Computer Science Program Proposal

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Abstract

This document is meant to serve as my vision for a complete computer science program at Amsterdam High School. It was developed based on conversations with stakeholders both internal and external to the district, as well as my personal expertise in the subject matter. My ultimate goal is to build from this vision a comprehensive computer science program that is accessible to all Amsterdam students, while providing opportunities for advanced study in partnership with FMCC's computer science department.

Key Points

This section serves as a *"spark notes"* version of this proposal. The key opportunities and hurdles are presented, and each is expanded upon further in the subsequent sections of this document.

What We Have

→ Explorations in Computer Science (full-year HS course, no-prerequisites)
→ Computer Science I - Intro to Programming (full-year HS course, Algebra I prerequisite)

What I am Proposing

Fall '24

→ Explorations in Programming (half-year HS course, no-prereq.)
- Split from Explorations in Computer Science

→ Explorations in Robotics (half-year HS course, no-prereq.)
- Split from Explorations in Computer Science
- We already have all of the robotics equipment and the competition arena for this course

→ Computer Science I - CIS-116 (full-year college course, Algebra I prereq.)
- Alignment of existing CSI course to match curriculum and rigor of matching FM course

→ Robotics - (full-year high school course, pre-req: any programming or robotics course)
- We already have all of the robotics equipment and the competition arena for this course

Fall '25

→ Computer Science II - CIS-216 (full-year college course, CIS-116 prereq.)
- This course will need to be designed/ developed from the ground up

Fall '26

→ Introduction to Artificial Intelligence - CIS-Elective (full-year college course, CIS-216 prereq.)
- This course will need to be designed/ developed from the ground up

Ongoing

→ Work with FMCC to build course sequences that qualify for SUNY Microcredentials
→ Identify existing programs (ie. SMART Scholars), that can take advantage of transportation

What We Need

→ Our Robotics courses will need a dedicated space in the high school. Students will design and iterate on robot designs for competitions in the classroom arena. Both the arena and student robots will need a secure classroom location where they can be left out in the room. Click here for an example of the arena in use Image of our already purchased equipment

→ This *"Robotics Lab (example)"* would ideally also have distance learning hardware installed, as any of our courses in computer science can be offered on the distance learning network.

→ Further conversation between myself and administration on steps to be taken to get this program off the ground.

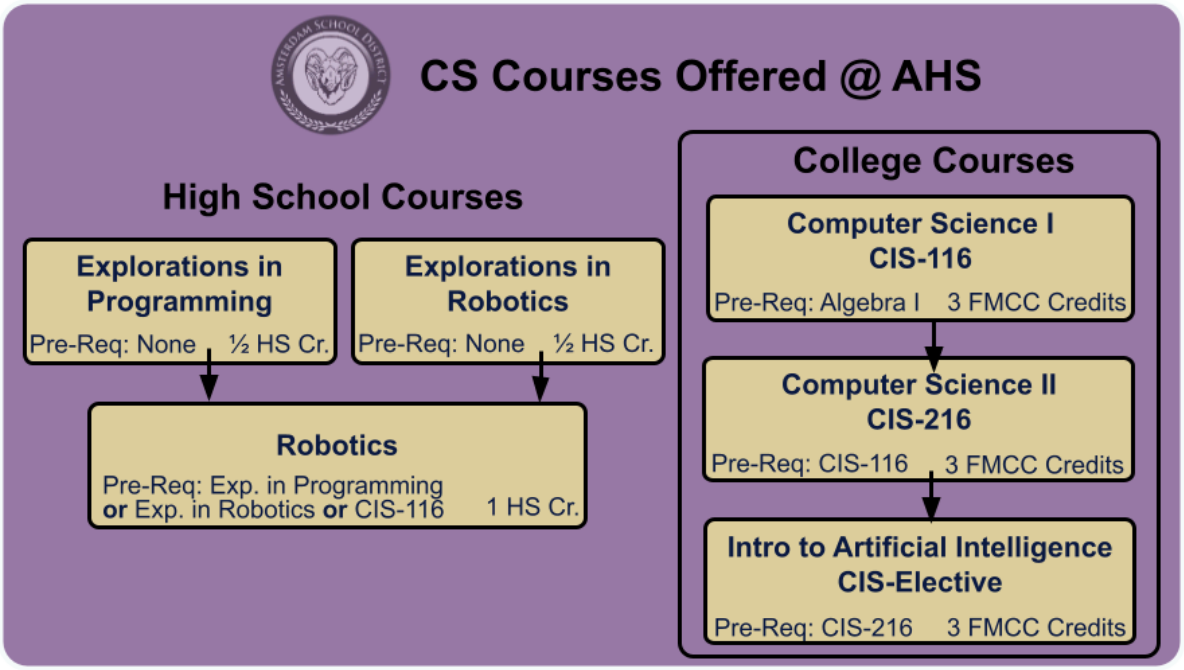
→ Further conversation with FMCC faculty on course alignment, opportunities for electives on and off campus, and course progressions that lead to SUNY Microcredentials.

