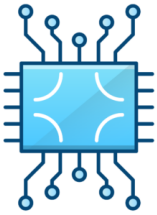
CMPSC 200 – Principles of Computer Organization

Course Syllabus, Fall 2020
Allegheny College


Course Instructor:
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Web Site: https://www.cs.allegheny.edu/sites/amohan/

Instructors Office Hours

- Monday, Wednesday, Friday: 11:15 am –12:15 pm (15-minute time slots)
- Tuesday, Thursday: 10:00 am –11:30 am (15-minute time slots)

To schedule a meeting with me during my office hours, please visit my web site (teaching page) and click the Schedule link in the top right-hand corner. The google calendar page has an option to browse my office hours or schedule an appointment by clicking the correct link and then reserving an open time slot. The instructor will hold virtual meetings with students during his office hours. Students are also encouraged to post appropriate questions to a channel in Slack, which is available at https://cs200fall20.slack.com/

Course Meeting Schedule
Lecture: Tuesday and Thursday, 08:00 am –9:15 am
Lab: Wednesday, 03:00 pm –04:50 pm

Course Description
An introduction to the basic organization and operation of computers, including logical structure, hardware components, machine and assembly language, and computer system performance. Topics include internal representation of information, instruction set architecture, instruction types and addressing techniques, computer arithmetic, memory systems, design and operation of the control unit, input/output devices and interfaces, assembly language and translation techniques, and modern architectural enhancements such as pipelining and multiprocessors. Special emphasis is on systems programming and assignments in a particular assembly language. One laboratory session per week.
Prerequisites: Computer Science 102 officially (CMPSC100 is sufficient)

Required Texts and Materials

- Required Text: Computer Organization and Design, David Patterson and John Hennessy, 5th Edition (ISBN13: 978-0124077263)
- Required Text: The C Programming Language, Brian Kernighan and Dennis Ritchie, 2nd Edition (ISBN13: 978-0131103627)

- Required Text: Alan Clements, Principles of Computer Hardware, 4th edition (ISBN13: 978-0199273133)
- Free Software: MARS (`http://courses.missouristate.edu/kenvollmar/mars/`)
- Free Software: Logisim (`http://www.cburch.com/logisim/index.html`)
- Course Website: `https://www.cs.allegheny.edu/sites/amohan/course.php?cid=MTQ=`
- Slack Channel: `http://cs200fall20.slack.com`

Learning Objectives

In the Patterson and Hennessy textbook, several questions are listed at the top of page 8; by the end of this course, you should know how to answer them, at least in part:

1. **Lo$_1$** - "What determines the performance of a program, and how can a programmer improve the performance?"
2. **Lo$_2$** - "How are programs written in a high-level language, such as C or Java, translated into the language of the hardware, and how does the hardware execute the resulting program?"
3. **Lo$_3$** - "What is the interface between the software and the hardware, and how does software instruct the hardware to perform needed functions?"
4. **Lo$_4$** - "What are the reasons for and the consequences of the recent switch from sequential processing to parallel processing?"

You'll also learn:

1. how to write, compile, and execute programs in the C programming language;
2. how to write, assemble, and execute programs in the MIPS assembly language;
3. how different types of data (integer, floating-point, character, Boolean, etc.) are internally represented and manipulated in a computer's memory;
4. how to assemble basic logic gates into complex logic circuits (such as a processor datapath).

