BU Summer Challenge 2024: Computer Science - Syllabus

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July 8-19, 2024

Course Description

The goal of this two-week CS Summer Challenge seminar course is to expose students to introductory college-level computer science topics. The course will cover the fundamentals of modern computer science and the basics of programming using Python. It will also touch on some of the broader concepts in the field of computer science such as algorithms, sorting and searching, optimization, randomization, and artificial intelligence.

Primary learning outcomes:

- ☐ Computer science fundamentals: *What is computer science? What problems/tasks can be automated? Software vs. Hardware. Data storage.*
- ☐ Python programming: *Variables and data types, lists, dictionaries, conditional statements, for/while loops, user input, functions, classes, files and exceptions.*
- ☐ Exposure to the landscape of computer science: *algorithmic theory, search and optimization, randomization, artificial intelligence, natural language processing.*

The course material will be transacted as a mix of (a) group discussions based on reference readings, (b) live programming tutorials, (c) practice exercises, and (d) whiteboard lecture notes.

Students will complete a group project of their choosing by the end of the course, and receive a final letter of evaluation from the instructor. By the start of the second week students should form groups of 2-3 and decide on an idea for a group project. The instructor will provide sample project ideas, though students will not be limited to these. Groups will present their projects on the final day of class. There are no exams or assignments and there will be no formal grade for the course.

Reference Books

- Algorithms to Live By ***(ALB)*** - The Computer Science of Human Decisions. Brian Christian, Tom Griffiths
- Python Programming: A Beginner's Guide. Ramsey Hamilton

Course Schedule: July 8-19, 2024

Day (Date)	Discussion Topics	Programming	Reading (ALB)
Monday (July 8)	Course Overview **Introduction to CS**	Python setup	
Tuesday (July 9)	Fundamentals: data storage, OS, software **Algorithmic methods I**	Variables and data types, lists	Introduction (pg. 1-7)
Wednesday (July 10)	**Search Problems**	Dictionaries, conditionals	Optimal Stopping (pg. 9-30)
Thursday (July 11)	**Optimal Stopping**	Dictionaries, conditionals	
Friday (July 12)	**Sorting**	Loops, Functions	Sorting (pg. 59-83)
Saturday (July 13)	*Weekend [No Class]*		
Sunday (July 14)			
Monday (July 15)	**Probability + Randomness**	Loops, Functions	Bayes' Rule (pg. 128-148)
Tuesday (July 16)	**Game Theory**	Objects, Classes, File I/O	Game Theory (pg. 229-255)
Wednesday (July 17)	**Artificial Intelligence + Machine Learning**	Objects, Classes, File I/O	Overfitting (pg. 149-168)
Thursday (July 18)	**Natural Language Processing**	Implementing search/sort algorithm	
Friday (July 19)	Project Presentations		