FAIRMONT STATE UNIVERSITY

MEMORANDUM

TO: Faculty Senate

FROM: Jack Kirby

DATE: March 8, 2017

SUBJECT: Curriculum Proposal #16-17-13

Computer Science

I recommend approval of the attached Curriculum Proposal 16-17-13. This proposal seeks to make a revision of curricula for the BS program in Computer Science (both Computer Science and Computer Security major options).

Dr. Christina Lavorata
Dr. Don Trisel
Dr. Mahmood Hossain
Ms. Leslie Lovett
Ms. Laura Ransom
Dr. Shayne Gervais

FAIRMONT STATE UNIVERSITY

MEMORANDUM

TO: Curriculum Committee

FROM: Jack Kirby JBK

DATE: February 13, 2017

SUBJECT: Curriculum Proposal #16-17-13

Computer Science

I recommend approval of the attached Curriculum Proposal 16-17-13. This proposal seeks to make a revision of curricula for the BS program in Computer Science (both Computer Science and Computer Security major options).

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Proposal Number:	16-17-13
School/Department/Program:	Science and Technology / Computer Science, Math, and Physics / Computer Science
Preparer/Contact Person:	Dr. Mahmood Hossain Associate Professor of Computer Science
Telephone Extension:	4967
Date Originally Submitted:	February 10, 2017
Revision:	
Implementation Date Requested	Fall 2017

I PROPOSAL

The intent of this proposal is to request a minor revision of curricula for the BS program in Computer Science (both Computer Science and Computer Security major options). The current and proposed program formats can be found in Appendix A.

For the Computer Science major option, the proposal replaces COMP 3300 or 3310 and MATH 2200 or 3362 with a pool of elective Computer Science and Math courses and replaces PHYS 1105/1106 with a pool of Science courses. In addition, the proposal replaces MATH 1170 (4 hour) with MATH 1561 (3 hour), a new course that is proposed in a separate MATH curriculum proposal.

For the Computer Security major option, the proposal renames the major as "Cybersecurity". The proposal adds COMP 4440 and CRIM 2250 to the degree requirements, replaces MATH 2200 with a pool of elective Computer Science and Math courses, and adds the science requirement to the major requirements. In addition, the proposal replaces MATH 1170 (4 hour) by the new course MATH 1561 (3 hour). The proposal changes COMP 3380 from 4 hours to 3 hours, changes the title of COMP 3380/3390/4400/4495, revises the content of COMP 3380/4400/4495, and creates a new course COMP 4450.

II DESCRIPTION OF THE PROPOSAL

A. Deletion of courses/credits from program

Computer Science Major Option

COMP 3300 Computer Graphics or COMP 3310 Artificial Intelligence (3)
MATH 1170 Introduction to Mathematical Analysis (4)
MATH 2200 Mathematical Logic or MATH 3362 Linear Algebra (3)
PHYS 1105 Principles of Physics I (5)
PHYS 1106 Principles of Physics II (5)

Total hours deleted: 20

Computer Security Major Option

MATH 1170 Introduction to Mathematical Analysis (4)
MATH 2200 Mathematical Logic (3)

Total hours deleted: 7

B. Addition of courses/credits to program

Computer Science Major Option

MATH 1561 Introduction to Mathematical Reasoning (3)

Any 3 courses from the following list with at least one COMP and at least one MATH course:

COMP 3300 Computer Graphics (3)	MATH 2510 Mathematical Logic (3)
COMP 3310 Artificial Intelligence (3)	MATH 3503 Calculus III (4)
COMP 3380 Introduction to Cryptography (3)	MATH 3504 Differential Equations (3)
COMP 4420 Selected Advanced Topics (3)	MATH 3520 Linear Algebra (3)
COMP 4450 Introduction to Data Mining (3)	MATH 3540 Numerical Analysis (3)
	MATH 3550 Probability and Statistics (3)

Any 2 courses from the following list:

BIOL 1105 Biological Principles I (4)	BIOL 1106 Biological Principles II (4)
CHEM 1105 Chemical Principles (5)	CHEM 2200 Foundational Biochemistry (4)
PHYS 1101 Introduction to Physics I (4)	PHYS 1102 Introduction to Physics II (4)
PHYS 1105 Principles of Physics I (5)	PHYS 1106 Principles of Physics II (5)

Total hours added: 20-23

Cybersecurity Major Option

COMP 4440 Software Engineering (4)

MATH 1561 Introduction to Mathematical Reasoning (3)

CRIM 2250 Cybercrime (3)

Any 1 course from the following:

COMP 3310 Artificial Intelligence (3)
COMP 3330 Analysis of Algorithms (3)
COMP 4400 Automata Theory (3)
COMP 4420 Selected Advanced Topics (3)
COMP 4450 Introduction to Data Mining (3)
MATH 2502 Calculus II (4)

Any 1 course from the following list:

BIOL 1105 Biological Principles I (4)
BIOL 1106 Biological Principles II (4)
CHEM 1105 Chemical Principles (5)
PHYS 1101 Introduction to Physics I (4)
PHYS 1105 Principles of Physics I (5)

Total hours added: 17-19

C. Provision for interchangeable use of course(s) with program(s)

Not Applicable

D. Revision of course content

COMP 3380 Cryptography in Computer Security: This will be changed to a 3-hour course, the lab component will be removed, and the title will be changed to *Introduction to Cryptography*. (Appendix B)

COMP 4400 Automata and Language Design: The title will be changed to *Automata Theory* and the content will be reduced. (Appendix B)

COMP 4495 Computer Security Internship: The title will be changed to *Cybersecurity Senior Project* and will allow both internal/external projects. (Appendix B)

E. Other changes to existing courses

COMP 3390 Network Security Technology will be renamed *Network Security* (Appendix B).

F. Creation of new courses

COMP 4450 *Introduction to Data Mining* (Appendix B)

A copy of the email from the registrar approving the course number is attached.

G. Attach an itemized summary of the present program(s) affected, if any, and of the proposed change(s).

The proposal does not affect the total credit hour requirement. It offers more flexibility for the majors by introducing a pool of elective CS and Math courses and providing more options for the science component of the major requirements.

III. RATIONALE FOR THE PROPOSAL

1. Quantitative Assessment:

Revising the requirements for Computer Science major

This proposal will give a student greater flexibility in choosing upper level Computer Science and Math classes. The proposal will also make it easier for a student to complete a second major in Cybersecurity with 17 extra hours of required coursework or a minor in Mathematics with 3-7 extra hours of required coursework or a second major in Mathematics with 21-24 extra hours of required coursework. To complete the extra coursework, a student can double dip on the general studies coursework as much as possible and can use 10-14 free elective hours, thereby making it possible to complete the requirements for an additional major/minor within 121-124 hours.

The proposal is in accordance with the requirements of ABET (Accreditation Board for Engineering and Technology) and the recommendations of ACM (Association for Computing Machinery) and IEEE-CS (Institute of Electrical and Electronic Engineers Computer Society).

Renaming the "Computer Security" major "Cybersecurity"

We propose that the name of the "Computer Security" program at FSU be rebranded to "Cybersecurity", and that this rebranding has the potential to attract both new students and their potential employers. A Google search trend analysis of the terms "cybersecurity", "cyber security", and "computer security" over the last five years shows that the use of "computer security" as a search term has been steadily decreasing while the uses of both "cybersecurity" and "cyber security" have been on the rise and completely dominate current searches (https://www.google.com/trends/explore?q=cybersecurity,computer%20security,cyber%20security). Additionally, the local employers (FBI, Northrop Grumman, NASA) who employ many of our graduates all use the term "cybersecurity" and rarely mention "computer security". Cybersecurity is clearly the current term used to describe the topics we teach in our "Computer Security" classes. We currently offer courses in network security, vulnerability assessment, and cryptography all of which go well beyond computer systems alone. We therefore propose this rebranding to stay at the top of the lists searched by prospective students, to keep pace with the industries that employ our graduates, and to clarify the educational goals of our program.

Revising the requirements for Computer Security major

Currently, only the Computer Science major option requires COMP 4440 Software Engineering, but the Computer Security major option does not. It is very important for any Computer Science student to learn how to follow the software life cycle from the requirement, specification, and design phases through the construction of actual software. They should learn team management skills, programming methodologies, debugging aids, documentation, evaluation and measurement of software, verification and testing techniques, and the problems of maintenance, modification, and portability. These needs have been documented in the recommendations of the Joint Task Force for Computing Curricula. Over the last several years, faculty members have been strongly encouraging the Computer Security majors to take this class, but it is ONLY counted as a free elective for them. This proposal will add COMP 4440 as a major requirement.

Revising COMP 3380 Cryptography in Computer Security

This course will be renamed as just *Introduction to Cryptography* and reduced to a 3-hour course. This course was originally intended to have a laboratory component. But over the last few years, this course has been transformed and has primarily focused on the mathematical and algorithmic aspects, and not on the laboratory components.

Revising COMP 3390 Network Security Technology

This course will be renamed as *Network Security* to reflect the actual content of the course. The underlying principles of network security is examined in this course, as opposed to a lower-level hands-on type course that primarily studies the technology used. This title is commonly used for similar courses at 4-year degree programs in computer security.

Revising COMP 4400 Automata and Language Design

This course will be renamed as Automata Theory. This was originally intended to include the content of two separate but related courses – Automata Theory and Programming Language Paradigms. It has been observed that the coverage of all the intended content becomes overwhelming for students and instructors have typically covered mostly the Automata Theory content in more details. The content of the course will be updated accordingly.

