University of Louisville
New Academic Program Proposal Template

Undergraduate, Graduate, and Professional Programs

After approval of the Letter of Intent, programs are to complete the New Academic Program Proposal template. There is a separate template for certificate credentials.

All forms are available at:

http://louisville.edu/oapa/new-academic-program-approval-page/new-academic-program-approval

Please ensure all questions are addressed clearly and completely to avoid unnecessary delays. Questions can be directed to the Office of Academic Planning and Accountability through the Program Approval Service Account (PROGAPPR@louisville.edu).

Send the following materials to the
Program Approval Service Account (PROGAPPR@louisville.edu):

- This Completed Proposal Template
- Proposed Program Curriculum
- Course syllabi for any new course offerings
- Faculty Roster Form
- CV for Program Director/Coordinator
- Course Template Form
- Proposal Budget Form
- Letter of Support from the UofL Libraries
- Letter of Support from the unit Dean
- Letter(s) of Support from any units, departments, or internal or external entities that have indicated their support for the program

The program approval process will not begin until all of the above documents are received. Please submit all materials listed above at the same time.

General Program Information

Program Name:	Bachelor of Arts in Computer Science (BACS)
Degree Level:	Undergraduate
Date:	3/13/2020
Department and Department Chair:	Computer Science and Engineering (CSE) Dr. Wei Zhang

School/College:	J. B. Speed School of Engineering
Program Director and Contact (if different); (please also include title):	Dr. Wei Zhang, Professor
CIP Code:	11.0701
Program Type (collaborative, joint, or single institution):	Single Institution
Is this program an advanced practice doctorate:	No
Number of Credit Hours required:	120
Accreditation or Licensure Requirements (if applicable):	SACS
Is an approval letter from the Education Professional Standards Board (EPSB) required for this program? **If so, attach a copy to this proposal.**	No
(Tentative) Institutional Board Approval Date:	April 2021
Proposed Implementation Date (semester and year):	Fall 2021
Anticipated Date for Granting First Degree:	Summer 2025

A. Centrality to the Institution's Mission and Consistency with State Goals

A program will adhere to the role and scope of the institution as set forth in its mission statement and as complemented by the institution's strategic plan.

1. Provide a brief description of the program. (copy the abstract provided in the program's Letter of Intent here).

(250 words or less; program's purpose/focus, primary areas of study, intended audience, academic level—undergraduate, graduate, or professional, length of the program, goals/objectives, rationale for program, skills or knowledge that students will acquire, relationship of program to general field). This description will be used for external reporting and should provide a concise programmatic overview.

CPE Instructions: *The succinct program description should be readily understandable to a constituent who is not familiar with the proposed discipline.*

The proposed Bachelor of Arts (BA) in Computer Science (CS) degree is in response to the existing need for technical jobs throughout the industry in Louisville and Kentucky as a whole. The structure of the program offers the students a chance not only to become well-equipped computer scientists but also to excel in other areas of studies that will match the students' interests. It will fulfill the demand in careers that rely on computer science and broad knowledge in application areas. The

program is designed to be eight semesters long with two co-ops (or internships) in between. The credit hours of the program cover the required thirty-one credit general education requirements, two hours earned from the co-ops (internships), a minimum of fifty-seven hours in the field of computer science and an additional minimum of thirty hours in other areas of study (OAS). A mutual agreement has been made between the Speed School of Engineering (CSE Department) and the Business School (CIS Department) that business is excluded from the OAS for the BACS program. Allowing students to choose other areas of studies that are not necessarily tied to sciences or engineering will make this degree attractive to students with leanings towards fields in liberal arts and the desire to work in a technically savvy industry. This degree should attract students directly from high schools, pre-engineering students, transfer students, and existing graduates with skills in other disciplines seeking to expand their knowledge and seek a future in a technical career. The program is also designed to leverage the expertise and infrastructure in existence in the Department of Computer Science and Engineering (CSE).

2. Explain how the proposed program relates to the institutional mission and academic strategic plan.

CPE Instructions: *Describe how the program will address the institution's mission and strategic goals. Highlight which areas of the institutional plan will be furthered through implementation of this program.*

Offering this degree will contribute to the university's mission by teaching an academically and professionally diverse undergraduate student body for the purpose of developing engaged and productive citizens, and thus providing engaged service to improve the quality of life locally and globally. The program will attract groups of students who have a strong and parallel interest in fields other than computer science and will give them a chance to utilize some of the course work they may have already completed in computational applications. This education path coupled with the opportunity to move in a technologically desired direction will improve student retention. Specifically, the proposed degree will help implement some of the strategic actions stated in the university's 2019-2022 strategic plan, including "Attract and enroll a capable, diverse, and engaged student body responsive to the demographic and workforce needs of the future"; "Improve retention and persistence to graduation and ensure progress toward equal outcomes for underrepresented, underprepared, low-income student sub populations"; "Inspire a student-centered culture by improving the efficiency and user experience of our systems and the faculty and staff's responsible ownership of student success"; and "Create a high quality, industry-focused, core skills certification that students can use as an employment tool alongside their academic credential when they graduate." This will enhance the health and well-being of our citizens since it prepares these students to create and apply this newly acquired knowledge and excel in a global economy and culture.

3. Explain how the proposed program addresses the state's postsecondary education strategic agenda.

http://cpe.ky.gov/ourwork/strongerbydegrees.html

CPE Instructions: *The state's strategic plan for postsecondary education focuses on the areas of opportunity, success, and impact. Identify which areas and specific policy objectives your program will address.*

Opportunity: Encourage more people to take advantage of postsecondary opportunities

Our current Bachelor of Science in Computer Science and Engineering (BS CSE) focuses on the computer science application in the fields of science and engineering, which requires more basic science and engineering courses. By comparison, the BACS program focuses on the application of computer science in areas other than science and engineering, which provides more flexibility in terms of elective courses for students to learn both computer science and another area of study. By doing so it provides the opportunity for students with diverse background and interests to learn computer science and its application in other areas.

Moreover, the BS CSE program emphasizes both computer science (software) and computer engineering (hardware), and students need to complete the required courses in both hardware and software to meet the degree requirement. The proposed BACS program, on the other hand, focuses on computer science (software), with a new course to cover the interface between software and the underlying hardware. While BACS students can still take computer hardware courses as electives, they are not required to do so if they are not interested in studying hardware in details. This can broaden the opportunities for students who are primarily interested in learning software and its applications. This also matches the increasing need of graduates and high-tech workforce in software development by industry in Louisville and our region.

Success: Increase degree and certificate completion, fill workforce shortages, and guide more graduates to a career path

There is a shortage of computer science graduates in the Louisville workforce. The proposed BACS program will produce more graduates in this field. Due to the flexibility of this program, it may also be a good choice for professionals who are looking for a second or completer degree. The CSE Department is working with the Speed School and Delphi Center to provide professional development opportunities for our faculty and to improve students' retention and graduation rates.

Impact: Improve the career readiness and employability of postsecondary education graduates

This will increase the capability for more students to succeed in fields requiring substantial knowledge in computer science while mastering other disciplines. This will positively impact the quality of the graduates of this program which will no doubt lead to stronger technical workforce, more economic growth and development, and make the city of Louisville and our Commonwealth more prosperous.

4. Explain how the proposed program furthers the statewide implementation plan.

http://cpe.ky.gov/ourwork/strongerbydegrees.html (click on "Publication"; the implementation plan begins on p. 19 of the document)

Adequate Funding: The new BACS degree requires only five new courses from the existing BS CSE degree program. The program will leverage the existing infrastructure and courses already in existence at the Department of Computer Science and Engineering since a significant majority of the computer science courses are already offered by the CSE program. In addition, the program requires a significant number of credit hours to be taken outside of the CSE department. These courses are referred to as other areas of studies and will be courses offered by departments that are already at the university, business excluded. Therefore; this program will be extremely efficient in its utilization of resources that are already available and will improve their overall use.

Accountability: The Department of Computer Science and Engineering and J.B. Speed School of Engineering are adequately equipped to be fully accountable for the program and to do so in a fashion that is collaborative to ensure that the common goals of the Commonwealth are addressed. We will use the state and UofL metrics to guide our progress. As an example, the efficient use of assets will result in a lower service cost per student, while the admission requirements will increase accessibility and enrollment. These two aspects are critical to the Commonwealth of Kentucky, the University of Louisville, and the general student body. Leveraging existing infrastructure will allow for the absorption of students at a low marginal cost. The net effect is that this will lower the cost of service per student.

Outcomes-based Funding: J.B. Speed School of Engineering and the Department of Computer Science and Engineering through the BACS program will seek to increase student population, retention and graduation rates of this program. Aggressive recruitment and retention policies along with retention-driven resources will serve to this increase of important state-identified, student-related outcomes.

Measures of Progress: As per the "STATE-LEVEL METRICS", the key measures of progress are identified as: (1) Percent of recent Kentucky high school graduates entering postsecondary education within the state who met statewide readiness standards, and (2) Percent of Kentuckians ages 25-64 enrolled in a Kentucky postsecondary institution. The proposed BACS degree program is designed to contribute to both measures by (1) providing recent Kentucky high school graduates with different interests (other than the traditional engineering) the opportunity to study computer science and (2) making the program attractive to students from other disciplines and the existing workforce members desiring to change careers.

Progress Reports: Progress reports will be based on the key metrics and are to be generated annually. The key metrics utilized will be the program retention rates, the number of students who graduate from the program, and starting salaries and/or wages of graduates, among others.

Campus Strategic Plans: The proposed BACS degree program is consistent with elements of the University of Louisville's strategic plan (http://louisville.edu/graduatecatalog/mission-statement).

The program is designed to: (1) Attract new students to the university, (2) serve existing students, and meet the employment needs of local and state-wide businesses and industries.

5. List the objectives of the proposed program.

a. Explain how the objectives deal with the specific institutional and societal needs that this program will address.

b. Explain how the proposed program relates to the institutional mission and academic strategic plan.

CPE Instructions: *These objectives should deal with the specific institutional and societal needs that this program will address. Societal needs encompass social, economic, environmental, and other needs at the local through global levels. Please note that "program objectives" are not synonymous with "student learning outcomes."*

Describe how the program will address the institution's mission and strategic goals. Highlight which areas of the institutional plan will be furthered through implementation of this program. The state's strategic plan for postsecondary education focuses on the areas of opportunity, success, and impact. Identify which areas and specific policy objectives your program will address.

This program is designed to provide the students a solid foundation and hands-on skills in computer science while allowing them to develop additional skills in other areas such as liberal arts, humanities, education, or sciences, excluding business. This is consistent with the Speed School of Engineering's mission, that is to serve the University, the Commonwealth of Kentucky, and the engineering profession by providing high quality educational programs to all students. The proposed BACS program is built on the rigorous computer science courses of the ABET-accredited BS CSE program, while allowing students with different interests to study a broad range of electives from both computer science and other areas of study. The BACS program, through different admission requirements, will allow the Speed School of Engineering to serve a large number of academically diverse student populations, fulfilling our mission to provide high quality educational programs to all students. This is also consistent with the UofL's mission of "teaching diverse undergraduate, graduate, and professional students in order to develop engaged citizens, leaders, and scholars". The BACS students will master techniques in programming, data structures, algorithm design, software systems, computer applications, database design and development, among others. They will be able to meet the technological needs of various industries such as manufacturing, health care, and various service sectors, and become engaged citizens and leaders in their fields. With the widespread use of computer technology in virtually all aspects of our society, there is an increasing need for more computer science graduates with skills in both computing and application areas, as well as a correspondent need for a diversified computing workforce. The proposed BACS program can address both these societal needs by producing more BACS graduates among diverse student populations.

6. Clearly state the admission, retention, and degree completion standards designed to encourage high quality.

This information will be viewed by an external audience, so please be clear and specific.

CPE Instructions: *Be as detailed as possible and address all three components – admission, retention, and completion.*

Admission Requirements:
The freshman admission into this program requires a high school GPA of 3.0 or above, an ACT composite score of 23 or above, and an ACT Mathematics score of 23 or above (SAT 560 or above). Students with fewer than 24 transferable semester hours can be accepted to the program if they meet the freshman admission standard and have a minimum college GPA of 2.8. Students with 24 hours or more transferable semester hours must have a minimum college GPA of 2.8 and at least a B-grade in Math 111. The program requires a minimum"C-" grade for any transferred course to be accepted as credit toward a degree.

Retention Plan and Standards:
Students must maintain a 2.25 cumulative GPA to remain in good standing. In order to make progress toward completion in four years, students should adhere to the advising Flight Plan (Curriculum Check-off Sheet) in order to make progress towards the degree. J. B. Speed School of Engineering where this program is housed has a comprehensive retention plan which includes assigned, proactive advising, in-house career planning, and an in-house student success center.

The Office of Student Success was established in 2014 with the goal of increasing retention and graduation rates for the Speed School of Engineering. This office oversees academic advising and provides academic services, community outreach, diversity initiatives, and co-curricular student growth opportunities. Staff in the office work closely with other Speed School academic and student affairs offices, including admissions and co-op and career services, to provide a Speed-specific support network. The office is led by the Director of Student Success, who supervises three assistant directors responsible for specific areas contributing to the overarching student success goals. The Assistant Director of Advising supervises seven professional academic counselors, all of whom hold a master's degree and participate in ongoing training and professional development.

Students are required to meet with their academic counselor a minimum of twice per year – once in the fall semester to discuss the coming spring semester, and once in the spring semester to discuss the coming summer and fall semesters. Generally, these appointments are conducted in person, though an exception is made for students out on a co-op rotation. These students "meet" with their academic counselor via email or phone. Should student questions or concerns arise outside of their two required advising appointments, academic counselors are also available to their students year-round on a walk-in basis and via email and phone.

At each advising appointment, advisors ask about the current semester, and depending on how the student is faring, refer to various support services if needed. They also discuss the courses the student should add for the coming semester, including which ones are critical to their degree progression. They answer questions, address concerns, and clarify academic policies and

procedures for their students. Advisors use a variety of tools to inform their conversation with the student, including but not limited to the Excel flight plan, Flight Planner, CardSmart, and PeopleSoft. At the conclusion of the appointment, advisors release the advising hold on the student's account. This hold prevents the ability to register, so it is only removed after a student has completed their required advising appointment.

Graduation Requirements: The BACS students must satisfy all university cardinal core requirements and complete all required courses and program requirements, a minimum of 120 earned credit hours, with at least 60 hours at a 4-year school. Students must have a cumulative university GPA of at least 2.25 and a cumulative program GPA of at least 2.25 and have neither missing nor outstanding "I" or "X" grades. Students must be formally recommended for the Bachelor of Arts degree in Computer Science by the J.B. Speed School of Engineering Faculty Assembly and by the Dean and must be approved for the degree by the Board of Trustees.

7. Clearly state the degree completion requirements for the program.

This information will be viewed by an external audience, so please be specific.

CPE Instructions: *Include all completion requirements, including any capstone courses, practicum experiences, etc.*

Graduation Requirements: The BACS students must satisfy all university cardinal core requirements and complete all required courses and program requirements, a minimum of 120 earned credit hours, with at least 60 hours at a 4-year school. Students must have a cumulative university GPA of at least 2.25 and a cumulative program GPA of at least 2.25 and have neither missing nor outstanding "I" or "X" grades. Students must be formally recommended for the Bachelor of Arts degree in Computer Science by the J.B. Speed School of Engineering Faculty Assembly and by the Dean and must be approved for the degree by the Board of Trustees.

The following table shows the 120 credit hours required for the proposed BACS program, including 31 credit hours in general education, 59 credit hours in computer science (including both required major courses and technical electives), and 30 credit hours in other area of study.

Proposed BA in CS Curriculum including Cardinal Core General Education Requirements (GER) and Other Area of Studies (OAS)

Fall 1			**Hrs**
GER	XXX	General Education Requirement	3
ENGL	101	Intro to College Writing I	3
CSE	120*	Introduction to Computer Science and Programming with Python	3
GER	XXX	MATH 180 or equivalent	3
OAS	XXX	Other Area of Studies	3
			15
Spring 1			
ENGL	102	Intermediate College Writing II (ENGL 101)	3
CSE	110*	Mathematical Foundations for BACS (ENGR 101 or equivalent)	3
CSE	130	Intro to Programming Languages in C/C++	3
GER	XXX	General Education Requirement	4
OAS	XXX	Other Area of Studies	3
			16
Fall 2			
CSE	220	OO Prog Design with Java (CSE 130)	3
CSE	235*	Computer Systems and Organization (CSE 110, CSE 130)	3
OAS	XXX	Other Area of Studies	3
OAS	XXX	Other Area of Studies	3
GER	XXX	General Education Requirement	3
			15
Spring 2			
CSE	302	Data Structures (CSE 110, CSE 130)	3
CSE	310	Discrete Structures (3rd yr)	3
CSE	335*	Intro to Databases (CSE 302 co-requisite)	3
COMM	111	Speech Communications	3
or	112	Business and Professional Speaking	0
			12
Summer 2		Co-op 1: Internship track	1
Fall 3			
CSE	350*	Introduction to Software Engineering and Application Development (CSE 302)	3

CSE	419	Introduction to Algorithms (CSE 302, CSE 310)	3
OAS	XXX	Other Area of Studies	3
OAS	XXX	Other Area of Studies	3
GER	XXX	General Education Requirement	3
			15
Spring 3			
CSE	420	Design of Operating Systems (CSE 302)	3
CSE	470	Mobile Apps Design and Development	3
CSE	XXX	CSE Elective	3
OAS	XXX	Other Area of Studies	3
OAS	XXX	Other Area of Studies	3
			15
Summer 3		Co-op 2: Internship track	1
Fall 4			
CSE	XXX	CSE Elective	3
CSE/XXX**	XXX	CSE or OAC Elective	3
CSE	XXX	CSE Elective	3
GER	XXX	General Education Requirement	3
OAS	XXX	Other Area of Studies	3
			15
Spring 4			
CSE	XXX	CSE Elective	3
CSE/XXX**	XXX	CSE or OAS Elective	3
CSE	496	BACS Capstone Design	3
GER	XXX	General Education Requirement	3
OAS	XXX	Other Area of Studies	3
			15
Credits			
			120

CSE Electives		
CSE	504	Automata Theory
CSE	516	Fundamentals of Computer Communications and Networks
CSE	522	Performance Evaluation of Computer Systems
CSE	528	Game Design and Programming

CSE	530	Design of Compilers
CSE	535	Databases Systems Design and Development
CSE	545	Artificial Intelligence
CSE	550	Software Engineering
CSE	564	Introduction to Cryptography
CSE	566	Information Security
CSE	568	Computer Forensics
CSE	590	Special Topics in Computer Science and Engineering
CSE	593	Independent Study in Computer Science and Engineering
** CSE/XXX are 6 hours of electives for the student to choose from CSE or OAC.		
GENERAL EDUCATION (Cardinal Core) REQUIREMENTS (31): Skills (12) and Disciplinary Perspectives & Diversity (19)		
XXX	XXX	Written Communication (WC)
XXX	XXX	Oral Communication (OC)
XXX	XXX	Quantitative Reasoning (QR)
XXX	XXX	Arts & Humanities (AH)
XXX	XXX	Social & Behavioral Sciences (SB) and Historical Perspective (SBH)
XXX	XXX	Natural Sciences (S, SL, B)
CSE: Computer Science and Engineering		
GER: General Education Requirements (Cardinal Core)		
OAS: Other Area of Studies (minimum of 30 Credit hours)		
Parentheses next to a course name indicate prerequisite(s) for that course		
New courses include CSE 110, 120, 235, 335, and 350; which are written in red color with a * attached to the course number.		

