the program at Madison.

Admission Requirements

Admission standards will be the same as current admission standards for Engineering PhD.

ATTACHMENT 5

B.S. in Data Science – Notice of Intent

The Notice of Intent to create the B.S. in Data Science can be found on the following pages.

Notice of Intent – B.S. in Data Science

University of Wisconsin–Milwaukee

November 2018

Name of the proposed program: Bachelor of Science in Data Science

Institutional setting: Joint degree awarded by the College of Engineering and Applied Sciences (Computer Science Division of the Department of Electrical Engineering and Computer Science) and the College of Letters and Sciences (Department of Mathematical Sciences)

Mode of delivery: Traditional in-person courses

Institutional contact information: Prof. Daniel Gervini, gervini@uwm.edu, Department of Mathematical Sciences

Description – Learning Outcomes

The objective of the BS major degree in Data Science is to prepare students for careers in data science, data analytics or related fields. To accomplish this goal, students will gain a solid foundation in statistical methods and programming techniques via a wide range of courses available through the Department of Mathematical Sciences at the College of Letters and Science and the Computer Science Division at the College of Engineering and Applied Sciences.

Upon completion of the program, students will:

- Be able to integrate methods and concepts from mathematics, statistics and computer science to solve data science problems, including data management and extraction of meaning from data.
- Demonstrate critical thinking related to data science problems and concepts.
- Demonstrate oral and written communication skills related to data science.
- Demonstrate awareness of the ethical aspects of data science.

Contents of the Program

The coursework consists of 120 total credits for the degree. There are 24 credits of preparatory courses, 36 credits of advanced core courses, plus electives and required UWM general education courses. The preparatory curriculum includes: calculus (12 credits), linear algebra (4 credits), introductory statistics (3 credits) and introductory computer programming (6 credits). The advanced curriculum includes: methodological statistics courses on regression models, multivariate analysis and statistical computing (12 credits), statistics and probability theory (6 credits), databases, artificial intelligence and data mining (15 credits), writing, communication and ethics (6 credits). There is a mandatory capstone course or internship at the end of the coursework, which will give students the opportunity to apply their skills in a real-world setting, in addition to electives from Computer Science, Mathematics or Mathematical Statistics.

Resources

No new resources are required for this program. The proposed coursework consists of courses regularly offered by the Computer Science Department and the Department of Mathematical Sciences.

Required approvals

Accreditation by the Higher Learning Commission.

Alignment with institutional mission

The proposed program responds to the following aspects of UWM Select Mission Statement, which can be found at https://uwm.edu/mission/:

> *To fulfill its mission as a major urban doctoral university and to meet the diverse needs of Wisconsin's largest metropolitan area, the University of Wisconsin–Milwaukee must provide a wide array of degree programs [...]. Fulfilling this mission requires the pursuit of these mutually reinforcing academic goals:*
>
> - *To develop and maintain high quality undergraduate, graduate and continuing education programs appropriate to a major urban doctoral university.*
> - *To attract highly qualified students who demonstrate the potential for intellectual development, innovation, and leadership for their communities.*
> - *To further academic and professional opportunities at all levels for women, minority, part-time, and financially or educationally disadvantaged students.*
> - *To promote public service and research efforts directed toward meeting the social, economic and cultural needs of the state of Wisconsin and its metropolitan areas.*
> - *To provide educational leadership in meeting future social, cultural, and technological challenges.*

The proposed Data Science program will advance these goals by providing students with a thorough preparation to meet the challenging requirements of the profession, by attracting students with strong STEM potential, and by fostering cooperation between UWM and the business community (e.g., through the Northwestern Mutual Data Science Institute).

Need for the program

Market demand

The job outlook for mathematicians and statisticians in the Occupational Outlook Handbook of the Bureau of Labor Statistics (https://www.bls.gov/ooh/math/mathematicians-and-statisticians.htm) states that "employment of statisticians is projected to grow 34 percent from 2016 to 2026, much faster than the average for all occupations. Growth is expected to result from more widespread use of statistical analysis to make informed business, healthcare, and policy decisions. In addition, the large increase in available data from the Internet will open up new areas for analysis. (...) The amount of digitally stored

data will increase over the next decade as more people and companies conduct business online and use social media, smartphones, and other mobile devices. As a result, businesses will increasingly need mathematicians to analyze the large amount of information and data collected." The handbook is very specific about data science, stating that "job opportunities are expected to be favorable for those with very strong quantitative and data analysis skills. Computer programming skills will remain important to many employers, as will be keeping up with new statistical methods and programming languages." According to this report there were 37,200 job positions for statisticians in the US in 2016, and this number is expected to grow to 49,800 in 2026.

For the state of Wisconsin, a labor market report generated at WisConomy, the Department of Workforce Development labor database (https://jobcenterofwisconsin.com/wisconomy/), shows that the number of job positions in Computer and Mathematical Occupations in the Professional, Scientific, and Technical Services industries is expected to grow from 17,299 in the year 2016 to 20,899 in 2026 (a 20.8% increase), and in the Finance and Insurance industries is expected to grow from 10,424 to 11,703 (a 12.3% increase) in the same period.

The recent creation of the Northwestern Mutual Data Science Institute at the University of Wisconsin-Milwaukee also demonstrates the demand for data science programs in the region.