Adding COMP 4450 Introduction to Data Mining

An introductory course in Data Mining has been taught two times in the last five years as COMP 4420 *Selected Advanced Topics*. This course is intended for upper classmen in the computer science/cybersecurity majors. With the unprecedented growth in the amount of data generated by businesses, science, web, and other sources in many forms, there is an ever-increasing need to extract useful information from the data. Data mining has tremendous economic and scientific implications. It has been applied to improving business, to analyzing the web, to protecting computer systems from security breaches, to detecting fraud, to revealing biological pathways, and others. Data Mining has become both an active area of research and a great field for employment opportunities. An undergraduate course in Data Mining is becoming a common trend in Computer Science programs across the country and will be a very important and much needed addition at FSU. Two Computer Science faculty members at FSU have expertise in the area and have worked with undergraduate students in data mining research projects.

Revising COMP 4495 Computer Security Internship

Currently, this course requires the students to pursue an actual internship with a government/private organization in their final year. Sometimes, it becomes difficult for students to find an internship that will allow them to pursue a security related project. It will be more flexible for students if they are allowed to complete the project either internally or externally, but still being able to apply all the cybersecurity concepts in a real world situation.

2. Qualitative Assessment:

Not Applicable

IV. PROPOSAL AFFECTING OTHER COLLEGES/SCHOOLS.

If this curriculum proposal is approved, starting in 2017-18, students in Cybersecurity major will be required to take CRIM 2250 *Cybercrime*. This course will also count towards General Studies Attribute 6 (Technology Literacy). A memo has been sent to Dr. Deanna Shields (Dean, College of Liberal Arts) notifying her about this.

By signing here, you are indicating your college's approval of this proposal.

Dean	College	Signature
Dr. Deanna Shields	College of Liberal Arts	Deanna Shields

V. PROPOSAL AFFECTING GENERAL STUDIES.

Not Applicable

VI. ADDITIONAL COMMENTS.

Not Applicable

APPENDIX A

B.S. Degree in Computer Science with major in Computer Science
Current Program

Required Major Courses		**HRS**
COMP 1100	Introduction to Computing	3
COMP 1102	Principles of Programming I	3
COMP 1108	Principles of Programming II	3
COMP 2200	Object-Oriented Programming	3
COMP 2201	Machine Organization	3
COMP 2230	Network Programming	3
COMP 2270	Data Structures	3
COMP 3300	Computer Graphics or	
COMP 3310	Artificial Intelligence	3
COMP 3330	Analysis of Algorithms	3
COMP 3340	Operating Systems	3
COMP 3395	Ethical Issues in Computing	3
COMP 4400	Automata Theory	3
COMP 4410	Database Management	3
COMP 4440	Software Engineering	4
MATH 1170	Introduction to Mathematical Analysis	4
MATH 1190	Calculus I	4
MATH 3315	Calculus II	4
MATH 2200	Mathematical Logic or	3
MATH 3362	Linear Algebra	
MATH 2216	Introduction to Discrete Mathematics	3
PHYS 1105	Principles of Physics I	5
PHYS 1106	Principles of Physics II	5
TOTAL HOURS FOR MAJOR		**71**

APPENDIX A

Required General Studies Courses	HRS
Attribute 1 – Critical Analysis ENGL 1102 Written English II	3
Attribute 2 – Quantitative Literacy MATH 1190 Calculus I	X
Attribute 3 – Written Communication ENGL 1101 Written English I	3
Attribute 4 – Teamwork Met in IG with COMM 2200	X
Attribute 5 – Information Literacy Met in IA with ENGL 1102	X
Attribute 6 – Technology Literacy TECH 1100 Technology and Society or Choice	3
Attribute 7 – Oral Communication COMM 2200 Introduction to Human Communication	3
Attribute 8 – Citizenship Any Course	3
Attribute 9 – Ethics Any Course	3
Attribute 10 – Health PHED 1100 Fitness and Wellness or Choice	2-3
Attribute 11 – Interdisciplinary and Lifelong Learning Any Course	3
Attribute 12 – Fine Arts Any Course	3
Attribute 13 – Humanities Any Course	3
Attribute 14 – Social Sciences Any Course	3
Attribute 15 - Natural Science Any Course expect PHYS Courses	4-5
Attribute 16 – Cultural Awareness and Human Dignity Any Course	3
TOTAL GENERAL STUDIES HOURS	**39-40**
TOTAL FREE ELECTIVES	**9-10**
TOTAL HOURS	**120**

