



# CMPT 422N - Computer Organization and Architecture Section 112 - Fall 2023

Brian Gormanly

## Overview:

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Instructor: Brian Gormanly

Lecture Location: HC 2005

Lecture Times: Monday / Thursday 9:30 - 10:45 am

Lab Location: HC 0005

Lab Time: Wednesday 2:00 pm - 3:15 pm

Web: <https://brightspace.marist.edu>

Phone: 845-575-2673

Email: [brian.gormanly@marist.edu](mailto:brian.gormanly@marist.edu)

Office Hours: HC 3003

- ❖ Monday 6:30 pm - 8:30 pm
- ❖ Wednesday 8:00 am - 11 am
- ❖ Email if you need to meet outside these hours, send at least 3 times you are available.

## Course:

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### Course Description:

The purpose of this course is to acquire an understanding and appreciation of a computer system's functional components and their characteristics. Students will learn instruction set architecture, the internal implementation of a computer at the register and functional level, and understand how main activities are performed at machine level as well as gain an appreciation for hardware design at micro level.

### Course Prerequisites:

CMPT 220 - Software Development I

### Course Objectives: <sup>1</sup>

1. Understand the basics of computer hardware and how software interacts with computer hardware. [1, 2]
2. Know the organization of the central processing unit (CPU) and memory hierarchy. [1, 2]
3. Use critical thinking to make informed decisions in the selection of hardware. [1, 2, 3, 5, 6]
4. Demonstrate how memory caches and virtual memory work. [1, 2, 5]
5. Learn and demonstrate how program performance is affected by processor cache sizes. [1, 2, 6]
6. Understand how the architecture affects program performance. [1, 2, 6]
7. Demonstrate how instructions can be implemented in a chip. [1, 2, 4]

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<sup>1</sup> The reference number in brackets [ ] indicates the department goal that is being met with the fulfillment of the objective. For the complete list of department goals please see the last page of this syllabus.

8. Learn how to use Java or C or assembly language to manipulate registers on a computer architecture performing a specific operation with data. [1, 2, 4]
9. Learn how computer organization influences high-level languages, and vice versa. [1, 2, 6]
10. Develop communication skills in the area of computing technology. [1, 4, 5]

### Course Learning Measurements: <sup>2</sup>

- Create a program in C or assembly language that works with data that fits and exceeds processor cache sizes, and measures the performance impacts of doing so. Applies to Course Objective: 2, 4, 5, 6, 8, 9
- Write a simple program in Java or C or assembly language to implement a high level program segment. Applies to Course Objective: 1, 4, 7, 8, 9
- Using an Arduino board, control an LED display via software. Applies to Course Objective: 3, 4, 7, 8
- Midterm Exam. Applies to Course Objective: 1, 2, 3, 4, 5
- Final Exam. Applies to Course Objective: 5, 6, 7, 8, 9
- Design Project. Applies to Course Objective: 1, 2, 3, 7, 8, 10

### Assessment:

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F	D	D+	C-	C	C+	B-	B	B+	A-	A
0-59	60-66	67-69	70-72	73-76	77-79	80-82	83-86	87-89	90-94	95-100

You will be graded on 1000 points that you can earn throughout the semester, the following shows how the points are distributed across your work:

Professionalism	50 points	5%
Quizzes	160 points 4 @ 40 points each	16%
Labs	165 points 1 @ 15, 3 @ 50 points	16.5%
Project	175 points	17.5%
Mid-Term	200 points	20%
Final	250 points	25%

### Required Materials:

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#### Required Textbook:

Patterson, Hennessy: "Computer Organization and Design, **ARM Edition**", Elsevier, 2017.  
 ISBN-13: 978-0-12-801733-3  
 ISBN-10: 0128017333

### Schedule:

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<sup>2</sup> The reference number in brackets [ ] indicates the related course objective.

This schedule is a general guide to how **I hope** the semester will progress. Anything here is subject to change. Any changes will be discussed during class lectures.