Student demand

Graduation data for the majors offered by the Department of Mathematical Sciences for the semesters between Spring 2014 and Spring 2018 show that 48 students received BA degrees in Actuarial Science, 9 BA or BS in Mathematics with concentration in Applied Mathematics, 1 BS in Mathematics with concentration in Statistics, 2 BS in Mathematics with concentration in Computational Mathematics, 8 BA or BS in Mathematics with concentration in Pure Mathematics, and 41 Mathematics majors without specified concentration until Spring 2017 and 13 since Fall 2017 (concentrations were discontinued in Fall 2017, so the last figure includes students interested in either pure or applied mathematics.) These data show that a large proportion of undergraduate students in the Department of Mathematical Sciences show interest in statistics, actuarial science and applied mathematics. We expect that a BS in Data Science will increase the visibility of our departments in this area and give UWM an opportunity to recruit students who otherwise may not have attended UWM.

Similar programs in the system and the region

There is only one major degree in Data Science offered at a UW institution, a BS in Data Science and Predictive Analytics offered by the College of Business and Economics at UW-River Falls. There is also a minor offered by the Department of Computer Science at UW-Whitewater. No other undergraduate degrees on Data Science are currently offered in the University of Wisconsin system, although the UW-Madison has recently circulated a Notice of Intent for a BS major in Data Science. However, since UWM is the urban research university in the system, it is in a unique position to collaborate with the business community via e.g. student internships.

In the region of Southeast Wisconsin, only the Department of Statistics, Mathematics and Computer Science at Marquette University offers a Data Science major. However, Marquette is a private catholic university with a very different mission and student profile than UW-Milwaukee.

This program, then, will not create unnecessary duplication.

ATTACHMENT 6

Proposal for Transformation of Center for By-Products Utilization (CBU) into Concrete Sustainability and Resilience Center (CSRC)

a. Name Concrete Sustainability and Resilience Center (CSRC), former CEAS Center for By-Products Utilization (CBU)

b. Description

Fit of Center: Concrete is the single most massively produced material in the history of humankind; both its tremendous ubiquity and its current 1-for-1-ton carbon footprint make it an immediate candidate for ecological optimization. Although modern research (including the contributions from CBU) demonstrated the possibility of marked improvements in sustainability and innovation, industry is still slow to adopt cutting-edge technologies. The purpose of the Concrete Sustainability and Resilience Center (CSRC) is to bridge the gap between contemporary research and industry adoption of new technologies.

Mission: The discovery, development, and implementation of material and processing innovations in concrete technology to attain a resilient and sustainable future for concrete industry.

Vision:

- An interconnected matrix of experts from industry and academia working in collaboration to rapidly identify, address, explore, and solve problems related to the development and implementation of cutting-edge concrete technologies.
- A streamlined research and innovation hub that reduces redundancies by close coordination in sites' focus on fundamental research thrust areas.
- The fostering of a multidisciplinary approach to addressing industrial implementation issues by the bringing-together experts in both foundational and applied fields of study; a nexus of structural, civil, environmental, materials, and chemical engineering experts committed to solutions-based approach to market, environmental, and governmental stakeholders.

Economic Relevance: By establishing a hub for solutions-based academic and industrial relationships to communicate and collaborate, we envision that the CSRC will usher a new era of concrete technology that:

- Dramatically improves the recycled materials content, as well as the compressive strength and durability of contemporary concrete, leading to tremendous reduction in the quantities of raw materials consumed by construction;
- Establishes practical structural design techniques, best practices, and ultimately useful codes for *practical implementation* of these innovations in modern concrete applications;
- 'Paves the way' for industry leaders to quickly adopt these newly established practices into their day-to-day operations, immediately improving efficiencies and bottom-line profitability.

Research Thrust Areas:

The proposed Concrete Sustainability and Resilience Center (CSRC) represents a consortium of UWM researchers and professionals, whose combined knowledge, skills, and teamwork can offer rapid development of extant theoretical and prototypical ideas into feasible *solutions* with the potential for immediate impact on the cement, concrete, and asphalt industry.

c. Organizational Structure

The CSRC is led by the director (CD) and associate directors (AD) comprising the board of directors (BoD). The director and BoD are appointed by the Dean of CEAS for 10 years. The CSRC director reports to the Dean of CEAS. The research activities and prospective planning are reported to CEAS at CSRC annual meeting with faculty and the Industrial Advisory Board (IAB). The bookkeeping and minutes of the meetings are recorded by the CSRC Secretary. The affiliated faculty works on concrete-related research projects independently as PIs or in collaboration with directors of CSRC.

d. List of Resources

The Structural Materials Laboratory provides well-equipped facilities for research, and service to industry associated with the performance of civil engineering materials such as concrete, cement and aggregates, structural steel, wood, and plastics.