B. Program Quality and Student Success

1. Required credit hours. Provide the information below.

Provide a copy of the proposed program curriculum.

See the response to A.7 above.

2. Briefly describe any proposed tracks, concentrations, or specializations the program will have.

List them in the table below and provided the requested information.

None

3. Provide the following information for the program and for each track, concentration, or specialization (some categories may not apply to all programs).

CPE Instructions: *A guided elective is any elective that is part of a major. A free elective is an elective from any academic area not required for a major or minor.*

Program/Track, Concentration, or Specialization	Total number of hours required for degree	Number of hours in degree program core	Number of hours in track	Number of hours in guided electives	Number of hours in free electives
BACS	120	39	30	12	6

4. What are the intended student learning outcomes of the proposed program? Will any of these outcomes differ by track?

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 in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
5. Apply computer science theory and software development fundamentals to produce computing-based solutions.
6. Apply computer science techniques and tools to solve problems in a chosen area of concentration.

5. Explain how the curriculum achieves the program-level student learning outcomes by describing the relationship between the overall curriculum or the major curricular components and the program objectives.

The curriculum should be structured to meet the stated objectives and student learning outcomes of the program.

Complete the table below and provide a brief description here.

CPE Instructions: *You may provide a narrative and/or copy and paste a visual (chart, table, graphic) into the text box to demonstrate the relationships between course-level student learning outcomes and program-level student learning outcomes.*

Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions:

ENGR	101 or	MATH 180
CSE	110*	Mathematical Foundations for BACS
CSE	302	Data Structures
CSE	310	Discrete Structures
CSE	419	Introduction to Algorithms

Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline:

CSE	120*	Introduction to Computer Science and Programming with Python
CSE	130	Intro to Programming Languages C/C++
CSE	235*	Computer Systems and Organization
CSE	302	Data Structures
CSE	350*	Introduction to Software Engineering and Application Development
CSE	419	Introduction to Algorithms
CSE	420	Design of Operating Systems
CSE	470	Mobile Apps Design and Development

Communicate effectively in a variety of professional contexts:

COMM 111	Speech Communications or
COMM 112	Business and Professional Speaking

Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline:

CSE	350*	Introduction to Software Engineering and Application Development
CSE	419	Introduction to Algorithms
CSE	420	Design of Operating Systems
CSE	496	BACS Capstone Design

Apply computer science theory and software development fundamentals to produce computing-based solutions:

CSE	335*	Intro to Databases
CSE	350*	Introduction to Software Engineering and Application Development
CSE	419	Introduction to Algorithms
CSE	420	Design of Operating Systems

Apply computer science techniques and tools to solve problems in a chosen area of concentration:

CSE	120*	Introduction to Computer Science and Programming with Python
CSE	130	Intro to Programming Languages C/C++
CSE	235	Computer Systems and Organization
CSE	350*	Introduction to Software Engineering and Application Development
CSE	419	Introduction to Algorithms
OAS	based on a chosen area of concentration	

Note: New courses include CSE 110, 120, 235, 335, and 350; which are written in red color with a * attached to the course number.

The main objective of the proposed BACS degree program is to provide the students a solid foundation and hands-on skills in computer science while allowing them to develop additional skills in areas such as liberal arts, humanities, education, or sciences, excluding business. The

students will master techniques in programming, data structures, algorithms design, software systems, computer applications, and database design and development. They will be able to meet the technological needs of various industries such as manufacturing, health care, and various service industries. Additionally, the BACS degree program meets UofL strategic priorities of increased enrollment. The post-secondary strategic requirements are supported through increased enrollment, provision of opportunity to various student populations, and through increased efficiency and asset utilization rates.

In addition to covering all general education requirements mandated by the Commonwealth, the objective of providing computer science educational fundamentals is supported through an undergraduate computer science common core of approximately 39 credit hours, followed by 12-18 credit hours of computer science electives, and 2 credit hours of required two-semester-long co-op/internships. This is supplemented by a minimum of additional 30 credit hours of electives that are intended to be in another area of studies that interests the particular student and form a concentration in that area such as mathematics, music, visual arts ... etc., but can be from within the university at large, excluding business. The program learning objectives are mapped to the core computer science courses above. These will be coupled with the courses the students will be advised to take in the other areas of studies based on their individual interests and with the electives in the computer science area. Six credit hours of electives can be in either computer science or other areas of studies.

The curriculum is entirely consistent with the program objectives. Students will be exposed to the fundamentals of computer science and other areas of study. Students will not be required to complete a calculus course sequence required for admission to the BS CSE degree but rather will require MATH 180 or ENGR 101. A new course in mathematical foundations for BACS will be introduced. These factors combined indicate that the program will increase J. B. Speed School of Engineering enrollment and thus the university at large, specifically when transfer students are considered.

The program is focused on providing availability to a larger number of populations. This is accomplished through a curriculum that, while maintaining instruction in the computer science core, provides the students with an alternative admission flexibility by offering a limited number of new additional required credit hours. This will make this program very attractive to students not currently being served by the university, mainly those desiring a career in computer science but not meeting or desiring to go through the stringent requirements needed for engineering programs. Due to the application of computing into virtually all areas of our society – not just engineering and science, it is important to meet this demand by providing students knowledge and skills in both computer science and application fields and by increasing the number of graduates in the high-tech workforce in Louisville and beyond.

6. Complete the New Program Course Form and submit it with this proposal.

Found at: http://louisville.edu/oapa/new-academic-program-approval-page/new-academic-program-approval

- Include full course names and course descriptions.
- List courses under the appropriate curricular headings.

- Where they exist, report actual course numbers, titles, and descriptions in the course template. If the program has no specific course numbers required under a particular heading, provide a description of the type(s) of course(s) required in the "course title" column and the number or range of credit hours required in the "credit hours" column.

7. Specify/highlight any distinctive qualities of the proposed program.

CPE Instructions: *Note any factors that make the program unique (e.g. whether any faculty are nationally or internationally recognized for expertise in this field; the program builds on the expertise of an existing locally, nationally or internationally recognized program at your institution; etc).*

The major qualities of the program are:

a. The computer science core is built on the ABET-accredited Computer Science and Engineering program offered by the CSE Department of the Speed School.
b. The program offers the flexibility of choosing other areas of study and a variety of computer science electives ranging from AI, data science to cybersecurity and software systems.
c. The remainder of the program credit hours allows for a highly customizable path that the students may follow to satisfy any additional requirements that will allow them to excel in any other area of study they choose.

8. Please answer the following:

a) Will this be a 100% distance learning program? Yes ☐ No ☒ (Note that we plan to make the BACS program a 100% distance learning program one year after it starts.)

CPE Instructions: *This is defined as an academic program in which all of the required courses in a program occur when students and instructors are not in the same place. Instruction may be synchronous or asynchronous.*

b) Is an approval letter from the Education Professional Standards Board (EPSB) required? Yes ☐ No ☒

CPE Instructions: *If this program leads to teacher, principal, or superintendent certification, rank change, etc., EPSB approval should be sought after CPE approval. Upon CPE approval, the program will be entered into the statewide program inventory. You should upload a pdf of the EPSB approval letter to the program's entry in the program inventory.*

c) Will this program utilize alternative learning formats (e.g. distance learning, technology-enhanced instruction, evening/weekend classes, accelerated courses)? Yes ☒ No ☐

If yes, please check all that apply below.

☒ Distance Learning

☐ Courses that combine various modes of interaction, such as face-to-face, videoconferencing, audio-conferencing, mail, telephone, fax, e-mail, interactive television, or World Wide Web

- ☐ Technology-enhanced instruction
- ☐ Evening/weekend/early morning classes
- ☐ Accelerated courses
- ☐ Instruction at nontraditional locations, such as employer worksite
- ☐ Courses with multiple entry, exit, and reentry points
- ☐ Courses with "rolling" entrance and completion times, based on self-pacing
- ☐ Modularized courses

The distance learning will provide additional opportunities for students who may not be able to take the regular face-to-face classes at the scheduled times.

9. Will this program replace or enhance any existing program(s) or tracks, concentrations, or specializations within an existing program? Yes ☐ No ☒

CPE Instructions: *If so, please explain which programs will be enhanced or eliminated as a result of the proposed program.*

10. How will the program support or be supported by other programs and/or units within the institution? Please also describe potential for collaboration with other programs within the institution.

CPE Instructions: *Explain any shared faculty, shared courses, collaborative research, etc.*

- The program will require 32 credit hours of general education requirements. These will be supported by various departments such as Communications, English, and Mathematics.
- Both the core and the elective CSE courses, which consists of 57 credit hours, will be supported by the Computer Science and Engineering department of J.B. Speed School of Engineering.
- An additional minimum of 30 credit hours designated as Other Area of Studies will be supported by departments in different schools at the university, business excluded. For example, if a student wishes to take most of these 30 hours in biology, then the dependency will be on the Department of Biology at the College of Arts and Sciences. In this case, the student can also choose to pursue a Minor in Biology, which is already available. Please see the supporting letter from the Dean of Arts and Sciences.
- Graduates from the BACS program will be able to apply for graduate programs in the CSE Department such as the MS in CS, the graduate certificate in data science, and the graduate certificate in cybersecurity, as well as interdisciplinary programs that integrate computer science with another area of study.
- The potential for collaboration will arise in cases when a student or a team of students might want to work on a project (e.g., capstone) that overlaps over CSE discipline and the other area of studies. This might involve the collaboration between faculty across units to supervise such a project.

11. Are new or additional faculty needed? Yes ☒ No ☐

a) If yes, please explain, indicating the number and role of each new faculty member and whether they will be part-time or full-time. Specify if part-time faculty or graduate assistants are included in the additional faculty resources needed.

CPE Instructions: *If new faculty are indicated, please ensure that related expenses are noted in the proposed budget.*

b) If yes, please provide a plan to ensure that appropriate faculty resources are available, either within the institution or externally, to support the program.

CPE Instructions: *Faculty resources should be adequate and appropriate for the proposed program. The qualifications of faculty should support the objectives and curriculum of the proposed program.*

c) What is the projected faculty/student ratio for the program?

CPE Instructions: *Provide an estimate based on expected enrollment.*

The BACS students will take many of the same General Education and Computer Science courses as our current BS CSE students, and we expect that the increase of 40 BACS students estimated for the first year can be accommodated in those shared courses. However, for computer science courses that have lab sessions or are programming-intensive, we request 1 additional graduate teaching assistant (GTA) per year for Years 1 to 4, including stipend ($22,000/yr), tuition ($20,475/yr), and health insurance ($254.67/month). These GTAs will also help in additional class sections that are needed as the BACS enrollment increases.

With respect to 5 new courses to be developed for the BACS program, we request an amount of $40K (including $16K in Year 1, and $24K in Year 2) as x-pay to current faculty to compensate their course development efforts at a rate of $8,000 per course. As the BACS program grows, we estimate to need at least three additional faculty (1 term faculty in Year 2, 1 term faculty in Year 3, and 1 tenure-track faculty in Year 4) to teach those courses or additional class sections. Funds for 1 term faculty starting from Year 2 and Year 3 include a 12-month salary of $80K and fringe at 28.5% with a 3% annual raise. Funds for a tenure-track faculty starting from Year 4 include a 9-month salary of $95K and fringe at 28.5% with a 3% annual raise. These faculty will need new office space and/or lab space.

As the BACS student enrollment increases, we expect to need additional academic and student affairs support. We estimate to need a 50% student recruiter ($20K) in Year 1, an academic advisor (40K) in Year 2, and a 75% co-op advisor ($30K) in Year 2.

It should be noted that with the projected enrollment of the program and the tuition revenue generated, we expect the tuition revenue will cover these additional resources within our unit (while providing additional tuition revenues for other units), which will be detailed in the New Program Budget Spreadsheet attached.

The speed school has 2,700 students and 122 full-time faculty in fall 2019, so the student-faculty ratio is 2700/122 = 22.1. With the projected BACS enrollment increase and the additional faculty members, the student-faculty ration of the program is expected to become 229/(16+3) = 12 in Year

5. However, it should be noted that the BACS faculty are also involved in the current BS CSE program. The student-faculty ratio of the entire Speed School with the addition of the BACS program is expected to be (2700+229)/(122+3) = 23.4 by Year 5, which only increases slightly.

12. Complete the SACS Faculty Roster Form found at the link below and submit it with this proposal.

Found at: http://louisville.edu/oapa/new-academic-program-approval-page/new-academic-program-approval

Also submit a copy of the program director's CV.

The Faculty Roster Form and the program director's CV are attached.

13. Is there a specialized accrediting agency related to this program? Yes ☐ No ☒

a. If yes, please identify the agency.

b. If yes, will the program seek accreditation?

14.a. Describe the library resources available to support this program.

Please also submit a letter of support from the UofL Libraries.

Access to the qualitative and quantitative library resources must be appropriate for the proposed program and should meet recognized standards for study at a particular level or in a particular field where such standards are available. Adequacy of electronic access, library facilities, and human resources to service the proposed program in terms of students and faculty will be considered.

A letter of library support is provided in a separate document to this package.

b. Describe the physical facilities and instructional equipment available to support this program.

Physical facilities and instructional equipment must be adequate to support a high-quality program. The proposal must address the availability of classroom, laboratory, and office space as well as any equipment needs.

An analysis of resource utilization shows that the CSE department and J.B. Speed School of Engineering possess sufficient classroom space and technology to support the proposed BACS program (though new office and lab space will be needed for new faculty). The CSE department currently houses 16 tenured or tenure-track full-time faculty, and three full-time term faculty. The department has two staff members. It has access to 10 classrooms in the engineering campus and four computer labs in Duthie Center of Engineering. Classrooms range in size from a seating capacity of 20 to 200. All classrooms are equipped with modern technology. The department also uses other classrooms in the new Belknap Academic Building and others building in Belknap campus. The labs range in size from 6 computers to 40 computers.

C. Program Demand/Unnecessary Duplication

Market Demand

1. Explain why this program is needed. Note if it replaces another program on campus.

This is an open-ended response that will be used in CPE agenda items. Remember that your audience is CPE, not higher education administrators, faculty, or staff.

Computer Science is changing every part of our lives, and it is not surprising that it is the number one source of all new wages in the U.S. economy. According to the U.S. Bureau of Labor Statistics, computing occupations constitute 58% of all projected new jobs in STEM fields based on their 2016-2026 employment projections, and currently there are more than 500,000 open computing jobs in the U.S. (Source: http://bit.ly/38OMyHK). This shortage is clearly reflected in H1B visa statistics as well, where 59% of H1B "skilled worker" visas were granted for computer science occupations in 2014, according to the U.S. Department of Labor, Office of Foreign Labor Certification (Source: http://bit.ly/2EmDonY).

In addition to the national shortage in a computing workforce, the local industry in Louisville also suffers from a tech shortage, based on a recent article published in Louisville Business First journal, the leading source for business news, data and networking for the Greater Louisville area (For more information, see: https://www.bizjournals.com/louisville/). In their June 28, 2019 article, editor David A. Mann interviewed with local leading companies in the Louisville area to find out what they are doing to meet their tech needs in the Louisville region. The editor found out that according to KentuckianaWorks, a local workforce development company, there are about 2,750 tech job postings in Louisville, and the tech sector itself needs the most workers. In addition, Norton Healthcare Inc. stated in this interview that they need a major workforce to develop apps and clinical technology in Louisville, as well as maintain electronic medical records; however, the pool of resources within this region is shallow. GE Appliances, Kindred Healthcare LLC, Humana Inc., and Interapt LLC are among other Louisville based companies who shared a similar view regarding the shortage in local tech talent. For more information and details, the full article can be accessed at: http://bit.ly/34udEke.

Unlike technical companies such as Google and Microsoft, which focuses on the computing technology itself, many computer science related jobs in Louisville and elsewhere require the application of computer science skills into different fields. The proposed BACS program will fill this important void by providing students the opportunity to learn both computer science and another area of study where computer science has significant application. Compared to the current BS CSE program that focuses on the engineering and science application of computer science, the proposed BACS program targets the application of computer science in areas other than engineering and sciences, which are abundant in Louisville and elsewhere. In addition, the BACS program is expected to attract students from underrepresented groups, thus potentially increase the diversity in high-tech workforce in Louisville and beyond.

The proposed BACS program does not replace another program on campus.

Student Demand

2. a. Provide evidence of student demand at the regional, state, and national levels.

Evidence of student demand is typically in the form of surveys of potential students or enrollments in related programs at the institution, but other methods of gauging student demand are acceptable.

CPE Instructions: *Explain how faculty and staff systematically gathered data, studied the data and estimated student demand for the program. Anecdotal evidence is not sufficient. If student surveys have been collected, provide information regarding sample size, sampling methodology, and response rate.*

According to the National Association of Colleges and Employers, computer science is the second highest paid college degree, just after mechatronic engineering graduates, and graduates studying computer science enjoyed the highest (76%) full-time employment rate in 2015. According to Horizon Media's WHY group survey, 50% of Americans rank computer science as one of the most important subjects to study. In addition, based on a study partnered by Gallup and Google, 91% of parents want their child to learn more computer science in the future; however, the National Center for Education Statistics (NCES) states that currently only 10% of STEM graduates study Computer Science. A summary of source data for all aforementioned statistics can be found at the following webpage: http://bit.ly/2YUgxcM. For student demand, faculty and staff relied on surveys performed by the National Center for Education Statistics available at the above source.

In addition, the BACS program can serve the pre-engineering students who are interested in learning computer science and meet our admission requirements. Based on the data we have in March 2020, among all the pre-engineering students who are admitted for the fall semester of 2020, 106 students have their composite and math ACT scores of 23 or above, and GPA of 3.0 or above, thus meeting the BACS admission requirements.

b. Identify the applicant pool and how students will be reached.

CPE Instructions: *If an undergraduate program, please provide information regarding plans to reach first-time freshman and other native students, as well as transfer students.*

One group of prospective students will be those who have completed a high school degree, and they can be reached in collaboration with the University of Louisville's and the J.B. Speed School of Engineering's undergraduate recruitment efforts, including the online advertisement, high school visits, and the J.B. Speed School of Engineering summer camps and enrichment programs. More information about our college-level outreach programs can be found at the following page: https://engineering.louisville.edu/experiencespeedschool/outreachprograms/

Another group of prospective students will be the ones who are part of the Kentucky Community and Technical College System (KCTCS). Students in the KCTCS system will be contacted via the Recruitment Fairs on the KCTCS campuses as well as communications through the Ultra program and the advising centers on the KCTCS campuses.

