



THE CATHOLIC UNIVERSITY OF AMERICA
DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

CSC 390-01 Computer Organization & Architecture
Spring 2018, Course Syllabus and Grading Policies

Credit Hours: 3
Classroom: Pangborn Hall, Room-303
Days and hours of class meetings: MoWe 2:10PM – 3:25PM
Instructor contact information:
 Name: Dr. Ujjal Kumar Bhowmik
 Office Location: Pangborn Hall, Room 314
 Phone: (202) 319-4765
 E-mail: bhowmik@cua.edu
 Office Hours: TuTh 9:30AM – 10:30AM, or by appointment

Course Description:

This course focuses on design alternatives in computer architecture. It covers instruction set architectures, memory subsystem organization, interfacing concepts, and inter-processor communication. Emphasis will be given to show the relationship between hardware and software and to focus on the concepts that are the basis of the current computers. Concepts related to pipelining, parallel and distributed algorithms will also be studied.

Pre-Requisite:

CSC326 (Switching Circuits and Logic Design)

Required Text:

Title: Computer Organization and Design: The Hardware/Software Interface, 5th Edition
Authors: David A. Patterson and John L. Hennessy
Publisher: Morgan Kaufmann Publishers, 2013
ISBN: 978-0124077263

Supplemental Text:

The Essential of Computer Organization and Architecture, Fourth Edition.
Authors: Linda Null and Julia Labour
Publisher: Jones and Bartlett Learning.
ISBN: 978-1-284-07448-2

Course Objective/Expected Learning Outcomes:

The objective of this course is to revise and enhance basic hardware and assembly language concepts, and to introduce principles of:

1. control and pipelining
2. memory hierarchies, caching, and virtual memory
3. I/O subsystem organization and control
4. multiprocessors

Topics Covered:

1. Computer abstractions and technology.
2. The role of performance
3. Instruction Set Architectures: Language of the Computer.
4. The processor components and architectural implementations.
5. Enhancing performance with pipelining.
6. Exploiting memory hierarchy.
7. Interfacing processors and peripherals.
8. Multicores and Multiprocessors

Contribution of Course to Meeting the Professional Component:

1. Provides a technical foundation for a career in computer science.
2. Provides modern tools for professional practice and/or pursuing graduate study.
3. Provide the ability to undertake the design of major microprocessor components.

Course Outcomes (CO):

After completion of the course students are expected to:

- CO1 Understand the aspects of both the hardware and software that affect program performance.
- CO2 Understand the interface between the software and the hardware and be familiar with typical Instruction Set Architectures (ISA).
- CO3 Understand the principles and techniques used in implementing a processors and how an Instruction is executed in a processor.
- CO4 Recognize the different computer components such as memory, memory hierarchy, storage and Input-Output units, and master fundamental architectural implementation techniques.
- CO5 Determine the performance of a program and learn how a programmer can improve the performance as well as the techniques that can be used by hardware designers to enhance the performance.
- CO6 Understand the reasons for and the consequences of the recent switch from sequential processing to parallel processing.

In general, students would master the different principles of computer organization and architecture using solid engineering fundamentals and quantitative cost/performance tradeoffs. The approach combines examples and measurements, based on commercial systems, to create realistic design experiences.

CSC Student Outcomes (SO)

The program enables students to achieve, by the time of graduation:

- SO1: An ability to apply knowledge of computing and mathematics appropriate to the discipline.
- SO2: An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
- SO3: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
- SO4: An ability to function effectively on teams to accomplish a common goal.
- SO5: An understanding of professional, ethical, legal, security and social issues and responsibilities.
- SO6: An ability to communicate effectively with a range of audiences.
- SO7: An ability to analyze the local and global impact of computing on individuals, organizations, and society.
- SO8: Recognition of the need for and an ability to engage in continuing professional development.
- SO9: An ability to use current techniques, skills, and tools necessary for computing practice.
- SO10: An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- SO11: An ability to apply design and development principles in the construction of software systems of varying complexity.

Relationship of Course Outcomes (CO) to Student Outcomes (SO) and ABET Outcomes (AO)

The Matrix below shows how and how these Course Outcomes are related to the Student Outcomes and ABET Outcomes for the Computer Science program.

	SO1/ AO1	SO2/ AO2	SO3/ AO3	SO4/ AO4	SO5/ AO5	SO6/ AO6	SO7/ AO7	SO8/ AO8	SO9/ AO9	SO10/ AO10	SO11/ AO11
CO1	X	X	X						X	X	X
CO2		X	X	X					X		X
CO3	X	X	X	X					X	X	X
CO4	X	X	X	X					X	X	X
CO5	X	X	X	X					X	X	X
CO6	X	X	X	X					X	X	X

Outcome Assessment:

The outcomes will be assessed through a combination of homework, quizzes, exams, and class participation.

