Changes to the Computer Science and Computer and Information Sciences Majors and Courses
Academic Year 2022-2023

Introduction

The primary changes purposed for the computing programs at Bethel University include:

A. Improving the programming sequence by changing the topics and levels in CSC 121, CSC 122, and CSC 321, and adding an additional 3 hours of programming in CSC 421
B. Separating the CSC 261 and 263 into a content course and a learning course (CSC 260) each.
C. Combining CSC 150 into CSC 112 and CSC 350 into CSC 490, and dropping CSC 262 to make the program easier to teach.
D. Moving two courses (CSC 312 and CSC 314) out of the topics course (CSC 310) into courses of their own.

Purpose

These changes are to meet needs of the students while making the programs easier to teach with one full time faculty member.

- Students need more time to mature in their programming skills
- Cloud computing (a distinctiveness of the programs) needs to be more prominent in the catalog.
- The number of different preparations in given semester for the full-time faculty member needs to be decreased.
- Courses need to be updated to keep up with the extremely dynamic nature of the field of computing

Consistency with the vision and mission

In 2019, Bethel embarked on a five year plan to bring back a strong computer science program. This proposal is part of that five year plan and is aimed to strengthen the computing programs. This fits the mission of the university in general and the department of Mathematics, Engineering, and Computer Science while not requiring any additional resources to be allocated. It enables the computing programs to continue without additional faculty until the program grows large enough to require additional faculty and the Bethel is in a place financial to hire a second person.

Implications and effects

Almost all the changes will only impact the CS and CIS majors and CS and IS minors. The number of hours for each has not changed. This proposal decreases the demand on the computer science faculty so that eventually overloads will not be required.

The change to CSC 102: Introduction to Programming is being made to allow other fields to use the course to introduce their students a programming language that is used in that discipline.

<u>Impact on other majors/programs</u>

By placing ITSC on the teaching schedule for traditional students, it will be used to meet the needs of most of the engineering students instead of CSC 121. It will be a better fit for those students. Engineering supports this change.

By adapting CSC 102's course description to allow for different language, it will allow this course to be added to other majors as they deem appropriate .

General studies impact
This does not affect the general studies program.

Data Support

- Over the past two years, students have not reached the level of programming needed in the first two semesters of programming. In other institutions, it is not uncommon for these courses to be 4 hours courses. Additional time is needed to allow them to reach the level they should be.
- Discussions were also made with Huntington College to align our curriculum in such as way that students from either campus could take courses at Bethel or Huntington as needed. This will allow students to take courses during semesters that the courses might not be offered at their home institutions (because of scheduling or other issues). It also allows them to take courses that might not be offered at their home institutions. Because the limited number of students doing this for a given class, this allows both programs more flexibility without significant increasing the work load for any class.
- The adding of CSC 312 and CSC 314 reflect the increase significance of cloud computing in the industry. By strengthening the emphasis of the degrees in the area of cloud computing, this proposal highlights the emphasis of cloud computing throughout the degrees. This is an area in computing that is becoming a prominent area for the future. This is currently a distinctive feature of our degrees.
- It does remove the compliance with the ABET curriculum which means we are not currently aiming for ABET accreditation for the next five years. Accreditation in this area is not essential not necessary.

5. Resources required
One goal of this proposal is to reduce the demand on the existing faculty. There is no increase in cost associated with this proposal. It will actually allow a small decrease in the resources required by allowing the sharing of courses with Huntington college on an as-needed basis.

All CSC course/lab offerings and teaching

All courses/labs are one section a semester unless otherwise specified

Course	Offering	Teaching and comments
CSC 102	EF	Course by full-time CS faculty and one lab (3 hours), other lab sections by professors for other disciplines as requested (2 hours)
CSC 112	EF	Full-time CS faculty (3 hours)
CSC 121	ES	Course and lab by full-time CS faculty (4 hours)
CSC 210	ASE	Full-time CS faculty (3 hours)
CSC 221	EF	Course and lab by full-time CS faculty (3 hours)
CSC 230	AFO	adjunct CS faculty (3 hours)
CSC 260	ASO	Course by full-time CS faculty (1 hour)
CSC 262	ASO	adjunct CS faculty (2 hours)
CSC 263	as needed	adjunct CS faculty (2 hours)
CSC 310	AFE	adjunct CS faculty (3 hours)
CSC 312	ASO	full-time CS faculty (3 hours)
CSC 314	AFE	adjunct CS faculty (3 hours)
CSC 322	ASE	full-time CS faculty (3 hours)
CSC 340	AFO	full-time CS faculty (3 hours)
CSC 398	summer and EF	adjunct CS faculty (1-3 hours)
CSC 420	ASO	Math full-time faculty (3 hours)
CSC 441	ASO	adjunct CS faculty (from Huntington College) (3 hours)
CSC 450	AFE	full-time CS faculty (3 hours)
CSC 463	AFE	adjunct CS faculty (3 hours)
CSC 490	ASO	full-time CS faculty (3 hours)
ITSC 121	ASE	Course and lab by full-time CS faculty (4 hours)

Implementation process
Most changes will start with the spring of 2023 with a few changes continuing through spring of 2024 to accommodate current students.

Offering Schedule (underline -> old catalog)
Spring 2023: CSC 121, CSC 150, CSC 260L, CSC 261, CSC 312, CSC 321, CSC 441, CSC 490
Fall 2023: CSC 102, CSC 112, CSC 221, CSC 230, CSC 314, CSC 340, CSC 350, CSC 398
Spring 2024: CSC 121, ITSC 121, CSC 150, CSC 210, CSC 322, CSC 420, CSC 441

This will allow all students that have started either major by fall of 2022 to have two sections of CSC 150. Any student with only one section needed for CSC 350 will be able to complete that. After that all students will be able to take CSC 112 and CSC 490 each for 3 hours. In addition, the students that have completed CSC 121 will be able to complete the programming sequence in the previous catalog before the students that will be taking CSC 121 this spring start the new sequence.

The engineering students typically take CSC 121 every even spring. By offering ITSC 121 instead during the same time, this change will be seamless.

Marking plans
Current marketing plans can continue.

Assessment and follow-up

Current assessment plans will be used and updated according to the existing plan

Summary of Changes:

Explanations:

- **CSC 310, CSC 312, and CSC 314**. CSC 310 is designed to be offered every semester with a different topic over a 2 year (or longer) period. Two topics (those of CSC 312 and CSC 314) are important enough to be courses in the catalog. They deal with the distinctiveness of the programs (cloud computing). Because they were already being taught as part of CSC 310, there is no added resources required to make them separate courses.
- **CSC 112, CSC 150, CSC 350, and CSC 490**. Instead of having separate courses for seminar, this material is being folded into CSC 112 and CSC 490. This will mean few preparations required of the faculty and easier scheduling for the students.
- **CSC 121, CSC 122, CSC 221, CSC 321, CSC 322, and CSC 421**. Over the past 3 years, assessment has shown that students new time and instruction to reach the desired skill level in programming. Nine hours is not enough. In addition, students were being pushed faster than most could achieve. By restructuring and adding more hours to the programming sequence we hope to address this need.
- **CSC 262**. The lack ability to find proper adjunct to teach this course and the need to trim and focus the courses have led to the decision to drop this course. If there opportunity and need arises, it can be offered as CSC 263.
- **CSC 260, CSC 261, and CSC 263**. In the past, CSC 261 and CSC 262 have include two separate components (via the use of a lab): content and learning how to learn. By separating these into different classes, it will be easier to handling scheduling and grading.
- **ITSC 121**. By putting ITSC 121 back into the schedule of classes for the traditional student, we will be able to address the different needs of engineering and computer science students separately and tune the two classes to meet different needs.
- **CSC 102**. The change the format of CSC 102 to allow for different lab sections to cover different programming languages will allow different disciplines to have a course individualize to their needs without placing additional demands on the CS faculty.
- **CSC 312**. By required all students to take this cloud we are reinforcing one of our distinctiveness (cloud computing) of our computing programs.

Course Changes:

Dropped Courses

CSC 122:	Programming: Data Structures: 3 hours
CSC 150:	Seminar 1. 0.5 hours
CSC 262:	Self-Directed Learning: System Administration. 3 hours
CSC 321:	Programming 3: Object Oriented Programming. 3 hours
CSC 350:	Seminar 2. 0.5 hours

Added Courses

CSC 221:	Programming 2: Design and Object Oriented Programming. 3 hours
CSC 260:	Introduction to Self-Directed Learning. 1 hour
CSC 312:	Introduction to Cloud Computing. 3 hours
CSC 314:	Introduction to Cloud-based Data Science and Machine Learning. 3 hours
CSC 322:	Programming 3: Advanced Data Structures. 3 hours
CSC 421:	Advanced Programming