The College will work closely with the Speed Admissions Office, regional recruiters, and our out-of-state recruiters through the State admission platform. In addition, since we plan to make the BACS a 100% online program one year after the program starts, we will work with the Delphi Center to make the online advertisement and recruiting efforts to attract online students, especially adult learners or professional who would like to get a second or completer degree, or to reskill or upskill themselves for computer science related jobs.

c. Describe the student recruitment and selection process.

CPE Instructions: *Describe the processes for recruitment and the admission criteria for both native and transfer students.*

Student recruitment will be performed through the University of Louisville's and the J.B. Speed School of Engineering's existing undergraduate recruitment efforts, as mentioned in Section C.2.b. Admission into this program requires a high school GPA of 3.0 or above, an ACT composite score of 23 or above, and an ACT Mathematics score of 23 or above. Students with fewer than 24 transferable semester hours are considered in a similar fashion as freshmen students and must meet the admissions requirements for new freshmen and have a minimum college grade point average of 2.80. Students with 24 hours or more transferable semester hours must have a 2.80 college grade point average and at least B- grade in Math 111. The program requires a minimum "C-" grade for any transferred course to be accepted as credit toward a degree.

d. Identify the primary feeders for the program.

CPE Instructions: *List the colleges, schools, programs from which students for this program will be recruited.*

The primary feeders of the program will be local high schools, including DuPont Manual, Male, Central High, other JCPS high schools, regional and nationwide high schools, pre-engineering students, as well as local and nationwide community colleges in KCTCS such as Jefferson Community & Technical College (JCTC).

e. Provide any evidence of a projected net increase in total student enrollments to the campus as a result of the proposed program.

CPE Instructions: *Explain how the program is designed to increase the overall institutional enrollment.*

To the best of our knowledge, the proposed BACS is first of its kind among public universities in Kentucky, which is expected to attract students from the entire Commonwealth and neighboring states. In addition, the University of Louisville is expanding efforts to attract out of state and international students. The addition of the BACS degree would make the J.B. Speed School of Engineering more competitive with other regional and out-of-state institutions. Once the online BACS program is launched, we also expect to attract more students online who can be from either in state or out of state.

f. Project estimated student demand for the first five years of the program.

Academic Year	Degrees Conferred	Majors (Headcount) Fall Semester
2021-2022	-	40 new, total: 40
2022-2023	-	60 new, total: 92
2023-2024	10	70 new, total: 146
2024-2025	20	80 new, total: 202
2025-2026	30	80 new, total: 229

The above projections are based on our experience and discussions with Speed Admissions. These numbers reflect the belief that a significant number of students enrolled in the BACS in early years will be from the pre-engineering students and transfer students from community colleges.

Employer Demand

3.a. Describe the types of jobs available for graduates, average wages for these jobs, and the number of anticipated openings for each type of job at the regional, state and national levels.

CPE Instructions: *If the program is being proposed to meet employer demand, provide evidence of this within your area of geographic responsibility as well as the state and national levels. The following are links to helpful resources on employer demand statistics.*

- *Kentucky Center for Education and Workforce Statistics*
- *Bureau of Labor Statistics: Employment Projections*
- *Bureau of Labor Statistics: Occupational Outlook Handbook*

Employer demand was assessed through an analysis of various job types identified in the Bureau of Labor Statistics' Employment Projections handbook for nation-wide jobs, Education and Workforce Development Cabinet's Kentucky Occupational Outlook handbook for state-wide jobs, and KentuckianaWorks's Occupational Outlook handbook for the Louisville region. These jobs types are: (1) Computer Systems Analysts; (2) Software Developers, Applications; (3) Software Developers, Systems Software; (4) Web Developers; (6) Database Administrators; (7) Network and Computer Systems Administrators; (7) Computer Network Architects; (8) Computer User Support Specialists; (9) Computer Network Support Specialists; (10) Computer Occupations, All Other. See the provided table in Appendix A, including the average wages of these jobs, and the number of anticipated opening for each job at the regional, state, and national levels.

Employer Demand

3.b. If the program is designed for students to enter the workforce immediately, please complete the table below.

- Indicate source of market demand information and timeframe for growth projections.
- Add more rows to the table as needed.

Most of the current Bureau of Labor Statistics projections are for 2016-2026. Other sources include; but are not limited to:

- Georgetown University Center on Education and the Workforce
- Bureau of Labor Statistics' Occupational Outlook Handbook
- Kentucky Center for Statistics
- KY Chamber, "Kentucky's Workforce, Progress and Challenges," January 2018
- https://www.kychamber.com/sites/default/files/Kentuckys%20Workforce%20Progress%20and%20Challenges%202018%20Final%20NEW.pdf
- Kentucky, Bridging the Talent Gap
- Document - https://www.bridgingthetalentgap.org/wp-content/uploads/2017/05/KY-Statewide.pdf
- Interactive website: https://bridgingthetalentgap.org/dashboards/

Type of Job	Regional Avg Wage	Regional # of openings	Regional Growth Projections (%)	State Avg Wage	State # of openings	State Growth Projections (%)	National Avg Wage	National # of openings	National Growth Projections (%)
Computer Systems Analysts	$73,904	1,693	10%	$75,381	3,248	10.5%	$ 88,740	53,400	8.8%
Software Developers, Applications	$81,851	3,650	23%	$80,322	5,567	33.4%	$ 103,620	99,200	25.6%
Software Developers, Systems Software	$86,020	999	15%	$86,915	1,835	21.7%	$ 110,000	35,400	10.1%
Web Developers	$69,431	511	10%	$58,095	1,218	17.8%	$ 69,430	15,100	13.0%
Database Administrators	$85,970	439	8%	$72,282	936	14.5%	$ 90,070	9,700	9.0%
Network and Computer Systems Administrators	$66,863	941	9%	$63,644	2,335	6.8%	$ 82,050	29,300	4.7%
Computer Network Architects	$83,282	445	11%	$75,928	1,265	12.2%	$ 109,020	12,200	5.3%
Computer User Support Specialists	$44,496	2,440	9%	$46,986	4,961	15.8%	$ 50,980	65,100	10.6%
Computer Network Support Specialists	$58,016	689	10%	$56,779	1,354	17.2%	$ 62,770	17,400	6.4%
Computer Occupations, All Other	$77,329	1,333	11%	$80,231	2,157	10.8%	$ 90,270	35,700	10.2%

***Source** (Regional - Louisville): KentuckianaWorks, Occupational Outlook for the Louisville Region, August 2019. (Time Frame: 2019-2029)*
***Source** (State): Education and Workforce Development Cabinet, Kentucky Occupational Outlook to 2026, September 2018. (Time Frame: 2016-2026)*
***Source** (National): Bureau of Labor Statistics, Employment Projections, Table 1.7. (Time Frame: 2018-2028)*

Employer Demand

3.c. Clearly describe evidence of employer demand.

Such evidence may include employer surveys, current labor market analyses, and future human resources projections. Where appropriate, evidence should demonstrate employers' preferences for graduates of the proposed program over persons having alternative existing credentials and employers' willingness to pay higher salaries to graduates of the proposed program.

Evidence of employer demand is provided in the following links for regional, state, and national employers separately:

- **Regional (Louisville):** KentuckianaWorks, Occupational Outlook for the Louisville Region, August 2019. (Time Frame: 2019-2029). There were 2,735 job posting in information technology in the second quarter of 2019 alone. In 2019, there were 3,650 jobs in software developers and applications that require a bachelor's degree for entry-level jobs, for which the BACS students would be a good match. In addition, there were 2,226 computer systems analysts, 1,333 computer occupations, 1,198 system software developers, 699 computer programmers, 590 database administrators, 441 information security analyst jobs in 2019. The BACS program will be able to graduate more students to meet the demands of those jobs available in Louisville alone. More details of the data can be seen at the following link.
    - **http://bit.ly/2TtJ9Zh**
- **State (KY):** Education and Workforce Development Cabinet, Kentucky Occupational Outlook to 2026, September 2018. (Time Frame: 2016-2026). The Commonwealth of Kentucky predicts a 14.9% increase of Computer and Information Systems Managers jobs, and 15.9% increase of all computer occupations in Kentucky, including computer systems analysts, computer programmers, software developers, application developers, system software developers, web developers, database administrators, etc. Given that UofL has many in-state students, the BACS program may benefit the Commonwealth of Kentucky in general, and Louisville in particular. More state data can be seen at the following link.
    - **http://bit.ly/2wExbD6**
- **National:** Bureau of Labor Statistics, Employment Projections, Table 1.7. (Time Frame: 2018-2028). The BoLS data indicates that the national growth of software and application developer jobs is expected to be 25.6%, which is significantly higher than all other computer occuaptions. Therefore, there will be significant employer demand of BACS graduates national-wide. More national data can be seen at the following link.
    - **http://bit.ly/3cCkwBo**

Academic Demand

4. If this is not a program that is designed for students to enter the workforce immediately after graduation, please indicate the skills that graduates will attain, the types of graduate programs the graduates are most likely to attend, and the types of jobs graduates will eventually seek.

This is a program designed for students to enter the workforce directly after graduation. However, Graduates from the BACS program will also be able to apply for graduate programs in the CSE Department such as the MS in CS, the graduate certificate in data science, and the graduate certificate in cybersecurity, as well as graduate computer science programs at other institutions. In addition, BACS graduates can apply for interdisciplinary programs that integrate computer science with another area of study.

5. Academic Disciplinary Needs:

If the program proposal is in response to changes in academic disciplinary need, as opposed to employer demand, please outline those changes. Explain why these changes to the disciple necessitate development of a new program.

CPE Instructions: *If the program is being proposed to meet changes in the academic discipline, please outline those changes and explain why they necessitate development of a new program.*

The program is not being proposed due to academic disciplinary needs.

6. If the proposed program is an advanced practice doctorate, explain the new practice or licensure requirements in the profession and/or requirements by specialized accrediting agencies that necessitate a new doctoral program.

The program is not an advanced practice doctorate.

Unnecessary Duplication (Similar Programs)

7. a. Are there similar programs in other Southern Regional Education Board (SREB) (https://www.sreb.org/states) or in the nation? If so, please identify the similar programs.

CPE isn't looking for an exhaustive list here. They just want an idea of how prevalent the program is in the nation and the SREB.

A procedure for addressing this: type the degree into a search engine and make a list of institutions offering the degree. If there were many institutions, choose a representative sample of major institutions (and label the list as representative). Sort the list into two categories: SREB and national. If the institution is in one of the states listed below it falls under the SREB category. You may have to use a few different/similar search terms/program names to locate programs at other institutions.

CPE Instructions: *SREB states include Alabama, Arkansas, Delaware, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.*

REPRESENTATIVE LIST

SREB (with clickable links to the programs)	National (with clickable links to the programs)
• Rice University • University of Virginia • University of Alabama at Birmingham • University of North Carolina at Chapel Hill • Clemson University • Duke University • Florida International University • Florida State University • The University of Texas at Austin	• University of Colorado Boulder • University of California Berkeley • Boston University • University of Minnesota • Rutgers University • University of Rochester • University of Arizona • The George Washington University • University of Wisconsin Madison

b. Are there similar programs that exist at public institutions in Kentucky? If so, please identify them.

A new program may serve the same potential student population. The proposed program must be sufficiently different from existing programs in the state or access to existing programs must be sufficiently limited to warrant initiation of a new program.

A BA in Computer Science (CS) program does not exist at public institutions in Kentucky. If approved, the University of Louisville will be the first institution offering this program at Kentucky. There are BS in CS programs existing in Eastern Kentucky University, Kentucky State University, Morehead State University, Murray State University, Northern Kentucky University, University of Kentucky, Western Kentucky University, and a BS in Computer Science and Engineering program offered by our department at the University of Louisville; however, they cannot generate enough graduates to satisfy the local or national employer demand as shown in the provided table in Appendix A.

The proposed BACS program is sufficiently different from the existing CS programs offered by state institutions in Kentucky. For example, compared to Murray State's BS CS program, which emphasizes scientific computing and problem solving, the BACS we propose is a Bachelor of Art program, which emphasizes the computer science applications in areas other than science and engineering. Thus, the BACS program will provide students flexibility to study another area where computer science can be applied to. Also, the BACS program requires two co-ops (or interns) so that students can develop and improve their professional skills in applying computer science to solve real-life problems in the industrial setting.

We believe that the shortage in computing workforce is mainly due to the unavailability of suitable computer science degree programs for students composed of a variety of skill sets and interests, and this new Bachelor of Arts program in Computer Science is specifically designed with this motive in mind, with the overall goal of increasing the number of computer science graduates and alleviating the shortage in computing workforce both locally and nationwide.

A BA in CS graduate can work in almost any job that a BS in CS graduate can work, except for the computing applications in engineering, since the CS components of both curriculums are very similar. However, our proposed BA in CS program offers additional learning and job opportunities for its graduates over a BS in CS program. The BACS program will provide students the flexibility of focusing on another area of study, which can broadly be in arts, social sciences, education, or

natural sciences, with business excluded. All these are done with rigorous training in computer science principles and skills that can be broadly applied to many application fields, where the subject area knowledge is also needed. This way, students can combine computer science with fields such as media art, education, music, linguistics, psychology, public health, sociology, to be a more valuable candidate in the job market and serve better to industries like graphic/game design, computer animation and film industry, computer science education, advanced manufacturing, digital media industry, music and recording technologies, medical and healthcare industry, etc. Students who would like to combine computer science with a natural science field such as math, physics, chemistry, biology, astronomy, geology, materials, etc., can perform interdisciplinary studies in computational versions of these natural science fields, and would become a valuable resource for both industry and academia.

c. Does the proposed program differ from existing programs in terms of curriculum, focus, objectives, etc.?

CPE Instructions: *If yes, explain the differences in curriculum, focus, and/or objectives. If the proposed program curriculum does not differ substantially from existing programs, then describe the collaborative arrangements being pursued with institutions that offer similar programs. Briefly describe the written and/or verbal conversations you have had with faculty and administrators at institutions with similar programs.*

The proposed program is aligned with the existing programs appearing in other SREB states and other schools nationwide; however, it differs significantly from the existing programs in the Commonwealth of Kentucky as well as at the University of Louisville (UofL) in terms of its curriculum and focus. Currently, UofL does not offer a BS in CS degree. The only CS-related baccalaureate program available at UofL is our department's BS in Computer Science and Engineering program, which includes a heavy engineering workload both in terms of its engineering fundamentals content as well as its Computer Engineering component, which is not only unnecessary for a baccalaureate degree in Computer Science, but also challenging for many students, for example, the pre-engineering students. To serve as an illustration, the followings are the core, non-CS related courses of our BS in Computer Science and Engineering program, which are completely irrelevant for a baccalaureate degree in Computer Science.

1. CHEM 201: General Chemistry I (3 credits)
2. CHEM 207: Introduction to Chemical Analysis I (1 credit)
3. ENGR 101: Engineering Analysis I (4 credits)
4. ENGR 110: Engineering Methods, Tools, and Practice I (2 credits)
5. ENGR 102: Engineering Analysis II (4 credits)
6. ENGR 111: Engineering Methods, Tools and Practice II (2 credits)
7. PHYS 295: Introductory Laboratories I (1 credit)
8. PHYS 298: Introductory Mechanics, Heat and Sound (4 credits)
9. ENGR 201: Engineering Analysis III (4 credits)
10. PHYS 296: Introductory Laboratories II (1 credit)
11. PHYS 299: Introductory Electricity, Magnetism and Light (4 credits)
12. ECE 210: Logic Design (3 credits)
13. ECE 211: Logic Design Laboratory (1 credit)
14. ECE 252: Introduction to Electrical Engineering (3 credits)
15. ENGR 205: Differential Equations for Engineering (2 credit)
16. ECE/CECS 412: Introduction to Embedded Systems (3 credits)
17. ENGR 330: Linear Algebra for Engineering (2 credit)

18. IE 360: Probability and Statistics for Engineers (3 credits)
19. IE 370: Engineering Economic Analysis (3 credits)
20. CECS 525: Microcomputer Design (4 credits)

The proposed BA in CS program replaces these courses with additional new Computer Science courses such as CSE 120: Introduction to Computer Science and Programming with Python, CSE 130: Mathematical Foundations for BACS, CSE 235: Computer Systems and Organization, CSE 470 Mobile Apps Design and Development, with additional advanced-level Computer Science elective courses, and 30 credits of other area of study courses in the fields such as media art, education, music, linguistics, psychology, public health, sociology, math, physics, chemistry, biology, astronomy, geology, and materials (excluding business), which makes it completely different from existing BS in Computer Science programs in the state of Kentucky as well as our existing BS in Computer Science and Engineering program at UofL.

d. Does the proposed program serve a different student population (e.g., students in a different geographic area, non-traditional students, etc.) from existing programs?

CPE Instructions: *If yes, describe the differences in the targeted student population and explain how your program reaches this new population.*

Yes. The proposed program serves a diverse student population who wants to study computer science and its applications in other areas. The program can also serve students who are seeking to get a second or completer degree in computer science.

e. Is access to existing programs limited? Please explain.

CPE Instructions: *If yes, explain why existing programs cannot reach this population.*

N/A

f. Is there excess demand for existing similar programs? Please explain.

CPE Instructions: *If yes, provide evidence that existing programs do not have the capacity to meet current student demand.*

No, the enrollment in our current BS in CSE program increased slowly or flattened out recently. The current program targets the computer science applications in engineering and sciences, which is not for students who would like to study computer science and its applications in other fields.

g. Describe how the proposed program will articulate with related programs in the state. It should describe the extent to which student transfer has been explored and coordinated with other institutions.

Attach all draft articulation agreements related to this program.

CPE Instructions: *Include a summary of initial discussions with other institutions (both community and technical colleges and universities) about pathways for student transfer. If none have occurred, please explain.*

Since this will be the first program among public universities in Kentucky, we did not have the opportunity to discuss pathways for student transfer with other public institutions in the state. The Computer Science Department at Bellarmine University offers a BACS program. However, it is a very small program with two faculty members so far (based on the information available on their departmental website). Also, Bellarmine is a private university with a tuition of $42,200 a year for undergraduate students. We do not expect much transfer between Bellarmine and UofL; however, we do offer Bellarmine students the options to take some of our CS regular and online courses that can be counted towards their degree program. The Speed School Admissions and Student Success Office work with the community colleges for transfer students, which can be accepted into the BACS program if they meet the admission requirements for transfer students. Once other institutions start creating a similar BACS program, then we would be happy to initiate more discussions about pathways for student transfer.

h. Will there be collaboration between the proposed program and existing state programs? If there will be collaboration, please explain what it will entail.

   If there will not be collaboration, please explain why there is no proposed collaboration with existing programs.

We do not envision any collaboration at this stage since this will be the first BA in Computer Science program in a public university in the state of Kentucky. We will allow Bellarmine CS students to take some of our BACS courses. Also, we will be open for future collaborations once other institutions start offering a similar program.

8. In the table(s) below, provide information about similar programs based on CIP codes. Include trend data on enrollment and degrees conferred for these programs.

Institutions may list other programs that are similar but may be classified in a different CIP code.

A search for similar programs or by CIP can be conducted at https://dataportal.cpe.ky.gov/KYAcademicProgInventory.aspx.
If assistance is needed to identify similar programs in Kentucky contact OAPA at PROGAPPR@louisville.edu.

Copy the table below as needed to address all similar programs.

Similar Program 1:	
Institution:	Murray State
Program Name:	Bachelor of Science in Computer Science
Comparison of Objectives/Focus/Curriculum to Similar Programs: *Explain the differences in curriculum, focus, and/or objectives. If the proposed program curriculum does not differ substantially from existing programs, then*	Murray State's Bachelor of Science degree in Computer Science is the only state program returned in our search by CIP from the CPE website. Murray State's computer science program is a Bachelor of Science degree

describe potential collaborations with other institutions.	program in the college of business, which offers two tracks in Game Development and Data Science respectively. By comparison, the proposed BACS is a Bachelor of Art program in the Speed School of Engineering, which emphasizes both the computer science theory and applications in areas other than business. The core computer science courses in our BACS program are mostly based on the computer science courses in our existing ABET-accredited BS in Computer Science and Engineering program, which provides students both breadth and depth in computer science, while enabling them to study another area where computer science can be applied to. Also, as part of our engineering school tradition, the BACS program requires two co-ops (or interns) so that students can develop and improve their professional skills in applying computer science to solve real-life problems in the industrial setting. In addition, the BACS program requires a capstone design project for senior students, while the Murray State program does not seem to require.
Comparison of Student Populations*: Describe how your target student population is different from those at other institutions and explain how your program reaches this new population (e.g. the proposed program is completely online while other programs are face-to-face or hybrid).*	Murray State's CS program targets business school students who are interested in computer science and its applications in business. The BACS program, by comparison, targets students with interests in learning both compute science and other areas such as liberal arts. As a regional university, Murray State targets different student population from University of Louisville. For example, Murray State admits students with a high school GPA of 2.0 - 2.99 with an ACT composite score of 18 or higher. By comparison, the BACS program requires a high school GPA of 3.0 or above and an ACT composite score of 23 or above. Moreover, the BACS program will be offered fully online in one year after its creation, allowing us to serve non-traditional students in Kentucky or other states to study computer science or complete their degrees at their own pace.
Access to Existing Programs: *Explain how/why existing programs cannot reach your target population and/or provide evidence that existing programs do not have the capacity to meet current student demand (e.g. the number of students on enrollment waiting list).*	There is a documented shortage of tech workforce in Louisville and Kentucky, and our current BS CSE program cannot meet current student demand and graduate enough students in this area. There are about 200 pre-engineering students at UofL, as well as other

	students who like to study computer science but are not interested in a traditional engineering program with much emphasis on advanced math, science and engineering courses. The BACS program will provide opportunities for these students to study computer science and its applications. Also, as an urban university in the city of Louisville, UofL is uniquely positioned to attract populations who are financially unable to study at locations other than Louisville or who prefer to have co-op experiences that may not be available in other universities.
Feedback from Other Institutions: *Summarize the feedback from colleagues at institutions with similar programs.*	The computer science cores are similar but with some differences as follows. The BACS program of UofL offers both C programming and object-oriented programming such as C++ and Java, while Murray State's curriculum focuses on C++ and other object-oriented programming. The BACS program teaches CSE 420 Design of Operating Systems, which is not in the Murray State's curriculum. The BACS program includes 6 CSE electives, which can be selected from a long list of computer science technical elective courses with breadth and depth that can leverage UofL School of Engineering's research strength and the integrated research and teaching in current and advanced topics in computer science.

D. Cost

The resource requirements and planned sources of funding of the proposed program must be detailed in order to assess the adequacy of the resources to support a quality program. This assessment is to ensure that the program will be efficient in its resource utilization and to assess the impact of this proposed program on the institution's overall need for funds.

1. Will this program require additional resources? Yes ☒ No ☐ If so, please provide a brief summary of new or additional resources that will be needed to implement this program over the next five years. Document the expected cost/expenditures in the table below.
Once the program commences, it will require the support of four (4) graduate teaching assistants. However, we will increase the 1 GTA per year as the enrollment increases for the first 4 years. Additionally, the program is expected to require a new term faculty in each of the second and third year from inception. A tenure-track position will need to be added in the fourth year. In addition to faculty and graduate assistants, a half-time recruiter will be needed with the start of the program, and a full-time academic advisor and a 75% co-op/internship advisor will need to be added in year two. We also request $40K to compensate faculty's time to develop 5 new courses. The annual

budget for Year 1 will be $87,231, which is then increased to $659,059 in Year 4. It is expected that the projected enrollment of the program and the tuition revenue generated for the unit will suffice to cover these additional resources within (while providing additional tuition revenues for other units of UofL), which will be detailed in the New Program Budget Spreadsheet attached.

2. Will this program impact existing programs and/or organizational units within your institution?
Yes ☒ No ☐

If so, please describe the impact. (Examples: reallocation of resources, faculty or staff reassigned, changes to other programs and/or course offerings or other programs, reduction or increase in students served, any other possible impact.)

CPE Instructions: *If yes, describe the programs that will be closed or reorganized or what resources will be impacted by the proposed program.*

The program will impact the existing Bachelor of Science in Computer Science and Engineering (BS CSE). The major impact will be the following course CSE courses that will be required for both BACS and BS CSE students: CSE 130, CSE 220, CSE 302, CSE 310, CSE 419, CSE 420, CSE 470, as well as some CSE technical elective courses that will be available to both BACS and BS CSE students. For the CSE classes with significantly more students, we expect to provide additional GTAs and instructors to cover additional class sections.

3. Provide adequate documentation to demonstrate sufficient return on investment to the state to offset new costs and justify approval for the proposed program.

CPE Instructions: *Note whether the program is predicted to increase retention rates, and, therefore, generate tuition dollars; increase revenue by attracting a new pool of students; meet employment needs in the state; feed into graduate that have been shown to be beneficial to the economic needs of the state, etc. If no new costs are anticipated, please explain.*

The Program Budget Spreadsheet shows that the program will generate a program surplus of $30,489 in its initial year, increasing to more than $723,000 totally for the subsequent four years.

- Complete the New Program Budget Spreadsheet.

Found at: http://louisville.edu/oapa/new-academic-program-approval-page/new-academic-program-approval

Notes for completing the Budget Spreadsheet:

- Provide an estimate of the level of new and existing resources that will be required to implement and sustain the program.
- Any existing resources reallocated to support this new offering should be estimated as an "internal reallocation" in both the Funding Sources and Expenses sections of the budget.
- Any new resources for which the unit/department plans to allocate funding should be listed as an internal "allocation" in the Funding Sources section of the budget.

- The program proposal is to be developed without the expectation of tuition-sharing or recovery agreements with the Provost. This approach ensures that the "cost" of operating the program is somewhat reflective of reality.
- For every place you add numbers (in both the Funding Sources and Expenses spreadsheet) provide a written explanation for the numbers, including how they were calculated. The CPE system won't let us submit the proposal without explanations for the budget numbers.
- The budget for the proposed program is to be in alignment with the latest budget assumptions (provided below as of 10/7/19) from the Budget Model Workgroup.

  Undergraduate*
  70% (net of mandatory student fees) of resident per credit hour tuition rate (i.e., the listed rate on the bursar's website) charged to undergraduate students is allocated to the academic unit where the instruction takes place. Every credit hour is treated the same under the model.

  Graduate/Professional*
  Graduate: 75% (net of mandatory student fees) of tuition review revenue allocated according to a student's home academic program.
  Professional: 85% of tuition revenues generated from professional degree (law, dentistry, medicine), doctoral, and DNP programs allocated to the student's home academic program. For purposes of the budget model, doctoral programs fall in the Professional category.

  *These definitions of the Budget Model are as of 10/7/19 and are subject to change.

- Note that there are three tabs to the Budget spreadsheet.

Funding Sources tab:
- Indicate funding to be supplied by the unit (include direct funding & In-kind support):
- Internal allocation and reallocation are those estimated dollars needed to fund the start-up and support the new academic program – typically defined as faculty, administrative/staff, and operational expenses.
- When calculating funding, consider the impact on current faculty workloads.
- Include the expected tuition revenue generated by anticipated student enrollment.
- If the program will use existing faculty or other existing resources, the amount of funding represented by those resources are to be listed in the Funding Sources table as reallocation of funds.
- If reallocation of "existing" funds are included in the Funding spreadsheet, the numbers should also be reflected in the Expenses spreadsheet.
- If the unit has allocated funds for any new expenses in the Funding Sources spreadsheet, the numbers should also be added to the Expenses spreadsheet.

Expenses tab:
- You do not have to estimate classroom space unless you believe that existing space is not sufficient to support the academic program.
- Any expenses identified as "existing" funds in the expenses spreadsheet should also be added to the Funding Sources spreadsheet as either internal reallocation or internal allocation.

Funding Source/Expenses Combined tab:

- This spreadsheet will pre-populate based upon the numbers entered into the Funding Sources and Expenses spreadsheets. The program must have more funding than expenses.

E. Program Review and Assessment

Describe program evaluation procedures for the proposed program. These procedures may include evaluation of courses and faculty by students, administrators, and departmental personnel as appropriate. Program review procedures shall include standards and guidelines for the assessment of student outcomes implied by the program objectives and consistent with the institutional mission.

1. Describe how each program-level student learning outcome will be assessed and how assessment results will be used to improve the program.

Complete the table below and add a description here, including how assessment results will be used to improve the program.

CPE Instructions: *Explain which student learning outcome(s) will be assessed by each assessment method and how frequently each assessment method is administered. Include both direct and indirect methods. Explain how assessment results will be used to make improvements to the program. Note that this item refers to a program-level, not course-level, assessment and thus course grades are not an appropriate source of data for program-level assessment.*

The student learning outcomes for the proposed BA in CS program are listed below.

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 in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
5. Apply computer science theory and software development fundamentals to produce computing-based solutions.
6. Apply computer science techniques and tools to solve problems in a chosen area of concentration.

Every outcome will be assessed by at least two courses, by both using direct measures such as exams, programming assignments, term projects, and capstone projects, as well as indirect measures including surveying students once per semester through the University of Louisville's online course evaluation system. The Undergraduate Curriculum Committee in the Department of Computer Science and Engineering will review the assessment and make recommendations for program improvement.

Program-level	Point of assessment (course, assignment, etc.)	Assessment Method (include direct and indirect assessments)	Frequency of the assessment method

Student Learning Outcome		NOTE: these are program-level assessments, thus course grades are not appropriate assessments	
1, 2, 5	CSE 302	Exams and Programming Assignments (direct); Survey (indirect)	Once Per Year
1-6	CSE 350	Exams, Term Projects and Presentations (direct); Survey (indirect)	Once Per Year
1-6	CSE 496	BACS Capstone Project and Presentation (direct); Survey (indirect)	Once Per Year

2. For each assessment method, please provide direct indicator(s) of achievement of program-level student learning outcomes and frequency of data collection.

Also provide indirect indicators of achievement where possible.

For exams (CSE 302, CSE 350), programming assignments (CSE 302), term projects (CSE 350), and the capstone project (CSE 496), the direct indicator of achievement of program-level student learning outcomes is defined as at least 80% of the students achieving satisfactory or higher performance as defined and evaluated by the course instructor. This data will be collected once per year, in CSE 302, CSE 350, and CSE 496 courses.

a. Which components will be evaluated?

CPE Instructions: *Identify each student learning outcome to be assessed and in which courses it is covered in the curriculum. Note whether employers, students/alumni, and/or faculty outside the program were involved in the development of student learning outcomes.*

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. (CSE 302, CSE 350, CSE 496)

2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. (CSE 302, CSE 350, CSE 496)
3. Communicate effectively in a variety of professional contexts. (CSE 350, CSE 496)
4. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline. (CSE 350, CSE 496)
5. Apply computer science theory and software development fundamentals to produce computing-based solutions. (CSE 302, CSE 350, CSE 496)
6. Apply computer science techniques and tools to solve problems in a chosen area of concentration. (CSE 350, CSE 496)

b. When will the components be evaluated?

CPE Instructions: *Identify the review cycle for each student learning outcome. For example, data may be collected every semester but results analyzed every third year.*

All learning objectives will be measured once per year.

c. When will the data be collected?

CPE Instructions: *Note when the data will be collected (which may be different than when the assessment is conducted).*

Data will be collected at the end of the fall semester of each year. For courses that are only offered in spring, data will be collected by the end of the spring semester.

d. How will the data be collected?

CPE Instructions: *Describe the methods and software used to collect the assessment data.*

The faculty will collect data in their courses.

e. What will be the benchmarks and/or targets to be achieved?

CPE Instructions: *Indicate the type of benchmark used (local standards, external peer benchmarks, best practices benchmarks, etc.) and the specific performance standards to be achieved for each student learning outcome.*

Explain the process by which the benchmarks and targets were determined. Note whether employers, students/alumni, and/or faculty outside the program were involved in the benchmarking process.

The program will seek to have a minimum of 80% of students to obtain a satisfactory or higher score. This will be applied to each of the six learning objectives identified above.

f. What individuals or groups will be responsible for data collection?

CPE Instructions: *Specify whether the assessment process will be led by one person, whether that person is faculty or staff, or whether this effort will be led by a group of faculty and/or staff.*

The faculty will collect data at the course level and program-specific recommendations within their courses. The Undergraduate Curriculum Committee in the Department of Computer Science and Engineering will in charge of assessment, led by the committee chair, who is a faculty member.

g. How will the data and findings be shared with faculty?

CPE Instructions: *Explain the elements of the data reports and the process by which it is shared with faculty.*

The data, analysis, and results will be shared with departmental faculty at an annual faculty and staff retreat or at faculty meetings as deemed appropriate. In addition, the data, analysis, and results will be shared with the Undergraduate Education Committee at the school level.

h. How will the data be used for making programmatic improvements?

CPE Instructions: *Explain the process by which faculty will discuss the assessment results and make curricular changes.*

The BACS program director and the Curriculum Committee of the department will review the data in total and discuss their findings with faculty in the annual retreat and/or faculty meetings. Findings will be evaluated by the entire faculty body and as needed, recommendations for improvement will be discussed. This broad assessment should lead to recommendations at the program level. The data will be analyzed and interpreted to illuminate potential areas/activities for improvement in BACS.

3. What are the measures of teaching effectiveness?

CPE Instructions: *Explain how the program will evaluate instructional quality.*

The University of Louisville's Office of Institutional Effectiveness determines a short set of standardized course evaluation questions related to teaching effectiveness to be used across all student evaluations. These questions were developed in conjunction with a group of unit associate deans. Course evaluations provide direct student feedback to course instructors who are then able to address areas needing improvement. In addition, course evaluations are measured outcomes of teaching performance. As a result, the BACS Program Director will discuss and address any identified weaknesses with instructors.

4. What efforts to improve teaching effectiveness will be pursued based on these measures?

CPE Instructions: *Explain how the information about teaching effectiveness will be used to make pedagogical changes in the program.*

Course instructors will have access to the Delphi Center's monthly workshops designed to improve teaching effectiveness. Typically, these one-hour training workshops are designed to present new teaching approaches, education paradigms, and instruction of emerging technology to improve teaching effectiveness. The Speed School also offers a teaching development program for new faculty members. In addition, peer evaluation and mentoring opportunities will be provided within

the departmental faculty to share discipline-specific teaching experiences and to improve teaching effectiveness in BACS courses.

5. What are the plans to evaluate students' post-graduate success?

New Academic programs undergo an interim program review after five years for undergraduate programs, four years for masters programs, and three years for doctoral programs. After the interim review, all programs are placed on the university's regular program review schedule.

The program review template requires that programs provide feedback from graduates, alumni, and employers. In your response to this question consider how you will collect satisfaction feedback from these groups.

CPE Instructions: *Explain how the program will identify graduate schools and employers and what questions will be asked in order to assess graduate school and/or workforce success.*

Short-term post-graduate success will be defined based upon placement in industry, government agency, and academic positions such as perusing graduate studies in computer science or closely related field. Intermediate and long-term success will be characterized by contributions to the field of computer science as evidenced by employment advancement, scientific publications, patents issued, honors, start-up companies established, and professional attainment by alumni. The BACS program will survey alumni in parallel with the JB Speed School of Engineering's Alumni Tracking program in the first year following graduation and every 5 years thereafter.

NOTE: All actions in the approval of new programs for public institutions are subject to a stipulation regarding the program's ability to attain specified goals that have been established by the institution and approved by the Council on Postsecondary Education (the Council). At the conclusion of an appropriate period of time, the program's performance shall be reviewed by Council staff following criteria established in the Council's Academic Programs Policy. For more information on the program review process see http://louisville.edu/oapa/academic-program-review-process.

Appendix A. Employer Demand.

1. If the program is designed for students to enter the workforce immediately, please complete the following table (see resources below the table)

2. Please provide source of employer demand information and time frame for the projections:

Type of Job	Regional Avg Wage	Regional # of openings	Regional Growth Projections (%)	State Avg Wage	State # of openings	State Growth Projections (%)	National Avg Wage	National # of openings	National Growth Projections (%)
Computer Systems Analysts	$73,904	1,693	10%	$75,381	3,248	10.5%	$ 88,740	53,400	8.8%
Software Developers, Applications	$81,851	3,425	23%	$80,322	5,567	33.4%	$ 103,620	99,200	25.6%
Software Developers, Systems Software	$86,020	999	15%	$86,915	1,835	21.7%	$ 110,000	35,400	10.1%
Web Developers	$69,431	511	10%	$58,095	1,218	17.8%	$ 69,430	15,100	13.0%
Database Administrators	$85,970	439	8%	$72,282	936	14.5%	$ 90,070	9,700	9.0%
Network and Computer Systems Administrators	$66,863	941	9%	$63,644	2,335	6.8%	$ 82,050	29,300	4.7%
Computer Network Architects	$83,282	445	11%	$75,928	1,265	12.2%	$ 109,020	12,200	5.3%
Computer User Support Specialists	$44,496	2,440	9%	$46,986	4,961	15.8%	$ 50,980	65,100	10.6%
Computer Network Support Specialists	$58,016	689	10%	$56,779	1,354	17.2%	$ 62,770	17,400	6.4%
Computer Occupations, All Other	$77,329	1,333	11%	$80,231	2,157	10.8%	$ 90,270	35,700	10.2%

***Source (Regional - Louisville)**: KentuckianaWorks, Occupational Outlook for the Louisville Region, August 2019. (Time Frame: 2019-2029)*
***Source (State)**: Education and Workforce Development Cabinet, Kentucky Occupational Outlook to 2026, September 2018. (Time Frame: 2016-2026)*
***Source (National)**: Bureau of Labor Statistics, Employment Projections, Table 1.7. (Time Frame: 2018-2028)*

Cost/Funding Explanation

Complete the following table for the first five years of the proposed program and provide an explanation of how the institution will sustain funding needs. For any existing dollar amounts and department allocation for new dollar amounts reported in the Expenses spreadsheet, also add the dollar amounts to the Funding Sources spreadsheet under Internal allocation or reallocation.