The concrete laboratory provides facilities for:

- aggregate testing and preparation
- concrete mixing, fabrication, curing, and preparation of test specimens
- testing of fresh and hardened concrete

For studying the response of materials under a wide range of environmental conditions, the laboratory with temperature-humidity controlled rooms are available. These include:

- large fog room for standard curing
- walk-in environmental chamber with various temperature controls (-20^{o}C to +20^{o}C)
- ovens (up to 260^{o}C and 1100^{o}C)

Concrete and Construction Materials Laboratory

- ASSHTO/ASTM tests of aggregates, cement, and concrete.
- The 2,000 kN (400,000 lbf) compression testing system with a rapid-change platen mounting system for AASHTO/ASTM cylinder, cube, beam, and block specimen testing with calibration accuracy to ASTM E4, EN/ISO 7500-1.
- The AASHTO/ASTM flexural and transverse tests based on 100 kN (20,000 lbf) Flexural Machine.
- Coefficient of Thermal Expansion (ASHHTO)

Advanced Cement Materials Laboratory

- Equipment to mix cement composites, milling equipment, casting cement and mortar test samples.
- Dual frame 250/25 kN (50,000/5,000 lbf) Compression Machine for ASTM C109, EN 196-1, calibration accuracy to ASTM E4, EN/ISO 7500-1. This unit is capable of performing the tests on a wide variety of specimen sizes of mortar, fly ash, portland and slag cement
- Admixtures and nano-materials processing equipment
- Durability assessment: freeze-thaw resistance, rapid chloride permeability, accelerated corrosion

CBU-Bloom ASHphalt Testing Laboratory

- ASSHTO/ASTM tests of aggregates, fillers, and bitumen.

- DSR (Dynamic Shear Rheometer) to characterize the viscous and elastic behavior of asphalt binders at medium to high temperatures as per as the Superpave PG asphalt binder specification.
- The AASHTO/ASTM Direct Tension Machine.
- The Bending Beam Rheometer (BBR) to measure a low-temperature stiffness and relaxation properties of asphalt binders.
- Rolling Thin-Film Oven / Pressure Aging Vessel for short-term and long-term aging if asphalt binders and consequent Superpave physical property testing.

Structural Testing Laboratory

- The MTS fatigue testing equipment for fatigue life of compacted Hot-Mix Asphalt (HMA) subjected to repeated flexural bending (AASHTO).
- The MTS testing equipment for low-temperature fracture toughness of HMA.
- Elastic, tensile (Instron), compression, and fatigue testing equipment (MTS), and displacement measurement devices; LabVIEW

Non-Destructive Evaluation (NDE) Laboratory

- Ultrasonic, pulse velocity, impact echo, acoustic emission, ground penetrating radar

UWM Advanced Analysis Facility (AAF)

- Ocean Optics UV-VIS Spectrometer (fiber optics), Mattson Galaxy FTIR Spectrometer, Mattson
- Dynamic Mechanical Analysis (DMA)
- Quantum FTIR Microscope, Bruker Vector FTIR Spectrometer with special reflectance and ATR attachments, Renishaw Raman Microscope, Fluorescent Microscope
- HP5950A XPS Spectrometer (X-Ray Photo Electron Spectroscopy – ESCA), EDAX Energy Dispersive X-Ray Low Element Analyzer, Secondary Ion Mass Spectroscopy (Millbrook MiniSIMS)
- Scintag XDS 2000 X-Ray Diffractometer, Topcon ABT Scanning Electron Microscope
- TA Instrument high sensitivity Thermo Gravimetry Analysis/Differential Scanning Calorimeter
- HP 5890 Gas Chromatograph with Mass Spectrometer, Agilent Technology 6890 N Gas Chromatograph

e. List of Faculty, Staff and Researchers

Konstantin Sobolev (Civil Eng, CD)
Habib Tabatabai (Civil Eng, AD)
Rani El-Hajjar (Civil Eng, AD)
Jian Zhao (Civil Eng, AD)
Hani Titi (Civil Eng)
Yue Liu (Civil Eng)
Michael Nosonovsky (Mech Eng)
Benjamin C Church (Material Eng)
Nidal H Abu-Zahra (Material Eng)
Nathan P Salowitz (Mech Eng)
Krishna M Pillai (Mech Eng)
Ilya V Avdeev (Mech Eng)

Nathaniel E Stern (Mech Eng)
Nikolai A Kouklin (Electrical Eng)
Steven E Hardcastle (AAF)
Marina Kozhukhova (Civil Eng, IAB, Secretary)
Steve Kosmatka (Civil Eng, IAB, AD)
Bruce W Ramme (Civil Eng, IAB, AD)

f. The Long-Term Plan for the Center

The Center will focus on research in the areas of nanoscale hydration, chemical admixtures, nanoparticles and nanofibers, supplementary cementitious materials, and byproduct utilization that can result in immediate incorporation to industrial-scale applications. Through 'bottom-up' design mentality in nano-engineering and biomimicry, concrete service life and recyclability will be addressed. The Center will continue the traditional research work previously explored by CBU on beneficial use of industrial by-products and will advance such revolutionary fields as molecular and micro-mechanical modelling, mechano-chemical activation of cement and engineering of nano-seeds, superhydrophobicity, and ultra-high performance concrete (UHPC).