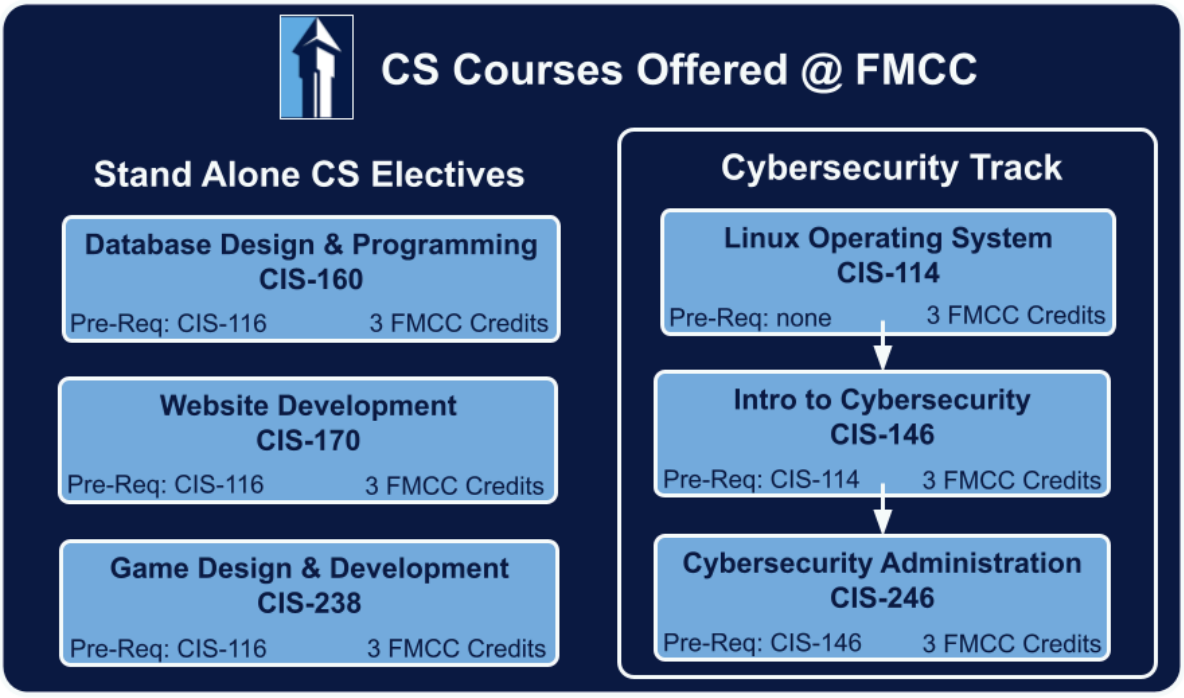
Rationale

All Amsterdam students should have exposure to computer science via hands-on experiences in programming, solution engineering, and algorithmic thinking tasks. As technology becomes more sophisticated and omnipresent in our society, demystifying the "*man inside the machine*" is becoming an increasingly vital skill for productive members of tomorrow's workforce. By fully committing to a robust and comprehensive computer science program, we are investing in our student's futures. Simultaneously we may position GASD as a leader in computer science and technology education in our region.

Program Overview

The diagram below serves as a map of the locally proposed computer science courses, and their connections to the larger course progression. FMCC on campus courses are also included. There exists a great opportunity to build a relationship with FMCC and their existing computer science offerings.





Course Offerings

Explorations in Programming ~ ½ HS Cr. ~ Prerequisites: None

In this half year course students will explore the Python programming language through hands-on graphics based problems. The core experience of this course is the creative task that each unit of study culminates with. These creative tasks allow students to flex their creative muscles and show off their newly attained technical knowledge on a project of their own design. Students may follow this course with Robotics, Explorations in Robotics, or Computer Science I.

Explorations in Robotics ~ ½ HS Cr. ~ Prerequisites: None

In this half year course students will design robotic vehicles to compete in various classroom challenges. Each robot's physical and software design will need to be iterated over through the engineering design and

development cycle. This hands-on course will expose students to engineering principles and programming in Python. Students may follow this course with Robotics, Explorations in Programming, or Computer Science I.

Robotics ~ 1 HS Cr. ~ Prerequisites: Explorations in Programming *or* Explorations in Robotics *or* CIS-116
This full-year course will allow students to expand upon their prior knowledge in either programming, robotics, or both. Students will spend the year working through larger scale competitive classroom challenges. The robot's will be more capable and complex than those built in previous courses, as will the Python programming that gets them moving. Students may follow this course with Computer Science I.

Computer Science I - CIS-116 ~ 3 FMCC Cr. ~ Prerequisites: Algebra I
This full-year college level course is a rigorous introduction to programming via the Python programming language. Students will build graphics based applications that encourage a deep understanding of programming concepts. Similar to Explorations in Programming this course will lean heavily on the end of unit creative tasks. These projects will allow students to flex their creative and technical muscles to build an application of their own design. This course is the gateway to a plethora of further computer science courses including; Computer Science II (CIS-216), Database Design and Development (CIS-160), Website Development (CIS-170), and Game Design & Development (CIS-238).

Computer Science II - CIS-216 ~ 3 FMCC Cr. ~ Prerequisites: CIS-116
This rigorous full-year college level course picks up where Computer Science I left off. Students will dive deeper into programming in Python and push their technical skills to the next level. This will include deep dives into concepts like object oriented programming, encapsulation, recursion, functional programming, and search/ selection algorithms. This course is essential for further study in computer science, and with its completion students will have the opportunity to enroll in Introduction to Artificial Intelligence (CIS-Elective).

Introduction to Artificial Intelligence - CIS-Elective ~ 3 FMCC Cr. ~ Prerequisites: CIS-216
This is perhaps the most exciting course in our proposed offerings. Artificial Intelligence is changing the world as we know it. This college level course provides the historical and algorithmic underpinnings of A.I. and allows students to develop A.I. systems using the Python programming language. Students will work on classical A.I. problems like optimization of graph search algorithms, adversarial search, knowledge representation and logical inference. Students will then also be exposed to modern A.I. architectures and algorithms like reinforcement learning and neural networks. This course will set students up for further study in Computer Science and provide a solid technical foundation upon which to continue their study.