Week	Topics	Text (P = provided)	Quiz	Due
1	Introduction Abstraction / Systems	P		Lab 0
2	Comp Org. & Arch / Major Comp. Computer Systems Software	Chapter 1 Chapter 1		
3	Number Systems Mathematics in Bases	P		CP1 - Lab 1
4	Mathematics in Bases Q1		Quiz 1	
5	Numerical Representation Numerical Representation	P P		Full - Lab 1
6	LMC LMC / ISA Algorithms	P P		
7	ISA in Practice / System Calls Q2	2-2.5 2.5-2.6	Quiz 2	
8	Review Midterm			Lab 2
9	Logic and Memory Design	P, A1,A2,A5,A7, A8,A9 4-4.4		
10	CPU Datapath CPU Pipelining and Parallelism	4.5-4.12		
11	CPU Pipelining and Parallelism Q3	5-5.4, 5.6-5.8	Quiz 3	Lab 3
12	Memory and Caching	P		
13	Polling / Interrupts Input and Output	P		
14	Text, Audio and Video	P,2.9,3.6,3.7		
15	Q4 / Final Review		Quiz 4	Project
F	Final Exam Week			

#### **Data for Research Disclosure:**

Any and all results of in-class and out-of-class assignments and examinations are data sources for research and may be used in published research. All such uses will always be anonymous.

## COVID-19

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Our in-person meetings will adhere to guidelines consistent with the New York State recommended guidelines.

Take a few minutes to review [Marist's covid website](#), which outlines issues and processes of interest to everyone at the College.

## Diversity and Inclusion Statement

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The college's academic mission is immeasurably enriched by students with diverse experiences. Our finest efforts as intellectual beings heavily rely on the exchange of ideas. Interactions in our classrooms among persons and groups with diverse backgrounds, ideologies, and experiences facilitate these efforts by allowing us all to be more reflective about the varied historical and social contexts in which we work and learn. For faculty and students to continue being leaders inside and beyond academia, we must ensure that we consider the diversity of all who comprise our communities and foster a climate in which those diverse influences are respected and valued. In this course, we will challenge each other's thinking while working collaboratively to ensure that the classroom is a space of safety and bravery. Our classroom offers an environment where individuals of varying opinions, experiences, and backgrounds can freely learn without fear of being silenced. Evidence of these efforts will manifest in readings, lectures/class discussion, seminars, and group projects. Aspects of diversity include, but are not limited to, race, ethnicity, color, nationality, sex, gender, gender identity, gender expression, class, sexual orientation, religion, age, ability, and veteran status. Students who would like to be identified in a manner other than what is indicated on the course roster can contact me privately to indicate name, pronoun and any other preferences they may have.

## Title IX

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Marist College is committed to providing a safe learning environment for all students. If you or someone you know has experienced sexual harassment, including sexual assault, dating or domestic violence, or stalking, support is available. Please contact the Title IX Office at [titleix@marist.edu](mailto:titleix@marist.edu) or (845) 575 - 3799 or visit [www.marist.edu/title-ix](http://www.marist.edu/title-ix) to file a report. Please be aware that faculty and staff are required to disclose incidents of sexual harassment or other potential violations of the Marist College Discrimination, Harassment, and Sexual Misconduct Policy to the Title IX Office. To speak to a confidential resource who does not have this reporting responsibility, contact Counseling Services at (845) 575 - 3314, Health Services at (845) 575 - 3270, or Campus Ministry at (845) 575 - 3000 (x2275).

# Policies:

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## **Late work:**

In exceptional cases, late work may be accepted, but will be graded late, with no credit guarantees. As soon as work is late you will lose 10% of the grade. For every 24 hours that passes after the due date you will lose an additional 10%. So if an assignment is due on a Tuesday at 3pm, and you turn it in the same Tuesday at 5pm, it will be 10% off. If you turn it in the next day (Wednesday) at 4pm it will be 20% off.

**NOTE:** After answers are posted, or graded work is handed back to the class, no late work will be accepted for credit (but will be graded somehow, sometime, if you seek feedback).

## **Attendance Policy:**

Students are expected to attend every class, there is generally a strong correlation between good attendance and good grades. You will be expected to answer test questions based on topics discussed in class. Additionally, in class announcements are the official means of communication and missing class will not be a legitimate reason for failure to meet any requirements conveyed during class. Your class participation grade will be based on your attendance as well as your participation in class discussions, and teamwork.

## **Quizzes:**

Quizzes will cover previous class lecture / reading material. Quizzes cover new material discussed since the last quiz. No makeup quizzes will be permitted at all! If you miss a quiz, that quiz grade is entered as a 0.

## **Tests:**

Tests will cover material up to the previous class lecture / reading material, the Final is not cumulative in this course and will be on all material in lectures and readings after the mid-term. No makeup tests will be permitted after a test has been given. If you anticipate not being able to make a scheduled test please see me well in advance of the test so we can schedule something before the test date.