APPENDIX A

B.S. Degree in Computer Science with major in Computer Science
Proposed Program

Required Major Courses		**HRS**
COMP 1100	Introduction to Computing	3
COMP 1102	Principles of Programming I	3
COMP 1108	Principles of Programming II	3
COMP 2200	Object-Oriented Programming	3
COMP 2201	Machine Organization	3
COMP 2230	Network Programming	3
COMP 2270	Data Structures	3
COMP 3330	Analysis of Algorithms	3
COMP 3340	Operating Systems	3
COMP 3395	Ethical Issues in Computing	3
COMP 4400	Automata and Language Design	3
COMP 4410	Database Management	3
COMP 4440	Software Engineering	4
MATH 1561	Introduction to Mathematical Reasoning	3
MATH 2562	Introduction to Discrete Mathematics	3
MATH 2501	Calculus I	4
MATH 2502	Calculus II	4
Elective Major Courses (Any 3 from the following with at least one COMP and at least one MATH course)		
COMP 3300	Computer Graphics	3
COMP 3310	Artificial Intelligence	3
COMP 3380	Introduction to Cryptography	3
COMP 4420	Selected Advanced Topics	3
COMP 4450	Introduction to Data Mining	3
MATH 2510	Mathematical Logic	3
MATH 3503	Calculus III	4
MATH 3504	Differential Equations	3
MATH 3520	Linear Algebra	3
MATH 3540	Numerical Analysis	3
MATH 3550	Probability and Statistics	3
Elective Science Courses (Any 2 from the following)		
BIOL 1105	Biological Principles I	4
BIOL 1106	Biological Principles II	4
CHEM 1105	Chemical Principles	5
CHEM 2200	Foundational Biochemistry	4
PHYS 1101	Introduction to Physics I	4
PHYS 1102	Introduction to Physics II	4
PHYS 1105	Principles of Physics I	5
PHYS 1106	Principles of Physics II	5
TOTAL HOURS FOR MAJOR		**71-74**

APPENDIX A

General Studies Courses	HRS
Attribute I – Critical Analysis ENGL 1102 or ENGL 1103 or Choice	3
Attribute 2 – Quantitative Literacy Met in Major requirements with MATH 2501	X
Attribute 3 – Written Communication ENGL 1101 or Choice	3
Attribute 4 – Teamwork COMM 2200 or Choice	3
Attribute 5 – Information Literacy ENGL 1102 or ENGL 1103 or Choice	X
Attribute 6 – Technology Literacy Any Course	3
Attribute 7 – Oral Communication COMM 2200 or Choice	X
Attribute 8 – Citizenship Any Course	3
Attribute 9 – Ethics Any Course	3
Attribute 10 – Health and Well-being Any Course	2-3
Attribute 11 – Interdisciplinary and Lifelong Learning Any Course	3
Attribute 12 – Fine Arts Any Course	3
Attribute 13 – Humanities Any Course	3
Attribute 14 – Social Sciences Any Course	3
Attribute 15 - Natural Sciences Met in Major requirements	X
Attribute 16 – Cultural Awareness and Human Dignity Any Course	3
TOTAL GENERAL STUDIES HOURS	**35-36**
TOTAL FREE ELECTIVES	**10-14**
TOTAL HOURS	**120**

Note: In order to complete a second major in Cybersecurity with 17 extra hours of required coursework or a second major in Mathematics with 21-24 extra hours of required coursework or a minor in Mathematics with 3-7 extra hours of required coursework, a student should double dip on the general studies coursework as much as possible and use the free elective hours. They will be able to complete the requirements for an additional major or a minor within 121-124 hours.

APPENDIX A

B.S. Degree in Computer Science with major in Computer Security
Current Program

Required Major Courses		**HRS**
COMP 1100	Introduction to Computing	3
COMP 1102	Principles of Programming I	3
COMP 1108	Principles of Programming II	3
COMP 2200	Object-Oriented Programming	3
COMP 2201	Machine Organization	3
COMP 2220	Fundamentals of Computer Security	3
COMP 2230	Network Programming	3
COMP 2270	Data Structures	3
COMP 3340	Operating Systems	3
COMP 3380	Cryptography in Computer Security	4
COMP 3390	Network Security Technology	4
COMP 4410	Database Management	3
COMP 4415	Vulnerability Assessment	4
COMP 4495	Computer Security Internship	3
BISM 2600	Introduction to Networking Administration	3
MATH 1170	Introduction to Mathematical Analysis	4
MATH 1190	Calculus I	4
MATH 2200	Mathematical Logic	3
MATH 2216	Introduction to Discrete Mathematics	3
TOTAL HOURS FOR MAJOR		**62**

APPENDIX A

Required General Studies Courses	**HRS**
Attribute1 – Critical Analysis ENGL 1102 Written English II	3
Attribute 2 – Quantitative Literacy MATH 1190 Calculus I	X
Attribute 3 – Written Communication ENGL 1101 Written English I	3
Attribute 4 – Teamwork Met in IG with COMM 2200	X
Attribute 5 – Information Literacy Met in IA with ENGL 1102	X
Attribute 6 – Technology Literacy TECH 1100 Technology and Society or Choice	3
Attribute 7 – Oral Communication COMM 2200 Introduction to Human Communication	3
Attribute 8 – Citizenship Any Course	3
Attribute 9 – Ethics Any Course	3
Attribute 10 – Health PHED 1100 Fitness and Wellness or Choice	2-3
Attribute 11 – Interdisciplinary and Lifelong Learning Any Course	3
Attribute 12 – Fine Arts Any Course	3
Attribute 13 – Humanities Any Course	3
Attribute 14 – Social Sciences Any Course	3
Attribute 15 - Natural Science Any Course expect PHYS Courses	4-5
Attribute 16 – Cultural Awareness and Human Dignity Any Course	3
TOTAL GENERAL STUDIES HOURS	**39-40**
TOTAL FREE ELECTIVES	**18-19**
TOTAL HOURS	**120**

APPENDIX A

B.S. Degree in Computer Science with major in Cybersecurity
Proposed Program

Required Major Courses		**HRS**
COMP 1100	Introduction to Computing	3
COMP 1102	Principles of Programming I	3
COMP 1108	Principles of Programming II	3
COMP 2200	Object-Oriented Programming	3
COMP 2201	Machine Organization	3
COMP 2220	Fundamentals of Computer Security	3
COMP 2230	Network Programming	3
COMP 2270	Data Structures	3
COMP 3340	Operating Systems	3
COMP 3380	Introduction to Cryptography	3
COMP 3390	Network Security	4
COMP 4410	Database Management	3
COMP 4415	Vulnerability Assessment	4
COMP 4440	Software Engineering	4
COMP 4495	Cybersecurity Senior Project	3
BISM 2600	Introduction to Networking Administration	3
CRIM 2250	Cybercrime	3
MATH 1561	Introduction to Mathematical Reasoning	3
MATH 2562	Introduction to Discrete Mathematics	3
MATH 2501	Calculus I	4
Elective Major Course (Any 1 from the following)		
COMP 3310	Artificial Intelligence	3
COMP 3330	Analysis of Algorithms	3
COMP 4400	Automata Theory	3
COMP 4420	Selected Advanced Topics	3
COMP 4450	Introduction to Data Mining	3
MATH 2510	Mathematical Logic	3
MATH 2502	Calculus II	4
Elective Science Course (Any 1 from the following)		
BIOL 1105	Biological Principles I	4
BIOL 1106	Biological Principles II	4
CHEM 1105	Chemical Principles	5
PHYS 1101	Introduction to Physics I	4
PHYS 1105	Principles of Physics I	5
TOTAL HOURS FOR MAJOR		**71-73**

APPENDIX A

General Studies Courses	HRS
Attribute I – Critical Analysis ENGL 1102 or ENGL 1103 or Choice	3
Attribute 2 – Quantitative Literacy Met in Major requirements with MATH 2501	X
Attribute 3 – Written Communication ENGL 1101 or Choice	3
Attribute 4 – Teamwork COMM 2200 or Choice	3
Attribute 5 – Information Literacy ENGL 1102 or ENGL 1103 or Choice	X
Attribute 6 – Technology Literacy Met in Major requirements with CRIM 2250	X
Attribute 7 – Oral Communication COMM 2200 or Choice	X
Attribute 8 – Citizenship Any Course	3
Attribute 9 – Ethics Any Course	3
Attribute 10 – Health and Well-being Any Course	2-3
Attribute 11 – Interdisciplinary and Lifelong Learning Any Course	3
Attribute 12 – Fine Arts Any Course	3
Attribute 13 – Humanities Any Course	3
Attribute 14 – Social Sciences Any Course	3
Attribute 15 - Natural Sciences Met in Major requirements	X
Attribute 16 – Cultural Awareness and Human Dignity Any Course	3
TOTAL GENERAL STUDIES HOURS	**32-33**
TOTAL FREE ELECTIVES	**14-17**
TOTAL HOURS	**120**

Note: In order to complete a second major in Computer Science with 20 extra hours of required coursework or a second major in Mathematics with 27-30 extra hours of required coursework or a minor in Mathematics with 10-14 extra hours of required coursework, a student should double dip on the general studies coursework as much as possible and use the free elective hours. They will be able to complete the requirements for an additional major or a minor within 121-124 hours.

APPENDIX B

REVISED COURSES

COMP 3380 Cryptography in Computer Security

Current Description

COMP 3380 Cryptography in Computer Security 4 hrs. This course provides an introduction to cryptography. Major topics to be covered include the history of cryptography and single and public key encryption. Students will develop various cryptographic applications implementing or using digital certificates, digital signatures, IPSec, Kerberos, PGP, PKI, Rijndael, secure e-mail, SSL and TLS. The course consists of four hours of lecture per week. PR: COMP 2270 and MATH 2216

Revised Description

COMP 3380 Introduction to Cryptography 3 hrs. This course provides an introduction to cryptography. Major topics to be covered include the history of cryptography and single and public key encryption. Students will develop various cryptographic applications implementing or using digital certificates, digital signatures, IPSec, Kerberos, PGP, PKI, Rijndael, secure e-mail, SSL and TLS. PR: COMP 2270 and MATH 2562

