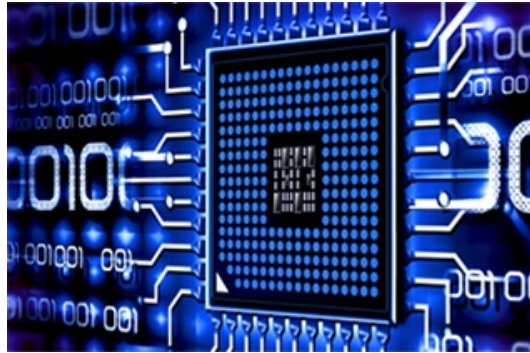


CMPSC 200 – Principles of Computer Organization
Course Syllabus Fall 2018
Allegheny College



Course Instructor:

Dr. Aravind Mohan

Office Location: Alden Hall 106

Office Phone: +1 8143322883

Email: amohan@allegheny.edu

Web Site: <https://www.cs.allegheny.edu/sites/amohan/>

Instructors Office Hours

- Monday, Tuesday, Wednesday, Thursday, and Friday: 11:00 am –12:00 pm (15 minute time slots)
- Friday: 1:30 pm –2:30 pm (15 minute time slots)

To schedule a meeting with me during my office hours, please visit my web site 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. Students are also encouraged to post appropriate questions to a channel in Slack, which is available at <https://cmpsc200Spring2018.slack.com/>, and monitored by the instructor and the teaching assistants.

Course Meeting Schedule

Lecture: Tuesday and Thursday, 09:30 am –10:45 am

Lab: Friday, 02:30 pm –04:20 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 101 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)
- Free Software: MARS (<http://courses.missouristate.edu/kenvollmar/mars/>)
- Free Software: Logisim (<http://ozark.hendrix.edu/~burch/logisim/>)
- Course Website: <http://www.cs.allegheny.edu/amohan/teaching/cs200/>
- Slack Channel: <http://cs200f2018.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. "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?"
2. "What is the interface between the software and the hardware, and how does software instruct the hardware to perform needed functions?"
3. "What determines the performance of a program, and how can a programmer improve the performance?"
4. "What techniques can be used by hardware designers to improve performance?"
5. "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 (and, if time permits, a little bit about ARM and Intel assembly languages);
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).

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. Internet resources will also be used to supplement lectures and discussions. The Lecture Structure and Lab Session Structure sections present in more detail the expectations and deliverables expected in each class session.

Students are responsible for attending each lecture and lab session when scheduled (see the **Attendance Policy** for further details). Course content will be delivered via BitBucket, and assignments should also be submitted to BitBucket (with the exception of paper exams).

Lecture Structure

Lectures will consist of two primary formats: Standard Lectures and Q&A Lectures.

- Standard Lectures: A standard lecture session will have the following format:
 - o 75 minutes 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.
 - o A 5-minute Review Form will be provided, to help the instructor understand how you have followed the course material for the current session and if any of the content was unclear. The Review form will be provided once a week, through an online platform. It is highly recommended to complete the review forms and provide necessary feedback to the instructor.
- Q&A Lectures: A Q&A lecture session will have the following format:
 - o A Q&A lecture session will be scheduled once in two to three weeks. During the class session, a flexible time interval is set for discussion based on questions to be discussed.

- During the session, the instructor brainstorm with the students and steer discussions towards answering the questions that have been submitted in advance of the scheduled lecture. The instructor may call up students randomly, to participate in the discussion.
- A 5-minute Review Form will be provided, to help the instructor understand how you have followed the course material for the current session and if any of the content was unclear. The Review form will be provided at the end of the Q&A session, through an online platform.

Lab Session Structure

A laboratory session will include the following components:

- A 10-minute Lab walk through, where the lab specification will be discussed in detail.
- A 100-minute in-depth exploration of some topic(s) from recent course material, due the following week and graded for Lab credit.

Grading and Evaluation

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

- Exam 1 (10%)
- Exam 2 (10%)
- Final Exam (20%)
- Lab Assignments (30%)
- Quizzes (20%)
- Attendance (5%)
- Participation (5%)

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

- **Exams:** Three exams will be given in this class, spaced roughly five weeks apart. 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. In addition, the grades for the exams will be affected negatively if the quality of language use or the mechanics of the calculations undermine the overall logic and credibility of the content. There will be a grade book administered by the course instructor and all the graded activities will be logged in the grade book. The grade book would be made accessible to the students who are registered in the course. If a student finds any grading discrepancy, it should be immediately discussed with the Instructor within a week from the time that the graded work was returned back.
- **Lab Assignments:** This course contains a weekly laboratory session, where students will 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. See the **Assignment Submission and Late Policy** section of this syllabus for details about the course Late Policy.
- **Weekly Quizzes:** Once in two to three weeks, an online/paper quiz will be administered that serves to test your knowledge on some of the fundamental topics discussed in the lecture materials and in the textbooks. The questions can be either strictly multiple choice or a combination of multiple choice and descriptive questions.
- **Attendance:** Students are expected to attend lecture and laboratory sessions in the classroom at the stated class time. Attendance will be determined by signing an attendance registration form that will be provided on randomly chosen day and times. See the **Attendance Policy** section of this syllabus for details about grade reductions as a result of lack of attendance.
- **Participation:** Interaction with the professor and your classmates is important in any Allegheny course. Students will be expected to join discussions on the course Slack channel, attend office hours with the instructor, and providing feedback on the pace and content of the course to the instructor.