Updated Courses

CSC 102:	Introduction to Programming. (Updated course description)
CSC 112:	Digital Citizen of the 21st Century. (3 hours instead of 2 and combining Seminar 1 with CSC 112)
CSC 261:	Self-Directed Learning: Web Programming. (Updated course description and 2 hours instead of 3)
CSC 263:	Self-Directed Learning: Introductory CS Topics: (2 hours instead of 3)
CSC 310:	Advanced Computer Science Topics: (Updated course description)
CSC 463:	Self-Directed Learning: Advanced CS topics (change in pre-requisite)
CSC 490:	Senior Capstone. (3 hours instead of 2 combining Seminar 2 with CSC 490)

Major Changes: **Computer Science**

Current	New
Bethel Core: Science component: BIOL 125, BIOL 126, CHEM 163, PHYS 121, PHYS 122	**Science with Lab**
CSC 112: Digital Citizen of the 21st Century (2 hours)	CSC 112: Digital Citizen of the 21st Century (**3 hours**)
CSC 121: Programming 1: Control Structures	CSC 121: Programming 1: Control Structures
CSC 122: Programming 2: Data Structures	**CSC 221: Programming 2: Design and Object-Oriented Programming (same number of hours)**
CSC 150: Seminar 1 (twice for total of 1 hour)	**no longer required**
CSC 210: Database Programming	CSC 210: Database Programming
CSC 230: Networks	CSC 230: Networks
CSC 261 or CSC 262 or CSC 263 (3 hours)	**CSC 260: Introduction to Self-Directed Learning**
	CSC 261 or CSC 263 (2 hours)
	CSC 312: Introduction to Cloud Computing (3 hours)
CSC 321: Programming 3: Object-Oriented Programming	**CSC 322: Programming 3: Advanced Data Structures**
CSC 340: Software Engineering Theory	CSC 340: Software Engineering Theory
CSC 350: Seminar 2 (twice for a total of 1 hour)	**no longer required**
CSC 398: Internship in Computer Science	CSC 398: Internship in Computer Science
CSC 420: Theory of Computation	CSC 420: Theory of Computation
	CSC 421: Programming 4: Advanced Programming
CSC 441: Software Engineering in Practice	CSC 441: Software Engineering in Practice
CSC 463: Self-Directed Learning: Advanced Computer Science Topics	CSC 463: Self-Directed Learning: Advanced Computer Science Topics
CSC 490: Senior Capstone (2 hours)	CSC 490: Senior Capstone (**3 hours**)
MATH 210: Discrete Mathematics	MATH 210: Discrete Mathematics
MATH 111 or MATH 252	MATH 111 or MATH 252
MATH: 3 hours above MATH 131	**no longer required**
choose 2 to 4 hours from BIOL 125, BIOL 126, CHEM 163, CHEM 164, NS 200, NS 333, PHYS 121, PHYS 122	**no longer required**
Choose 6 hours from CSC 310, CSC 450, CSC 463	**Choose 6 hours from CSC 310, CSC 314, CSC 450, CSC 463**
Total: 54-58 hours	**Total: 55-57 hours**

Computer and Information Sciences

Current	New
CSC 112: Digital Citizen of the 21st Century (2 hours)	CSC 112: Digital Citizen of the 21st Century **(3 hours)**
CSC 121: Programming 1: Control Structures	CSC 121: Programming 1: Control Structures
CSC 122: Programming 2: Data Structures	**CSC 221: Programming 2: Design and Object-Oriented Programming (same number of hours)**
CSC 150: Seminar 1 (twice for total of 1 hour)	**no longer required**
CSC 210: Database Programming	CSC 210: Database Programming
CSC 230: Networks	CSC 230: Networks
CSC 261 or CSC 262 or CSC 263	**CSC 261 or CSC 263**
	CSC 312: Introduction to Cloud Computing (3 hours)
	CSC 312: Introduction to Cloud Computing (3 hours)
CSC 340: Software Engineering Theory	CSC 340: Software Engineering Theory
CSC 350: Seminar 2 (twice for a total of 1 hour)	**no longer required**
CSC 398: Internship in Computer Science	CSC 398: Internship in Computer Science
CSC 463: Self-Directed Learning: Advanced Computer Science Topics	CSC 463: Self-Directed Learning: Advanced Computer Science Topics
CSC 490: Senior Capstone (2 hours)	CSC 490: Senior Capstone (**3 hours**)
CSC: any 9 hours	CSC: any **6 hours**
BADM 222 or WRIT 231	BADM 222 or WRIT 231
Total: 40-42 hours	Total 40-42 hours