COVID-19 specific information

- **Remote Attendance:** If you are participating entirely remotely this semester and relying on technology to attend class meetings, occasional technology problems that disrupt your participation will not harm your participation grade, but as with illnesses and family emergencies, chronic absences, for this reason will require a more extensive discussion with me and may impact your grade.
- **Face Coverings and Physical Distancing:** A mask covering both your mouth and your nose is required for all in-person activities, per College policy; you will not be permitted to enter or stay in a classroom or other learning space without a face covering, and class time missed for this reason may count against your participation grade. Face coverings are also required for in-person office hours and consultations with other campus professionals. Physical distancing must be respected at all times in the classroom. Chairs will be positioned 6 feet apart and should remain so.
- **Illness and In-person Attendance:** If you feel ill, please stay in your residence and complete the daily health screening, and err on the side of caution when deciding whether or not to come to class. Especially if you feel feverish or have a cough, please avoid contact with others; if you feel like you'd like to "power through" class rather than miss it and have to make it up, please do so remotely.
- **Keeping Devices Charged:** You will need to ensure that your laptop, tablet, or other device is sufficiently charged so that you may participate in class(es). Even if you are in-person in the classroom, you may need to use a device, especially as you will be 6 feet from your nearest peer. It wont be possible for all students to charge their devices at once in the classroom, so please make sure you bring the power cord(s) for your devices to class, pack a power strip if you have multiple devices, and pay attention to the power meter on your device.

Teaching and Learning Methods

The main mode of learning in this class is following along with the posted course material and reading the accompanying sections in each textbook. Students are responsible for reading assigned portions of the textbook, whether or not the topics are discussed in the lectures. The instructor will ask questions to stimulate thinking and participation. Students comments and questions are highly encouraged via the course Slack channel. Online resources will also be used to supplement lectures and discussions. Lectures are delivered to all students simultaneously during scheduled class time with some students in the classroom and other students remote. To maintain physical distancing and to implement the College's healthy safety guidelines, students are divided into two

groups so that we rotate attending class in person and remotely. Course activities will be planned so they are engaging for both in-room and remote students. Members of group A are expected to attend the class in-person on Tuesdays and online on Thursdays. Members of group B are expected to attend the class in-person on Thursdays and online on Tuesdays. Students who had opted to be remote are expected to attend the class online during their scheduled timings. If a student is unable to attend a class session, then proper arrangement should be done by consulting the Professor. A list of students registered in the class, and their respective group details are shown below:

Student Name	Group	Day/Time
Teona Bagashvili	A	Tuesday 8:00 am to 9:15 am
Jordan Byrne	B	Thursday 8:00 am to 9:15 am
Declan Casey	A	Tuesday 8:00 am to 9:15 am
Steve Cho	B	Thursday 8:00 am to 9:15 am
Michael Eltman	A	Thursday 8:00 am to 9:15 am
Megan Corletti	B	Tuesday 8:00 am to 9:15 am
Cameron Hachtel	A	Tuesday 8:00 am to 9:15 am
Alexandra Heinle	B	Thursday 8:00 am to 9:15 am
Caden Koscinski	A	Tuesday 8:00 am to 9:15 am
Nathan Loria	B	Thursday 8:00 am to 9:15 am
John Malagise	A	Tuesday 8:00 am to 9:15 am
Robert McMaster	B	Thursday 8:00 am to 9:15 am
Charles Misback	A	Tuesday 8:00 am to 9:15 am
Megan Munzek	B	Thursday 8:00 am to 9:15 am
Hannah Schultz	A	Tuesday 8:00 am to 9:15 am
Nolan Thompson	B	Thursday 8:00 am to 9:15 am
Alexander Yarkosky	A	Tuesday 8:00 am to 9:15 am
Pedro Carmo	B	Thursday 8:00 am to 9:15 am

Table 1: Tentative Group Schedule, Fall 2020

Lecture Structure
Lecture sessions will have the following format:

- 1hr and 20 mins of lecture content, which will include multiple segments of:
  1. Listening to lectures.
  2. Exploring and enhancing provided code.
  3. Attempting practice problems and/or interacting with non-code sample material.
  4. Making detailed notes from class discussions.
- A feedback form may be provided regularly, to assess the student's understanding level of the course material.

Lab Session Structure
A laboratory session will include the following components:

- A short video will be provided along with the lab sheet. In this video, an overview of the lab specification will be presented to the students.
- A 100-minute in-depth exploration of some topic(s) from the recent course material, graded for Lab credit.