You must add an explanation/justification for any dollar amount reported in this table.

*The FundingSource Expenses-Combined spreadsheet will pre-populate from the numbers entered into the Funding Sources and Expenses spreadsheets. The total funding and expenses shown in the Combined spreadsheet should be the same (i.e., there should be enough funding to cover the proposed expenses). Provide an explanation for any excess funding beyond those needed to cover expenses.

A.	Funding Sources, by year of program:	1st Year	2nd Year	3rd Year	4th Year	5th Year
	Total Resources Available from					
	~ New					
	~ Existing					
	Narrative Explanation/Justification:					

	Funding Sources, by year of program (continued)	1st Year	2nd Year	3rd Year	4th Year	5th Year
	Total Resources Available from Other Non-State Sources					
	~ New					
	~ Existing					
	Narrative Explanation/Justification:					

Cost/Funding Explanation

Funding Sources, by year of program *(continued)*	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
State Resources					
~ New					
~ Existing					

Narrative Explanation/Justification:

Funding Sources, by year of program *(continued)*	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Internal					
Internal Allocation					
Internal Reallocation					

Cost/Funding Explanation

Narrative Explanation/Justification: *The sources and process of allocation and reallocation should be detailed, including an analysis of the impact of the reduction on existing programs and/or organization units. Internal reallocation are those estimated dollars that will be dedicated to fund the start-up and support of the new academic program – typically defined as faculty, administrative/staff and operational expenses.*

Funding Sources, by year of program *(continued)*	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Student Tuition					
~ New	117720	333540	587946	878976	1029396
~ Existing					

Narrative Explanation/Justification: *Describe the impact of this program on enrollment, tuition, and fees.*

See the Full Proposal (Section C, Part f) for a breakdown of student enrollment projections for new and existing students. We are estimating revenue to the unit based on the total number of additional students to the university x the CSE credit hours per year to be taught in the Speed School x $327 per credit hour, which is the projected revenue to units for FY21. Noth that $327/credit hour to SSoE is derived based on the fact that the undergraduate resident tuition rate is $489 per credit hour and 70% (net of mandatory student fees) of resident per credit hour tuition rate charged to undergraduate students is allocated to the academic unit where the instruction takes place.

Total					

Cost/Funding Explanation

	~ New	$ 117,720.00	$ 333,540.00	$ 587,946.00	$ 878,976.00	$ 1,029,396.00
	~ Existing	$ -	$ -	$ -	$ -	$ -

		1st Year	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
A.	**TOTAL - Funding Sources** (**REVENUES**)	$ 117,720.00	$ 333,540.00	$ 587,946.00	$ 878,976.00	$ 1,029,396.00

	$ 2,947,578.00	**Funding Total over 5 Years (will pre-populate)**		

Cost/Funding Explanation

Complete the following expense spreadsheet for the first five years of the proposed program

Provide a detailed explanation wherever dollar amounts are reported, including how the numbers were calculated.

You should also add any existing dollar amounts and department allocation for new dollar amounts reported in this Expenses spreadsheet to the Funding Sources spreadsheet (under Internal allocation or reallocation).

*The FundingSource Expenses-Combined spreadsheet will pre-populate from the numbers entered into the Funding Sources and Expenses spreadsheets. The total funding and expenses shown in the Combined spreadsheet should be the same or show an excess in funding (provide an explanation for any excess funding).

B.	Breakdown of Budget Expenses/Requirements	1st Year	2nd Year	3rd Year	4th Year	5th Year
	Staff					
	Executive, Administrative, Managerial					
	~ New					
	~ Existing					
	Other Professional					
	~ New	$ 25,700.00	$ 116,421.00	$ 117,215.13	$ 118,033.08	$ 118,875.58
	~ Existing					
	Faculty					
	~ New	$ -	$ 102,800.00	$ 211,768.00	$ 347,630.41	$ 358,059.32
	~ Existing	$ 16,000.00	$ 16,000.00	$ 8,000.00		
	Graduate Assistants					
	~ New	$ 45,531.00	$ 91,062.00	$ 136,593.00	$ 182,124.00	$ 182,124.00
	~ Existing					
	Student Employees					
	~ New					
	~ Existing					
	Narrative Explanation/Justification: *Includes salaries for all listed above and explain how they were calculated. Identify the number of new faculty required and whether the new hires will be part-time or full-time. Identify the number of assistantships/stipends that will be provided. Include the level of support for each assistantship/stipend.*					

Cost/Funding Explanation

To support the BACS program, we request to have 1 new term faculty in Year 2 and Year 3, respectively, and 1 tenure-track faculty at Year 4. The term faculty's base salary is $80K/year, with 28.5% fringe benefits and 3% annual raise. The tenure-track faculty's base salary is $95K/year, with 28.5% fringe benefits and 3% annual raise. To support the recruiting, advisoring efforts for BACS students, we also request to add three Academic and Student Affair (ASA) staff, including a 50% recruiter in Year 1, a 100% academic adviosr in Year 2, and a 75% co-op advisor in Year 1, all of which are budgeted with a base salary of $40K/year, 28.5% fringe benefits and 3% annual raise. In addition, we request 1 graduate teaching assistant (GTA) per year for the first 4 years. Each GTA includes a base stipend of $22K/year, $20,476 tuition/year, and $254.67/month for the health insurance. To compensate faculty's time to develop 5 new courses for the BACS program, we also request $40K budget for new course development ($8K/course).

Breakdown of Budget Expenses/Requirements *(continued)*	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Equipment and Instructional					
~ New					
~ Existing					
Narrative Explanation/Justification:					

Breakdown of Budget Expenses/Requirements *(continued)*	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Library					
~ New					
~ Existing					

Cost/Funding Explanation

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Contractual Services					
~ New					
~ Existing					

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Academic and/or Student Support					
~ New					
~ Existing					

Cost/Funding Explanation

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Other Support Services					
~ New					
~ Existing					

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Faculty Development					
~ New					
~ Existing					

Cost/Funding Explanation

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Assessment					
~ New					
~ Existing					

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
Student Space and Equipment (if					
~ New					
~ Existing					

Cost/Funding Explanation

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	1st Year	2nd Year	3rd Year	4th Year	5th Year
doctorate)					
~ New					
~ Existing					

Narrative Explanation/Justification:

Breakdown of Budget Expenses/Requirements (continued)	1st Year	2nd Year	3rd Year	4th Year	5th Year
Other					
~ New					

Cost/Funding Explanation

	~ Existing					
	Narrative Explanation/Justification:					
	Total					
	~ New	$ 71,231.00	$ 310,283.00	$ 465,576.13	$ 647,787.49	$ 659,058.90
	~ Existing	$ 16,000.00	$ 16,000.00	$ 8,000.00	$ -	$ -
B.	**TOTAL - Expenses/Requirements** (EXPENDITURES)	*1st Year*	*2nd Year*	*3rd Year*	*4th Year*	*5th Year*
		$ 87,231.00	$ 326,283.00	$ 473,576.13	$ 647,787.49	$ 659,058.90

$ 2,193,936.52	**Expenses Total over 5 Years (will pre-populate)**	

		1st Year	2nd Year	3rd Year	4th Year	5th Year
A.	TOTAL - Funding Sources (REVENUES)	$ 117,720.00	$ 333,540.00	$ 587,946.00	$ 878,976.00	$ 1,029,396.00
B.	TOTAL - Expenses/Requirements (EXPENDITURES)	1st Year	2nd Year	3rd Year	4th Year	5th Year
		(87,231.00)	(326,283.00)	(473,576.13)	(647,787.49)	(659,058.90)
	BALANCE - (**SURPLUS/DEFICIT**)	$30,489.00	$7,257.00	$114,369.87	$231,188.51	$370,337.10

BACS Curriculum

	Fall 1	Spr 1	Fall 2	Spr 2	Sum 3	Fall 3	Spr 3	Sum 4	Fall 4	Spr 4	Total
SSoE cr hrs	3	6	6	9	1	6	9	1	9	9	59
non-SSoE cr hrs	13	10	9	3	0	9	6	0	6	6	62
total cr hrs	16	16	15	12	1	15	15	1	15	15	121

Estimated enrollment of full time BACS students

			year 1	year 2	year 3	year 4	year 5
		Fr	40	60	70	80	80
yr 1 to 2 retention rate	0.8	So		32	48	56	64
yr 1 to 3 retention rate	0.7	Jr			28	42	49
yr 1 to 4 retention rate	0.6	Sr				24	36
enrollment of FT BACS students			40	92	146	202	229

Estimated total SCH generated by full time BACS students

	year 1	year 2	year 3	year 4	year 5
Fr	1280	1920	2240	2560	2560
So		864	1296	1512	1728
Jr			868	1302	1519
Sr				744	1116
ɔtal est. SCH of FT BACS students	1280	2784	4404	6118	6923

Estimated SSoE SCH generated by full time BACS students

	year 1	year 2	year 3	year 4	year 5
Fr	360	540	630	720	720
So		480	720	840	960
Jr			448	672	784
Sr				456	684
ɜt. SSoE SCH of FT BACS students	360	1020	1798	2688	3148

UNIVERSITY OF LOUISVILLE
J.B. SPEED SCHOOL OF ENGINEERING

Office of the Dean

March 9, 2020

Dr. Beth Boehm
Executive Vice President and Provost
University of Louisville

Dear Provost Boehm:

It is with enthusiasm that I express my support for the proposed Bachelor of Arts in Computer Science (BACS) program in the Department of Computer Science and Engineering (CSE) of the J. B. Speed School of Engineering. The BACS program takes a holistic approach to teach computer science and its applications. Built on rigorous computer science core courses that are offered in the current BS CSE program, the BACS program provides students the flexibility to study other areas such as natural and social sciences and humanities, where BACS students can apply their fundamental knowledge and practical skills of computing. Such a holistic and interdisciplinary approach will not only help cultivate students' intellect and imagination but also prepare them for a wide range of computing jobs in Louisville and beyond that increasingly require understanding and knowledge in the application fields.

The BACS program can leverage many existing courses that are already available in the BS CSE program, as well as a variety of programs from the College of Arts and Sciences and other UofL colleges. Thus, the resource demand is expected to be moderate to low, while it can have a substantial enrollment impact across units. Moreover, the BACS program has great potential to increase Speed School enrollment, including students who are inspired by this new major, some of our pre-engineering students, transfer students, students who are interested in both liberal arts and computing, and traditional or adult students who want to get double majors or completer degrees.

Compared to the current BS CSE program, which is an ABET-accredited engineering program that requires depth in mathematics, engineering, and sciences, the BACS program focuses on a balance of knowledge in computer science and effective applications of computing. Even though both programs share the same computer science courses, they target different students with different interests and backgrounds. The BS CSE degree focuses on the science and engineering of computing while the BACS degree targets the applications of computing. At the same time, due to its flexibility, the BACS program actually offers new opportunities (through more technical electives) for students to develop understanding and skills in a focused emerging computing area such as artificial intelligence, data science, and cybersecurity.

The BACS program is completely in line with our efforts to increase enrollment and is expected to produce more graduates with knowledge and skills in both computing and an application field (e.g., Communications, Geography, or English), which can help reduce the technical workforce shortage here in Louisville and Kentucky. In addition, the BACS students can choose to pursue their graduate study in Computer Science at UofL or elsewhere, which may benefit CSE graduate programs as well.

University of Louisville • Louisville, KY 40292
P: 502.852.6281 F: 502.852.7033 E: speed@louisville.edu W: louisville.edu/speed

The proposed BACS program correlates with UofL's Strategic Plan and Speed School's mission. Thus, I fully endorse that the Bachelor of Arts in Computer Science program be added to the Speed School of Engineering's degree offerings.

Sincerely,

Emmanuel G. Collins
Dean, Speed School of Engineering

UNIVERSITY OF LOUISVILLE
COLLEGE OF ARTS & SCIENCES

David. S. Owen, Ph.D.
Interim Dean
Professor of Philosophy

April 3, 2020

Dr. Gye:

We are happy to provide a letter in support of the proposed BA in Computer Science through J.B. Speed School of Engineering. We shared the information on the proposed curriculum with several departments in the College of Arts and Sciences and received very positive support for the program. All departments with minors could potentially be "other areas of study" for the BA; minors have less than 30 credits (the largest is 24 credits) so, they would easily fit into the program as described. We see this proposed curriculum as one that will attract new students to the university who would experience an innovative program that combines computer science with a strong liberal arts education.

We recognize that A&S Advisors would advise students on trajectories for their minors, Cardinal Core classes and other configurations of courses that meet requirements of the degree (to the extent that the courses are in A&S). This will require collaboration between our Advising groups. If the program were to grow at the pace described in the proposal, there may be a need for additional advising support in three or four years.

We believe that this is an excellent opportunity for A&S to collaborate with Speed on interdisciplinary curricula that appeal to our current future students and we look forward to being a part of making this program successful.

Sincerely,

David S. Owen
Interim Dean

University of Louisville • Louisville, KY 40292
P: 502.852.6490 E: asdean@louisville.edu W: louisville.edu/artsandsciences

UNIVERSITY OF LOUISVILLE

Department of Mathematics
College of Arts and Sciences

Dear Provost Boehm,

I am writing this letter to give you the strong support of the Department of Mathematics for the creation of the Bachelor of Arts in Computer Science degree. The proposal for the program makes clear the need for students who not only possess skills in computer science but who also possess skills in liberal arts or other areas to meet the needs of today's industry.

The Department of Mathematics will participate in this degree by providing instruction for the Cardinal Core requirements of its students. I do not anticipate any increase in costs to the department. In fact, the department stands to benefit from majors in this degree who decide to take courses in higher mathematics, and from the opportunities this program affords for collaboration between Mathematics and Computer Science.

David Swanson, Chair
Department of Mathematics

Department of Mathematics • College of Arts and Sciences • University of Louisville • Louisville, Kentucky 40292
P: 502.852.6826 **F:** 502.852.7132

UNIVERSITY OF LOUISVILLE
UNIVERSITY LIBRARIES

Office of the Dean

April 2, 2020

Connie Shumake
Office of the Provost
University of Louisville
Louisville, KY 40292

Connie,

We have been asked to provide a letter of support for the proposed Bachelor of Arts program in Computer Science and Engineering in the Speed School. We have completed a review of our available resources in this area. In general, these resources are adequate to support the proposed program though we note that additional book and journal resources should be added in the computer science area going forward as resources permit. I am attaching a copy of our review.

Please contact us if you have any questions or need additional information.

Sincerely,

Robert E. Fox, Jr.
Dean, University Libraries

CC: Emmanuel Collins
Sarah Drerup
Bruce Keisling
Claudene Sproles
Wei Zhang

EVALUATION OF LIBRARY RESOURCES

ESSENTIAL TO THE SUPPORT OF:

BACHELOR OF ARTS IN

COMPUTER SCIENCE AND ENGINEERING

Sarah Drerup

STEM Librarian

Dean Robert E. Fox, Jr.

University Libraries

March, 2020

BACKGROUND

The University of Louisville (UofL) Libraries are comprised of five separate libraries: Ekstrom Library serving humanities, social sciences, life sciences, business, engineering, physical sciences, and technology; Kornhauser Health Sciences Library; Anderson Music Library; Bridwell Art Library; and the Law Library. University Archives and Special Collections center is also part of the UofL library system. Resources relevant to computer science are primarily found in Ekstrom Library.

UofL's library system supports the instructional and research needs of over 22,000 full and part-time students and more than 7,000 faculty and staff. UofL belongs to the Association of Research Libraries (ARL), an organization of North American libraries affiliated with 124 large, comprehensive research institutions, as well at the State-Assisted Academic Library Council of Kentucky (SAALCK), and Kentuckiana Metroversity, a consortium of Louisville area libraries.

The Speed School of Engineering at the University of Louisville offers multiple ABET accredited degree programs. Currently, the Speed School of Engineering offers a Bachelor of Science in Computer Science and Engineering. The Bachelor of Science degree requires 37 hours of general education requirements and 74 hours of computer science requirements. The proposed Bachelor of Arts in Computer Science and Engineering degree includes 36 hours of general education requirements, 56 hours of computer science requirements, and 36 hours comprised of other areas of study to include liberal arts. The new Bachelor of Arts in Computer Science degree program will also include the development of six additional courses taught at the Speed School of Engineering.

Sections of this report compares UofL's library resources to three benchmark institutions. The University of Colorado Boulder, Wright State University, and the University of Virginia currently offer a Bachelor of Arts in Computer Science.

COLLECTIONS

Books

According to WorldCat, UofL only has around three hundred eBooks and print books related to computer science that have been published within the last five years. The majority are housed at Ekstrom library or available electronically in eBook format. Computer science is a field that is constantly innovating and having more current resources is imperative to the advancement of research and maintaining support for the program.

Academic institutions that offer similar degree programs tend to have much more robust ebook collections related to computer science. Examples of ebook series owned by benchmark institutions that would support research and bring value to our collection:

- Lecture Notes in Computer Science by Springer: Lecture Notes contains conference proceedings on the latest developments in all areas of computer science.
- Synthesis by Morgan & Claypool Publishers: Synthesis is a digital library offering ebooks that synthesize an important research topic in engineering and computer science and is purchased by hundreds of academic institutions with degree programs comparable to UofL.

- ENGnetBASE by Taylor & Francis Group: A collection of over 4,320 ebooks and handbooks in all disciplines of engineering to include computer science.

As funds allow, Ekstrom Library will make efforts to add newly published books, ebooks, or ebook packages related to computer science.

Journals

UofL has online full-text access to all journals which are listed in the top twenty most frequently used and cited journals on the subject of computer science according to Web of Science:

Full Journal Title	**Journal Impact Factor**	**Online Full-Text**
IEEE Communications Surveys and Tutorials	22.973	2000-Present
IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE	17.73	1979-Present
IEEE Transactions on Neural Networks and Learning Systems (No longer in publication)	11.683	1990-2011
Journal of Statistical Software	11.655	Open Access
IEEE WIRELESS COMMUNICATIONS	11	1994-Present
Information Fusion	10.716	2000-Present
IEEE Transactions on Cybernetics	10.387	2013-Present
IEEE Internet of Things Journal	9.515	2018-Present
MEDICAL IMAGE ANALYSIS	8.88	1996-Present
IEEE TRANSACTIONS ON FUZZY SYSTEMS	8.759	1993-Present
IEEE TRANSACTIONS ON EVOLUTIONARY COMPUTATION	8.508	1997-Present
IEEE TRANSACTIONS ON MEDICAL IMAGING	7.816	1982-Present
IEEE NETWORK	7.503	1987-Present
IEEE Transactions on Industrial Informatics	7.377	2005-Present
IEEE Transactions on Systems Man Cybernetics-Systems - Parts A-C	7.351	1971-Present
ARCHIVES OF COMPUTATIONAL METHODS IN ENGINEERING	7.242	1997-Present
INTERNATIONAL JOURNAL OF INTELLIGENT SYSTEMS	7.229	1996-Present Missing 1980-1995 backfile
IEEE TRANSACTIONS ON IMAGE PROCESSING	6.79	1992-Present
ACM TRANSACTIONS ON GRAPHICS	6.495	1982-Present
IEEE Transactions on Dependable and Secure Computing	6.404	2004-Present

Of the next twenty most frequently used and cited periodicals, UofL currently does not have access to *International Journal of Neural Systems* or *Foundations and Trends in Information Retrieval*. As funds allow, Ekstrom Library will make efforts to purchase subscriptions to these publications.

