Computer Systems

CAS CS210 - Fall 2021 A1

Piazza: piazza.com/bu/fall2021/cs210a1
Gitlab: https://cs210-gitlab.bu.edu
Gradescope: https://www.gradescope.com/courses/297911

Lectures: Tuesday and Thursday 9:30AM-10:45AM, CGS 511
Discussions: Monday 8:00-8:50AM, 9:05-9:55AM, 10:10-11AM, 11:15AM-12:05PM, 12:20-1:10PM (check your schedule for location)

Instructor: Vasiliki Kalavri, https://cs-people.bu.edu/vkalavri/
TAs: Ting Hsu (hsutingl@bu.edu), Jerry Zhang (jerryzz@bu.edu)
CAs: Shimli Satpathy, Isabella Taboada, Rahul Razdan, Xiangzhe (Jack) Ruan, Siqi Zheng

Office Hours: To be announced in Piazza.

Important Dates
Last Day to DROP Classes without a 'W' grade is Oct 7, 2021.
Last Day to DROP Classes WITH a 'W' grade is Nov 5, 2021.

Course Description

This course takes a programmer's perspective to learn about the inner structure of computer systems, the design and implementation of abstractions that enable humans to use computers efficiently, the basics of Programming C, the mapping between C and assembly and between assembly and machine language, and the role of operating system software. Our goal is to learn what a "beautiful" computer system is and how it works. Quoting an Italian painter named Carlotti:

Beauty is the summation of the parts working together in such a way that nothing needs to be added, taken away or altered.

We will also learn how to become strong ("brilliant") programmers who write fast and reliable programs. Quoting Albert Einstein:

Computers are incredibly fast, accurate, and stupid; humans are incredibly slow, inaccurate and brilliant; together they are powerful beyond imagination.

CS 210 is a principal course for computer science majors. It provides background for courses in the systems area such as operating systems, compilers, networks, not to mention more advanced courses in computer architecture.

Prerequisites

This course assumes that students have a solid background in Java or C++ programming from CAS CS 111 or equivalent. CS 112 is also recommended, but not essential for students with strong programming skills. A solid working knowledge of operating systems, such as Unix/Linux and Windows, is also assumed. CS 131 or MA 293 is important for the material on Boolean logic and data representation.

Textbooks

Required CSAPP Text: Randal E. Bryant and David R. O Hallaron,http://csapp.cs.cmu.edu/,"Computer Systems: A Programmer's Perspective", 3rd. Prentice Hall, 2016, ISBN-13: 978-0-13-610804-7

Required CPAMA Text: K.N. King, "C Programming: A Modern Approach", Second Edition,W. W. Norton & Company, 2008.

The required text is available from the BU bookstore and online retails. Two optional books you might find useful are:

Optional: R. Nigel Horspool, "C Programming in the Berkeley Unix Environment", 1987.
Optional: Brian W. Kernighan and Rob Pike, "The UNIX Programming Environment", PrenticeHall, 1984. (Another Classic Text).

Online Organization

1. The primary resource for the class is the course piazza site: http://piazza.com/bu/fall2021/cs210a1
Please ensure you are registered on the site. If you have any questions or difficulties email the TA.

2. We will be using git repositories for all assignments in this class. Specifically, we will be using our BU gitlab service: http://cs210-gitlab.bu.edu
You will receive an invitation email to sign in and establish a password. Please post on piazza if you have any questions or difficulties.

3. Additionally we will use the gradescope site https://www.gradescope.com/courses/297911 for submission and grading of assignments and exams. For programming portions of assignments we will exploit gradescope and gitlab integration. You must upload your assignments to gradescope from the matching CS210 assignment gitlab repository.

Lecture Conduct

Once the lecture has begun it is a distraction to your classmates to arrive late. Avoid these situations by arriving on time and planning your travel appropriately. The use of mobile devices during lectures is strictly forbidden.

Grading

Your final grade will be determined approximately as follows:

Midterms	30%	Average of the two midterm exams. The midterm exam average will be tentatively weighted 60% of the best grade and 40% of the lower grade.
Final Exam	30%	A final exam will be held during the assigned examination period. The exam will be cumulative covering all material from the course.
Assignments	35%	Several assignments which can require both written and programming solutions.
Participation & Effort	5%	Your participation and effort will be assessed using your Piazza participation, GIT histories, quiz performance and lecture, discussion and office hours participation.

Grading (except for the final exam) is done by a number of class graders, under the direct supervision of the Teaching Assistants and the professor. If you have an issue with a grade (homework or exam), please contact the Teaching Assistant. Only if the issue is not resolved to your satisfaction, please contact the professor. Grades must be appealed within two weeks of receipt.

