

**San José State University**  
**Department of Computer Science**

**CS 147**  
**Computer Architecture**  
**Section 01**  
**Spring 2016**

**Course and Contact Information**

<b>Instructor:</b>	Feiling Jia
<b>Office Location:</b>	DH 282
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<b>Office Hours:</b>	Monday 19:15 – 20:15
<b>Class Days/Time:</b>	Monday/Wednesday 18:00 - 19:15
<b>Classroom:</b>	DH 250
<b>Prerequisites:</b>	CS 47 or CMPE 102 or equivalent (with a grade of "C-" or better)

**Faculty Web Page and Canvas**

Course syllabus and schedule (updated weekly) can be found on my [faculty web page](http://www.cs.sjsu.edu/~jia/CS147-S2016/Spring2016-CS147.htm) at <http://www.cs.sjsu.edu/~jia/CS147-S2016/Spring2016-CS147.htm>. Other course materials, such as handouts, slides and assignments, are available on the Canvas learning management system. You are responsible for regularly checking the faculty web page and Canvas (or other communication system as indicated by the instructor) to learn of any updates.

**Course Description**

Introduction to the basic concepts of computer hardware structure and design, including processors and arithmetic logic units, pipelining, and memory hierarchy.

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Course topics include Hardware Description Languages, Data Representation in Computer Hardware, Computer Arithmetic, Memory Organization, Control Unit Operation and Implementation, Instruction Formats, Pipelining and Vector Processing, Multiprocessing, and RISC Architecture and Principles.

### **Course Goals**

To examine alternative organizations and architectures associated with the implementation of basic computer hardware functions such as the memory hierarchy and its management, central processing unit (CPU) and arithmetic logic unit (ALU), instruction sets, and RISC.

### **Course Learning Outcomes (CLO)**

Upon successful completion of this course, students should be able to:

- Understand the role of each major hardware component of a computer system and their synergistic interaction with each other and software.
- