



University Council

March 11, 2022

UNIVERSITY CURRICULUM COMMITTEE – 2021-2022

Susan Sanchez, Chair

Agricultural and Environmental Sciences – Nicholas Fuhrman

Arts and Sciences – Jonathan Haddad (Arts)

Rodney Mauricio (Sciences)

Business – Jim Carson

Ecology – Amanda Rugenski

Education – David Jackson

Engineering – Kun Yao

Environment and Design – Ashley Steffens

Family and Consumer Sciences – Sheri Worthy

Forestry and Natural Resources – Joseph Dahlen

Journalism and Mass Communication – Dodie Cantrell-Bickley

Law – Randy Beck

Pharmacy – Michelle McElhannon

Public and International Affairs – Leah Carmichael

Public Health – Allan Tate

Social Work – Harold Briggs

Veterinary Medicine – Shannon Hostetter

Graduate School – Wendy Ruona

Ex-Officio – Provost S. Jack Hu

Undergraduate Student Representative – Matthew Jue

Graduate Student Representative – Sarah Burns

Dear Colleagues:

The attached proposal from the Franklin College of Arts and Sciences to offer a new Undergraduate Certificate in Cybersecurity and Privacy will be an agenda item for the March 18, 2022, Full University Curriculum Committee meeting.

Sincerely,

Susan Sanchez, Chair

University Curriculum Committee

cc: Provost S. Jack Hu  
Dr. Marisa Pagnattaro

# PROPOSAL FOR A CERTIFICATE PROGRAM

**Date:** February 9, 2021

**School/College/Unit:** Franklin College of Arts and Sciences

**Department/Division:** Computer Science

**Certificate Title:** Undergraduate Certificate in Cybersecurity and Privacy

**Effective Term:** Fall 2022

**CIP:** 11100301

**Which campus(es) will offer this certificate?** Athens

**Program Abstract:** The Computer Science Department is proposing a new Undergraduate Certificate in Cybersecurity and Privacy. This certificate would be useful for undergraduate students in Computer Science, as well as some students in Mathematical Sciences and Engineering, who aim to become experts in the growing field of Computer Security and Privacy. Admission is open to undergraduate students across the university, but is specifically targeted towards undergraduate students in Computer Science and Data Science, as well as related mathematical and engineering disciplines.

## 1. Purpose and Educational Objectives

**State the purpose and educational objectives of the program. How does this program complement the mission of the institution?**

The Computer Science Department is proposing a new Undergraduate Certificate in Cybersecurity and Privacy. This certificate would be useful for students in Computer Science and Data Science, as well students in Mathematical Sciences and Engineering. The certificate program aims to develop expertise in various aspects of computer security and privacy, such as networking, operating systems, network and systems security, and data and communications privacy. The need for expertise in the broad field of Cybersecurity and Privacy has grown tremendously in recent years.

The global economic losses from cybercrime have recently skyrocketed to nearly \$1 trillion, according to an estimate by security firm McAfee and reported by *The Washington Post* (<https://www.washingtonpost.com/politics/2020/12/07/cybersecurity-202-global-losses-cybercrime-skyrocketed-nearly-1-trillion-2020/>). In addition, the U.S. government has initiatives to expand cybersecurity education and the professional workforce, such as the Comprehensive National Security Initiative. The executive branch has/will "begin a campaign to promote

cybersecurity awareness and digital literacy from our boardrooms to our classrooms and begin to build the digital workforce of the 21st century"

(<https://obamawhitehouse.archives.gov/issues/foreign-policy/cybersecurity/national-initiative>).

The proposed certificate program is intended to help provide a well-trained workforce to meet the increasing demand for cybersecurity experts in the modern economy.

## 2. Need for the Program

**Explain why this program is necessary. In addition, provide the following information:**

**a. Semester/Year of Program Initiation:** Fall 2022

**b. Semester/Year of Full Implementation of Program:** Fall 2022

**c. Semester/Year First Certificates will be awarded:** Spring 2023

**d. Annual Number of Graduates expected (once the program is established):** 20

**e. Projected Future Trends for number of students enrolled in the program:** The faculty expects continued growth based on the increase of students in the Computer Science (B.S.) major from 441 in fall 2013 to 1,282 in fall 2021. In addition, the number of students in the Data Science (B.S.) major is currently 76, and the number of students in engineering majors is increasing as well.

Students majoring in Computer Science and Data Science, as well as related Mathematical and Engineering disciplines, would benefit from the proposed certificate program. The course content will align with the USG Cyber Security Initiative which focuses on cyber education and training resources across USG in order to meet the needs of the U.S. Army Cyber Command, the National Security Agency, the financial transaction processing industry, and the health informatics/electronic medical records industry. The initiative aims to create a cybersecurity workforce of sufficient scale, quality, and capability to meet the needs of Georgia companies, military installations, government agencies, and other institutions.

There is a great demand and opportunities for cybersecurity graduates. According to research from Cybersecurity Ventures, an estimated 3.5 million cybersecurity jobs will be unfilled by 2021, and of the candidates who apply, fewer than one in four are even qualified

(<https://cybersecurityventures.com/jobs/>).

For more information, please refer to: <http://gov.georgia.gov/press-releases/2014-12-10/deal-state-acts-high-demand-career-initiative-report>. Also note the report from Information Systems Audit and Control Association, Inc. (ISACA): "Cybersecurity skills are in high demand, as threats continue to plague enterprises around the world. An overwhelming majority of students surveyed by ISACA recognizes this and plans to work in a position that requires cybersecurity knowledge. However, one in five report that their universities do not offer cybersecurity courses and less than half feel they will have the adequate skills and knowledge when they graduate" (<http://www.isaca.org/cyber/pages/cybersecurity-fundamentals-certificate.aspx>).

This proposed certificate is in line with the UGA strategic plan. The Computer Science Department is one of the few departments on campus to receive an authorization to hire a tenure track Assistant Professor in the area of Data and Communications Privacy and a joint

tenure-track Assistant Professor with the College of Engineering on Secure Big Data.

### **3. Student Demand**

- a. Provide documentation of evidence of student demand for this program, which may include a student survey.**
- b. Provide evidence that demand will be sufficient to sustain reasonable enrollment.**

The Computer Science Department currently has over 1,150 students in its undergraduate major and more than 200 students in its minor, as well as increasing enrollment in the current courses related to the certificate program. Nationally, a large number of universities have started programs in Cybersecurity and are experiencing an undiminished and sustained upward trend. The department completed a formal survey of the undergraduate Computer Science majors. Of the 162 responses, 59%, 34%, 7% of students “definitely would”, “might”, and “would not” consider pursuing a certificate in Cybersecurity and Privacy, respectively.

- c. To what extent will minority student enrollments be greater than, less than, or equivalent to the proportion of minority students in the total student body?**

The certificate is expected to have diversity composition similar to those in the degree programs it draws from. Advertising and outreach to minorities will be included.

### **4. Program of Study**

**Provide a detailed program of study for the certificate program, including:**

- a. Specific course prefixes, numbers, and titles**
- b. Identify any new courses created for this program**

Cybersecurity spans all aspects of computer systems and networks, from hardware to software to systems' architecture and design. To complete the Undergraduate Certificate in Cybersecurity and Privacy, students must complete 18-20 hours of undergraduate coursework, with 8 hours of core courses and 10-12 hours of elective coursework related to Cybersecurity and Privacy.

The proposed certificate requires students to first acquire the foundations of computer and network security, which will be achieved via either CSCI 4760/6760, Computer Networks, or CSCI 4730/6730, Operating Systems. As security threats generally focus on attacking vulnerable computer systems and networks, these first two classes are foundational because they include key concepts on systems and network security that represent a pre-requisite to cybersecurity-specific courses. For instance, the Operating System course teaches concepts such as process isolation and access control. The Computer Networks course includes material related to the confidentiality, integrity, and authenticity of network communications. In addition, it teaches basic concepts related to Web security.

Students may select their own specialization path by selecting either CSCI 4250, Cyber Security, which focuses on system-level cybersecurity topics, or CSCI 4260, Data Security and Privacy,

which focuses more on data security and privacy issues.

