San José State University
College of Engineering/ Electrical Engineering
EE 275-02, Advanced Computer Architectures, spring, 2020

Course and Contact Information

Instructor(s): John (JeongHee) Kim
Office Location: ENG259
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Email: jeonghee.kim@sjsu.edu & jeonghee_kim@yahoo.com
Office Hours: Tu, Tr 5:50-6:30 & by appointment.
Class Days/Time: Tu & Tr 7:30 to 8:45 pm
Classroom: ENG345
Prerequisites: EE 270 or EE271 & Basic computer organization and logic circuits; Hardware Description Language (Verilog or VHDL) (optional); Assembly language programming (desirable); High-level programming language (C/C++/Python/Matlab/Simulink) (optional).

Course Description

Performance metrics, instruction set architectures, instruction pipelining and pipeline hazards, instruction-level parallelism, multithreading, cache and virtual memory, I/O performance and advanced topics in storage systems, topologies and hardware/software issues of interconnection networks. Prerequisite: EE 270 or EE271.

Course Format

This course adopts a flipped classroom delivery (in class format) format.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on Canvas Learning Management System course login website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through MySJSU on Spartan App Portal http://one.sjsu.edu (or other communication system as indicated by the instructor) to learn of any updates. For help with using Canvas see Canvas Student Resources page (http://www.sjsu.edu/ecampus/teaching-tools/canvas/student_resources)

Course Learning Outcomes (CLO)

1) Analyze different performance characteristics of a computer system.
2) Apply digital design techniques to the microarchitecture construction of a processor.
3) Analyze hardware & software trade-offs to design the instruction set architecture (ISA) interface.
4) Identify advanced issues in design of computer processors, caches, and memory.
5) Analyze performance trade-offs in computer design.
6) Apply knowledge of processor design to improve performance in algorithms and software systems.

Required Texts/Readings

Textbook

Other Readings
To be distributed or informed in the class

Course Requirements and Assignments

Lectures
- The course will follow the selected subjects as listed on the course description. Additional theory, demo and examples will be given and discussed in class as much as time permits.
- Please note that lecture materials are NOT solely based on the required text and so students are responsible for following up the lecture in order to prepare themselves for the exams
- Students are responsible for the reading the text, handouts, lecture presentations, etc.
- Students are responsible for following up and keeping track of the in-class lecture materials.
- Students are responsible for finding and reading additional books, papers, examples, etc. in order to gain more understanding of the materials discussed in the lectures.

Midterm and Final Exams and Design Project

There will be two midterm exam, a comprehensive final exam, project presentation, and quizzes. The Final exam date (Thursday, May 14: 19:45-22:00) is posted by the university. Since make-up exams will NOT be allowed, please make sure that you are able to attend all exams at the indicated scheduled dates and times (from the beginning of the semester).

☐ All exams are closed-book exams.
- One sheet (double-side 8.5x11) of only hand-written note is allowed for each midterm exam and two sheets of hand-written notes (one sheet from each midterm exam) are allowed for the final exam.
- Only basic calculators may be allowed (It will be notified before each exam).
- All exams are in-class exams
- No computer, tablet/pad, or cell phone will be allowed

☐ There will be no make-up exams

Homework Assignments

- Homework assignments and/or lab exercises will be given with due dates

- If you turn in assignments late, maximum of 10% credits will be given. Solutions to the homework assignments and all other info are posted in group site

- If 75% of combined HW, projects and quizzes are not done by end of semester, you will get F grade automatically.
• HW has to have cover page given in the site otherwise you will not get any credits or deducted up to 100 percent. Final solutions on HW and exam must be boxed. Otherwise you will not get credits. Only one side of page must be used in the HWs. (No HW sending through an email will be accepted.) HW should be clean, legible, stapled on top left corner and proper paper should be used.

• If unreasonable or out of common sense behavior happens in the class, one will be asked to leave from the class and will be given “F” grade. (No feet on a table or chair, taking hat off, no cellphone use or web surfing, no talking with neighbors). And I will drop you from the class if the class is disturbed unreasonably with my right.

• **No food** is allowed (Water is ok). All the exams and quizzes are done in the class and only allowed to use pencil, eraser (no pen) and calculator.

• Homework must be submitted in class on time.

• Do NOT submit HW via email. Submit HWs in class as hard-copies (paper) only

• Late submission will NOT be accepted (absolutely!).