## **Labs:**

The labs in this course are the building blocks you will need to be prepared for the course project. They will reinforce the lecture material and ensure that you have a practical understanding of the tools and theory needed to build a software project. Your grade on your project will be significantly impacted by how much effort you put into the course labs.

## **Projects:**

Project requirements will be provided during the semester. Projects help you gain hands-on experience and confidence that will allow you to leverage technology to give you every advantage in your career and personal life. They will be graded against the criteria set in the project requirements. This course is project based and is intended to build both your skills working with other software engineers as a team as well as your individual skills.

## **Communication:**

Please email me ([brian.gormanly@marist.edu](mailto:brian.gormanly@marist.edu)) including in your email subject the course number and name. I will usually be able to respond to your inquiry within 24 hours. Please see the office hours section at the top of this syllabus for information on setting up times to meet in person.

### **Academic Honesty:**

- Students are expected to uphold the school's standard of conduct relating to academic honesty (please refer to the Marist College Student handbook for detailed information on the definitions and consequences for cheating and plagiarism). Students assume full responsibility for the content and integrity of the academic work they submit. The guiding principle of academic integrity shall be that a student's submitted work, examinations, reports, and projects must be that of the student's own work. Students shall be guilty of violating the honor code if they:
  - Represent the work of others as their own.
  - Use or obtain unauthorized assistance in any academic work.
  - Give unauthorized assistance to other students.
  - Modify, without instructor approval, an examination, paper, record, or report for the purpose of obtaining additional credit.
  - Misrepresent the content of submitted work.
- Student's are also expected to adhere to the ACM code of ethics while enrolled in this class (and hopefully after as well). Please take a few minutes to familiarize yourself with them.
  - <https://www.acm.org/about-acm/acm-code-of-ethics-and-professional-conduct>
- Collaboration vs. Cheating:
  - You are encouraged to discuss course material, concepts and assignments with other students in the class, these conversations are part of a healthy learning environment. All work you turn in, however, must be your own. If you are caught copying or submitting material that is not solely your work, you will fail the course and a letter will be sent to the department chair.

### **Plagiarism Prevention:**

Marist College is committed to the fundamental values of preserving academic honesty as defined in the Student Handbook. The instructor reserves the right to utilize electronic means to help prevent plagiarism.

### **Turnitin:**

In this course you are required to participate in the use of Turnitin (<http://turnitin.com>). Turnitin is a service used by Marist College faculty to compare a student's written work with its very large database of sources, student papers from other institutions, and the like, to check for originality. Work submitted to Turnitin will be used only for purposes of assessing originality, and will not be shared beyond Turnitin or used for any other purpose.

Additional information about this system can be found at <http://www.turnitin.com>.

**IMPORTANT:** Students are encouraged to review the resources at:

[http://www.turnitin.com/research\\_site/e\\_home.html](http://www.turnitin.com/research_site/e_home.html) which will provide you with the information on how to properly cite sources and understand what is meant by plagiarism.

## **Accommodations and Accessibility:**

The Marist College Office of Accommodations and Accessibility provides individualized support to students in order to ensure access to a complete education. Information about Marist's support services can be found at <http://www.marist.edu/accommodations-accessibility/>.

Students with disabilities who believe they may need accommodations in this class are encouraged to contact the Office of Accommodations and Accessibility at 575-3274, or via email at [accommodations@marist.edu](mailto:accommodations@marist.edu) as soon as possible to better ensure that such accommodations are implemented in a timely fashion.

All efforts have been made to ensure the iLearn system is compliant with Americans with Disabilities Act (ADA) regulations. Information about the accessibility of the system can be found at: <http://tinyurl.com/28p59pq>

## **Support Links:**

Marist College provides a range of resources to help you get the most from your online educational experience:

- For access to iLearn support, click the links at the bottom of the iLearn login screen (<http://ilearn.marist.edu>). Here, you will find access to a brief web tutorial for an overview of iLearn tools, 1- or 2-page tips sheets for using specific tools, and a page of frequently asked questions for students.
- For additional technical support please contact: [helpdesk@marist.edu](mailto:helpdesk@marist.edu)  
Or call: 1-845-575-4357 (HELP)  
Important information about the Marist College Help Desk (including hours) is available at the Help Desk Website: <http://www.marist.edu/it/helpdesk/>  
**Please note:** the Help Desk is usually closed on weekends, so you will need to plan your schedule accordingly when completing assignments with weekend due dates in this course.
- Marist College also has a number of academic resources, including tutoring, writing assistance, and advising, and proofreading assistance. You are encouraged to visit <http://www.marist.edu/academics/resources.html> to learn more about these support tools.