Databases

UofL and benchmark institutions have subscriptions to the following databases related to computer science and engineering:

- ACM Digital Library
- IEEE Explore
- INSPEC
- MathSciNet
- ScienceDirect
- Web of Science
- Wiley Online Library

These databases offer abstracts and full-text access to the periodicals listed above in addition to thousands of conference proceedings, book chapters, and patents.

The following databases are not available at UofL but are listed as available resources on the websites of other benchmark institutions:

- Computers and Applied Sciences Complete – Ebsco – Title list of this database includes multiple journals we receive through other vendors. If we would like to purchase this database in the future, an in-depth comparison would need to be made to verify we are purchasing the titles through the vendor that can give us the best price.
- Advanced Technologies and Aerospace Database – Proquest - Title list of this database includes multiple journals we receive through other vendors. If we would like to purchase this database in the future, an in-depth comparison would need to be made to verify we are purchasing the titles through the vendor that can give us the best price.
- American Institute of Mathematical Sciences Database – AIMS does offer five open access journals which are currently listed on the UofL Computer Engineering and Computer Science library subject guide.

SERVICES

Inter-Library Loan

Books and periodicals not held by the UofL Libraries are identified through online databases and WorldCat, an online catalog with more than 32 million records describing materials owned by libraries around the world. Requested materials are obtained through UofL's traditional Interlibrary Loan (ILL) service, and supplemented by the University Libraries participation in KUDZU, a consortium of major university libraries in the southeastern United States. Articles and chapters are transferred to requestors via email.

Research Assistance

Each library within the University of Louisville Libraries offers instruction programs designed to meet the needs of its researchers. Ekstrom Library provides research assistance via email, telephone, in-person research appointments, and online chat.

STAFFING

Ekstrom Library has a dedicated STEM librarian who will be the primary point of contact for students and faculty associated with the proposed Bachelors of Arts in Computer Science and Engineering.

CONCLUSION

The Libraries at the University of Louisville already supports a Bachelor of Science degree and Master degree in Computer Science and Engineering. However, six new courses are to be included with the proposal for the Bachelor of Arts in Computer Science and Engineering. In their letter of intent, the Speed School of Engineering does not anticipate a need for any new library books, journals, databases, or other services to support the new program. After further review, it does appear UofL Libraries can strengthen its support of the proposed program and current programs by increasing our number of book and ebook collections related to computer science as well as expanding journal collections through the purchase of new databases.

Course Syllabus
CSE 110

1. Course	CSE 110	Title	Mathematical Foundations for Computer Science
2. Credits	3	Contact Hours	
3. Coordinator			
4. Textbook	• Mathematics for Computer Science, June 2018 Edition by Lehman, Leighton, and Meyer. Available free at: https://courses.csail.mit.edu/6.042/spring18/mcs.pdf • Schaum's Outline of Probability and Statistics, 4th Edition by Schiller, Srinivasan, and Spiegel. ISBN: 9780071795579. • Discrete Mathematics and Its Applications, 7th Edition by Kenneth Rosen. ISBN: 0073383090.		
5. Course Information			
Catalog Description	The course covers mathematical and statistical concepts necessary for design and analysis of computer algorithms as well as developing system performance models, by visiting selected topics from number theory, vectors and matrices, combinatorics, probability, and statistics.		
Prerequisites	Calculus I or equivalent.		
Type of Course	Required for BA in CS.		
6. Goals for Course			
Course Objectives	a. Demonstrate understanding of number theory, including divisibility, greatest common divisors, modular arithmetic, remainder arithmetic, prime numbers, number systems, and Euler's theorem. b. Demonstrate understanding of vectors and matrices, including multiplication, transpose, determinants, eigenvalues and eigenvectors. c. Demonstrate understanding of combinatorics, including pigeonhole principle, permutations, combinations, and binomial theorem. d. Demonstrate understanding of probability, including Bayes' theorem, random variables, expectation and variance. e. Develop understanding of statistics, including summarizing measured data, parameter estimation, and confidence intervals.		
7. List of Topics			
Detailed Schedule	a. Number Theory (2 weeks): Divisibility, greatest common divisors, modular arithmetic, remainder arithmetic, prime numbers, number systems, and Euler's theorem.		

	b. Vectors and Matrices (2 weeks): Multiplication, transposes, determinants, inverse matrices, linear equations, eigenvalues and eigenvectors. c. Combinatorics (4 weeks): Counting, pigeonhole principle, permutations, combinations, binomial coefficients, binomial theorem, generalized permutations and combinations, principle of inclusion-exclusion. d. Probability theory (3 weeks): Bayes' theorem, expectation and variance, random variables, distribution functions, law of large numbers, central limit theorem, tail probability estimations (3 weeks). e. Statistics (1 week): Summarizing measured data, parameter estimation, confidence intervals, and linear regression models (1 week).

CSE-120

Introduction to Computer Science and Programming with Python

Summer 2020 (3 Credit Hours)

Instructor:

Dr. xxxx
Duthie Center for Engineering 221.
Phone: 852-0477.
E-mail: xxxx

Office Hours:

Tuesday – Thursdays: 3:30 pm, or available by appointment

The best way to contact me is via email, and responses will be as timely as possible, and typically within 24 hours. Students are also welcome to schedule a face-to-face or telephone meeting with me. I am not accessible by phone or email from 12 pm on Saturdays until 8 am Monday mornings (EST). Although a response may be received during this timeframe, it should not be depended upon. Just a gentle reminder: It is best not to wait until the night before an assignment is due to ask a question.

Class:

In-class section:

Time: Monday, Wednesday and Friday XX:XX pm – XX:XX pm
Location: TBD

Online section:

Material will be posted weekly Monday, Wednesday and Friday

Required Material:

Text Books:

1. Deitel, P. J., & Dietal, H. (2020). Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and the Cloud. Pearson Education, Incorporated.

Online Laboratory (CodeZinger):

In this course Online Laboratories are included using www.codezinger.com. These laboratories will be part of the course grades. An online purchase is required for each section, the class key required to access the lab sections is:

Class Name
CSE-XXX Python Labs
Class Key
XXXXXXXX

Course Description and Topics Covered:

Computer Science is an essential discipline in shaping modern life, impacting transportation, communication, and common transactions, among other elements. While the initial application of computing was restricted to highly technological domains, its role has shifted to a far more general and widespread one. In particular, the rise of data analysis and semi-automation in fields such as medicine, financial management, and security has made a basic knowledge of computer science and computational thinking extremely desirable to students and professionals across diverse domains and career paths.

This course seeks to introduce fundamental computer science concepts through a mixture of information technology instruction and mathematical thinking, alongside highly accessible Python programming tasks. Python is an interpreted, high-level programing language with a wide range of general applicability. In recent years, Python has become a fundamental tool for numerical and data analysis, scientific computation, and engineering applications.

This course includes five modules, all of which address related but distinct levels of the computing process. Among the topics included are basic syntax, program development, functions, arrays and vectors, lists and dictionaries, strings, files, object-oriented programming, and practical problem solutions and applications. The course is divided in five modules: 1) An introduction to computer science 2) Programming fundamentals, 3) Elementary data structures, 4) Program development, and 5) Practical applications. Each module will address one or more essential computer scientific principles including, but not limited to conceptual abstraction, algorithmic complexity, code reusability, and security. Active student participation through discussion and programming is a requirement for this course.

Course Objectives:

At the end of each module the successful student will be able to:

Module 1: Introduction to Computer Science

1. Provide a description of fundamental computer science terminology, including computer systems, software engineering, data structures, and algorithms.
2. Explain basic elements of discrete mathematics and its role in computer science.
3. Define information quantization and its role in both discrete mathematics and the computational process.
4. Explain distinctions between hot-button computing terms like machine learning, artificial intelligence, big data, and the Cloud.
5. Understand how programming language is translated to machine language, and the role of machine language.

Module 2: Programming Fundamentals

1. Understand basics of conceptual abstraction in programming.

2. Describe the differences between compiled and interpreted languages and be able to identify critical trade-offs in utilizing them.
3. Use the proper Python language syntax.
4. Utilize and explain fundamental Python programming concepts.
5. Distinguish basic Python language elements including statements, expressions and libraries.

Module 3: Elementary Data Structures

1. Explain how information is codified, stored, and retrieved in computing applications.
2. Describe and use data types including arrays, lists, and dictionaries.
3. Utilize functions to manipulate data structures in Python.
4. Evaluate trade-offs in storage, speed, and usability conferred by various data structures.
5. Understand the principles and value of code reusability.

Module 4: Program Development

1. Explain basic principles of software engineering.
2. Define algorithm complexity and scalability.
3. Be able to explain Big O notation in relation to best-case and worst-case algorithm performance.
4. Interpret pseudo-code and develop algorithms using Python.
5. Read and write from and to external files and programs using Python.

Module 5: Practical Applications

1. Select appropriate programming concepts, data structures and algorithms to solve real world problems.
2. Design and implement practical problem-solving applications using Python.
3. Perform statistical analysis to explain program results and their relevance to a given application.
4. Effectively present program results and statistics through visualization tools.
5. Understand fundamentals of software security.

Cardinal Core Learning Outcomes:

This course will provide students with the tools they need to conduct *quantitative reasoning* in the computer scientific problem-solving environment as follows.

1. Interpret information presented in mathematical and/or statistical forms: Module 1 will explore discrete mathematics and information quantization in the computer science world, while module 5 provides insight into statistical analysis of information gleaned from computing applications.

2. Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically: Module 1 introduces fundamental elements of discrete mathematics in computer science and their representation, while module 4 will present the use of Big-O notation to represent computational complexity.

3. Determine when computations are needed and execute the appropriate computations: Module 3 introduces the appropriate selection of data structures to codify information in applications, while module 4 provides an overview of algorithm selection to efficiently conduct required computation.

4.Apply an appropriate model to the problem to be solved: Module 2 explores the process of selecting an appropriate programming language and locating libraries to address a computing problem, while modules 3 and 4 explore the process of selecting the correct data structure and algorithm to apply, respectively. Module 5 ties together the selection process to address real-world problems.

5.Make inferences, evaluate assumptions, and assess limitations in estimation, modeling, and/or statistical analyses: Module 4 provides an assessment of theoretical best-case and worst-case computational speed estimates using Big-O notation, while Module 5 includes details on applying practical post-execution analysis of program results.

Course Assessment – Grading, Assignments, Exams, and Policy:

1. **Programming assignments:** You will be given **4** programming assignments that will count as **20%** of your grade. Late assignments will not be accepted without a valid excuse defined by the University standards. All assignments must be submitted via Blackboard and in the specified format. **Assignment dates in the calendar below are tentative.**
2. **Laboratories:** Two coding laboratories per module will be assigned on CodeZinger, these Laboratories will be graded and will count for the **20%** of your grade.
3. **There will be two exams (a midterm and a final exam).** These tests are scheduled to take into account all work restricted holidays as defined by the University. You are not allowed to miss any of these exams. Each of these exams will count as **20%** of your grade. **All exams are closed book and closed notes. The exams will be taken via Blackboard, each exam will be single attempt.**
4. There will be one final project that will represent the **20%** of your grade. On this project you should solve a real problem from a public dataset.
5. The grading scale is as follows:

   100 - 95.00 = A+ ,
   94.99 - 90.00 = A,
   89.99 - 85.00 = B+,
   84.99 - 80.00 = B,
   79.99 - 75.00 = C+,
   74.99 - 70.00 = C,
   69.99 - 65.00 = D+,
   64.99 - 60.00 = D and
   59.99 - 0 = F.

6. The test will be available for the 24 hours period of the test date. The duration of the exam is precisely one hour and fifty minutes. Once the exam is started it must be finished in one sitting without any breaks. Only one attempt is allowed.

The tests will be available online using *Respondus* and *Respondus Monitor* which are tools provided by the university for monitoring. The information is available in:
https://louisville.edu/delphi/blackboard/help/student-help/respondus-lockdown-browser-help

It is your responsibility to insure that your hardware and network connections are functioning and in order. You will need to have a functioning camera, you will need to show an ID proving who you are and you will need to scan and show your surroundings.

Collaboration and Cheating Policy:
Students are encouraged to cooperate in studying and to learn from each other or seeking knowledge from a variety of sources such as journals, magazines, or the web. However, **all submitted assignments must be original and the result of the individual's own work**. Cheating or copying of assignments or exams will not be tolerated and will be pursued.

Title IX/Clery Act Notification:
Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain **confidential** support from the PEACC Program (852-2663), Counseling Center (852-6585), and Campus Health Services (852-6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (852-5787) or University of Louisville Police (852-6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is **not confidential** under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.
For more information, see http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure

Course Syllabus
CSE 235

1. Course	CSE 235	Title	Computer Systems and Organization
2. Credits	3	Contact Hours	
3. Coordinator			
4. Textbook	• Computer Systems: A Programmer's Perspective, 3rd Edition from Bryant and O'Hallaron. ISBN: 013409266X. (Referred to as B&O below). • The C Programming Language, 2nd Edition by Kernighan and Ritchie. ISBN: 9780131103627. (Referred to as K&R below).		
5. Course Information			
Catalog Description	This course provides an introduction to the fundamental concepts of computer systems by exploring how computer systems execute programs and manipulate data, working from the C programming language down to the microprocessor. Topics covered include a tour of computer systems and hardware, advanced C programming techniques necessary to implement computer systems, data representation and manipulation techniques, and machine-level representation of programs in assembly language.		
Prerequisites	CSE 110 and CSE 130.		
Type of Course	Required for BA in CS.		
6. Goals for Course			
Course Objectives	a. Demonstrate understanding of computer systems and its hardware organization. b. Develop hands-on experience in advanced C programming techniques. c. Demonstrate understanding of representing and manipulating information in a computer. d. Demonstrate understanding of machine level representation of programs. e. Develop hands-on experience on assembly programming.		
7. List of Topics			
Detailed Schedule	a. A Tour of Computer Systems (1.5 weeks – Chapter 1 of B&O): Compilation process; hardware organization of systems including buses, I/O devices, main memory, cache memories, and processor; storage hierarchy; components of an operating system; communication and networks; and concurrency and parallelism. b. Advanced C Programming (2.5 weeks): i. Overview of C and C-Strings (Chapters 1-4 of K&R) ii. Pointers and Arrays (Chapter 5 of K&R): Pointers and addresses, function arguments, address arithmetic, pointers to		

	pointers, multidimensional arrays, and command-line arguments. iii. Structures (Chapter 6 of K&R): Basic structures, structures and functions, arrays of structures, pointers to structures, self-referential structures, table lookup, typedefs, unions, bit-fields. iv. Input and Output (Chapter 7 of K&R): Standard input and output, formatted input and output, variable length argument list, file access, error handling using stderr and exit. v. The UNIX System Interface (Chapter 8 of K&R): File descriptors, low level I/O system calls, random data access. c. Representing and Manipulating Information (4 weeks – Chapter 2 of B&O): i. Information Storage (1 week): Data sizes, addressing and byte ordering, hexadecimal notation, words, string representations, boolean algebra, bit-level & logical operations. ii. Integer Representations (1 week): Integral data types, unsigned encodings, two's-complement encodings, conversion between signed and unsigned conversion. iii. Integer Arithmetic (1 week): Unsigned addition, two's complement addition, two's complement negation, unsigned multiplication, two's complement multiplication, multiplying by constants, dividing by powers of two. iv. Floating Point (1 week): Fractional binary numbers, IEEE Floating point representation, rounding, floating point operations. d. Machine Level Representation of Programs (4 weeks – Chapter 3 of B&O): i. Data Access and Logical Operations (1 week): Program encodings including machine level code as well as data formats, accessing information including operand specifiers and data movement instructions. Arithmetic and logical operations including load effective address, unary and binary operations, shift operation, special arithmetic operations. ii. Control (1 week): Condition codes, jump instructions, translating conditional branches, loops, conditional move instructions, switch statements. iii. Procedures (1 week): Stack frame structure, transferring control, register usage conventions, recursive procedures.

	iv. Array allocation and Access (1 week): Pointer arithmetic, nested arrays, fixed and variable sized arrays.

1. Course: CECS 335
2. Title: Introduction to Databases
3. Credits: 3
4. Contact Hours: 42
5. Coordinator: Badia, Antonio
6. Textbook: Murach's MySQL, 3rd edition.
7. Course Information
   - Catalog Description: This course is intended as an introduction to database management and programming for Computer Science students, both majors in the BS and BA degrees and minors. It covers the basics of SQL for database creation and querying, including procedural extensions and language bindings for database access through applications, and an introduction to database design.
   - Prerequisites: CECS 130 (Introduction to Programming), CECS 302 (Data Structures).
   - Type of Course: Required for BS and BA in CS, elective for minor in CS.
8. Goals for Course:
   - Course Objectives:
     - To introduce students to data modeling and storage in database systems, in particular the relational data model.
     - To introduce students to the Structured Query Language (SQL) for creating and querying the database.
     - To introduce students to typical database access and interaction within applications.
     - To introduce students to the basis of database design.
   - Student Outcomes:
     - An ability to design a system, component, or process to meet desired needs (ABET SLO c).
     - An ability to identify, formulate, and solve engineering problems (ABET SLO e).
     - An ability to use the techniques, skills, and modern engineering tools (ABET SLO k).
9. List of Topics:
   - Introduction to Database Systems
     - Information System role.
     - Computer Architecture constraints.
   - The Relational Data Model.
     - Databases, Schemas and Tables.
     - SQL: CREATE statements.
     - Users and permissions.
     - SQL: managing users.
   - Querying the database.
     - SQL: simple SELECT statement.
     - SQL: aggregations and grouping.
     - SQL: complex SELECT: subqueries.

  - SQL: views and windows.
  - SQL: stored procedures and functions.
  - SQL: triggers.
  - Embedded SQL.
- Designing the database.
  - Tidy tables.
  - Dealing with optional and multi-values attributes.
  - Conceptual models: the E-R model.
  - Translating from E-R to schemas.