Some of the prospective research areas are the following:

<u>Green eco-cement and binders</u>

- Utilization of fly-ash and off-spec coal combustion co-products (CCP)
- Replacement of portland cement with supplementary cementitious materials and off-spec by-products
- New pozzolans and nanoparticles
- Alkali activated binders and geopolymers
- Effective applications including hybrid reactive powder asphalt pavements

<u>Nano-engineered cements and concrete</u>

- Bottom-up and molecular engineering of components and hydrated structure
- Biomimetic design
- Mechano-chemical activation

<u>Durability enhancement</u>

- Corrosion of reinforcement
- Mitigation of sulphate attack and acid resistance
- Superhydrophobic composites
- Anti-icing and de-icing performance

<u>Smart concrete</u>

- Photocatalytic and photovoltaic
- Stress-sensing materials
- Self-healing concrete and composites
- 3D printing solutions and digital concrete

<u>High performance concrete</u>

- High-strength matrices
- Fiber-reinforced composites
- Micromechanical modeling of composites

Ultra-high performance concrete

- Ultra-high-strength matrices
- New structural forms that maximize the benefits of UHPC
- Precast concrete applications

g. Description of Collaborations

There is no overlaps with existing centers and institutes at UWM.

Academic Partnerships:

- Northwestern University: S.P. Shah, NSF Center for Advanced Cement-Based Materials (ACBM)
- MIT: F-J. Ulm and R. Pellenq, Concrete Sustainability Hub (CSH)
- ASU: B. Mobasher and N. Narayanan
- Oregon State: J. Weiss
- UT Arlington: Maria Konsta-Gdoutos
- Temple University: Ahmed Faheem

Prospective Industry Support:

- We Energies
- Bloom
- US Gypsum
- Spancrete
- AECOM
- BASF
- OBG
- Bostik
- LafargeHolcim
- Cemex

ATTACHMENT 7

B.A. in Computer Science Authorization to Implement

The Authorization to Implement documentation for the B.A. in Computer Science can be found on the following pages.

REQUEST FOR AUTHORIZATION TO IMPLEMENT A BACHELOR OF ARTS IN COMPUTER SCIENCE AT UNIVERSITY OF WISCONSIN (UW-MILWAUKEE) PREPARED BY UW-MILWAUKEE

ABSTRACT

The University of Wisconsin-Milwaukee proposes to establish a Bachelor of Arts in Computer Science (B.A. CompSci). The development of the program responds to the demonstrated need for graduates with software skills combined with specialization in a different area. It has been shown that so-called ``CS+X'' programs broaden the representation of participants in Computer Science, with respect to race and gender. Establishing the program will provide students with marketable skills alongside an existing major, or two minor areas. Graduates will be better equipped to lead in their chosen field with additional computer-science-related skills. The program will be comprised of 120 credits, including 38 credits of major course requirements (mathematics and computer science). Students are also required to have a second major (in any field) or two minor areas of concentration (which can be demonstrated in a variety of different ways). Thus, the remaining 82 credits are used to satisfy general university requirements (including general education requirements) and the additional major or two minor areas. In this way, students will have gained competency in at least two, perhaps three areas, including computer science.

PROGRAM IDENTIFICATION

Institution Name
University of Wisconsin-Milwaukee

Title of Proposed Program
Computer Science

Degree/Major Designations
Bachelor of Arts

Mode of Delivery
Single institution
Face-to-face

Projected Enrollments and Graduates by Year Five

Table 1 represents enrollment and graduation projections for students entering the program over the next five years. It is anticipated that 10 existing students will switch out of the existing B.S. Computer Science (BSCS) program in the first two years so that they can graduate more easily. The assumption is that starting at a low level, intake eventually reach 20 new students each year entering the program. The average student retention rate is conservatively projected using the (more rigorous) existing CEAS programs to be 85% in year 2, 72% in year 3, 61% in year 4, and 52% in year 5. By the end of Year 5, it is expected conservatively that 85

students will have enrolled in the program and 40 students will have graduated from the program.

Table 1: Five-Year Degree Program Enrollment Projections

Students/Year	Year 1	Year 2	Year 3	Year 4	Year 5
New Students	5	10	15	20	20
Continuing Students	10	13	24	32	45
Total Enrollment	15	28	39	52	65
Graduating Students	5	5	10	10	10

Tuition Structure

For students enrolled in the B.A. CompSci, standard tuition and fee rates will apply. For the current academic year, residential tuition and segregated fees total $4799.21 per semester for a full-time student enrolled in 12-18 credits per semester. Of the total amount, $753.65 is attributable to segregated fees. Nonresident tuition and segregated fees total $10,584.17 per semester for a full-time student enrolled in 12-18 credits per semester. Again, of the total amount, $753.65 is attributable to segregated fees and the remainder to tuition.

Classes in the College Engineering and Applied Science, including all Computer Science classes have an additional "differential tuition" of $21.63 per credit. As the proposed program requires 34 credits of Computer Science, differential tuition adds $735.42 to the total cost of the entire degree.

Department or Functional Equivalent

Department of Electrical Engineering and Computer Science

College, School, or Functional Equivalent

College of Engineering and Applied Science

Proposed Date of Implementation

August 2020

DESCRIPTION OF PROGRAM

Overview of the Program

The program requires 120 credits including general education credits. Of these 38 are major requirements, as detailed below. Additionally, the student must complete a second major or have two minor areas of concentration.

Student Learning Outcomes and Program Objectives

Graduates of the program will have an ability to

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements.

3. Communicate efficiently in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

The program education objectives are as follows:

- Alumni of the program will have successful careers built on their understanding of formal and applied methods of solving problems using computer science in their chosen context.
- In their professional lives, alumni of the program will demonstrate problem-solving and design skills, including the ability to formulate problems and their solutions, think creatively, communicate effectively, and work collaboratively.
- Alumni of the program will exercise professional responsibility and be able to adapt to an ever-changing professional environment.