Midterms and Exam

There will be two midterm exams and one final exam which will include all material covered from the beginning of the semester until the day of the exam. All exams will be open book. The two 75 minute midterms are held during the semester on Oct 5 and Nov 4. These dates are not flexible. The final will be held during the assigned exam slot. Please plan your work and travel plans at the end of the semester accordingly.

Midterm and Exam Conduct

We will be administering the midterms and exams online using Blackboard or Gradescope. The tests will be made available over a window of several hours within which you must start and complete it within an alot time limit. Details will be provide on piazza prior to each test.

Assignments

Late Policy

Each assignment will have a due date. No late submissions will be allowed. Extensions may be granted only for religious holidays and certified medical reasons. No incompletes will be given, except for reasons of dire illness shortly before the end of the course, and only if a significant amount of work has been completed (e.g., attending lectures, handing in most assignments, and attending the midterms).

Distribution and submission

At various points in the term you will be given assignments. These assignments will be distributed as a gitlab repository. You are expected to clone these repositories and do all your work with these folders. Your assignment grades may include an examination of your git histories for the assignment. If you are confused by any of this we encourage you to start and participate in Piazza discussion about how to do the assignments and how to use git. Assignments can include written and programming portions. Solutions to both will be submitted through Gradescope.

Programming

The first thing you must do is activate your CS user account. Please follow the instructions here: http://www.bu.edu/cs/resources/laboratories/account/. We will be using Docker and Microsoft Visual Studio Code. You will need to install this software on your personal computers. Further help and instructions will be posted on Piazza. Each assignment will specify what you need to submit and how it will be graded. If you are unclear what is required for a particular assignment or its grading, consult the TA well before the due date. Don't forget that when you submit your programming portions via gradescope it will only consult what has been committed to your repository. So don't forget to commit your final versions.

Written

Written portions of your assignments are to be submitted via gradescope as well. We will provide you with a pdf. Your answers must be typed or written on this pdf. It is this pdf that you will submit to gradescope. You can either use an electronic tool to add your answers or print a copy and handwrite your

solutions. However, in both cases you must upload an electronic version. Do not hand in your assignment in the class or during office hours. Do not hand in your assignment by slipping it under the office door of the Instructor.

Quizzes

Short quizzes may be given in lectures or discussion sessions. Make sure you are doing the readings on time.

Office hours

The professor and TAs will hold office hours either in-person or via Zoom. The purpose of the office hours is to answer specific questions or clarify specific issues. Office hours are not to be used to fill you in on a class you skipped or to explain entire topics. Please come to class and to your discussion sessions. To reach the teaching staff at times other than office hours, please use piazza.

Teaching Assistants and Discussions

Students are expected to attend the weekly discussion section via zoom that they have been assigned to. The Teaching Assistants will lead the discussion sessions. The objectives are: to present material on the required tools such as “vscode” and “git”, and “C” programming, that reinforce the concepts covered in the lectures, and answer questions (or provide clarifications) regarding the homework and programming/lab assignments. The Teaching Assistant will post information to Piazza as necessary. In addition to the discussion the Teaching Assistants will hold office hours. The times are TBA at this point. Once determined the information will be posted to Piazza.

Course Policies

Academic conduct

Academic standards and the code of academic conduct are taken very seriously at our university. Please take the time to review the CAS Academic Conduct Code if you are unfamiliar with the contents. See http://www.bu.edu/academics/resources/academic-conduct-code/ for the CAS Academic Conduct Code, in particular regarding plagiarism and cheating on exams. Copies of the CAS Academic Conduct Code are also available in room CAS 105. A student suspected to violate this code will be reported to the Academic Conduct Committee, and if found culpable, the student will receive a grade of "F" for the course.

Assignments must be completed individually. Discussion of issues in computer systems is encouraged, but representing the work of another person as your own is expressly forbidden. This includes "borrowing", "stealing", copying programs/solutions or parts of them from others. We may use an automated plagiarism checker. Cheating will not be tolerated under any circumstances. Handing in your own work a day or two late will affect your grade far less than turning in a copy of someone else’s work on time!

Any resources, including material from other students (current or past), that are used, beyond the text or that provided by the TA or professor must be clearly acknowledged and attributed. Using such material may at the discretion of the TA or professor result in a lower grade. However, if such

material is used and not acknowledged and attributed, it will automatically be considered as possible academic misconduct.

Attendance Policy

Students are expected to attend each class session unless they have a valid reason for being absent. If you must miss class due to illness or another reason, please notify the instructor as soon as possible, ideally before the absence.

https://www.bu.edu/academics/policies/attendance/

Absence Due to Religious Observance

If you must miss class due to religious observance, you will not be penalized for that absence and you will receive a reasonable opportunity to make up any work or examinations that you may miss. Please notify the instructor of absences for religious observance as soon as possible, ideally before the absence.

https://www.bu.edu/academics/policies/absence-for-religious-reasons/

Disability Services

Students with documented disabilities, including learning disabilities, may be entitled to accommodations intended to ensure that they have integrated and equal access to the academic, social, cultural, and recreational programs the university offers. Accommodations may include, but are not limited to, additional time on tests, staggered homework assignments, note-taking assistance. If you believe you should receive accommodations, please contact the Office of Disability Services to discuss your situation. This office can give you a letter that you can share with instructors of your classes outlining the accommodations you should receive. The letter will not contain any information about the reason for the accommodations.