Process of Improvement:

The student performances on the homework, quizzes, and exams will provide information on which areas of the course need to be strengthened. The student evaluations will provide feedback on the success of the course and will provide information on which areas of the course need improvement.

Evaluation and Grading:

The course grade will be based on a 100 point scale. Exams will be given approximately every 4 to 5 weeks. The weights assigned to Exams, Assignments/Projects, and Quizzes are as follows:

		Approximate Date
Short Quizzes	5% -10%	~Almost in every week
Homeworks/ Project	20% -25%	~Tentatively 8 homeworks/Projects
Exam 1	20%	~February 21 (Wednesday)
Exam 2	20%	~March 28 (Wednesday)
Final Exam*	30%	~May 4 th (Friday) 1:00PM-3:00PM

*The final exam must be given on the day and time assigned by the Registrar. Final examinations, if required, must be administered in the final examination period. Please plan accordingly for travel, work or appointments.

A student having an exam scheduling conflict such as:

1. two or more exams scheduled for the same time period
- or 2. three or more exams scheduled for one day

must report to her/his school's Academic Dean's Office no later than fourteen calendar days before the end of classes. The dean will assist the student in rescheduling the exam(s) for the courses having the lowest enrollment(s). All make-up exams must be completed at the earliest possible time during the final examination period.

Final Grades will be assigned based on all the work you have completed during the semester. Grading for this course will be as follows:

A ≥ 90%, 87% ≤ A- < 90%, 83% ≤ B+ < 87%, 80% ≤ B < 83%, 77% ≤ B- < 80%, 73% ≤ C+ < 77%, 70% ≤ C < 73%, 67% ≤ C- < 70%, 60% ≤ D < 67%, F < 60%.

(for more information, please visit, <http://policies.cua.edu/academicundergrad//gradesfull.cfm#II>)
Reports of grades in courses are available at the end of each term on <http://cardinalstation.cua.edu>

Academic Honesty/Integrity:

Academic integrity is not merely avoiding plagiarism or cheating, but it certainly includes those things. More than anything, having academic integrity means taking responsibility for your work, your ideas, and your effort, and giving credit to others for their work, ideas and effort. If you submit work that is not your own – whether test answers, whole papers or something in-between – I have a responsibility to hold you accountable for that action. I also have a responsibility to treat you with respect and dignity while doing so.

The following sanctions are presented in the University procedures related to Student Academic Dishonesty:

“The presumed sanction for undergraduate students for academic dishonesty will be failure for the course. There may be circumstances, however, where, perhaps because of an undergraduate student’s past record, a more serious sanction, such as suspension or expulsion, would be appropriate. ...In the more unusual case, mitigating circumstances may exist that would warrant a lesser sanction than the presumed sanction.”

or

“The presumed sanction for undergraduate students for academic dishonesty will be failure for the course. In the context of graduate studies, the expectations for academic honesty are greater, and therefore the presumed sanction for dishonesty is likely to be more severe, e.g., expulsion. ...In the more unusual case, mitigating circumstances may exist that would warrant a lesser sanction than the presumed sanction.”

For more information about what academic integrity means at CUA, including your responsibilities and rights, visit <http://integrity.cua.edu>.

Accommodations for students with disabilities:

Any student who feels s/he may need an accommodation based on the impact of a disability should contact the instructor privately to discuss specific needs. Please contact Disability Support (dss.cua.edu) to coordinate reasonable accommodations for students with documented disabilities.

Academic Support Services

The university’s primary academic support resources are located on the 2nd floor of the Pryzbyla Center. These affiliated offices and services include:

The Undergraduate Advising Center offers guidance to all undergraduates, especially first-year students, as they move toward their academic goals.

Phone: (202) 319-5545 **Email:** cua-advising@cua.edu **Web:** advising.cua.edu

The Center for Academic Success provides academic support services for all students through a broad base of programs and services, including Tutoring Services, Workshops, Academic Coaching, Individual Skills Meetings, Peer Mentoring, and more.

Phone: (202) 319-5655 **Email:** cua-academicssuccess@cua.edu **Web:** success.cua.edu

The Writing Center provides free, one-on-one consultations with trained graduate instructors for writing projects across all disciplines at any stage of the process, from brainstorming to revising.

Appointments in the main location, 202 Pryz, can be scheduled in advance online (<http://english.cua.edu/wc/>). Drop-in appointments are also welcome based on availability in the Pryz and at the satellite location in the Mullen Library Lobby (see website for days and hours).