Computer Engineering and Computer Science

University of Louisville

Louisville, Kentucky, 40292

Introduction to Software Engineering

CECS-350 Syllabus

Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (852-2663), Counseling Center (852-6585), and Campus Health Services (852-6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (852-5787) or University of Louisville Police (852-6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.
For more information, see the Sexual Misconduct Resource Guide. http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure

Professor-in-Charge
Dr. Hui Zhang
Phone: (502)-852-0468
Email: hui.zhang [at] louisville.edu
Office Hours: tbd

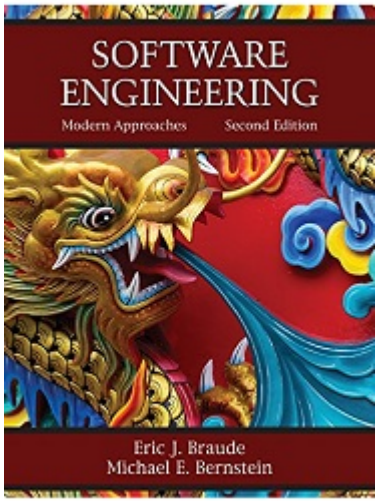
Lectures: tbd.

Course Prerequisites: tbd

Course Description:
Software engineering is an engineered discipline in which the aim is the production of software products, delivered on time and within a set budget, that satisfies the client's needs. It covers all aspects of software production ranging from the early stage of product concept to design and implementation to post-delivery maintenance. This course introduces the major concept, techniques, and tools of software engineering so that students can prepare for their future IT and software careers. Moreover, through group curated projects, students can obtain hands-on experiences on entire phases and workflow of the software process.

Course Objectives:
At the conclusion of this course, the successful (passing) student will be able to:
1. design, implement and test a large software project
2. use qualitative and quantitative measures to assess the software product and the software process used
3. be able to integrate necessary language or learning activities into the development cycle
4. be able to work cooperatively in teams
5. be able to provide a variety of required documentation throughout the development cycle
6. be able to give a professional presentation of the finished product to a group of peers

Textbook:
Software Engineering: Modern Approaches by Eric Braude and Michael E. Bernstein., Wiley Publishers, Second Edition, 2011. ISBN 978-0-471-69208-9. (**A pdf version is available online. Download the same**.)



Additional Optional Reference:

- *Software Engineering* by S. Pfleeger, J Atlee, Prentice Hall 4th edition, ISBN 0131469134
  An Electronic version is available for half the price to download, if you wish.
- *Introduction to Agile Methods* by Sondra Ashmore and Kristyn Runyan, Addison Wesley, 2015
  ISBN 978-0-321-92956-3
- *Testing Computer Software*, 2nd Edition by Cem Kaner, Jack Faulk, and Hung Quoc Nguyen. John Wiley and Sons. New York NY. ISBN: 0-471-35846-0.
- A number of free e-books and other internet based reference materials covering different aspects will be given in class.

Reading Assignments: Reading assignments serve as an aid to the class lecture topics. They will be given in class and are expected to be completed before the next class. Unannounced quizzes may be given on reading assignments.

CURRICULUM VITAE OF
Wei Zhang, Ph.D.

Wei Zhang
Professor and Chair
Department of Computer Science and Engineering
Speed School of Engineering
University of Louisville
Louisville, KY 40292

Phone: (502) 852-0715
Email: wei.zhang@louisville.edu
Homepage: https://engineering.louisville.edu/faculty/wei-zhang/

I. EDUCATION

Ph.D. in Computer Science and Engineering, Pennsylvania State University, Department of Computer Science and Engineering, August 2003

M.S. in Computer Science, Institute of Software, Chinese Academy of Sciences, July 2000

B.S. in Computer Science, Peking University, China, July 1997

II. PROFESSIONAL EXPERIENCE

8/2019 – current	Professor and Chair, Department of Computer Science and Engineering, University of Louisville
7/2014 – 7/2019	Professor, Department of Electrical and Computer Engineering, Virginia Commonwealth University
8/2010 – 6/2014	Associate Professor (tenured), Department of Electrical and Computer Engineering, Virginia Commonwealth University
8/2003 – 7/2010	Assistant and Associate Professor (tenured), Department of Electrical and Computer Engineering, Southern Illinois University Carbondale

III. SELECTED PUBLICATIONS

Note: Dr. Zhang has published 170+ refereed journal and conference papers. The following is a selected list of publications in the past 2 years (2018-2020).

1. X. Wang and W. Zhang. pacSCA: A Profiling-Assisted Correlation-based Side-Channel Attack on GPUs. To appear in Proc. of the 38th IEEE International Conference on Computer Design (ICCD), October, 2020.
2. H. Wen and W. Zhang. Denial of Service in CPU-GPU Heterogeneous Architectures. To appear in Proc. of the 2020 IEEE High Performance Extreme Computing Conference, September, 2020.

3. X. Wang and W. Zhang. Packing Narrow-Width Operands to Improve Energy Efficiency of General-Purpose GPU Computing. To appear in Proc. of the 2020 IEEE High Performance Extreme Computing Conference, September, 2020.
4. H. Wen and W. Zhang. Heterogeneous Cache Hierarchy Management for Integrated CPU-GPU Architecture. In Proc. of the 2019 IEEE High Performance Extreme Computing Conference, September, 2019.
5. H. Wen and W. Zhang. Improving Parallelism of Breadth First Search (BFS) Algorithm for Accelerated Performance on GPUs. In Proc. of the 2019 IEEE High Performance Extreme Computing Conference, September, 2019.
6. X. Wang and W. Zhang. Execution Units Power-Gating to Improve Energy Efficiency of GPGPUs. In Proc. of the 2019 IEEE International Conference on Green Computing and Communications (GreenCom-2019), July 2019.
7. X. Wang and W. Zhang. Cracking Randomized Coalescing Techniques with An Efficient Profiling-Based Side-Channel Attack to GPU. In Proc. of Hardware and Architectural Support for Security and Privacy (HASP) Workshop, in conjunction with ISCA, June, 2019.
8. X. Wang and W. Zhang. An Efficient Profiling-Based Side-Channel Attack on Graphics Processing Units. National Cyber Summit (NCS), June, 2019.
9. H. Wen and W. Zhang. Reducing Inter-Application Interferences in Integrated CPU-GPU Heterogeneous Architectures. In Proc. of the 36th IEEE International Conference on Computer Design (ICCD), Oct, 2018.
10. X. Wang and W. Zhang. Energy-Efficient DNN Computing on GPUs Through Register File Management. In Proc. of the 2018 IEEE High Performance Extreme Computing Conference, September, 2018.
11. H. Wen and W. Zhang. Exploiting GPU with 3D Stacked Memory to Boost Performance for Data-Intensive Applications. In Proc. of the 2018 IEEE High Performance Extreme Computing Conference, September, 2018.
12. H. Wen and W. Zhang. Regression Based WCET Analysis For Sampling Based Motion Planning In Proc. of the 2018 IEEE High Performance Extreme Computing Conference, September, 2018.
13. Y. Huangfu and W. Zhang. WCET Analysis of GPU L1 Data Caches In Proc. of the 2018 IEEE High Performance Extreme Computing Conference, September, 2018.
14. X. Wang and W. Zhang. GPGPU Functional Units Power Gating for Leakage Energy Reduction. To appear in Journal of Computing Science and Engineering.
15. X. Wang and W. Zhang. Exploring Time-Predictable and High-Performance Last-Level Caches for Hard Real-Time Integrated CPU-GPU Processors. To appear in Journal of Computing Science and Engineering.

16. H. Wen and W. Zhang. Cache Leakage Reduction Techniques for Hybrid SPM-Cache Architectures. Accepted by Journal of Circuits, Systems, and Computers (JCSC).
17. Y. Huangfu and W. Zhang. Estimating the Worst-Case Execution Time of the Shared Data Cache in Integrated CPU-GPU Architectures. Journal of Computing Science and Engineering, Vol. 12, No. 4, December 2018, pp. 139-148.
18. X. Wang and W. Zhang. Packing Narrow-Width Operands to Improve GPU Performance. Journal of Computing Science and Engineering, Vol. 12, No. 2, June 2018, pp. 37-49.
19. H. Wen and W. Zhang. Exploring GPU Data Cache Leakage Management Techniques. Journal of Computing Science and Engineering, vol. 12, no. 3, pp.106-114, 2018.
20. X. Wang and W. Zhang. Improving CPU and GPU Performance by Sample-Based Dynamic LLC Bypassing. Journal of Computing Science and Engineering, vol. 12, no. 2, pp.50-62, June, 2018.
21. L. Wu and W. Zhang. Cache-Aware SPM Allocation Algorithms for Performance and Energy Optimization on Hybrid SPM-Cache Architecture. Journal of Computing Science and Engineering, Vol. 12, No. 3, September 2018, pp. 91-105.
22. L. Wu and W. Zhang. Cache-Aware SPM Allocation to Reduce Worst-Case Execution Time for Hybrid SPM-Caches. Journal of Circuits, Systems, and Computers (JCSC), Vol. 27, No. 5, May 2018.

IV. SPONSORSHIP OF SCHOLARLY ACTIVITIES

PI (Co-PI is noted)	Project Title	Funding Agency	Requested from Funding Agency
Wei Zhang (2021-2026) PI	Scholarships, Community, and High-impact Practices to Improve Undergraduate Student Success in Computer Science and Engineering	NSF	$1,000,000
Wei Zhang (2018-2019) PI	NSF REU Supplement: A Time-Predictable Integrated CPU-GPU Architecture for Hard Real-Time Systems	NSF	$16,000
Wei Zhang (2016-2019) PI	NSF EDU: Collaborative: Integrating Embedded Systems Security into Computer Engineering and Science Curricula	NSF	$50,000
Wei Zhang (2016-2017) PI	NSF REU Supplement: A Time-Predictable Integrated CPU-GPU Architecture for Hard Real-Time Systems	NSF	$16,000

Wei Zhang (2016-2017) PI	NSF Supplemental: A Time-Predictable Integrated CPU-GPU Architecture for Hard Real-Time Systems	NSF	$75,000
Wei Zhang (2014-2017)	CSR: Small: A Time-Predictable Integrated CPU-GPU Architecture for Hard Real-Time Systems	NSF	$500,000
Wei Zhang (2013-2015)	Exploiting Intel Atom Processors for Endian-Neutral Advanced Engineering Programming	Intel	$25,000
Wei Zhang (2012-2014)	Intel Atom Based Computer Organization and Design	Intel	$20,000
Wei Zhang (2011-2014)	REU Supplement: SHF:SM: A Time-Predictable Multicore/Manycore Architecture for Real-Time Systems	NSF	$16,000
Wei Zhang (2010-2014)	SHF:SM: A Time-Predictable Multicore/Manycore Architecture for Real-Time Systems	NSF	$256,164
Wei Zhang (2010-2013)	VCU Startup Fund	VCU	$125,000
Wei Zhang (2011-2013)	Develop Intel Atom based Multithreaded Programming and Real-Time Analysis Course Modules	Intel	$30,000
Wei Zhang (2010-2012)	Collaborative Proposal: Problem-Based Learning of Multithreaded Programming for Multi-Core Processors	NSF	$42,102
Wei Zhang (co-PI, 2010) M. Daneshdoost (PI) F. Pourboghrat, A. Mehta	Motorola Innovation Generation Grant (SIUC)	Motorola	$25,000
Wei Zhang (2009-2012)	SHF:SM: A Time-Predictable Multicore/Manycore Architecture for Real-Time Systems (SIUC)	NSF	$280,000
Wei Zhang (2009-2010)	REU Supplement: CSR---EHS: A VLIW Architecture and Compiler Framework for Time Predictability (SIUC)	NSF	$16,000
Wei Zhang (2009-2010)	2009 Excellence through Commitment Undergraduate Teaching Enhancement Award	SIUC	$23,000
Wei Zhang (2009-2011)	Collaborative Proposal: Problem-Based Learning of Multithreaded Programming for Multi-Core Processors (SIUC)	NSF	$95,285

Wei Zhang (2008-2010)	REU Supplement: CSR---EHS: A VLIW Architecture and Compiler Framework for Time Predictability (SIUC)	NSF	$12,000
Wei Zhang (2008-2009)	REU Supplement: CSR---EHS: A Dynamic Compilation Framework for Energy Reduction on Mobile Devices (SIUC)	NSF	$12,000
Wei Zhang (2007-2008)	Efficient Statistical WCET Analysis of Java Applications by Exploiting Program-Flow Information (SIUC)	IBM	$17,000
Wei Zhang (2007-2010)	CSR---EHS: A VLIW Architecture and Compiler Framework for Time Predictability (SIUC)	NSF	$120,000
Wei Zhang (2007-2008)	REU Supplement: SGER: A VLIW/Superscalar Heterogeneous Multi-core Architecture and the Compiler Support (SIUC)	NSF	$12,000
Wei Zhang (2006-2009)	CSR---EHS: A Dynamic Compilation Framework for Energy Reduction on Mobile Devices	NSF	$120,000
Wei Zhang (2006-2007)	SGER: A VLIW/Superscalar Heterogeneous Multi-core Architecture and the Compiler Support	NSF	$99,812
Wei Zhang (2005)	Incorporating Reconfigurable Functional Units into Superscalar Microprocessors for Dual Instruction Execution	Altera	$2,995 (software donation)
Haibo Wang (PI) Themistoklis Haniotakis Wei Zhang (co-PI, 2004)	UNIX System Accessibility Enhancement Project	SIUC	$19,000 $10,000 matching
Wei Zhang (2004-2005)	Compiler and Hardware Cooperative Branch Prediction	SIUC	$15,992
Wei Zhang (2003-2004)	SIUC ORDA Startup Grant	SIUC	$30,000

V. PROFESSIONAL SERVICE

ExCom Member-at-large IEEE Richmond Section, 2011, 2012, 2013

Student Activity Chair of IEEE Richmond Section, 2015, 2016, 2017, 2018

Workshop Chair, the 7th IEEE/IFIP International Conference on Embedded and Ubiquitous Computing (EUC), August, 2009

Poster Chair, 14th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), St. Louis, MO, April 22 - April 24, 2008

Publicity Chair, the 2007 International Conference on Embedded Software and Systems (ICESS'07), 2007

Invited Session Chair:

- The 36th IEEE International Conference on Computer Design (ICCD), Oct, 2018, Session 7A: GPU and Accelerators
- The IEEE 23rd International Conference on Parallel and Distributed Systems (IEEE ICPADS 2017), December, 2017, Session 4D: GPU Acceleration.
- The 35th IEEE International Performance Computing and Communications Conference (IPCCC), Dec, 2016
- The 33rd IEEE International Performance Computing and Communications Conference (IPCCC), Session 8: Cloud Computing. Dec, 2014.
- The 11th IEEE International Conference on Embedded Software and Systems (ICESS), August, 2014.
- The 32nd IEEE International Performance Computing and Communications Conference (IPCCC), Session 1: System Optimization. Dec, 2013.
- The 2008 IEEE/IFIP International Conference on Embedded and Ubiquitous Computing (EUC 2008), December 2008.
- Session 2: The 4th IEEE International Symposium on Embedded Computing (SEC-07), May, 2007
- Session 2: Low Power Design and Technology, The ACM Great Lakes Symposium on VLSI 2006 (GLSVLSI'06), May 14-16, 2006
- Session 6B, Asia-Pacific Computer Systems Architecture Conference, September 2004

Technical Program Committee Member:

- The IEEE High Performance Extreme Computing Conference (HPEC), 2020
- The National Cyber Summit (research track), 2020
- The 38th IEEE International Conference on Computer Design (ICCD), 2020
- The 7th IEEE International Conference on Cyber Security and Cloud Computing (IEEE CSCloud 2020)
- The 5th IEEE International Conference on Intelligent Data and Security (IEEE IDS 2020)
- The 6th IEEE International Conference on High Performance and Smart Computing (IEEE HPSC 2020)
- The 6th Workshop on Performance Engineering with Advances in Software and Hardware for Big Data Sciences (PEASH), December 2019

- The 37th IEEE International Conference on Computer Design (ICCD), 2019
- The 6th IEEE International Conference on Cyber Security and Cloud Computing (CSCloud 2019), 2019
- The 5th IEEE International Conference on High Performance and Smart Computing (HPSC 2019), 2019
- IEEE International Conference on Consumer Electronics (ICCE), 2019
- 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications (TrustCom), 2018
- The IEEE High Performance Extreme Computing Conference (HPEC), 2018, 2019
- The 10th National Cyber Summit (NCS'18), 2018, 2019
- The 30th ACM/SIGAPP Symposium On Applied Computing (SAC 2015), Operating System track, 2015
- The 29th IEEE International Parallel & Distributed Processing Symposium (IEEE IPDPS 2015), 2015
- IEEE International Conference on Pervasive Intelligence and Computing (PICom), 2014, 2015, 2016, 2017, 2018
- The IEEE International Conference on Embedded Computing (EmbeddedCom), 2014
- The International Conference on Smart Grids and Green IT Systems (SMARTGREENS), 2012, 2013
- The IEEE International Conference on Networking, Architecture, and Storage (NAS), 2011, 2012, 2013, 2014, 2015
- The IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), 2009, 2010, 2011, 2012
- IEEE Frontiers in Education(FIE), 2012
- The ACM Great Lakes Symposium on VLSI, 2007, 2008, 2009, 2010
- International Conference on Embedded Software and Systems (ICESS), 2005, 2007, 2008, 2009, 2010, 2011, 2012, 2014, 2015, 2016
- The 26th ACM Symposium on Applied Computing (SAC), Track on Real-Time Systems (RTS), March 2011
- The 4th International Conference on Contemporary Computing (IC3), August, 2011
- The sixth International Conference on Embedded and Multimedia Computing (EMC 2011), August 2011
- The International Conference on Embedded Software and Systems, 2008, 2009, 2010
- The Work-in-Progress (WIP) session of The 30th IEEE Real-Time Systems Symposium, December 2009
- 2009 International Conference on Multimedia Information Networking and Security (MINES 2009), November 2009.
- The 8th IEEE International Conference on Embedded Computing (EmbeddedCom-09), September 2009
- The 14th IEEE International Conference on Parallel and Distributed Systems (ICPADS), 2008, 2010

- The First International Conference on Contemporary Computing NOIDA, August 7-9, 2008
- The IEEE International Conference on Embedded and Ubiquitous Computing (EUC), 2008, 2019
- The IEEE 9th International Conference on Computational Science and Engineering, July 2008
- The 2007 MEDEA Workshop Memory Performance: Dealing with Applications, Systems, and Architecture (MEDEA'07), in conjunction with PACT 2007 Conference, Sept. 2007
- The 2007 International Workshop on Embedded Parallel and Distributed Computing (EDPC'07), September, 2007
- The 4th IEEE International Symposium on Embedded Computing (SEC-07), May, 2007
- The 2006 MEDEA Workshop Memory Performance: Dealing with Applications, Systems, and Architecture (MEDEA'06), in conjunction with PACT 2006 Conference, Seattle, Sept. 16- 20, 2006
- The ACM Great Lakes Symposium on VLSI 2006 (GLSVLSI'06), May 14-16, 2006
- The 2005 MEDEA Workshop Memory Performance: Dealing with Applications, Systems, and Architecture (MEDEA'05), in conjunction with PACT 2005 Conference, Saint Louis, Missouri, Sept. 17- 21, 2005
- The 2005 International Conference on Embedded Systems and Application (ESA'05), 2005

