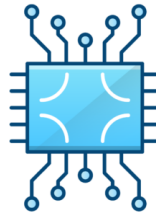
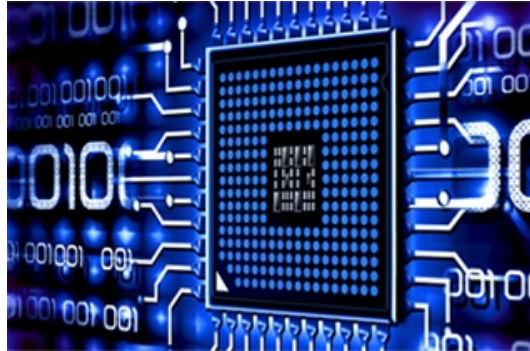


**CMPSC 200 – Principles of Computer Organization**  
Course Syllabus Fall 2022  
Allegheny College



Course Instructor:

Dr. Aravind Mohan

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Instructors Office Hours

- Monday, Wednesday, and Friday: 10:00 am –11:20 am (20 minute time slots)
- Monday, Wednesday, and Friday: 1:30 pm –2:50 pm (20 minute time slots)
- Tuesday, Thursday: 11:00 am –12:00 pm (20 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 in Discord channel named #computer-organization

Course Meeting Schedule

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

Lab: Thursday, 02:30 pm –04:20 pm

### Course Description

A study of the low-level operation of computer systems. Participating in hands-on activities that often require teamwork, students investigate how computers process instructions in modern computers as information is encoded, stored, and executed in a machine's physical structures. In addition to learning how to program in assembly and machine languages, students investigate the design and logical operation of processors and the mathematics of machine computation. During a weekly laboratory session, students use state-of-the-art technology to complete projects, reporting on their results through both written documents and oral presentations. Students are invited to use their own departmentally approved laptop in this course; a limited number of laptops are available for use during class and lab sessions.

**Prerequisites:** Computer Science 102 officially (CMPSC101 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.alleggheny.edu/sites/amohan/course.php?cid=MTc=>
- Discord Channel: #computer-organization

### 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 Discord channel. Online resources will also be used to supplement lectures and discussions. The Lecture and Lab Session Structure section below provide additional details related to the course.

Lecture Structure

Lecture sessions will have the following format:

- 1hr and 15 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.

Lab Session Structure

A laboratory session will include the following components:

- A 10 to 20 minutes Lab walk through, where the lab specification will be discussed in detail at the start of the session.
- A 100-minute in-depth exploration of some topic(s) from 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 Grade Book. 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 back. The total grade for the course will be based on the following, weighted appropriately:

- Midterm Exam (10%)
- Final Exam (15%)
- Lab Assignments (40%)
- Quizzes (10%)
- Project (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, namely midterm and finals. The finals 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 undermines the overall logic and credibility of the content.
- **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.
- **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.
- **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.
- **Class Participation:** Students are expected to attend lecture and laboratory sessions at the stated class time. Interaction with the professor and your classmates is important in any Allegheny course. Students will be expected to join discussions on the course Discord channel, attend office hours with the instructor, complete homeworks for participation credits, and provide 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.

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 Discord

The instructor will primarily respond to the student queries through the course Discord channel and his Allegheny email account. In general, you can expect the instructor to reply to your queries 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 Discord channel, so that the instructor, TL, 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 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. 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 solutions to logical problems, 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 this semester*

In Table 1 displayed below, an outline of the topics covered this semester is provided. Some shifting in the schedule of topics is possible, but the exam dates are firm.