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 source.

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.

Attendance Policy

It is mandatory for all students to attend all of the class and laboratory sessions. It is very important to come to the class room before the start of the class session and attend the entire session. There will be an attendance registration form provided atleast three times during the semester, on randomly chosen days and time in either the lecture or laboratory sessions. Attendance registration is required to be done atleast two out of three times to receive the full attendance credit. If the attendance registration is done only one out of three times, a partial credit of 50% will be awarded towards the attendance credit. If the attendance registration is not done in any of the three times it was given, then no points will be awarded towards the attendance credit. If you will not be able to attend a session, then please see the course instructor at least one week in advance to describe your situation.

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.

Email and Slack

The instructor will primarily be checking the course Slack channel and his allegheny email account on regular basis. In general, you can expect the instructor to reply to your email messages during week days. Students who are struggling with the course material or who have question should begin by posting their question (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

In order to minimize confusion and maximize learning, students must invest time to prepare for the 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 data set, 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. In order 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 data sets that are made available through the course website.

Honor Code

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 else's 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 in accordance with 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 1 and 2 displayed on next page, a rough outline of the topics covered this semester is provided. Some shifting in the schedule of topics is possible, but the exam dates are firm (probably).



Week	Date	Topics\ Readings
1	28 Aug - 3 Sep	Introduction; C programming (PH 1.1 - 1.4; KR Chapter 1)
2	4 - 10 Sep	Performance Assessment; C Programming - Control flow & Functions (PH 1.5 - 1.7; KR selected topics from Ch 3, 4)
3	11 - 17 Sep	C Programming - Pointers and Arrays (KR Chapter 5)
4	18 - 24 Sep	C Programming - Structures (KR Chapter 6)
5	25 Sep - 1 Oct	Internal Representation Of Data (Chapter 3 of PH)
6	2 - 8 Oct	Digital Logic Introduction
	FIRST EXAM:	Thu 4 Oct, during class timings
7	9 - 15 Oct	Logic Expression Evaluation (PH 3.1 - 3.5)
	Fall break:	6 - 9 Oct
8	16 - 22 Oct	Combinational Logic (PH App. B; 4.1 - 4.4)
9	23 - 29 Oct	Sequential Logic (PH excerpts from 4.5 - 4.10)
10	30 Oct - 5 Nov	MIPS Assembly Language Programming Introduction (PH 4.5 - 4.10)
11	6 - 12 Nov	MIPS Functions and Arrays (PH 4.5 - 4.10)
	SECOND EXAM:	Thu 6 Nov, during class timings
12	13 - 19 Nov	Instruction Set Architecture (PH 4.5 - 4.10)
13	20 - 26 Nov	Instruction Set Architecture Continuation (PH 4.5 - 4.10)
	Thanks Giving break:	21 - 25 Nov
14	27 Nov - 3 Dec	Processor Internals - Data Path Basics(PH Ch 4)
15	4 - 10 Dec	Processor Internals - Pipelining and Hazards (PH Ch 4)
	LAST DAY of classes: FINAL EXAM:	Tue 11 Dec 13 Dec, 7 p.m.

Table 1: Tentative Schedule for CMPSC 200 Lecture Session, Fall 2018

Week	Laboratory Session	Topic
1	31 Aug	Lab 01: Introduction to C
2	07 Sep	Lab 02: C Control flow and Functions
3	14 Sep	Lab 03: C Arrays & Pointers
4	21 Sep	Lab 04: C Structures
5	28 Sep	No new lab for Midterm 1
6	5 Oct	No new lab for fall break
7	12 Oct	Lab 05: Introduction to Digital Logic Design
8	19 Oct	Lab 06: Combinational Circuit Design
9	26 Oct	Lab 07: Sequential Circuit Design
10	2 Nov	Lab 08: Introduction to MIPS
11	9 Nov	Lab 09: MIPS Arrays
12	16 Nov	Lab 10: MIPS Functions
13	23 Nov	No new lab for thanks giving break
14	30 Nov	Lab 11: Advanced MIPS
15	07 Dec	Optional Lab Session

Table 2: Tentative Schedule for CMPSC 200 Laboratory Session, Fall 2018