Program Requirements and Curriculum

This proposed program is housed within the College of Engineering and Applied Science (CEAS). It will follow the College's existing admission requirements which are repeated here.

Admission to the College is based on an overall assessment of both academic and non-academic qualifications. The primary review factors for admission are the strength and quality of the high school curriculum, high school class percentile, grade point average, and the result of the ACT or SAT. Well-prepared freshman applicants will have four years of mathematics (including one-and-a-half years of algebra, one year of geometry, and one-half year of trigonometry) and four years of natural science (including biology, chemistry, and physics). The College also will consider non-academic qualifications such as leadership skills, diversity in personal background, work experience, motivation, and maturity. Freshmen applicants will be considered for admission directly to the major or to the First-Year Program. Admission directly to the major is selective.

Transfer student admission is based on an overall assessment of both academic and non-academic qualifications. For transfer applicants, the primary factors considered for admission are the grade point average on transferable courses and the level of curriculum completion. The College also will consider non-academic qualifications such as leadership skills, diversity in personal background, work experience, motivation, and maturity. Transfer applicants will be considered for admission directly to the major or the Transfer Transition Program based on the number of transfer credits and GPA.

Students admitted to the First-Year Program or Transfer Transition Program (Computer Science-Intended) may apply for major status with their academic advisor at the time they believe they meet the requirements.

1. Complete first semester calculus with a C or better grade.
2. Complete GER Oral and Written Communication Part A.
3. Computer Science majors must complete CompSci 251 with a C or better grade.
4. Obtain a 3.00 GPA or a lower minimum grade point as set by the department (currently 2.50).
5. Major required courses (see below) may be repeated only once. No more than two courses may be repeated.

First-Year students have a maximum of three semesters to complete the admission to major requirements. Part-time students may be granted an extension by their academic advisor.

Transfer Transition students have a maximum of two semesters to complete the admission to major requirements. Part-time students may be granted an extension by their academic advisor.

Table 2 illustrates the program curriculum for the proposed program. Students must satisfy the general education requirements of the University: Oral and Written Communication levels A and B, and Quantitative Literacy levels A and B (the latter are satisfied through the Mathematics requirement specified below), and breadth requirements (3 credits of arts, 6 of humanities, 6 of natural sciences (of which the calculus course will provide 4-5 credits) and 6 of social sciences). The program requires one semester of calculus and also 34 credits of major course requirements. In addition, a student must either complete (or have completed) a second major, or demonstrate two minor areas of concentration. The alternate major or minor areas of concentration must overlap no more than six credits total with major course requirements of this degree. Furthermore, at least fifteen credits of the major course requirements should be completed at UW-Milwaukee.

Table 2: Bachelor of Arts in Computer Science Program Curriculum

Mathematics Requirements:		
	MATH 211 or 213 or 221 or 231 (Calculus)	4-5 credits
Major course requirements (34 credits total):		
Core	COMPSCI 150 (Survey of Comp. Sci.)	3 credits
	COMPSCI 250 (Intro. Programming)	3 credits
	COMPSCI 251 (Intermediate Prog.)	3 credits
	COMPSCI 315 (Comp. Org. & Assem. Prog.)	3 credits
	COMPSCI 317 (Discrete Info. Structures)	3 credits
	COMPSCI 351 (Data Structures & Algorithms)	3 credits
	COMPSCI 395 (or similar) (Soc. Prof. Ethic.)	3 credits
	EAS 200 (or similar) (Professionalism and Career)	1 credit
Computer Science Electives	COMPSCI 300-level or higher	12 credits
Other Credits		
General Education	Arts	3 credits
	Humanities	6 credits
	Natural Science (with lab)	1-2 credits
	Social Sciences	6 credits
Electives	This must include an additional major or two minor areas of concentration	65 credits
Total Credits		120 credits

Minor Areas of Concentration

For the purposes of this degree program, a "minor area of concentration" can be any of the following:

- An Associate's degree at UWM or another school;
- A declared UWM Minor;
- A declared UWM Certificate;
- At least fifteen credits of courses in a single curricular code (other than CompSci), of which at least six credits are at the 300-level or higher.

As described above, the two minor areas of concentration can overlap with the major course requirements by no more than six credits total.

Assessment of Outcomes and Objectives

Courses in Computer Science are regularly assessed for program improvement as part of the ABET accreditation of the BSCS. This assessment work can be used to assess student outcomes in the major course requirements. In particular, the four student outcomes listed above are already assessed in CompSci 351 (1 and 2), CompSci 395 (3 and 4), and EAS 200 (4). The program will also regularly survey the graduates of the program to determine whether the educational objectives are being met.

Diversity

The major will help both in broadening participation in Computer Science with respect to race and gender, and also will also make it easier for students from diverse backgrounds to graduate with a degree in Computer Science.

The department is a founding institution in the BRAID initiative of AnitaB.org (https://anitab.org/braid-building-recruiting-and-inclusion-for-diversity/). One of the commitments is to build joint majors that encourage broader participation. Instead of building specific joint majors (e.g., CS + Biology), this proposed program will enable anyone with interest in another field to have a second major in Computer Science by requiring fewer than 40 additional credits.