Grading and Evaluation

The grading and evaluation process is transparent. At any time during the semester, students can monitor their progress by looking at the Canvas grade book. The total grade for the course will be based on the following, weighted appropriately:

- Midterm Exam (10%)
- Final Exam (15%)
- Lab Assignments (35%)
- Course Project (15%)
- Skill Tests (15%)
- Class Participation (10%)

A more detailed breakdown of the expectations for grades in the course is as follows:

- **Exams:** Two exams will be given in this class, that is the midterm and the final exam. The final will be cumulative, as later parts of the course will build on your knowledge from previous weeks. Raw grades for the exams are based on the accuracy and merit of the content. Also, the grades for the exams will be affected negatively if the quality of language use or the mechanics of the calculations undermines the overall logic and credibility of the content. There will be a grade book administered by the course instructor (through Canvas) and all the graded activities will be logged in the grade book. The grade book is accessible to the students who are registered in the course. If a student finds any grading discrepancy, it is highly recommended that this issue should be immediately discussed with the Instructor within a week from the time that the graded work was returned.
- **Lab Assignments:** During laboratory sessions, students are expected to investigate some of the topics that are noted in the textbooks and lecture in more detail. This investigation will take the form of solving one or more coding challenges, answering one or more problems prompted by the textbook, and/or a guided walkthrough of a new concept. All laboratory sessions will be conducted remotely. See the **Assignment Submission and Late Policy** section of this syllabus for details about the course Late Policy.
- **Course Project:** This course has a final project component for students to demonstrate what they have learned during the semester. More details about the requirements of the project will be shared at a later point.
- **Skill Tests:** Once in two to three weeks, an online skill test will be administered that serves to test your knowledge on some of the fundamental topics discussed in the lecture materials and the textbooks. Questions in the test may be either strictly multiple-choice or a combination of multiple-choice and descriptive questions.
- **Class Participation:** Students are expected to attend and participate in lecture and laboratory sessions based on the schedule provided in Table-1 of this document. Interaction with the instructor and your classmates is important in any Allegheny course. Students are expected to join discussions on the course Slack channel, attend virtual office hours with the instructor, and providing feedback on the pace and content of the course to the instructor. Please refer to the COVID-19 section above for more details.

Assignment Submission and Late Policy

Every assignment has a due date and time. Failure to hand in the assignment by the deadline will result in a late submission penalty. Assignments handed in within one week of the deadline will receive automatic grade reductions of 20% (in addition to any points deducted for errors). Assignments will not be accepted more than one week past the deadline unless you can provide documented extenuating circumstances. Any extenuating circumstances must be documented through the Learning Commons, Counseling Center, Dean of Students Office, Health Center, or other authoritative sources.

If you are unable to attend class or lab for any reason beyond illness or injury, you must make arrangements with the course instructor to turn in assignments before class. Exams must be taken at scheduled times. This includes the final exam. Please check the syllabus and with the instructor one week before making any travel plans for the end of the semester or around breaks. Missed exams will receive a grade of zero without a documented illness or emergency.

Statement of Community

Allegheny students and employees are committed to creating an inclusive, respectful and safe residential learning community that will actively confront and challenge racism, sexism, heterosexism, religious bigotry, and other forms of harassment and discrimination. We encourage individual growth by promoting a free exchange of ideas in a setting

that values diversity, trust, and equality. So that the right of all to participate in a shared learning experience is upheld, Allegheny affirms its commitment to the principles of freedom of speech and inquiry, while at the same time fostering responsibility and accountability in the exercise of these freedoms.

Diversity & Inclusion
At Allegheny College, we understand that a diverse and inclusive learning environment inspires creativity and innovation, which are essential to liberal arts education. We also know that to address current and emerging national and global challenges, it is important to learn with and from people who have different backgrounds, thoughts, and experiences.

We would like to create a learning environment in our class that supports a diversity of thoughts, perspectives, and experiences, and honors your identities (including race, gender, class, sexuality, ability, socioeconomic status, politics, religion, etc.). We (like many people) are still in the process of learning about diverse perspectives and identities. If something is said in class (by anyone) that made you feel uncomfortable, please talk to the instructor about it. If you feel like your performance in the class is being impacted by your experiences outside of class, please dont hesitate to come and talk with the instructor.