The following is a list of core and elective courses required for the proposed certificate:

**Core Courses (8 hours):**

CSCI 4250/6250, Cyber Security (4 hours) **or** CSCI 4260/6260, Data Security and Privacy (4 hours)

CSCI 4730/6730, Operating Systems (4 hours) **or** CSCI 4760/6760, Computer Networks (4 hours)

**Electives (10-12 hours)** - choose additional courses from the list below (if not taken above in the Core Courses section):

CSCI 4250/6250, Cyber Security (4 hours)

CSCI 4260/6260, Data Security and Privacy (4 hours)

CSCI 4270/6270, Introduction to Computer Forensics (4 hours)

CSCI 4730/6730, Operating Systems (4 hours)

CSCI 4760/6760, Computer Networks (4 hours)

CSCI 4780/6780, Distributed Computing Systems (4 hours)

CSCI 4960, Faculty Mentored Research in Computer Science (2-4 hours)

MATH 4450/6450, Cryptology and Computational Number Theory (3 hours)

MIST 5775/7775, Cyber Threat Intelligence (3 hours)

The course descriptions are listed below:

**CSCI 4250/6250, Cyber Security (4 hours)**

Basic concepts of computer security and the theory and current practices of authentication, authorization, and privacy mechanisms in modern operating systems and networks.

Prerequisite: CSCI 4730/6730 or CSCI 4760/6760.

**CSCI 4260/6260, Data Security and Privacy (4 hours)**

Examination of security and privacy issues related to protecting personal data in various environments (for example: cloud computing, smart grid, and internet of things) cover the fundamentals and principles of data security and privacy, and computational and statistical techniques for constructing secure and private systems.

Prerequisite: CSCI 1302.

**CSCI 4270/6270, Introduction to Computer Forensics (4 hours)**

The principles and practice of computer forensics. Topics include computer crime, software vulnerabilities, intellectual property, privacy issues, countermeasures, methods and standards for extraction, preservation, and deposition of legal evidence in a court of law.

Prerequisites: CSCI 4730/6730 or CSCI 4250/6250

**CSCI 4730/6730, Operating Systems (4 hours)**

Coverage of the key concepts in modern operating systems. Specific topics include process management, synchronization mechanisms, scheduling strategies, deadlock detection/avoidance,

memory management, file systems, protection and security, and distributed systems. Concepts will be reinforced through programming projects using a realistic operating system.

Prerequisites: (CSCI 4720 or CSEE 4280) and CSCI 2720.

**CSCI 4760/6760, Computer Networks (4 hours)**

In-depth coverage of computer networks, including digital data transmission and encoding, layered protocol models, Internet protocol, Internet client-server software, and network design methodology.

Prerequisites: CSCI 2720 and (CSCI 2670 or CSEE 2220).

**CSCI 4780/6780, Distributed Computing Systems (4 hours)**

The fundamental concepts in distributed computing and the practical techniques for building distributed systems. Topics include distributed computing models, naming, synchronization, replication and consistency, fault tolerance, and security. Widely deployed distributed systems are used as case studies. Students design, implement, and analyze prototype systems.

Prerequisites: CSCI 2720 and CSCI 1730

**CSCI 4960 - Faculty Mentored Research in Computer Science (2-4 hours)**

Content will vary in response to the interests, needs, and capability of the students and faculty involved. Individual, guided study in computer science. An individual student or team of students will define the research question, the research methods, or in some cases both, aspects of a project. The student understands and can explain how his/her part of the project contributes to a larger initiative. This may be accomplished through a thorough literature review of the research area. At the end of the semester, the student will reflect on their experience, interpret both processes and outcomes of research, and be able to articulate what he/she has learned and can identify how failures or successes may shape further research questions or goals. Students are required to submit a paper or a report on their findings, they will also acquire experience in scientific writing. To fulfill the requirements of the course, students will also be required to present their findings to a panel of faculty members or to present their research in the form of a poster at our annual CS Research Day. This course/program fulfills the Experiential Learning Requirements for students with majors in Franklin College.

Prerequisite: Permission of Department

**MATH 4450/6450, Cryptology and Computational Number Theory (3 hours)**

Recognizing prime numbers, factoring composite numbers, finite fields, elliptic curves, discrete logarithms, private key cryptology, key exchange systems, signature authentication, public key cryptology.