The smaller major requirements will also make it easier for students from diverse backgrounds to graduate with a Computer Science degree since the requirements are substantially less rigorous than those of the (current) BSCS. Students transferring in with an associates' degree and/or with a partially completed major will be able to use this prior work as a "minor area of concentration."

Collaborative Nature of the Program

Given that the program accepts an associate's degree as a minor area, approving this program will make transfer after completion of such a degree at other UW schools (or UW-Milwaukee branch campuses) more attractive.

Projected Time to Degree

A full-time student would be able to complete the major course requirements in six semesters taking no more than six credits of CompSci along with other courses. Because of pre-requisite chains, it would be difficult to complete all requirements in fewer than five semesters, but since this program is intended to be taken alongside another major (or two minors), this constraint is unlikely to prevent timely graduation. Students who transfer in with an associate's degree, or two years of prior post-secondary coursework will typically require five additional semesters unless they had completed introductory programming and at least pre-calculus before arriving. In that case, completion within four semesters should be possible.

Program Review

According to established UWM policy, the program will be reviewed once after five years and then every ten years henceforth.

JUSTIFICATION

Rationale and Relation to Mission

The proposed new program fits well with UWM's "Select Mission Statement" as seen online at https://www4.uwm.edu/discover/mission.cfm. In particular, UWM seeks to "develop and maintain high quality undergraduate ... programs," "attract highly qualified students," "further academic and professional opportunities for women, minority, part-time, and financially or educationally disadvantaged students," and "provide educational leadership in meeting future social, cultural, and technological challenges."

The program described here is a high-quality program that will attract students who wish to be challenged in two or more separate academic areas, in a way to boost the employment potential for students primarily working in arts or humanities. It is also common wisdom that these inter-disciplinary programs can attract a more diverse pool of students, not solely white, male, and middle-class.

Some Computer Science faculty report that having a more interdisciplinary skill set would be valuable, especially for applications related to the analysis of data from a variety of domains, including health or environment (e.g., freshwater). Support for such connections would strengthen UWM's mission.

Institutional Program Array

The proposed BA CompSci is intended to complement other degree programs. For example, this degree could usefully combined with the BS IST, or with degrees in Biological Sciences, Linguistics, Digital Arts and Culture, Criminal Justice or Theater just to name a few. The department is committed to the "CS+X" concept and intends to work with student advisers to determine good combinations. It is hoped that this program will improve multi-disciplinary collaboration at UWM.

Given that the major course requirements of the program are a subset of those of our existing BS CompSci degree, some students are expected to transfer from the BS CompSci to the new degree program. A transfer might permit those students to graduate earlier, and in the case of some students, could be a more tractable path to finishing with a computer science degree at all. However, the overall level of such "cannibalization" is likely to be low since the BA CompSci requires a second major or two minor areas. In contrast to the existing BS program, the proposed major primarily serves a different population, those students wanting a truly multi-disciplinary education.

Other Programs in the University of Wisconsin System

In Wisconsin, UW-Eau Claire, UW-La Crosse, UW-Madison, UW-Oshkosh, UW-River Flls, UW Stevens Point, UW-Superior, and UW-Whitewater currently offer a BA in Computer Science or a related field. Additionally, UW-Stout offers a BS in Computer Science with an "inter-disciplinary" concentration which functions similarly to a BA. The other UW Schools (UW-Green Bay, UW-Milwaukee, UW-Parkside, UW-Platteville) all offer a BS in Computer

Science. Most of the other degrees require more CS and/or Mathematics credits than the program we propose here.

The BA at Madison anticipates being used as an "additional major" (as also proposed here) and the BA at Whitewater requires that the student complete an additional minor or major (as also proposed here). The inter-disciplinary concentration at Stout requires a minor, second major or other coursework for at least 24 credits. The proposed program is fulfilling a similar purpose in encouraging (or requiring) a multi-disciplinary approach.

Thus the State already has many programs substantially similar to our proposed program, but the market demand for software developers and related fields is anticipated to climb (already 19% percent in the four years 2013--17 and an anticipated 13% additionally in the next ten years nationally, and 28% regionally), and Milwaukee, as the largest metropolitan area of the state is a particularly good place to center a degree with such affinity with industry. In conclusion, market demand suggests that all programs should be able to thrive.

Need as Suggested by Current Student Demand

UW-Milwaukee contracted with EAB to survey demand for the program. They reported that schools that introduce a BA in Computer Science typically see an increase in enrollment. In the four schools they surveyed, they saw increases from 30 a year (at the lowest) to 130 a year increase (at the highest). At UWM, there is anecdotal evidence of students wanting to combine Computer Science with Art or Linguistics. Many of the students already in the BS CompSci program are second-degree students; such students would have a much faster option to a Computer Science degree with the proposed curriculum.