## **Department Goals, Objectives, and Assessment:**

Marist College Department of Computing Technology Goals, Objectives, and Assessment are as follows for your reference. Please refer to corresponding matching with this course goals and objectives in previous sections in this syllabus.

1. Prepare students for employment in a technology field or for graduate study in a technology field.
  - 1.1. At the time of graduation, 100% of those students who seek employment in a technology-related job will be employed. Measurement tool: Survey completed by graduating seniors.
  - 1.2. At the time of graduation, 100% of those students who seek admission to graduate school will be admitted to at least one graduate program. Measurement tool: Survey completed by graduating seniors.
2. Provide students with both theoretical knowledge and skills-based proficiencies in the five core technology competencies: programming, hardware, data communications, data management, and systems/software analysis and design.
  - 2.1. Programming
    - 2.1.1. At least 80% of courses in the CS major will require programming.
    - 2.1.2. At least 35% of courses in the ITS major will require programming.
    - 2.1.3. At graduation, 100% of students will demonstrate programming skills with a grade of B or better. Measurement tool: Capping course project evaluation.
  - 2.2. Hardware
    - 2.2.1. Each major will include one hardware architecture course appropriate to the major.
    - 2.2.2. Students in each major will complete the appropriate hardware architecture course with a grade of at least C. Measurement tool: Course grade.

- 2.3. Data Communications
  - 2.3.1. Students will be required to complete at least one theoretical course in Data Communications and one practical (applied) course in Data Communications.
  - 2.3.2. At graduation, 100% of students will have demonstrated competency in the design and development of networks. Measurement tool: Course grade in applied networking course.
- 2.4. Data Management
  - 2.4.1. Students will be required to complete at least one course in Database Management.
  - 2.4.2. At graduation, 100% of students will have demonstrated competency in the design and implementation of a database system as part of a software system. Measurement tool: Capping course project.
- 2.5. Systems/Software analysis and Design
  - 2.5.1. At least 20% of courses required for CS majors will include material and experience with the analysis and design of software systems.
  - 2.5.2. At least 50% of courses required for ITS majors will include material and experience with the analysis and design of information systems.
  - 2.5.3. At graduation, 100% of students will be able to complete a software/systems design and development project with a grade of B or better. Measurement tool: Faculty evaluation of capping course projects.
- 3. Provide students with fundamental knowledge of business administration and management so that graduates will be able to work effectively within businesses and other organizations.
  - 3.1. All students will take at least one general business course.
  - 3.2. Students with an IS concentration will also study basic principles of accounting and economics.
  - 3.3. At graduation, 100% of students will be able to complete a software/systems design and development project with a grade of B or better. Measurement tool: Faculty evaluation of capping course projects.
- 4. Develop interpersonal skills for working effectively on teams.
  - 4.1. At least 35% of courses will require projects that are prepared by a team of students.
  - 4.2. At least 20% of courses will have at least 25% of course time devoted to small group work.
  - 4.3. At graduation, 100% of students will be able to contribute effectively to a team project. Measurement tool: Student evaluations of team members in the capping course project.
- 5. Develop effective written and oral communication skills.
  - 5.1. At least 35% of courses will require oral presentations, either by individuals or a team of individuals.
  - 5.2. At graduation, 100% of students will score 5 or better (out of 7) on evaluations of oral presentations. Measurement tool: Faculty evaluations of capping course project presentations.
  - 5.3. At least 35% of courses will require written documentation of project work.
  - 5.4. At graduation, 100% of students will be able to prepare the documentation of a project with a grade of B or better. Measurement tool: Faculty evaluations of capping course project documentation .
- 6. Educate students about the behavioral, social, and ethical aspects of technology.
  - 6.1. All courses that include a team project will include a discussion of appropriate ethical behavior when working with colleagues.
  - 6.2. All courses that involve programming will include a discussion of appropriate ethical behavior when developing software.
  - 6.3. All students will complete a 300-level ethics course as part of their core course requirements with a grade of B or better. This course will focus on the social and ethical impacts of technology on global society. Measurement tool: Course grades.