Revised course outline:

- Introduction to Cryptography
    - Basic terms and definitions
    - Overview of types of ciphers
        - Symmetric ciphers
        - Public-key ciphers
    - Types of cryptanalytic attacks
        - Ciphertext-only
        - Known-plaintext
        - Chosen-plaintext
        - Chosen-ciphertext
- Classical Cryptography
    - The Caesar Cipher
    - Other substitution ciphers
        - Monoalphabetic substitution ciphers
        - Homophonic substitution ciphers
        - Polygram substitution ciphers
    - Transposition ciphers
        - Columnar Transposition ciphers
        - Cryptanalysis
- Modern Cryptography
    - The Data Encryption Standard (DES)
    - Double DES
    - Triple DES and “meet-in-the-middle” attacks
    - Public Key (asymmetric) ciphers
    - Digital Signatures
    - The RSA algorithm
    - Hybrid systems
    - Key exchange
    - Merkle-Hellman Knapsack algorithm
    - The Rabin cipher system
    - William’s Extension of the Rabin system

APPENDIX B

Outcome	Direct Assessment	Satisfactory performance standard
List and describe the basic types of cryptographic systems and cryptanalytic attacks.	Exam/Homework	A class average of 70% or more on associated questions.
Demonstrate and implement various classical cryptographic systems, including substitution and transposition ciphers.	Projects	A class average of 70% or more.
Demonstrate knowledge of various cryptanalytic methods, such as statistical analysis, the Kasiski Test, and the Friedman Test.	Exam/Homework	A class average of 70% or more on associated questions.
Demonstrate knowledge of the details of the Data Encryption Standard (DES).	Exam/Homework	A class average of 70% or more on associated questions.
Implement a block cipher cryptosystem such as DES.	Projects	A class average of 70% or more.
Demonstrate and implement a public-key cryptosystem such as RSA or Rabin's.	Projects	A class average of 70% or more.

APPENDIX B

REVISED COURSES

COMP 3390 Network Security Technology

Current Description

COMP 3390 Network Security Technology 4 hrs. This course combines classroom and laboratory work to explore network security attacks and solutions. Commercial-Off-The-Shelf (COTS) network devices such as servers, routers, bridges, switches, hubs, firewalls, scanners and intrusion detection systems will be configured to demonstrate network security solutions for selected real-world scenarios. The course consists of three hours of lecture and two hours of lab per week. PR: COMP 1102, COMP 2220, and BISM 2600.

Revised Description

COMP 3390 Network Security 4 hrs. This course combines classroom and laboratory work to explore network security attacks and solutions. Commercial-Off-The-Shelf (COTS) network devices such as servers, routers, bridges, switches, hubs, firewalls, scanners and intrusion detection systems will be configured to demonstrate network security solutions for selected real-world scenarios. PR: COMP 2270, COMP 2220, and BISM 2600.

APPENDIX B

REVISED COURSES

COMP 4400 Automata and Language Design

Current Description

COMP 4400 Automata and Language Design 3 hrs. This course covers the theoretical foundations of computer science and the abstractions of computational processes in programming languages. Topics include formal languages, grammars, automata, Turing machines, programming language paradigms, data types, expressions, control structures, binding strategies, run-time environments, compilers, and interpreters. PR: COMP 2270 and MATH 2216.

Revised Description

COMP 4400 Automata Theory 3 hrs. This course covers the theoretical foundations of computer science and the abstractions of computational processes. Topics include finite automata, regular languages and grammars, context-free languages and grammars, pushdown automata, and Turing machines. PR: COMP 2270 and MATH 2562.

Revised course outline:

- Basic Concepts
    - Mathematical preliminaries
    - Introduction to formal languages, grammars, and automata
    - Acceptors and transducers
- Finite Automata
    - Deterministic and non-deterministic finite automata
    - Equivalence of DFAs and NFAs
- Regular Languages and Regular Grammars
    - Regular expressions
    - Regular languages
    - Regular grammars
    - Properties of RLs
- Context-Free Languages and Context-Free Grammars
    - Context-free grammars
    - Parsing and ambiguity
    - Simplification of context-free grammars
    - Normal Forms
    - Properties of CFLs
- Pushdown Automata
    - Deterministic and nondeterministic pushdown automata
    - Pushdown automata and context-free languages
- Turing Machines
    - Turing machines as language accepters
    - Turing machines as transducers
    - Deterministic and nondeterministic Turing machines
    - Turing Thesis
- Context-Sensitive Languages and Linear Bounded Automata
    - Context-Sensitive languages and grammars
    - Linear bounded automata
- Hierarchy of Formal Languages and Automata
    - The Chomsky hierarchy