VI. AWARDS:

2016 Engineer of the Year Award, RJEC (Richmond Joint Engineer Council), March 2017

2009 SIUC Excellence Through Commitment Outstanding Scholar Award for the College of Engineering, 2009

2009 Excellence Through Commitment Undergraduate Teaching Enhancement Award, SIUC 2009

IBM Faculty Award (2007 Real-time Innovation Award), 2007

Outstanding Young Faculty Teacher Award, Department of Electrical and Computer Engineering, Southern Illinois University Carbondale, 2004

Faculty Roster Form
Qualifications of Full-Time and Part-Time Faculty

Name of Institution: University of Louisville

Name of Primary Department, Academic Program, or Discipline: Computer Science and Engineering Department, Bachelor of Arts in Computer Science

Academic Term(s) Included: Fall, Spring, and Summer Date Form Completed: 4/5/2020

NAME (F, P)	COURSES TAUGHT Including Term, Course Number & Title, Credit Hours	ACADEMIC DEGREES& COURSEWORK Relevant to Courses Taught, Including Institution & Major List specific graduate coursework, if needed	OTHER QUALIFICATIONS & COMMENTS Related to Courses Taught
Nihat Altiparmak, (F)	Fall, CSE 420, Design of Operating Systems Spring, CSE 420, Design of Operating Systems Spring, CSE 629, Distributed System Design	B.S., Computer Engineering, Bilkent University, 2007 M.S., Computer Science, University of Texas at San Antonio, 2012 Ph.D., Computer Science, University of Texas at San Antonio, 2013	
Bassel Arafeh, (F)	Fall, CSE 220, OO Programing Design with Java Fall, CSE 611, Computer Architecture Spring, CSE 596, CSE Capstone Design Summer, CSE 220, OO Programing Design with Java Summer, CSE 596, CSE Capstone Design	BScs, Electrical Engineering, Cairo University, 1974 ME, Electrical Engineering, Texas A & M University, 1980 PhD, Computer Science, Texas A & M University, 1986	
Antonio Badia, (F)	Fall, CSE 535, Introduction to Databases Fall, CSE 536, Data Management and Analysis Spring, CSE 535, Introduction to Databases Spring, CSE 630, Advanced Databases	Ph.D., Computer Science, Indiana University, 1997	
Dar-Jen Chang, (F)	Fall, CSE 625, Parallel Programming Fall, CSE 628, Computer Graphics Spring, CSE 528, Game Design and Programming Summer, CSE 530, Design of Compilers Summer, CSE 590, Big Data, Graph Analytics	B.S., Mathematics, National Tsing Hua University, 1970 M.S., Computer Information/Control Engineering, University of Michigan, 1982 Ph.D., Mathematics, University of Michigan, 1982	
Ahmed Desoky, (F)	Fall, CSE 419, Introduction to Algorithms Fall, CSE 619, Design of Computer Algorithms Spring, CSE 564, Introduction to Cryptography Spring, CSE 619, Design of Computer Algorithms Spring, CSE 635, Data Mining with Linear Models Summer, CSE 566, Information Security	B.S., Electrical Engineering, Cairo University, 1968 B.S., Mathematics, Cairo University, 1972 M.S., Statistics, North Carolina State University, 1980 Ph.D., Electrical Engineering, North Carolina State University, 1983	
Adel Elmaghraby, (F)	Fall, CSE 694, Case Studies in Deep Learning	B.S., Computer Science, Alexandria University, 1973 M.S., Electrical Engineering, University of Wisconsin - Madison, 1978 Ph.D., Electrical Engineering, University of Wisconsin - Madison, 1982	

Hichem Frigui, (F)	Fall, CSE 627, Digital Image Processing Spring, CSE 590-04, Introduction to Machine Learning	B.S., Computer & Electrical Engineering, University of Missouri - Columbia, 1990 M.S., Electrical Engineering, University of Missouri - Columbia, 1992 Ph.D., Computer Engineering, University of Missouri - Columbia, 1997	
Ibrahim Imam, (F)	Fall, CSE 570, Mobile Device Programming Fall, CSE 631, Database Security Spring, CSE 640, Web Applications Design and Development Spring, CSE 596, CSE Capstone Design	B.S., Mathematics, Robert College, 1971 B.S., Mechanical Engineering, Bogazici University, 1973 M.A., Mathematics, Auburn University, 1974 Ph.D., Mathematics, Auburn University, 1982	
Mehmed Kantardzic, (F)	Fall, CSE 504, Automata Theory Fall, CSE 632, Data Mining Spring, CSE 504, Automata Theory	B.S., Electrical Engineering, University of Sarajevo, 1972. M.S., Computer Science, University of Sarajevo, 1976. Ph.D., Computer Science, University of Sarajevo, 1980.	
Andrew Karem, (F)	Fall, CSE 220, OO Programing Design with Java Spring, CSE 220, OO Programing Design with Java Spring, CSE 302, Data Structures Summer, CSE 310, Discrete Structures Summer, CSE 535, Introduction to Database	Ph.D., Computer Science and Engineering, University of Louisville, 2019	
Anup Kumar, (F)	Fall, CSE 522, Performance Evaluation of Computer Systems Fall, CSE 590, Big Data Analytics Tools and Technology Spring, CSE 516, Fundamentals of Computer Networks Spring, CSE 590, Introduction to Cloud Computing	B.E., Computer Science, University of Allahabad, 1983 M.S., Electrical Engineering, University of Manitoba, 1986 (Transferred to Ph.D. Program) Ph.D., Electrical and Computer Engineering, North Carolina State University, 1989	
Adrian Lauf, (F)	Fall, CSE 525, Microcomputer Design Spring, CSE 525, Microcomputer Design Spring, CSE 613, Network Security Summer, CSE 412, Embedded Systems	B.E., Computer Engineering, Vanderbilt University, 2005 M.S., Electrical Engineering, Vanderbilt University, 2007 Ph.D., Electrical Engineering, Vanderbilt University, 2010	
Olfa Nasraoui, (F)	Fall, CSE 620, Combinatorial Optimization and Modern Heuristics Spring, CSE 621, Web Mining for E-Commerce	B.S., Computer Engineering & Electrical Engineering, University of Missouri - Columbia, 1990 M.S., Electrical Engineering, University of Missouri - Columbia, 1992 Ph.D., Computer Science & Computer Engineering, University of Missouri - Columbia, 1999	
Juw Won Park, (F)	Fall, CSE 596, CSE Capstone Design Fall, CSE 694, Current Topics in Bioinformatics Spring, CSE 596, CSE Capstone Design	B.S. in Computer Science Korea University, Seoul, Republic of Korea, 1995 M.S. in Computer Science University of Iowa, Iowa City, IA, USA, 1999 Ph.D. in Computer Science University of Iowa, Iowa City, IA, 2009	
Eric Rouchka, (F)	Fall, CSE 310, Discrete Structures Spring, CSE 660, Introduction to Bioinformatics	B.S., Mathematics, Computer Science, Biology, Rockhurst College, 1994 M.S., Computer Science, Rensselaer Polytechnic Institute, 1996 D.Sc., Computer Science, Washington University - St. Louis, 2002	
Daniel Sierra, (F)	Fall, CSE 130, Introduction to Programming Languages on C/C++ Spring, CSE 130, Introduction to Programming Languages on C/C++ Spring, CSE 590-01, Introduction to Deep Learning Algorithm Methods Spring, CSE 590-03, Python and Data Analytics Summer, CSE 130, Introduction to Programming Languages on C/C++ Summer, CSE 590, Introduction to Quantum Computing	Physics Engineering, EAFIT University, Medellin-Colombia. 2010 Ph.D. The Science Faculty, School of Physics at National University of La Plata, Argentina, 2014	

Roman Yampolskiy, (F)	Fall, CSE 130, Introduction to Programming Languages on C/C++ Fall, CSE 545, Artificial Intelligence Spring, CSE 130, Introduction to Programming Languages on C/C++	A.S., Computer Science, Monroe Community College, 2000 M.S., Computer Science, Rochester Institute of Technology, 2004 Ph.D., Computer Science & Engineering, The State University of New York - Buffalo, 2008	
Hui Zhang, (F)	Fall, CSE 550, Software Engineering Spring, CSE 550, Software Engineering Spring, CSE 694, Scientific Data Visualization	BS, Computer Science, Zhejiang University, Hangzhou, China, 1999 MS, Computer Science, Zhejiang University, Hangzhou, China, 2002 PhD, Computer Science, Indiana University, 2008	
Wei Zhang, (F)	Fall, CSE 611, Computer Architecture	Ph.D. in Computer Science and Engineering, Pennsylvania State University, 2003 M.S. in Computer Science, Institute of Software, Chinese Academy of Sciences, 2000 B.S. in Computer Science, Peking University, China, 1997	
David King, (P)	Fall, CSE 311, Ethics and Law in Computer Science Spring, CSE 311, Ethics and Law in Computer Science	B.S., Computer Science, University of Louisville, 1974 ME, Computer Science, University of Louisville, 1976 JD, Law, University of Louisville, 1986	
Michael Losavio, (P)	Fall, CSE 311, Ethics and Law in Computer Science Spring, CSE 311, Ethics and Law in Computer Science	B.S., Mathematics, Louisiana State University, 1978 J.D., Law, Louisiana State University, 1981	

F, P: Full-time or Part-time;
All courses listed are 3 credit hours

Course Title (CIP)

Degree Program Core Courses (i.e., Courses required by ALL students in the Major--includes Premajor or Preprofessional courses)

Course Prefix	Course #	Course Title	Course Description	Type of Course: program core (C) or pre-major/ pre-professional (P)	Credit Hours	Existing (E) or New (N) Course
CSE	120	Introduction to Computer Science and Programming with Python	This course seeks to introduce fundamental computer science concepts through a mixture of information technology instruction and computational thinking, alongside the highly accessible programming language Python	C	3	N
CSE	110	Mathematical Foundations for Computer Science	The course covers mathematical and statistical concepts necessary for design and analysis of computer algorithms as well as developing system performance models, by visiting selected topics from number theory, vectors and matrices, combinatorics, probability, and statistics.	C	3	N
CSE	130	Intro to Programming Languages C/C++	Introduction to programming languages with C and C++. It includes laboratory exercises on the writing and compiling computer programs in C, C++.	C	3	E
CSE	220	OO Prog Design with Java	Introduction to Object Oriented Program design principal concepts and program development using Java programming language. It includes laboratory exercises on the design and implementation of computer applications in Java.	C	3	E
CSE	235	Computer Systems and Organization	This course provides an introduction to the fundamental concepts of computer systems by exploring how computer systems execute programs and manipulate data, working from the C programming language down to the microprocessor. Topics covered include a tour of computer systems and hardware, advanced C programming techniques necessary to implement computer systems, data representation and manipulation techniques, and machine-level representation of programs in assembly language.	C	3	N
CSE	302	Data Structures	Study of information representations and relationship between the form of representation and processing techniques. Transformations between storage media. Referencing of information as related to the structure of its representation and implications for the design of the referencing language.	C	3	E
CSE	310	Discrete Structures	Engineering applications using computer structures including algebraic computational structures, finite state machines, relational structures, propositional logic, trees, graphs, groups, machine equivalence, introduction to formal grammar. Applications of these structures to engineering problems including fluid flow, communication systems, artificial intelligence, digital logic, and algorithm evaluation	C	3	E
CSE	335	Intro to Databases	This course is intended as an introduction to database management and programming for Computer Science students, both majors in the BS and BA degrees and minors. It covers the basics of SQL for database creation and querying, including procedural extensions and language bindings for database access through applications, and an introduction to database design.	C	3	E
CSE	350	Introduction to Software Engineering and Application Development	Software engineering is an engineered discipline in which the aim is the production of software products, delivered on time and within a set budget, that satisfies the client's needs. It covers all aspects of software production ranging from the early stage of product concept to design and implementation to post-delivery maintenance. This course introduces the major concept, techniques, and tools of software engineering so that students can prepare for their future IT and software careers. Moreover, through group curated projects, students can obtain hands-on experiences on entire phases and workflow of the software process	C	3	N
CSE	419	Introduction to Algorithms	This course covers an introduction to algorithms, spanning topics ranging from computational complexity to advanced tree and graph algorithms.	C	3	E
CSE	420	Design of Operating Systems	The course is designed to cover basic concepts of operating systems design and implementation including processes management, memory management, input/output and file management, storage management, distributed systems, and security	C	3	E
CSE	470	Mobile Apps Design and Development	This course covers the basic concepts in designing and implementing applications running on Apple's iOS and Google's Android operating systems.	C	3	E
CSE	496	Capstone Design	This course requires solving a real-world design problem in computer engineering. It uses hardware and software design methods and tools learned in previous coursework emphasizing teamwork, written and oral communication.	C	3	N
			Total Credit hours Required for Program Core (i.e., # of hours in degree program core) **Note: number recorded will automatically populate Core Hours in "Summary of Total Program Hours" table**		**39**	**NA**

Core Courses Required for Track(s), Concentration(s), or Speciality(s) (if applicable)

Course Prefix	Course #	Course Title	Course Description	Course Required for Track (T), Concentration (C) or Specialty (S)	Credit Hours	Existing (E) or New (N) Course
			Total Credit hours Required for Program Options (Track(s), Concentration(s), or Speciality) (if applicable) **Note: number recorded will automatically populate Program Option hours in "Summary of Total Program Hours" table**		**0**	**NA**

GUIDED Elective Courses (i.e., Specified list of Program Electives AND/OR Electives focused on a specific track/concentration/or speciality) (if applicable)

Course Prefix	Course #	Course Title	Course Description	Course Required for Program (P), Track (T), Concentration (C) or Specialty (S)	Credit Hours	Existing (E) or New (N) Course
CSE	**5XX**		**A total of 4 required CSE electives**	**P**	**12**	**E**
Varies	**Other Area of Study**		**10 courses from other area of study such as biology, math, psychology, etc.**	**P**	**30**	**E**
CSE/OAS			**A total of 6 credit hours the student may choose from CSE electives or other area of studies**	**P**	**6**	**E**
CSE	**TBD**	**co-op/internship.**	**Workplace Experience as a co-op or internship**	**P**	**2**	**N**
			# of REQUIRED Credit hours in Guided Electives (i.e., electives for a focused or track/concentration/speciality are). If 9 hours is required and there are 15 hours to choose from, then only 9 hours are required) **Note: number recorded will automatically populate Guided Elective hours in "Summary of Total Program Hours" table**		**50**	**NA**

FREE Elective Courses (i.e, general program electives, open to the students to choose) (if applicable)

Course Prefix	Course #	Course Title	Course Description	Course Required for Program (P), Track (T), Concentration (C) or	Credit Hours	Existing (E) or New (N) Course
			Students must complete 31 hours of General Education requirements. 12 of these hours are specified below. The rest are listed by category below			
ENG	**101**	**Intro to College Writing I - WC**	**Students engage in critical thinking and writing by developing their writing processes and producing finished prose. Required writing consists of multiple drafts of 4-6 papers of varying lengths.**	P	**3**	**E**
ENG	**102**	**Intermediate College Writing II - WC**	**Students practice more sophisticated approaches to writing processes and products with an emphasis on how literacy functions in U.S. society, both with and outside of the academy. Additional emphasis on conducting primary and secondary research, generating longer texts, improving critical reading, and awareness of how diversity is reflected within literacy practices in U.S. society. Required writing consists of multiple drafts of at least four papers of varying lengths, with one extended documented paper.**	P	**3**	**E**
MATH	**180**	**Elements of Calculus - QR**	**Differential and integral calculus of polynomial, logarithmic, and exponential functions with applications. Note: Does not count toward mathematics major or minor.**	P	**3**	**E**
COMM	**111**	**Introduction to Public Speaking - OC**	**Training in fundamental processes and attributes of effective public speaking.**	P	**3**	**E**
			Arts & Humanities (AH)		6	
			Social & Behavioral Sciences (SB) and Historical Perspective (SBH)		6	
			Natural Sciences (S, SL, B)		7	

Total # of Credit Hours in Free Electives (i.e., general program electives) (if applicable)	**Note: number recorded will automatically populate Free Elective Hours in "Summary of Total Program Hours" table**	**31**	

Summary of Total Program Hours	Required Core Hours (i.e., # of hours in degree program core)	39	NA
	Required Program Options - Track/Concentration/Specialty Hours (if applicable)	0	NA
	Guided Elective Hours (e.g., focused or track/concentration/speciality area specific electives) (if applicable)	50	NA
	Free Elective Hours (i.e., general program electives) (if applicable)	31	NA
	Total # of credit hours required for Program	**120**	**NA**
Information to be completed by PIE Office			
	# of new courses		NA
	Total # of Courses (includes new and existing)		NA
	Precentage of new courses (more than 25% may require SACS Substantive Change)	#VALUE!	NA

From: Shumake,Connie Covington
To: Boehm,Beth A.; ben@futurelou.com
Cc: Program Review-OAPA,Service Account
Subject: RE: Letter of Endorsement for BA in Computer Science
Date: Thursday, April 23, 2020 2:56:59 PM

Hello,
We will add this information to the program approval file for the BA.

Thanks!

From: Boehm,Beth A. <beth.boehm@louisville.edu>
Sent: Wednesday, April 22, 2020 10:11 PM
To: ben@futurelou.com
Cc: Shumake,Connie Covington <connie.shumake@louisville.edu>
Subject: FW: Letter of Endorsement for BA in Computer Science

Thank you, Ben. I appreciate the kind words about my most recent letter to faculty. I'm forwarding your letter of endorsement to Connie Shumake, who oversees our new academic programs process.

Best, Beth

Beth A. Boehm
Professor of English
Executive Vice President and
University Provost

From: Ben Reno-Weber <ben@futurelou.com>
Date: Wednesday, April 22, 2020 at 4:14 PM
To: Beth Boehm <beth.boehm@louisville.edu>
Subject: Letter of Endorsement for BA in Computer Science

Hey Dr. Boehm,

I hope the world is treating you well. I saw your inspiring note to the faculty about the current moment and about planning to re-open (or *gulp* not). UofL is lucky to have you at this moment.

This might be too late to be useful because it got lost in my inbox as COVID hit, but I wanted to offer the endorsement of the Microsoft Future of Work Initiative of the undergraduate BA in Computer Science curriculum and program as the design is proposed.

Our industry and academic partners felt it was a strong adaptation to the evolving needs of industry in the emerging "data economy." If you need any more details beyond that, I am happy to offer it, but we very much look forward to continuing our partnership with UofL and the Speed School.

Best,
Ben

BEN RENO-WEBER, Director
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