Prerequisite: MATH 4000/6000.

**MIST 5775/7775 - Cyber Threat Intelligence (3 hours)**

Cyber threat intelligence (CTI) aims to provide valuable intelligence to help organizations be aware of and protect against cyber-attacks. This course provides students with a hands-on introduction to the fundamental concepts and tools of cyber threat intelligence.

*These elective courses are related to Cybersecurity and Privacy as follows:*

- Distributed Computing Systems includes fundamental concepts such as fault tolerance and the security of geographically distributed and complex systems.
- Operating Systems includes topics related to systems security, including OS kernel security.
- Cryptology and Computational Number Theory is relevant due to the importance of encryption for the providing integrity and confidentiality of network communications and to enable private multi-party computation.
- Cyber Security, Cyber Forensics, Data Security and Privacy, topics in Computer Networks and Operating Systems, and Cyber Threat Intelligence are all directly related to cybersecurity and privacy.

## **5. Model Program and Accreditation**

- a. Identify any model programs, accepted disciplinary standards, and accepted curricular practices against which the proposed program could be judged. Evaluate the extent to which the proposed curriculum is consistent with these external points of reference and provide a rationale for significant inconsistencies and differences that may exist.**

The following universities in the state of Georgia offer certificates in Cybersecurity (<https://cybersecurityguide.org/states/georgia/>):

- Augusta State University
  - [Undergraduate Cyber Defender Certificate](#) (19 hours)
  - [Undergraduate Advanced Cyber Defender Certificate](#) (21 hours)
- Columbus State University
  - Non-Credit [IT Workforce Certificate in Cybersecurity](#)
  - Non-Credit [IT Workforce Certificate in Network Intensive Cybersecurity](#)
- Georgia Institute of Technology
  - [Cybersecurity Certificate](#)
- Georgia Southern University
  - [Undergraduate Cyber Security Certificate](#)
- Kennesaw State University
  - [Graduate Certificate in Information Technology Security](#)
  - [Undergraduate Certificate in Cybersecurity](#)

The proposed Undergraduate Certificate in Cybersecurity and Privacy has two core courses and electives from Computer Science and Mathematics. The proposed certificate is more rigorous than the above-mentioned certificates, and it additionally offers courses on Privacy and Computer Forensics.

There are a number of other universities offering graduate and undergraduate certificates in Cybersecurity as well as full degree programs at the Master's and Doctoral levels.

**b. If program accreditation is available, provide an analysis of the ability of the program to satisfy the curricular standards of such specialized accreditation.**

The undergraduate major in Computer Science (B.S.) is accredited by the Accreditation Board for Engineering and Technology (ABET). This certificate will be subject to the same accreditation.

**6. Student Learning Outcomes**

**Describe the proposed learning outcomes for the certificate program.**

- Students in this program will learn foundational cybersecurity and privacy concepts, gain practical secure software development skills, and learn common practices on how to defend against common cybersecurity and privacy attacks.
- Students will be able to use their enhanced and improved hands-on experiences and skills to address various security and privacy issues.
- Students should be able to evaluate cybersecurity weaknesses in IT design decisions.

**7. Assessment**

**Describe how the learning outcomes for the program will be assessed.**

For every related course offered, the learning outcomes are evaluated based on both student performance in projects and exams as well as feedback collected from students through anonymous surveys.

All academic programs are reviewed annually to assess the program outcomes and student learning outcomes. Students completing the Undergraduate Certificate in Cybersecurity and Privacy are required to take all the necessary courses that will encompass the student learning outcomes for the program.

In addition, the new certificate will be assessed as part of the UGA comprehensive program review carried out every seven years.



## Documentation of Approval and Notification

**Proposal:** Undergraduate Certificate in Cybersecurity and Privacy

**College:** Franklin College of Arts and Sciences

**Department:** Computer Science

**Proposed Effective Term:** Fall 2022

Department:

- Computer Science Department Head, Dr. Thiab Taha, 03/08/2021

School/College:

- Franklin College of Arts and Sciences Associate Dean, Dr. Jean Martin-Williams, 09/14/2021

Use of Courses:

- Management Information Systems Department Head, Dr. Maric Boudreau, 3/1/22