Need as Suggested by Market Demand

In their report, EAB described the market demand from employers for students with the skills provided in the proposed degree program:

> *Regional employers seek bachelor's-level computer science professionals in 28,237 job postings during H2 2017, a 19 percent increase from 23,646 postings in H2 2013. The Bureau of Labor Statistics (BLS) projects the national employment of "computer and information technology occupations" to increase 13 percent from 2016 to 2026, due to increased demand for workers with skills in cloud computing, big data analysis, and information security. Similarly, Wisconsin's Workforce and Labor Market Information projects statewide employment of "computer system analysts" to increase 28 percent from 2014 to 2024.*

They cite the US Bureau for Labor Statistics (https://www.bls.gov/ooh/computer-and-information-technology/home.htm) and the Wisconsin Workforce and Labor Market Information System (http://worknet.wisconsin.gov/worknet/jsoccsrch_results.aspx?menuselection=js&occ=151121&occname=&area=SW).

The EAB report also recommends that UWM encourage students to partner with local industry in providing experiential learning opportunities. The department of Computer Science is well-placed to take the lead here since our capstone course (which will be open to, but not mandatory for BA Computer Science students) was recently redesigned to use industry-initiated projects as the focus of the semester.

ADDITIONAL DOCUMENTATION TO BE SUBMITTED:

Three additional documents must be submitted along with the Request for Authorization to Implement a Degree narrative to apei@uwsa.edu. These additional documents are:

- Cost and Revenue Projections Spreadsheet (Excel format)
- Cost and Revenue Projections Narrative (Word format)
- Institutional Letter of Commitment (PDF format)

These documents will be combined into one PDF document for the Board of Regents' packet later.

Cost and Revenue Projections Spreadsheet – Additional Document #1 (Excel format)

Please utilize the spreadsheet template located at the Academic Program Planning and Array webpage at https://www.wisconsin.edu/program-planning/. The provost must sign the cost and revenue projections spreadsheet. The submitted document must be clean and readable. Avoid submitting scanned documents.

Cost and Revenue Projections Narrative – Additional Document #2 (Word format)

The Cost and Revenue Projections Narrative supports the completion and discussion of the Cost and Revenue Projections spreadsheet document. Together, the budget spreadsheet and narrative illustrate the financial sustainability of the proposed program and document how projected revenues will offset the program costs over a five-year period.

A template for this narrative, including the introduction and six sections, is located on page seven of this guide.

Institutional Letter of Commitment – Additional Document #3 (PDF format)

The letter of commitment is signed by the institution's provost. The letter should be addressed to the President of the UW System (copied to the Associate Vice President of Academic Programs and Educational Innovation) and affirm that:

- The program has been designed to meet the institution's definition and standards of quality, and will make a meaningful contribution to the institution's select mission, overall academic plan, and academic degree program array;
- There is institution-wide support for the program, including institutional governance approval;
- The necessary financial and human resources are in place and/or have been committed to implement and sustain the program; and
- Program evaluations are in place.

COST AND REVENUE PROJECTIONS NARRATIVE – Additional Document #2 (Word format)

Introduction

Note unique program characteristics that may impact budget projections, e.g., distance delivery, direct assessment competency-based, differential tuition/fee structure, cost recovery model, collaborative program delivery with other institutions, or the elevation of a submajor/emphasis.

Section I – Enrollment

This section includes both student headcount and student Full Time Equivalent (FTE) enrollments. The headcount figures in this section should match the enrollment figures listed in the program authorization document. If student FTE projections are lower than the headcount projections, describe how the student FTEs were calculated. New students are those who were not enrolled at the institution the previous semester. Continuing students are those who were enrolled at the institution during the previous semester. Count as continuing students those currently enrolled at the institution and whom the institution expects to change their course of study to the new program. Note any unique enrollment features of the program (e.g., cohort).

Section II – Credit Hours

This section highlights credits generated by the program and grounds staffing requests and/or the need to develop new courses/sections. Include only credit hour attributable to major/program requirements. Do not include degree credits attributable to general education program requirements. New credit hours reflect new courses or sections not previously offered by the institution.

Describe how credit hours were calculated. Note any unique features of the program model that will influence the need for new course sections, or if existing capacity will be used to meet demand. If the program will be offered as a collaborative, report the aggregate credit hours in the financial spreadsheet. In the narrative, detail how these credit hours will be distributed across collaborating institutions.

Section III – Faculty and Staff Appointments

Estimate the number of faculty/staff Full Time Equivalent (FTE) appointments needed to implement and sustain the proposed program. New faculty/staff include those who did not hold an appointment with the institution during the previous academic year. Continuing faculty/staff include those who have current appointments with the institution. Discuss the rationale for redirected appointments. If this is a collaborative program, discuss how faculty/staff FTE appointments will be shared.

Section IV – Program Revenues

Report both the short- and long-term tuition and non-tuition revenue sources that will support delivery of the program. If the program will eventually operate on a cost recovery basis, note the point at which expected revenues will fully support the program.

Tuition Revenues: Describe how new tuition revenues were calculated for new and continuing students unaccounted for in Section I.

Examples of how tuition revenue may be calculated and reported:

1. Based on student FTE enrollments multiplied by the published resident or nonresident full-time tuition rate reported in the program authorization document. If the FTE tuition is calculated for a bachelor's degree program, please account for any reallocation of tuition revenues to support general education programming in Section V.
2. Using annual anticipated credit enrollment per student x student head count, multiplied by the per-credit resident or nonresident tuition rate. It is assumed that the actual per-credit-hour tuition rate may be lower given the credit tuition plateau.

Program/Course Fees: If applicable, describe how fees were calculated. These may include fees attributable to online courses or fees specific to the academic program.

