



SAINT LOUIS UNIVERSITY
MADRID

ECE 3217 M01: Name of Course
Spring 2018

Class Days and Time: MW, 18:30-19:45

Classroom: PAH-24

Prerequisite(s): grade "C" or better in MATH-135 and CSCI-150

Credit(s): 3

Instructor: Javier I. Romero Ardoy

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Instructor's Campus Phone: 91 554 58 58, ext. 000

Office: PAH-Science office

Office Hours: M, 19:45-20:45

Course Description:

This course introduces the student to the basics and fundamentals of computers. In a structured and systematic way, the way computers work and are constructed is presented. It all begins by introducing what a computer is and part of its history. From there, the basic model and the instruction lifecycle are covered. In order to better understand how the computer manages data and instructions, binary representation and basic electronic circuits are reviewed. Measuring performance allows a computer architect to make the right design choices so we will see how (difficult it is) to measure and determine a computer's performance. Up to here, we have collected different concepts that we will apply in studying a real implementation of a processor: the (basic) MIPS architecture. This basic MIPS implementation will be improved with different mechanisms as pipelining and memory caches. Finally, virtual memory will also be covered as part of the memory hierarchy paradigm.

Course Goals and Student Learning Outcomes: At the end of the course, students will:

- Understand the basic concepts of computer architecture, based on the von Neumann model.
- Get familiar with the different subsystems (CPU, ALU, Memory, I/O) and understand design decisions affecting performance and cost.
- Study a real example: MIPS instructions and addressing.
- Prepare students for more detailed courses on related topics.

The following learning outcomes have been defined for the Electrical and Computing Engineering courses.

Program Learning Outcomes (PLOs)	
A	An ability to apply knowledge of computing and mathematics appropriate to the discipline.
B	An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.

C	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
D	An ability to function effectively on teams to accomplish a common goal.
E	An understanding of professional, ethical, legal, security and social issues and responsibilities.
F	An ability to communicate effectively with a range of audiences.
G	An ability to analyze the local and global impact of computing on individuals, organizations, and society
H	Recognition of the need for and an ability to engage in continuing professional development.
I	An ability to use current techniques, skills, and tools necessary for computing practice.
J	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computerbased systems in a way that demonstrates comprehension of the trade-offs involved in design choices.
K	An ability to apply design and development principles in the construction of software systems of varying complexity.
L	Knowledge and application of probability, statistics, and advanced math.
M	Knowledge of mathematics and the basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic systems which may include hardware and software
N	Knowledge of discrete mathematics.

In the table below, the learning outcomes of this course are outlined, mapped to the Program Learning Outcomes in Electrical and Computer Engineering.

PLOs	Student Learning Outcomes	Assessment Method
A	A.1. Students will possess an ability to apply Boolean algebra to computer design. A.2. Students will possess an ability to generate snippets of assembly language software code.	<ul style="list-style-type: none"> • Assignments. • Midterm and Final exams.

B	<p>B.1. Students will possess an ability to modify a computer's architecture or organization to comply with new instructions or performance requirements</p> <p>B.2. Students will possess an ability to improve memory performance of a computer by using cache mechanisms.</p> <p>B.3. Students will possess an ability to improve the cache organization of a computer.</p> <p>B.4. Students will possess an ability to improve the cache architecture of a computer.</p> <p>B.5. Students will possess an ability to improve the memory performance of a computer by using virtual memory mechanisms.</p> <p>B.6. Students will possess the knowledge to differentiate RISC and CISC computer architectures.</p>	<ul style="list-style-type: none"> • Assignments. • Midterm and Final exams.
C	<p>C.1. Students will possess an ability to design a computer based on Von Neumann's model.</p> <p>C.2. Students will possess an ability to design a basic RISC processor down to the logic gate layer.</p> <p>C.3. Students will possess an ability to determine the performance of a computer based on different criteria for comparison</p>	<ul style="list-style-type: none"> • Assignments. • Midterm and Final exams.
J	<p>J.1. Students will possess an ability to apply Von Neumann's model in computer architecture and organization design.</p> <p>J.2. Students will possess an ability to apply single-cycle and pipeline processor architectures in the design of a computer's processor.</p> <p>J.3. Students will possess an ability to design direct mapped, set associative and full associative cache organizations for a computer.</p> <p>J.4. Students will possess an ability to design virtual memory organizations for a computer.</p> <p>J.5. Students will possess the knowledge of the MIPS processor architecture, instruction set and addressing modes, its main design principles and an organization example.</p>	<ul style="list-style-type: none"> • Assignments. • Midterm and Final exams.
M	<p>M.1. Students will possess an ability to theoretically design simple electronic circuits with combinational and sequential components using truth tables, Karnaugh maps and Boolean algebra.</p>	<ul style="list-style-type: none"> • Assignments. • Midterm and Final exams.
N	<p>N.1. Students will possess a basic knowledge of binary numbers and Boolean algebra.</p>	<ul style="list-style-type: none"> • Assignments. • Midterm and Final exams.

Saint Louis University - Madrid Campus is committed to excellent and innovative educational practices. In order to maintain quality academic offerings and to conform to relevant accreditation requirements, the Campus regularly assesses its teaching, services, and programs for evidence of student learning outcomes achievement. For this purpose anonymized representative examples of student work from all courses and programs is kept on file, such as assignments, papers, exams, portfolios, and results from student surveys, focus groups, and reflective exercises. *Thus, copies of student work for this course, including written assignments, in-class exercises, and exams may be kept on file for institutional research, assessment and accreditation purposes.* If students prefer that Saint Louis University - Madrid Campus does not keep their work on file, they need to communicate their decision in writing to the professor.

Required Texts and Materials:**Textbook:**

- “Computer Organization and Design: The Hardware/Software Interface, 5th Ed.” by David A. Patterson and John L. Hennessey, Morgan Kaufmann.

Reference book:

- "Computer Organization and Architecture, Global Edition", W. Stallings. (Prentice-Hall).

Attendance Policy:

It is mandatory to attend all classes unless a reasonable excuse is given.

Make up exams are not given. Students who legitimately miss an exam, due to a doctor’s visit or family emergency must provide written documentation of the circumstances. A letter from the university counselor is accepted. Exams that are missed illegitimately result in a score of F. Grades for these students will be based on the remaining exams. Missing more than one exam results in an F grade.

Course Requirements and Grading Rationale/System:

Students are encouraged to participate in class discussions and to ask questions.

Useful information for the course may be found on the web (Blackboard)

Announcements may be made during the semester.

Syllabus, reading and homework problems are subject to change.

Students are responsible for all lecture material, handouts, homework and assigned reading.

There is a 10% penalty for the first weekday late for an assignment. There is a 25% penalty for up to one week late.

Late assignments will not be accepted later than one week after the due date.

The grade will be obtained from the following areas:

- Homework: 20%
- Midterm Exam: 30%
- Final Exam: 50%

Grading scale:

- $90\% \leq A \leq 100\%$,
- $87\% \leq A- < 90\%$
- $84\% \leq B+ < 87\%$
- $80\% \leq B < 84\%$
- $77\% \leq B- < 80\%$
- $74\% \leq C+ < 77\%$
- $70\% \leq C < 74\%$
- $66\% \leq C- < 70\%$
- $60\% \leq D < 66\%$
- $F < 60\%$

E-mail: Campus and course announcements will often be handled by e-mail. Students should check their “@slu.edu” e-mail regularly.

University Statement on Academic Integrity: Academic integrity is honest, truthful and responsible conduct in all academic endeavors. The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity." Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern.

The governing University-level Academic Integrity Policy can be accessed on the Provost's Office [website](#). Additionally, SLU-Madrid has posted its academic integrity policy online: <http://www.slu.edu/madrid/academics>. As a member of the University community, you are expected to know and abide by these policies, which detail definitions of violations, processes for reporting violations, sanctions and appeals.

The professor will review these matters during the first weeks of the term. Please direct questions about any facet of academic integrity to your faculty, the chair of the department of your academic program, or the Academic Dean of the Madrid Campus.

University Title IX Statement: Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the University. If you speak with a faculty member about an incident of misconduct, that faculty member must notify SLU's Title IX deputy coordinator, Marta Maruri, whose office is located on the ground floor of Padre Rubio Hall, Avenida del Valle, 28 (mmaruri@slu.edu; 915-54-5858, ext. 213) and share the basic fact of your experience with her. The Title IX deputy coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

If you wish to speak with a confidential source, you may contact the counselors at the SLU-Madrid's Counseling Services on the third floor of San Ignacio Hall (counselingcenter-madrid@slu.edu; 915-54-5858, ext. 230) or Sinews Multiplettherapy Institute, the off-campus provider of counseling services for SLU-Madrid (www.sinews.es; 917-00-1979). To view SLU-Madrid's sexual misconduct policy and for resources, please visit the following web address: <http://www.slu.edu/Documents/Madrid/campus-life/SLUMadridSexualMisconductPolicy.pdf>.

Students with Special Needs: In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:

- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Academic Dean's Office (San Ignacio Hall) or by going to <https://www.slu.edu/madrid/academics/student-resources>.

