of instructor.
This course provides a study of programming and problem solving using a scalable structured programming language. The course assumes competency with programming and problem solving using variables, conditional statements, loops, classes (objects) and arrays. The course begins with a brief introduction to these prior programming concepts, before moving on to more advanced concepts such as class inheritance and interfaces, generics and beginning data structures such as linked lists, stacks and queues. The course includes more advanced programming techniques such as exceptions, recursion, networking and data structures.basic instruction sets, addressing modes, CPU design,
memory organization and Input-Output organization.
More advanced topics including vector processing and multiprocessors will also be introduced.

CPSC 256. C/C++ Programming for Engineers and Scientists (3-3-0)
Prerequisite: CPSC 250 with C- or higher.
This course explores problem-solving techniques for problems primarily from fields of engineering and sciences to include procedural and object-oriented program development, editing, compiling, linking and debugging using C/C++ programming language. Applications in hardware-oriented programming, embedded environment and computer simulation are also studied.

CPSC 270. Data and File Structures (3-3-0)
Prerequisite: CPSC 255 with a grade of C- or higher.
Pre or Corequisite: ENGR 213.
Study of objects and data structures. Trees, graphs, heaps with performance analysis or related algorithms. Structure, search, sort/merge and retrieval of external files. Programming assignments will involve application of the topics covered.

CPSC 280. Introduction to Software Engineering (3-3-0)
Prerequisite: Grade of C- or higher in CPSC 255.
This course introduces the theory and practice of building reliable software systems. It covers the life-cycle of software development and its existing models, methods for modeling, designing, testing and debugging software and techniques to choose appropriate models to build systems involving individuals or teams of developers.

CPSC 327. C++ Programming (3-3-0)
[Formerly CPSC427, equivalent]
Prerequisites: CPEN 214 and ENGR 213 and a grade of C- or higher in CPSC 255.
Designed for students who already know how to program, but do not know C++. This is a comprehensive introduction to C++. The course will emphasize basic C++, in particular

memory management, inheritance and features needed for low level programming.

CPSC 330. Computer Organization (3-3-0)
Prerequisites: CPSC 250/250L, CPEN 214.
Study of computer organization and architecture. Examine functional organization of a von Neumann computer including computer micro-operations, control organizations,

CPSC 335. Data Communication Systems (3-3-0)
Prerequisites: CPSC 250/250L.
A broad overview of computer networking topics to include the OSI model, protocols, applications, TCP/IP, addressing and subnetting, wired and wireless technologies and network security.

CPSC 336. Network Implementation and Administration I (3-3-0)
Prerequisites: CPSC 250, restricted to BSIS majors, cybersecurity majors or permission of department chair.
Study of TCP/IP based networks for a UNIX environment and the integration of different types of virtualization and cloud solutions with various operating systems. Routing, domain name servers and sockets are included in network configuration. Once networks are set up, they are configured to serve a purpose through the implementation and administration of information servers such as web and database servers with consideration for functionality and security.

CPSC 350. Information Systems Analysis (3-3-0)
Prerequisites: CPSC 150/150L.
Introduction to information systems profession. Tools and techniques for profiling organizations and analyzing their goals and needs to determine and specify information systems requirements. Practical experience in real-life information systems analysis.

CPSC 351. Information Systems Design and Implementation (3-3-0)
Prerequisites: CPSC 250/250L, 350.
Lecture/project-based course for systematic design, implementation, and maintenance of information systems. Based on given requirements for an information system, the course guides students in methods, tools and techniques for realizing the desired system.

CPSC 360. Programming Language Concepts (3-3-0)
Prerequisite: Grade of C- or higher in CPSC 255.
Basic concepts dealing with information binding, arithmetic, string handling, data structures, storage and mapping, input/output and execution environment. Specialized concepts concerning recursion, multiprocessing, list processing and language extensibility. Several programming languages will

be examined.
CPSC 410. Operating Systems I (3-3-0)
Prerequisites: CPSC 270 and 327.
Introduction to operating systems, I/O processing, interrupt structure and multiprocessing-multiprogramming, job2025-2026School of Engineering and Computing
management, resource management, batch and interactive processing, deadlock problem, computer networking through teleprocessing and system performance evaluation.ment approaches. Written and oral presentation of project.
CPSC 420. Algorithms (3-3-0)
Prerequisites: CPSC 270 and ENGR 213.
The application of analysis and design techniques to numerical and non-numerical algorithms which act on data structures. Examples will be taken from areas such as combinatorics, numerical analysis, systems programming and artificial intelligence.
CPSC 425. Object Oriented Programming and Design (3-3-0)
Prerequisite: CPSC 280.
Object-oriented design and applications of an object oriented programming language. Presents object-oriented design methods and provides guidance in the effective implementation of object oriented programs.
CPSC 430. Simulation Modeling (3-3-0)
Prerequisites: MATH 125; MATH 135 or 140 or 148; MATH 235 or 260; CPSC 250/250L.
Examines the quantitative analysis of management problems. This course is the information science equivalent of engineering courses in operations research. Emphasis on essence of systems modeling and simulation, prospects for obtaining computer solutions and extracting the most value out of the system’s model and its computer solution rather than mathematics of quantitative analysis.
CPSC 440. Database Management Systems (3-3-0)
Prerequisites: CPSC 250/250L.
Database (DB) concepts. Relational, hierarchical and network models. Query languages, data sub-languages and schema representations. The DB environment: DB administration, security, dictionaries, integrity, backup and recovery. May be taken as research intensive.
CPSC 441. Big Data Technologies (3-3-0)
Prerequisites: MATH 235 or 260; CPSC 336, 440; restricted to BSIS majors or permission of department chair.
This course covers facets of cloud computing and big data management, including the study of the architecture of the cloud computing model with respect to virtualization, multitenacy, privacy, security, cloud data management and indexing, scheming and cost analysis; it also includes relevant

programming models, crowd sourcing and data provenance.

CPSC 445. WI: Information Science Capstone (3-3-0)
Prerequisites: ENGL 223 with a C- or higher and CPSC 350. Pre or Corequisite: CPSC 440.
A major project that includes a study of the factors necessary for successful implementation and operation of information systems; the traditional life cycle approach to managing and controlling application development and alternative develop-

CPSC 470. Theoretical Computer Science (3-3-0)
Prerequisites: CPSC 270, 360; MATH 240.
Presentation of basic results relating to formal models of computation. Emphasis is placed on developing skills in understanding rigorous definitions in computing and in determining their logical consequences.

CPSC 471. Applied Artificial Intelligence (3-3-0)
Prerequisites: CPSC 255 or 256 and MATH 235 or 260 or ENGR 210 or PHYS 340 each with a grade of C- or higher.
This course is an introduction to the mathematical and computational foundations of artificial intelligence. Its emphasis is on those elements of artificial intelligence that are most useful for practical applications. Topics include heuristic search, problem solving, game playing, knowledge representation, logical inference, planning, reasoning under uncertainty, expert systems, machine learning and language understanding. Programming assignments are required.

CPSC 472. Introduction to Robotics (3-3-0)
Prerequisites: CPSC 255 or 256 and MATH 235 or 260 or ENGR 210 or PHYS 340 each with a grade of C- or higher.
This course presents an overview of applied robotics. The course will cover introductions to configuration space representations, rigid body transforms in 2D and 3D, robot kinematics, basic control theory, motion planning, perception and machine decision making. Perception topics include basic computer vision and laser rangefinder (LIDAR)-based obstacle detection and mapping. The course includes hands on development and system integration using various robotic platforms. Programming will be done in Ubuntu Linux in a mixture of C++ and Python; no prior experience is required, but students will be expected to self-teach the specifics necessary to complete the projects.

CPSC 475. Android Mobile Computing (3-3-0)
Prerequisite: CPSC 255 with a grade of C- or higher.
This course covers core concepts of the Android programming platform and its key components using the Android SDK and the Java programming language. Topics discussed include application lifecycle, user interface design, activities and intents, data persistence, networking, messaging, location-based applications and android services.

CPSC 480. Software Design and Development (3-3-0)

Prerequisite: CPSC 280.
Presentation and application of formal approaches to state-of-the-art techniques in software design and development.
CPSC 495. Special Topics (Credits vary 1-3)
Prerequisites: As announced.
Topics vary, determined by the special interests and needs of students and the expertise of faculty.

CPSC 498. Capstone Project in Computer Science (3-3-0)
Prerequisites: CPSC 270 and 327 and senior standing.
Directed projects or research under the supervision of a faculty member.control, password security and database security. Additionally, topics such as buffer overflows, vulnerabilities, secure coding practices, secure configuration, auditing and logging will be covered.

Prerequisites: CYBR 328, CPSC 336.
This course covers detailed security assessment of web based applications including APIs, cross site scripting (XSS), vulnerability discovery and management, application architecture and configuration, etc. The topics will be covered from both offensive and defensive perspectives.
CYBR 198. First Year Cybersecurity Seminar (1-1-0)
This course provides an overview of key concepts in cybersecurity and a guided exploration that requires connecting these concepts to other disciplines, current events and cybersecurity tools. First year students and students interested in exploring cybersecurity for the first time will work closely with faculty and more experienced students to prepare for each of the topics. Additionally, participation in a community-based cybersecurity activity or event is required.
CYBR 298. Second Year Cybersecurity Seminar (1-1-0)
Prerequisite: CYBR 198 or permission of instructor.
This course provides a continued overview of key concepts in cybersecurity and open exploration that requires connecting these concepts to other disciplines, current events and cybersecurity tools. Students with prior cybersecurity experience or experience in CYBR 198 will work to guide less-experienced students in their exploration of the topics. Additionally, participation in planning a community-based cybersecurity activity or event is required.
CYBR 328. Foundations and Principles of Cybersecurity (3-3-0)
Prerequisites: CPSC 250/250L.
This course examines the foundational concepts and basic principles necessary for the understanding and study of cybersecurity. A wide breadth of topics is explored to prepare students for future courses in the cybersecurity major.
CYBR 428. Network Security and Cryptography (3-3-0)

[Formerly CPSC 428, equivalent]
Prerequisites: CYBR 328 and CPSC 335
Study of encryption algorithms and network security practices. Security issues, threats and attacks. Symmetric ciphers ("secret-key encryption"): classical and contemporary algorithms, standards and applications. Public-key encryption: theoretical background, practical implementations, key-management, hash algorithms. Network security practices: authentication, IP security, electronic mail and web security, system security.
CYBR 429. Computer and System Security (3-3-0)
[Formerly CPSC 429, equivalent]
Prerequisite: CYBR 328 or permission of associate dean of school.
Restricted to BSIS majors, cybersecurity majors.
Study of computer and system security practices, policies and principles. Designed as a counterpart to CYBR 428, this course will focus on topics such as account and access
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CYBR 444. Policy Planning and Assurance (3-3-0)
Prerequisite: CYBR 328.
This course covers security policy, legal systems, ethical issues, physical security, disaster recovery, business continuity issues, and risk in the context of cybersecurity in information systems. Additional topics also include maintenance of essential business processes following a disaster, restoration of systems, assurance, and building systems with formal evaluation methods.
CYBR 448. Advanced Cryptography and Cybersecurity (3-3-0)
Prerequisites: CYBR 428, 429; ENGR 213.
This course provides an in-depth exploration of important cybersecurity methods and practices. The course also includes advanced exploration of the role infrastructure plays on security, including topics on operating systems, intrusion detection and prevention, advanced network security and advanced cryptography.
CYBR 498W. Cybersecurity Capstone (3-3-0)
Corequisite: CYBR 448.
The capstone course is a major project that includes the study and exploration of an area of cybersecurity. Projects are expected to research and/or implement a cybersecurity-related solution. Written and oral presentations are required.
The Curriculum in Data Science
DATA 201. Introduction to Data Science (3-3-0)
Prerequisites: CPSC 250/250L, MATH 125.
Corequisities: MATH 235 or 260.
This course provides an introduction to data science. Topics include data collection, processing, analysis and visualiza-

tion. Additional topics include clustering algorithms and regression. Students will learn how to critically evaluate and produce their own quantitative results. This is a projects-based course.

DATA 301. Data Science Methodology (3-3-0)

Prerequisite: DATA 201 with a grade of C- or higher.

This course provides an introduction to data science. Topics include data collection, processing, analysis and visualiza-