Grants/Extramural Funding: If applicable, describe any program revenue from grant/extramural funds that will be applied to program implementation. Share how the allocation(s) to support students or program costs were calculated.

Program Revenue (PR): Describe any source of PR that will be generated or allocated from other units and used to offset direct and indirect program costs incurred during the growth phase of the program. Detail how the allocation and revenues were calculated.

General Program Revenue (GPR): Describe any source of GPR that will be allocated from other units and used to offset direct and indirect program costs. Detail how the allocation and revenues were calculated.

Section V – Program Expenses

Describe any new costs to the institution associated with the new program.

Expenses – Salary and Fringe: Detail the instructional and non-instructional expenses attributed to the proposed program. Discuss how salary and fringe were calculated, referencing faculty/staff FTE appointments reported in Section III.

Other Expenses: Detail and discuss any expenses related to the use of university facilities, capital equipment, operations, maintenance, and/or library. Detail other costs associated with supplies and expenses, such as marketing, program materials, charges for university services, or planned reinvestments in the program. Describe the nature of these costs in the narrative.

Section VI – Net Revenue

If positive net revenue, discuss how funds will be reinvested at the institution. If negative net revenue, explain how any deficit will be addressed.

Items	Projections				
	2020	2021	2022	2023	2024
	Year 1	Year 2	Year 3	Year 4	Year 5
Enrollment (New Student) Headcount	15	15	15	20	20
Enrollment (Continuing Student) Headcount		13	24	32	45
Enrollment (New Student) FTE	15	15	15	20	20
Enrollment (Continuing Student) FTE		13	24	32	45

	Projections				
	2020	2021	2022	2023	2024
	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman	5	10	15	20	20
External Transfer students (assumed Jr standing.)	0	0	0	0	0
Internal Transfers (UWM)	10	5	0	0	0
Total	15	15	15	20	20

Attrition Rates	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman	0	0.85	0.72	0.61	0.52
External Transfer students (assumed Jr standing.)	0	0.85	0.72	0.61	0.52
Internal Transfers (UWM)	0	0.85	0.72	0.61	0.52

	Projections				
	2020	2021	2022	2023	2024
	Year 1	Year 2	Year 3	Year 4	Year 5
Freshman/Sophmore	5	14	24	33	37
Junior/Senior	10	14	15	20	28

Cohort One - 2020 Start	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman	5	4	4	3	3
External Transfer students (assumed Jr standing.)	0	0	0	0	0
Internal Transfers (UWM)	10	9	7	6	5
	15	13	11	9	8

Cohort One - 2021 Start	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman		10	9	7	6
External Transfer students (assumed Jr standing.)		0	0	0	0
Internal Transfers (UWM)		5	4	3	3
		15	13	10	9

Cohort One - 2022 Start	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman			15	13	11
External Transfer students (assumed Jr standing.)			0	0	0
Internal Transfers (UWM, but NOT CEAS)			0	0	0
			15	13	11

Cohort One - 2023 Start	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman				20	17
External Transfer students (assumed Jr standing.)				0	0
Internal Transfers (UWM)				0	0
				20	17

Cohort One - 2024 Start	Year 1	Year 2	Year 3	Year 4	Year 5
Incoming freshman					20
External Transfer students (assumed Jr standing.)					0

Internal Transfers (UWM)	0
	20

COST AND REVENUE PROJECTIONS NARRATIVE – Additional Document #2 (Word format)

Introduction

The BA CS assumes normal UWM tuition and a standard CEAS tuition differential charge of 20.83 a credit. We assumed 80% instate tuition and 20% out of state tuition, on par with actual CEAS experience.

Section I – Enrollment

It is anticipated that 10 existing students will switch out of the existing B.S. Computer Science (BSCS) program in the first two years so that they can graduate more easily. The assumption is that starting at a low level, intake eventually reach 20 new students each year entering the program. The average student retention rate is conservatively projected using the (more rigorous) CEAS program of 85% in year 2, 72% in year 3, 61% in year 4 and 52% in year 5.

Section II – Credit Hours

The BA in CS will not require new classes to teach, but will integrate the BA students in to current classes for the BS in CS degree. It is anticipated that in year 1, 3 new sections will be needed rising to 12 in year 5.

Section III – Faculty and Staff Appointments

As this program will utilize current CEAS classes and sections, no new staff need be added until enrollments require the addition of extra sections. We are predicting that to occur in year 5. Until then, we has showing 1 FTE of current instructional staff being allocated to this program.

Section IV – Program Revenues

Tuition Revenues: Current UWM tuition was used on a per FTE basis, assuming a low 24 credits per FTE (2 semesters of 12 credits).

Program/Course Fees: As noted above, a CEAS differential tuition of 20.83 per credit was applied to the credits attributed to CEAS.

Section V – Program Expenses

Describe any new costs to the institution associated with the new program.

Expenses – Salary and Fringe: In the first four years, the cost of 4 sections at $5,000 each are allocated to this program. That is the going rate in the College for an adhoc to teach the class. In the 5th year, one CS faculty is added at a salary of $90,000. A fringe rate of 41% is added to all the salaries.

Other Expenses: No other expenses are specifically cited.

Section VI – Net Revenue

Positive revenue will attribute to the College and be used to help offset budget reductions or simply go to normal college operations.