IS Minor: Same number of total hours
Old: CSC 102, CSC 112 (2 hours), CSC 150/350 (for one hour), CSC 210, CSC 230, (CSC 261, CSC 262, or CSC 310), any 6 more hours of CSC
New: CSC 102, CSC 112 (3 hours), CSC 210, CSC 320, (CSC 261, CSC 310, or CSC 312), any 6 more hours of CSC

CS Minor: (same number of total hours)
Old: CSC 112 (2 hours), CSC 121, CSC 122, CSC 150/250 (for one hour), 9 more hours of CSC courses
New: CSC 112 (3 hours) CSC 121, CSC 221, 9 more hours of CSC courses

Courses

CSC 102: Introduction to Programming

- Revised (Change in grading, description)
- 2 hours with lab. (One hour lecture, 2 hour lab)
- Grading scheme. Letter grade for lecture, separate letter grade for lab. Must pass both during same semester
- Concurrent course is the lab. No pre-requisite
- Description: A gentle introduction to programming for students with no or limited computer programming experience. Students will write small computer programs to practice problem solving and programming methodologies. Labs will be structured around the language common in a given discipline. One lecture and one lab per week.
- Objectives:
  - Student will understand how to write simple programs
  - Students will understand programming terms including variables, selection, repetition, and functions/procedures
- Performance determined by exams and homework for course and lab assignments and exams for lab.

CSC 112: Digital Citizen of the 21st Century

- Revised (hours and description)
- 3 hours (no lab)
- Grading scheme: Letter grade
- No pre-requisites or concurrent courses
- Description: The study of computing and the ways it shapes and influences 21st century citizens and society. Provides the basic understanding of computing capabilities and limitations for a more informed discussion of the issues. Covers foundational concepts of computing including technical skills (such as use of Linux) needed during the major, soft skills (including note taking and time management), architecture, o.s., programming languages, and ethics. Also will include guest speakers from industry and projects done by upperclassmen. Three lectures a week.
- Objectives:
  - Students will understand various ethical and cyber security issues in today's digital world.
  - Students will understand the impact of technology on today's work and the world's impact on technology
  - Students will begin to develop technical writing skills by writing a 2-3 page technical paper and taking notes.
  - Students will have a fundamental understanding of the workings of a computer.
- Performance determined by exams and homework

CSC 221: Programming 2: Design and Object-Oriented Programming

- New
- 3 hours (2 hour lecture and 2 hours of lab)
- Grading scheme: Letter grade for class (no grade for lab)
- Pre-requisite: CSC 121
- Description: A continuation of Programming 1. Students learn to design more complex programs larger complex object-oriented programs. Also includes graphical, event, and concurrent programming. Two lectures and one lab per week.
- Objectives:
  - Students will learn to design and code complex multi-object programs.
  - Students will learn to develop graphics based interfaces for programs
  - Students will be introduced to event and concurrent programming.
  - Students will be introduced to additional programming tools and enviornments including source code verison software
- Performance determined by exams, homework, and lab assignments

CSC 260: Introduction to Self-Directed Learning

- New
- 1 hour
- Grading scheme: Letter Grade
- Concurrent course: CSC 261 or CSC 263
- Description: Students will learn and experience how to be productive when learning about new technology on their own. This includes an understanding of the strengths and weaknesses of different types of resources, and understanding of how to maximize the learning a given resource provides, and learning to create a plan for their own learning. The concurrent CSC 261 or CSC 263 course will be used as an example. Students will create a learning plan for CSC 463. One lecture a week.
- Objectives:
  - Learn to choose the right resource for the learning objective
  - Learn how to maximize the learning using a given resource
  - Create a learning plan for CSC 463.
- Performance determined by homework

CSC 261: Self-Directed Learning: Web Programming

- Revised (course description and hours)
- 2 hours (was 3 hours)
- Grading scheme: Letter grade
- Concurrent course: CSC 260
- Description: Students will use independent learning techniques combined with class discussions to learn to build websites. One lecture and on-line lessons per week.
- Objectives:
  - Students will understand how to build web sites using HTML, CSS, JavaScript, and PHP.
  - Students will understand security and ethical issues associated with websites
- Performance