Phone: (202) 319-4286 **Email:** cua-writingcenter@cua.edu **Web:** english.cua.edu/wc/

The Math Center is staffed with Math Faculty and Tutors who are trained to assist students struggling in areas ranging from the basics to complex problems in calculus and statistics. Any student who feels he or she may need assistance in this or any other math class is welcome to visit the Math Center in Pryz 204 Monday through Thursday between the hours of 4:00 and 10:00pm. No appointment is necessary and services are absolutely free.

Phone: (202) 319-5655 **Email:** cua-academicsuccess@cua.edu

Disability Support Services provides programs and services designed to support and encourage the integration of students with disabilities into the mainstream of the university community.

Phone: (202) 319-5211 **Email:** cua-disabilityservices@cua.edu **Web:** dss.cua.edu

The Counseling Center provides free individual and group counseling services, psychiatric consultation, alternative testing, and emergency services to CUA students. In addition, we provide consultation services and outreach programs to the CUA community. Appointments can be scheduled in person in 127 O'Boyle Hall, or by phone.

Phone: (202) 319-5765. **Web:** counseling.cua.edu

Class Attendance, Participation, and Student Feedback:

Throughout the semester students will be assigned homework problems that should be completed in an individual manner and submitted on the Blackboard. Exams will be based on the homeworks and materials discussed in the class. It is highly recommended that sufficient time be allotted to homework problems. Failure to do so will result in a lack of understanding of the materials. Homework solutions will be posted on the **Blackboard** after the due date/time of submission. **No late homework will be accepted.** There will also be at least two projects during the semester. There will be frequent short quizzes throughout the semester. These short quizzes are typically 2/3 minutes quiz (open book/notes) and are based on the lecture given on the same day. To do well in the quizzes, you have to be attentive in the class and ask questions to make sure you understand the concept discussed in the class. There will be two Exams and a Final during the semester. **Exams** are open books/notes but **no laptop/mobile devices will be allowed.** Absence from an Exam will be excused only for medical reasons or serious immediate family problems. Students who anticipate missing the test for legitimate CUA or professional activities should talk to the instructor at least one (1) week prior to the test date and discuss an acceptable resolution. A grade of zero (0) will be assigned for the missed test unless excused or discussed prior with the instructor. Any question / confusion regarding test scores must be presented in writing within one week (i.e., 7 calendar days) after the exam/quiz has been returned. It is the responsibility of student to seek timely discussions with the instructor for re-evaluation of the test scores. After that time period, special circumstances must exist for consideration.

Regular class attendance and participation in discussions is expected. Regular attendance is highly recommended. If you anticipate not being able to attend class for a particular reason, it is best to e-mail me with the information. Students are responsible for all materials covered and assigned during the semester. No student will perform poorly because of lack of access to the Instructor. Students are suggested to seek advice from the Instructor in case of any problem, academic, personal or otherwise. The classroom learning experience depends on both a professional teaching environment and student participation. I strongly prefer an interactive class. Let me know if you do or do not understand what is being lectured. Please ask questions! All students are expected to be respectful to other students. Student feedback is required to ensure that a suitable learning environment is maintained in the class. The university conducts a formal course evaluation at the end of each semester. The results of the evaluation are used to assess various aspects of effectiveness of learning in the course. Students are strongly encouraged to provide the instructor with constructive criticisms regarding all aspects of class activities.

USEFUL LINKS:

- *MARS (MIPS Assembler and Runtime Simulator)*
<http://courses.missouristate.edu/KenVollmar/mars/>
MIPS architecture and Assembly Language Overview:
<http://logos.cs.uic.edu/366/notes/mips%20quick%20tutorial.htm>
- Computer Architecture Tutorial
<http://www.cs.iastate.edu/~prabhu/Tutorial/title.html>
- How Stuff Works
<http://computer.howstuffworks.com/>

Class Schedule:

1. Computer Abstraction and Performance – 2 week
2. Instruction set – 1.5 weeks
3. Processors – 2.5 weeks
4. Pipelining– 2 week
5. Memory Hierarchy – 2.5 weeks
6. Interfacing & Peripheral Devices – 2 weeks
7. Multiprocessors – 1.5 weeks

Blackboard:

All announcements and related supplemental material for this course will be posted on the Blackboard. It is the responsibility of each student to regularly check for updates and important course information on the Blackboard.

Important Dates (Academic Calendar - Spring 2018):

January 19 (Friday), - last day to drop a regular session course without record (use Cardinal Station).

March 28 (Wednesday) - last day to withdraw from regular session courses with a “W” grade (use Cardinal Station).

April 19 (Thursday) – University Research Day. Everybody has to attend the research day events.

(Ujjal Kumar Bhowmik)

Course Instructor