If you already have a letter of accommodation, share it with your instructor as soon as possible.

Disability & Access Services
25 Buick Street, Suite 300
617-353-3658
access@bu.edu
http://www.bu.edu/disability/

Student Health Services

Health services are available to students, including wellness education and mental health services (behavioral medicine). See:
http://www.bu.edu/shs/
http://www.bu.edu/shs/wellness/
http://www.bu.edu/shs/behavioral/index.shtml

Class Schedule

The dates of the midterms and assignments are fixed and not flexible, please plan your term and travel appropriately.

The rest of the syllabus is tentative and will be fleshed out as the semester proceeds. The exact topics and readings for a lecture will be updated as they get resolved. Similarly the exact number and schedule for assignments will be determined as we go. That being said, we are striving to keep to the tentative assignment schedule that is indicated in the weekly calendar below.

The class will closely follow the material from the text books. The detailed syllabus indicates the readings that we will be covering. The topics build on each other. You will find it very difficult with later topics if you do not ensure understanding of a preceding topic. As such, we encourage you to reach out to the staff via Piazza, discussions and office hours to clarify your understanding. **Do not turn to the internet, your classmates, or any other sources if you are feeling overwhelmed**. We are here to teach and help you master a subject that we love. There will be zero tolerance for plagiarism. Each lecture will have pointers to readings. You should read this material prior to the lecture. In the syllabus, CSAPP refers to the text entitled “Computer Systems: A programmer’s perspective”, and CPAMA refers to “C Programming: A Modern Approach". Lectures, however, will not be restricted to text material or what is on online versions of the lecture slides. Lectures may cover additional or alternative material.

Date	Topics	Readings	Assignments
9/2/21	Welcome & logistics		#1 released
9/7/21	Intro to Computer Systems & tools	CSAPP 1	
9/9/21	C fundamentals	CPAMA 1-5	
9/13/21	**Discussion #1**		#2 released
9/14/21	Loops, functions	CPAMA 6, 9	#1 due
9/16/21	Arrays, program organization	CPAMA 8,10	
9/20/21	**Discussion #2**		
9/21/21	Data types	CPAMA 7	#2 due
9/23/21	Pointers	CPAMA 11	#3 released
9/27/21	**Discussion #3**		
9/28/21	Strings & pointer arithmetic	CPAMA 12, 13, CSAPP 3.8.2	
9/30/21	Structs, unions, eums	CPAMA 16.1-16.5, CSAPP 3.9.1-3.9.2	
10/4/21	**Discussion #4**		
10/5/21	**MIDTERM 1**		
10/06/21			#3 due
10/7/21	Bitwise operations	CPAMA 20.1, CSAPP	

		2.1.6-2.1.9	
10/12/21	**Substitute Monday: Discussion #5**		#4 released
10/14/21	Intro to data representation	CSAPP 2.1-2.2	
10/18/21	**Discussion #6**		
10/19/21	Implications of data representation	CSAPP 2.3-2.5	
10/21/21	File operations	CPAMA 22.1-22.2, CSAPP 10.1-10.4	
10/25/21	**Discussion #7**		
10/26/21	Address space layout	CSAPP 9.1, 9.2, 9.7.2	
10/28/21	Dynamic memory allocation, linked lists	CPAMA 17.1-17.5, CSAPP 9.9	#5 released
11/1/21	**Discussion #8**		#4 due
11/2/21	Advanced uses of pointers	CPAMA 17.6-17.7, CSAPP 3.10.1	
11/4/21	**MIDTERM 2**		
11/8/21	**Discussion #9**		
11/9/21	Assembly	CSAPP 3.1-3.5	BONUS released
11/11/21	Assembly	CSAPP 3.6	
11/15/21	**Discussion #10**		
11/16/21	Assembly	CSAPP 3.7	#6 released
11/18/21	Assembly	CSAPP 3.8-3.10	#5 due
11/22/21	**Discussion #11**		
11/23/21	The memory hierarchy	CSAPP 6.1-6.3	
11/29/21	**Discussion #12**		
11/30/21	Cache memories	CSAPP 6.4-6.5	
12/2/21	Cache memories	CSAPP 6.6	
12/6/21	**Discussion #13**		
12/7/21	Performance optimization	CSAPP 5.12, 5.14	#6 due, BONUS due
12/9/21	Review		