CSC 263: Self-Directed Learning: Introductory CS Topics

- Revised (course description and hours)
- 2 hours (was 3 hours)
- Grading scheme: Letter grade
- Concurrent course: CSC 260
- Description: An introductory topic of computer science is covered. Students learn via on-line lessons and class discussion. One lecture and on-line lessons per week.
- Objectives:
- Performance:

CSC 310: Advanced CS Topics

- Revised (new course description)
- 3 hours
- Grading scheme: Letter grade
- Pre-requisite: permission of the instructor
- Description: An advanced cutting edge computer science topics such as Internet of Things and mobile computing will be covered. Topic to be determined by demand and the instructor. Can be taken up to 4 times as long as the content is different. Three lectures a week.
- Objectives:
  - Students will learn a specific advanced topic in computing and the ethical and security issues associated with it.
- Performance

CSC 312: Introduction to Cloud Computing

- New
- 3 hours
- Grading scheme: Letter grade
- Pre-requisite: CSC 121
- Description: A study of the fundamentals of cloud computing including PaaS, SaaS, and IaaS, Security and ethical issues directly associated with cloud computing are included. Students will gain experience in the cloud. Three lectures a week.
- Objectives:
  - Students will learn to use many of the basic features of a cloud provider
  - Students will create their own application in the cloud
  - Students will understand the strengths and weaknesses of cloud computing
  - Students will be prepared to use the cloud in their future computing work.
- Performance: based on assignments, projects, and exams

CSC 314: Introduction to Cloud-based Data Science and Machine Learning

- New
- 3 hours
- Grading scheme: Letter grade
- Pre-requisites: CSC 221 and CSC 210. CSC 312 is recommended
- Description: A study of the resources available to do data science and machine learning in the cloud. Includes an overview of the different aspects of data science and machine learning. Three lectures a week.
- Objectives:
  - Students will create two projects in the cloud of their choosing: one with data science and one with machine learning
  - Students will learn the fundamentals of data science and machine learning and the ethical issues associated with each.
- Performance: Projects, assignments and exams

CSC 322: Programming 3: Advanced Data Structures

- New
- 3 hours
- Grading scheme: Letter grade
- Pre-requisite: CSC 221
- Description: A continuation of Programming 2. Students will learn to design and use data structures including stacks, different types of queues, different types of trees, graphs, and other advanced data structures. Complex sorting routines and algorithm analysis will be covered. Three lectures a week.
- Objectives:
  - Students will be able to appropriately use data structures found in a language's API
  - Students will be able implement different data structures on their own
  - Students will be able to use complex and efficient sorting algorithms
  - Students will be able to do algorithm analysis
- Performance: Programs, homework, and exams

CSC 463: Self-Directed Learning: Advanced Computer Science Topics

- revised (pre-requisite)
- 3 hours (was 2)
- Grading scheme: Letter grade
- Pre-requisite: CSC 260
- Description: Students will pick one advanced cutting edge topic (typically could computing, machine learning, big data, Internet of things, or mobile computing), develop their own learning goals and strategies, get them approved and learn the material on their own. Students will be required to develop a project to demonstrate what they have learned. Can be taken up to two times as long as the topic is different. Topics must also differ from those taken in CSC 310. One lecture a week
- Objectives:
  - Students will know how to direct their own self-learning for future tasks.
  - Students will know how to demonstrate the ideas they have learned.
  - Students will know how to identify security and ethical issues in a topic of their own choosing
- Performance: Based on semester project

CSC 421: Programming 4: Advanced Programming

- new
- 3 hours
- Grading scheme: Letter grade
- Pre-requisite: CSC 322
- Description: A study of the characteristics of high quality programs and how to create them. Different design patterns are included. Three lectures a week.
- Objectives:
  - Students will create a large program using advanced quality programming concepts
  - Students will be able to design complex testing and documentation of a program
  - Students will use proper methodologies when programming
  - Students will be able to identify and apply the appropriate techniques to a given problem.
- Performance: Project, programs, homework, and exams.

CSC 490: Senior Capstone

- revised (hours and description)
- 3 hours (was 2)
- Grading scheme: Letter grade
- Description: This is a capstone experience for all computing majors. It covers advanced principles of computing including optimization, parallelism, advanced architecture, and other fundamental topics not covered elsewhere in the curriculum. It also includes career skills. Students will present their work to their peers. Guest speakers may also present. Three lectures a week.
- Objectives:
  - Students will be able to learn and present new complex computing material
  - Students will learn recurring themes in computing
  - Students will be exposed to advanced issues in computing
- Performance