SUNY Microcredential

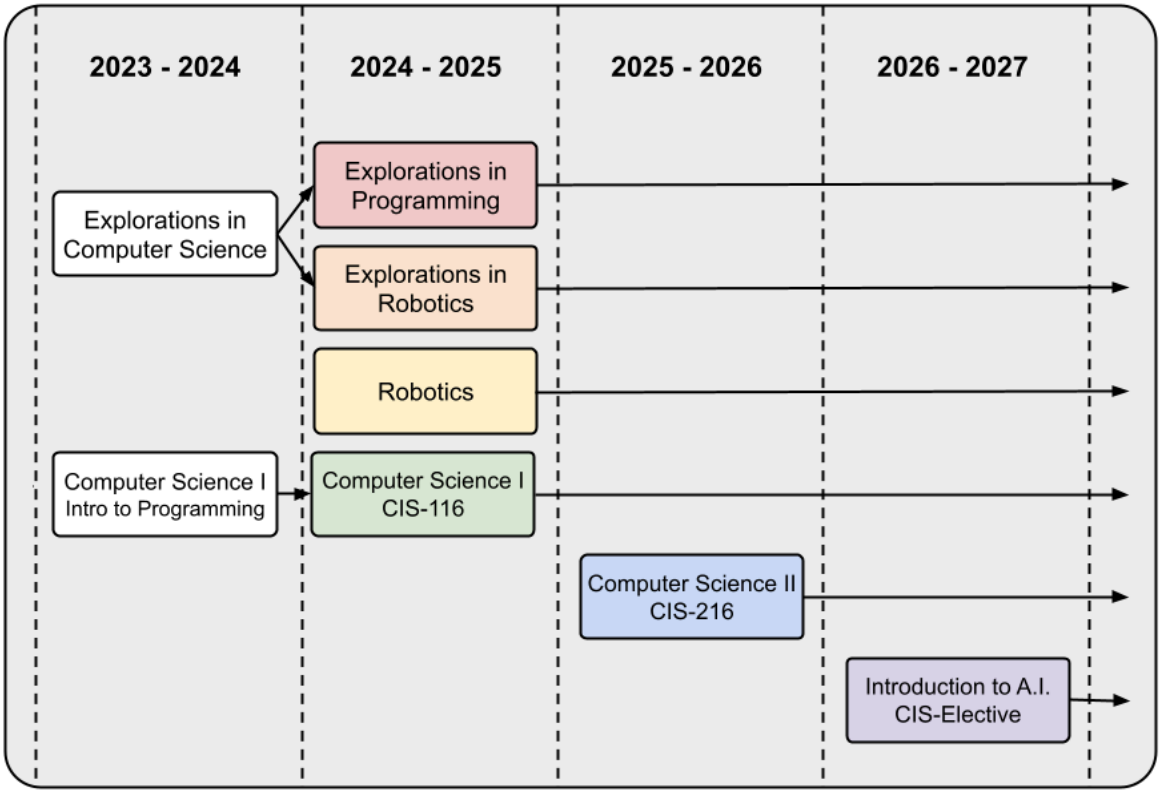
A SUNY Microcredential is a targeted educational sequence of courses/ experiences that concentrates on a specific set of skills. They are verified and awarded through SUNY institutions including FMCC. Discussions with FMCC faculty have revealed that this may be an ideal and attractive path for CS students to receive certification of their accomplishments in our college level CS courses. Currently FMCC has two CS related Microcredentials with the potential for more as we build out our program. Here is an example of one.

Distance Learning

It is incredibly important to make note that all of our computer science courses could be offered on the distance learning network. This would increase the likelihood that student seats are filled, and get some return on our investment for dedicating a full time teaching position to this program. This would also allow us to connect other school districts with the opportunities available through our relationship with FMCC. We also currently have enough robotics equipment to send out robotics kits to receive sites.

Implementation Timeline

The graphic below serves as a visual representation of the proposed course rollout over the next 3 school years. It is important to note that the current editions of Explorations in Computer Science and Computer Science I would no longer exist after mutating into new courses in the 2024-2025 school year.



Program Needs

The two major roadblocks to this program's successful implementation are teaching time and physical classroom space. Assuming I am able to transition to a full computer science load for the 2024-2025 school year, I will end up losing my current classroom (S-14) to a new Earth Science teacher. The robotics equipment and the competition arena will need a dedicated space where they can be constructed and out for the majority of the school year. Ideally this would be a room repurposed as a *"Robotics Lab"*, where all computer science courses could be taught from. If this space could be outfitted with distance learning equipment we could deliver computer science courses on the distance learning network from this same location.

In 2024-2025 I would have 3 preps in both the fall and spring semester. In 2025-2026 I would have 4 preps, which is still a workable situation if the district allows. In order to launch Introduction to Artificial Intelligence in the fall of 2026 and to keep our existing courses we would need to have another staff member teach some CS courses at least part-time. To earn a Computer Science Teaching Certification a teacher with an existing certification in another area needs 12 credits of CS. Faculty at FMCC indicated this is another area where they may be able to offer coursework in an effort to increase the number of qualified educators in the subject area.

Appendix A: AHS robotics equipment, currently stored in room S-14.

Appendix B: Example of a Robotics Lab using VEX robotics equipment