• **There are no make-up homework/projects.** To get credit for your homework/lab assignments, submissions must be neat, clean, and must be done professionally and seriously. Your official name (not nickname), course #, and homework # must be visibly shown on each assignment.

“Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practice. Other course structures will have equivalent workload expectations as described in the syllabus.”

**Final Examination or Evaluation**

• The final exam is an in-class exam.
• The exam date and time is defined in Course Schedule (last page of this syllabus) or can be found in the university final exam schedule.
• It is a comprehensive exam; the exam covers the all materials covered in the class.
• More details can be found in University policy S17-1 (http://www.sjsu.edu/senate/docs/S17-1.pdf)

**Grading Information**

The overall course grades (letter-grades) will be assigned based on a defined grading standard as shown below. The weights of the whole course work assignments are:

1. Homework assignments & projects & Quizzes 35% (HW & Qz (15%) & P (20%))
2. Two midterm exams 40% (20% each)
3. One final exam 25%

And the overall course grade (letter-grade) will be assigned based on the distribution below:
Grading criteria (Example: 74% results in a grade of C plus):

0<F<57=D minus <60<D<64<D plus <67<C minus <70<C<74<C plus <77<B minus <80<B<84<B plus<87<A minus<90<A<100
Classroom Protocol

- EE275 students understand that professional attitude is necessary to maintain a comfortable academic environment in the classroom. For examples:
  - Students will put their cell phones in quiet/vibration mode during the lecture.
  - Students understand that drinking water, juices, etc. during the lecture is acceptable but NOT eating.
- Students will not skip the lecture and then ask the instructor to summarize the lecture later on.
- Office hours are for students to have questions, not for the instructor to summarize the lecture for any specific student.
- Students will come to the class on time and leave the class at the end of the lecture.
- Students will consult the course syllabus for class policies and requirements before requesting the instructor for any special considerations and/or exceptions
- To minimize possible tension during the exams, students are requested to follow the exam rules closely.
- Students will works, HW and projects, by their own and will not share the work with other students
- Students understand that long-term learning is their responsibility and will always keep it up.

If you need explanations on lecture materials, homework assignments, exams, etc..., please see me in-person during my office hours. Do NOT email me for these matters. If you must send me an email, please clearly specify your full-name, course, section, etc. I will not respond to email that I do not know the author or emails that have no manners.

University Policies (Required - Delete the word “Required” in final draft)

Per University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (http://www.sjsu.edu/gup/syllabusinfo), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources.

EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“ I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

• Take an exam in place of someone else, or have someone take an exam in my place
• Give information or receive information from another person during an exam
• Use more reference material during an exam than is allowed by the instructor
• Obtain a copy of an exam prior to the time it is given
• Alter an exam after it has been graded and then return it to the instructor for re-grading
• Leave the exam room without returning the exam to the instructor.”
No In-Complete grade will be given

Measures Dealing with Occurrences of Cheating

• Department policy mandates that the student or students involved in cheating will receive an “F” on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.
• A student’s second offense in any course will result in a Department recommendation of suspension from the University.

EE275 / Advanced Computer Architectures, spring, 2020, Course Schedule

Indicate the schedule is subject to change with fair notice and how the notice will be made available.

Course Schedule (tentative)

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<th>Week/Lesson/Module</th>
<th>Topics, Readings, Assignments, Deadlines</th>
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<td>syllabus and Introduction</td>
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<td>2</td>
<td>History of Computing</td>
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<td>3</td>
<td>Arithmetic Circuit Review, IEEE Floating-point arithmetic circuits</td>
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<td>4</td>
<td>Instruction set architecture</td>
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<td>5</td>
<td>Addressing modes and instruction format, control sequencing</td>
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<td>Performance measures</td>
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<td>Cache memory design parameters</td>
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<td>Pipeline hazards, ILP</td>
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<td>Forward chaining, branch prediction</td>
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<td>15</td>
<td>Loop unrolling and software pipeline</td>
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<td>16</td>
<td>DLP, Vector processor</td>
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<td>Memory interleaving</td>
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<td>Array processor</td>
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<td>Week/Lesson/Module</td>
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<td>19</td>
<td>Multiprocessor and TLP</td>
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<td>Cache coherence, MESI protocol</td>
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<td>GPU and CUDA, Heterogeneous computing</td>
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<td>Warehouse-Scale Computers, Data Center, Request-Level Parallelism</td>
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<td>AI/Machine Learning architecture and DNN Accelerator</td>
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<td>29</td>
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<td>Final Exam</td>
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