APPENDIX B

Outcome	Direct Assessment	Satisfactory performance standard
Design a finite automata that can accept a given regular language.	Exam/Homework	A class average of 70% or more on associated questions.
Convert a non-deterministic finite automata into a deterministic one.	Exam/Homework	A class average of 70% or more on associated questions.
Design a pushdown automata that can accept a given context-free language.	Exam/Homework	A class average of 70% or more on associated questions.
Use the pumping lemma to show that a given language is not regular/context-free.	Exam/Homework	A class average of 70% or more on associated questions.
Transform a context-free grammar into a normal form.	Exam/Homework	A class average of 70% or more on associated questions.
Design a Turing machine for computing a simple mathematical function.	Exam/Homework	A class average of 70% or more on associated questions.
Describe the Chomsky hierarchy of formal languages and identify a given language's location in the hierarchy.	Exam/Homework	A class average of 70% or more on associated questions.

APPENDIX B

REVISED COURSES

COMP 4495 Computer Security Internship

Current Description

COMP 4495 Computer Security Internship 3 hrs. This course allows students to obtain real-world computer security work experience through an internship with either a government agency or local high technology company. PR: Instructor approval required.

Revised Description

COMP 4495 Cybersecurity Senior Project 3 hrs. This course allows students to obtain real-world computer security work experience either through an internal project or through an internship with a government or private organization. PR: Instructor approval.

APPENDIX B

NEW COURSE

COMP 4450 Introduction to Data Mining 3 hrs. This course introduces the fundamental topics in data mining, as well as application of data mining in real-world problems. Topics include data preprocessing, classification, clustering, association mining, web mining, etc. PR: COMP 2270 and MATH 2562.

Detailed course outline:

- Introduction
  - Definition of data mining
  - Data mining tasks
  - History and social implications
- Data
  - Types of data
  - Data statistics
  - Data visualization
  - Measures of similarity and dissimilarity
- Data Preprocessing
  - Motivation
  - Data cleaning
  - Data reduction
  - Data transformation
- Classification
  - Basic concepts
  - Measuring performance
  - Distance based Methods
  - Decision trees
  - Neural networks
  - Bayesian methods
- Clustering
  - Basic concepts
  - K-means clustering
  - Hierarchical clustering
  - Graph-based clustering
  - Cluster evaluation
- Association Mining
  - Basic concepts
  - Apriori algorithm
  - Evaluation of association rules
- Other Topics
  - Web Mining
  - Data Warehousing

Outcome	**Direct Assessment**	**Satisfactory performance standard**
Demonstrate an understanding of the basic concepts in data mining.	Exam/Homework	A class average of 70% or more on associated questions.
Demonstrate an understanding of classification algorithms.	Exam/Homework	A class average of 70% or more on associated questions.
Demonstrate an understanding of clustering algorithms.	Exam/Homework	A class average of 70% or more on associated questions.
Demonstrate an understanding of association mining algorithms.	Exam/Homework	A class average of 70% or more on associated questions.
Analyze real world data using existing data mining tools.	Projects	A class average of 70% or more.

APPENDIX D

Model Schedule (Starting in Fall 2017)
B.S. in Computer Science (Major in Computer Science)

Freshman First Semester		
COMP 1100	Introduction to Computing	3
COMP 1102	Principles of Programming I	3
MATH 1561	Introduction to Mathematical Reasoning	3
ENGL 1101	Written English I	3
General Studies		3
		15
Freshman Second Semester		
COMP 1108	Principles of Programming II	3
MATH 2562	Introduction to Discrete Mathematics	3
ENGL 1102	Written English II	3
General Studies		6
		15
Sophomore First Semester		
COMP 2200	Object-Oriented Programming	3
COMP 2270	Data Structures	3
MATH 2501	Calculus I	4
General Studies		6
		16
Sophomore Second Semester		
COMP 2201	Machine Organization	3
COMP 2230	Network Programming	3
MATH 2502	Calculus II	4
General Studies		6
		16
Junior First Semester		
COMP 3330	Analysis of Algorithms	3
COMP 3340	Operating Systems	3
Science Elective		4
General Studies		3
		13
Junior Second Semester		
COMP 3395	Ethical Issues in Computing	3
Major Elective		3
Science Elective		4
General Studies		6
		16
Senior First Semester		
COMP 4400	AutomataTheory	3
COMP 4410	Database Management	3
Major Elective		3
Free Elective		6
		15
Senior Second Semester		
COMP 4440	Software Engineering	4
Major Elective		3
Free Elective		7
		14

Note: In order to complete a second major in Cybersecurity with 17 extra hours of required coursework or a second major in Mathematics with 21-24 extra hours of required coursework or a minor in Mathematics with 3-7 extra hours of required coursework, a student should double dip on the general studies coursework as much as possible and use the free elective hours. They will be able to complete the requirements for an additional major or a minor within 121-124 hours.