Disability Statement
Students with disabilities who believe they may need accommodations in this class are encouraged to contact Student Disability Services (SDS) at (814) 332-2898. SDS is part of the Learning Commons and is located in Pelletier Library. Please do this as soon as possible to ensure that such accommodations are implemented in a timely fashion.

Learning Commons
If you are not already, you should become familiar with the Learning Commons, located in Pelletier Library (`http://sites.allegheny.edu/learningcommons/`). Among other things, the staff at the Learning Commons can assist you with study and time management skills, writing, and critical reading. You should know that if you are having trouble in this class, or if I think you can specifically benefit from their services, I will refer you to the Learning Commons. Experienced peer writing and speech consultants in the Learning Commons help writers and speakers to determine strategies for effective communication and to make academically responsible choices at any stage in the writing or speaking process and on assignments in any discipline. Both appointments and drop-in sessions are available. To view the hours of operation, and to make an appointment, visit the Learning Commons website.

Religious Accommodations
If you need to miss a class or reschedule a final examination due to religious observance, please speak to the instructor well in advance to make arrangements. See
`http://sites.allegheny.edu/religiouslife/religious-holy-days/`

Email and Slack
The instructor will primarily respond to the student queries through the course Slack channel and his Allegheny email account regularly. In general, you can expect the instructor to reply to your queries during weekdays.
Students who are struggling with the course material or who have questions should begin by posting their questions (unless a private concern) to the Slack channel so that the instructor or a fellow student can provide an answer within the bounds of the Honor Code.

Class Preparation
To minimize confusion and maximize learning, students must invest time to prepare for class discussions and lectures. During the class periods, the course instructor will often pose demanding questions that could require group discussion, the creation of a program or solving logical problems, a vote on a thought-provoking issue, or a group presentation. Only students who have prepared for class by reading the assigned material and reviewing the current assignments will be able to effectively participate in these discussions. More importantly, only prepared students will be able to acquire the knowledge and skills that are needed to be successful in both this course and the field of computer science. To help students remain organized and effectively prepare for classes, the course instructor will maintain a class schedule with reading assignments and presentation slides. During the class sessions, students will also be required to download, use, and modify programs and solutions to logical problems, that are made available through the course website.

Academic Integrity

Allegheny College operates under an Honor Code, to which all students are subject. See The Compass: Student Handbook. You should educate yourself appropriately as to how this applies to you. Plagiarism and other forms of intellectual dishonesty will not be tolerated. All students enrolled at Allegheny College are bound by the Honor Code. It is expected that your behavior will reflect that commitment. To this end, we expect that you will adhere to the following Department Policy:

Department of Computer Science Honor Code Policy

It is recognized that an important part of the learning process in any course, and particularly in computer science, derives from thoughtful discussions with teachers, student assistants, and fellow students. Such dialogue is encouraged. However, it is necessary to distinguish carefully between the student who discusses the principles underlying a problem with others, and the student who produces assignments that are identical to, or merely variations on, someone elses work. It will therefore be understood that all assignments submitted to faculty of the Department of Computer Science are to be the original work of the student submitting the assignment, and should be signed following the provisions of the Honor Code. Appropriate action will be taken when assignments give evidence that they were derived from the work of others.

You are encouraged to periodically review the specifics of the Honor Code as stated in the College Catalogue, The Compass, and elsewhere.

Additionally, the Honor Committee co-chairs have requested that a signature, as well as the following phrasing, be included on all submissions of graded work:

> "This work is mine unless otherwise cited."

Structure of the Semester

In Table 2, a rough outline of the topics covered this semester is provided. Some shifting in the schedule of topics is possible.

Topics	Learning Objective
Bits and Bytes	$\mathbf{Lo_{1,2}}$
Data Representation	$\mathbf{Lo_2}$
Binary Arithmetic	$\mathbf{Lo_2}$
Logic Design	$\mathbf{Lo_3}$
Assembly Language	$\mathbf{Lo_3}$
Pipelining	$\mathbf{Lo_4}$

Table 2: Tentative Topic List for CMPSC 200, Fall 2020