| Week | Date  | Topics   | Readings                    |
|------|---|--|-----------------------------|
| 1    | 08/30 - 09/04                                       | Introduction to Computer Organization                                  | <b>PH</b> 1.1 - 1.4;        |
|      | <b>Lab: Thursday 09/01</b>                          | <b>Software Installation Workshop</b>                                  |                             |
| 2    | 09/05 - 09/11                                       | C Programming Part-1   | <b>KR</b> Chapter 1,3,4     |
|      | <b>Lab: Thursday 09/08</b>                          | <b>Lab 1: C Programming</b>  |                             |
| 3    | 09/12 - 09/18                                       | C Programming Part-2   | <b>KR</b> Chapters 5,6      |
|      | <b>Lab: Thursday 09/15</b>                          | <b>Lab 2: Arrays in C</b>  |                             |
| 4    | 09/19 - 09/25                                       | C Programming Part-2   | <b>KR</b> Chapters 5,6      |
|      | <b>Lab: Thursday 09/22</b>                          | <b>Lab 3: Multidimensional Arrays in C</b>                             |                             |
| 5    | 09/26 - 10/02                                       | Performance Assessment   | <b>PH</b> Chapter 1.5 - 1.7 |
|      | <b>Lab: Thursday 09/29</b>                          | <b>Lab 4: Structs, Arrays, and Pointers</b>                            |                             |
| 6    | 10/03 - 10/09                                       | Internal Data and Computations   | <b>PH</b> Chapter 3         |
|      | <b>Lab: Thursday 10/06</b>                          | <b>Lab 5: Transformations</b>  |                             |
| 7    | 10/10 - 10/16                                       | Internal Data and Computations   | <b>PH</b> Chapter 3         |
|      | <b>Tuesday 11 Oct</b><br><b>Thursday Oct 13th</b>   | <b>Fall Break No Classes</b><br><b>No Lab (Exam Prep)</b>              |                             |
| 8    | 10/17 - 10/23                                       | Reserved Week for catch up   |                             |
|      |   | <b>Thursday, Oct 20th, Midterm Exam</b><br><b>(during lab timings)</b> |                             |
| 9    | 10/24 - 10/30                                       | Internal Data and Computations   | <b>PH</b> Chapter 3         |
|      | <b>Tuesday 25 Oct</b><br><b>Lab: Thursday 10/27</b> | <b>Gator Day No Classes</b><br><b>Lab 6: Low-level Operations</b>      |                             |
| 10   | 10/31 - 11/06                                       | Logic Design   | <b>AC</b> Chapter 2         |
|      | <b>Lab: Thursday 11/03</b>                          | <b>Lab 7: Logic Design</b>   |                             |
| 11   | 11/07 - 11/13                                       | MIPS   | <b>PH</b> Chapter 4         |
|      | <b>Lab: Thursday 11/10</b>                          | <b>Lab 8: Assembly Programming</b>                                     |                             |
| 12   | 11/14 - 11/20                                       | Advanced Logic Design  | <b>AC</b> Chapter 3         |
|      | <b>Lab: Thursday 11/17</b>                          | <b>Project Session 1</b>   |                             |
| 13   | 11/21 - 11/27                                       | Advanced Logic Design and MIPS   | <b>AC</b> Chapter 3         |
|      | <b>Thursday Nov 24</b>                              | <b>Thanks Giving Break</b>   |                             |
| 14   | 11/28 - 12/04                                       | Advanced MIPS  | <b>PH</b> Chapter 4         |
|      | <b>Lab: Thursday 12/01</b>                          | <b>Project Session 2</b>   |                             |
| 15   | 12/05 - 12/11                                       | Processor  | <b>PH</b> Chapter 4         |
|      | <b>Lab: Thursday 12/08</b>                          | <b>Project Presentation</b>  |                             |
| 16   | 12/12 - 12/18                                       | Reserved Week for catch up   |                             |
|      | <b>Wednesday 14th Dec</b>                           | <b>Study Day No Classes:</b>   |                             |
|      |   | <b>Thursday, Dec 15th, Final Exam</b><br><b>(7:00 to 10:00 PM)</b>     |                             |

Table 1: Tentative Schedule for CMPSC 200 Lecture Session, Fall 2022