APPENDIX D

Model Schedule (Starting in Fall 2017)
B.S. in Computer Science (Major in Cybersecurity)

Freshman First Semester		
COMP 1100	Introduction to Computing	3
COMP 1102	Principles of Programming I	3
MATH 1561	Introduction to Mathematical Reasoning	3
ENGL 1101	Written English I	3
General Studies		3
		15
Freshman Second Semester		
COMP 1108	Principles of Programming II	3
MATH 2562	Introduction to Discrete Mathematics	3
ENGL 1102	Written English II	3
COMM 2200	Introduction to Human Communication	3
General Studies		3
		15
Sophomore First Semester		
COMP 2200	Object-Oriented Programming	3
COMP 2270	Data Structures	3
COMP 2200	Fundamentals of Computer Security	3
MATH 2501	Calculus I	4
General Studies		3
		16
Sophomore Second Semester		
COMP 2201	Machine Organization	3
COMP 2230	Network Programming	3
BISM 2600	Introduction to Network Administration	3
General Studies		6
		15
Junior First Semester		
COMP 3380	Introduction to Cryptography	3
COMP 3340	Operating Systems	3
Science Elective		4
General Studies		3
		13
Junior Second Semester		
COMP 3390	Network Security	4
COMP 3395	Ethical Issues in Computing s	3
Major Elective		3
General Studies		3
Free Elective		3
		16
Senior First Semester		
COMP 4415	Vulnerability Assessment	4
COMP 4410	Database Management	3
General Studies		3
Free Elective		6
		16
Senior Second Semester		
COMP 4440	Software Engineering	4
COMP 4495	Cybersecurity Senior Project	3
General Studies		3
Free Elective		4
		14

Note: In order to complete a second major in Computer Science with 20 extra hours of required coursework or a second major in Mathematics with 27-30 extra hours of required coursework or a minor in Mathematics with 10-14 extra hours of required coursework, a student should double dip on the general studies coursework as much as possible and use the free elective hours. They will be able to complete the requirements for an additional major or a minor within 121-124 hours.

Hossain, Mahmood

From: Noone, Diana
Sent: Thursday, February 09, 2017 9:10 AM
To: Shields, Deanna
Cc: Kirby, Jeri; Trisel, Donald; Hossain, Mahmood; Lavorata, Christina
Subject: Re: Memo about curriculum change

Deanna,
I support this! I don't know how we turn this down. I think it is great they now have a cyber security major. This will also enhance the NSI and CJ majors.
Thank you
Diana

Diana C. Noone, Ph.D., J.D.
Chair, Social Sciences
Professor of Criminal Justice
Department of Social Sciences
Fairmont State University
1201 Locust Avenue
Fairmont, WV 26554-2470
(p) 304-367-4238
(fax) 304-367-4785
dnoone@fairmontstate.edu

> On Feb 9, 2017, at 8:55 AM, Shields, Deanna <Deanna.Shields@fairmontstate.edu> wrote:
>
> Diana,
> Let me know what you think.
> Deanna
>
> From: Hossain, Mahmood
> Sent: Wednesday, February 08, 2017 10:45 PM
> To: Shields, Deanna
> Cc: Trisel, Donald; Kirby, Jack
> Subject: Memo about curriculum change
>
> Dear Deanna,
>
> Hope this finds you well! I am writing you to notify you about a curriculum proposal we are submitting to make some changes in the requirements of the Computer Security major (to be renamed Cybersecurity). We are including CRIM 2250 Cybercrime as part of the major requirements. An official memo is attached to this email. Please let me know if you have any questions.
> Regards,
>
> Mahmood
>
>
> Mahmood Hossain, Ph.D.
> Chair, Department of CSMP

> Associate Professor of Computer Science Fairmont State University 201G
> Engineering Tech Building
> 1201 Locust Avenue
> Fairmont, WV 26554
> Voice: (304) 367-4967
>
>
> [cid:999c3931-dd9a-42ba-a577-381e77c379ee@prod.exchangelabs.com]
>
> <Memo_Deanna_Shields.pdf>
> <image002.jpg>

Hossain, Mahmood

From: Gervais, Shayne
Sent: Friday, February 03, 2017 11:09 AM
To: Hossain, Mahmood
Subject: RE: Creating new course for the catalog

Looks clear to use on my end.

Shayne Gervais, PhD
University Registrar
Fairmont State University
317 Turley Center
304-367-4658
sgervais@fairmontstate.edu

From: Hossain, Mahmood
Sent: Thursday, February 02, 2017 10:40 PM
To: Gervais, Shayne
Subject: Creating new course for the catalog
Importance: High

Hi Shayne,

We are submitting a curriculum proposal where we are creating a new course. Could you please let us know if we can use COMP 4450 as the course number?

Thanks,

Mahmood

Mahmood Hossain, Ph.D.
Chair, Department of CSMP
Associate Professor of Computer Science
Fairmont State University
201G Engineering Tech Building
1201 Locust Avenue
Fairmont, WV 26554
Voice: (304) 367-4967


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