Students with a documented disability who wish to request academic accommodations must contact Disability Services to discuss accommodation requests and eligibility requirements. Once successfully registered, the student also must notify the course instructor that they wish to access accommodations in the course. Please contact Disability Services at disabilityservices-madrid@slu.edu or +915 54 58 58, ext. 230 for an appointment. Confidentiality will be observed in all inquiries. Once approved, information about the student's eligibility for academic accommodations will be shared with course instructors via email from Disability Services. For more information about academic accommodations, see "Student Resources" on the SLU-Madrid webpage.

Note: Students who do not have a documented disability but who think they may have one are encouraged to contact Disability Services.

Course outline:

- Introduction to Computer Architecture
- Organization of Computer Systems and Fetch-Decode-Execute cycle
- Review of Data Representation
- Review of Boolean Logic, Gates, and Circuits
- Assessing and Understanding Performance
- Software Architecture and MIPS ISA
- MIPS Instructions and Addressing
- Single-Cycle Datapath Implementation
- Introduction to Pipelining
- Cache Memory Hierarchy
- Cache Organization
- Cache Performance
- Virtual Memory

Spring 2018 Course Schedule:

JANUARY	
Wednesday 10	First Day of Classes
Thursday 11	
Friday 12	
Monday 15	
Tuesday 16	
Wednesday 17	
Thursday 18	
Friday 19	
Sunday 21	Last Day to Drop a Class without a Grade W and/or Add a Class; Last Day to Choose Audit (AU) or Pass/No Pass (P/NP) Options
Monday 22	
Tuesday 23	
Wednesday 24	
Thursday 25	
Friday 26	No Classes Application Deadline for Spring Semester Degree Candidates
Monday 29	
Tuesday 30	
Wednesday 31	
FEBRUARY	
Thursday 1	
Friday 2	
Monday 5	
Tuesday 6	
Wednesday 7	
Thursday 8	
Friday 9	
Monday 12	
Tuesday 13	
Wednesday 14	Ash Wednesday Registration for Summer 2018 Begins
Thursday 15	
Friday 16	
Monday 19	
Tuesday 20	

Wednesday 21	Midterm exam
Thursday 22	No Classes (Winter Break)
Friday 23	
Monday 26	
Tuesday 27	Professors' Deadline to Submit Midterm Grades
Wednesday 28	
MARCH	
Thursday 1	
Friday 2	
Monday 5	
Tuesday 6	
Wednesday 7	
Thursday 8	
Friday 9	Last Day to Drop a Class and Receive a Grade of W
Monday 12	
Tuesday 13	
Wednesday 14	
Thursday 15	Last Day to Submit Transfer Application for Fall Semester
Friday 16	
Monday 19	
Tuesday 20	
Wednesday 21	
Thursday 22	
Friday 23	
Monday 26	<i>Semana Santa</i> Holiday (Campus Closed)
Tuesday 27	
Wednesday 28	
Thursday 29	<i>Jueves Santo</i> (Campus Closed)
Friday 30	<i>Viernes Santo</i> (Campus Closed)
APRIL	
Monday 2	
Tuesday 3	
Wednesday 4	Registration for Fall 2018 Semester Begins
Thursday 5	
Friday 6	
Monday 9	
Tuesday 10	
Wednesday 11	
Thursday 12	
Friday 13	
Monday 16	
Tuesday 17	
Wednesday 18	
Thursday 19	
Friday 20	
Monday 23	
Tuesday 24	
Wednesday 25	
Thursday 26	
Friday 27	
Monday 30	
MAY	
Tuesday 1	<i>Día del Trabajador</i> (Campus Closed)

Wednesday 2	<i>Día de la Comunidad</i> (Campus Closed)
Thursday 3	Spring 2018 Final Day of Classes
Friday 4	Spring 2018 Final Exams
Monday 7	
Tuesday 8	
Wednesday 9	
Thursday 10	
Friday 11	University Housing Move-out Date
Saturday 12	Commencement
Sunday 13	Professors' deadline to submit spring 2018 final grades

Final Exam Schedules Spring 2018

	4 May (Fr)	7 May (Mn)	8 May (Tu)	9 May (Wd)	10 May (Th)
08:30-11:30	Mn classes that meet at 9:00 & 9:30	Mn classes that meet at 10:00	Mn classes that meet at 11:00 & 11:30	Tu classes that meet at 9:30	Tu classes that meet at 8:00
12:00-15:00	Tu classes that meet at 11:00	Mn classes that meet at 13:00	Tu classes that meet at 14:30	Mn classes that meet at 12:00 & 12:30	Tu classes that meet at 12:30
15:30-18:30	Mn classes that meet at 14:30	Tu classes that meet at 17:00 & 17:30	Mn classes that meet at 16:00	Tu classes that meet at 16:00	Mn classes that meet at 17:30
19:00-22:00	---	---	Mn classes that meet at 18:30 & 19:00	Tu classes that meet at 19:00	---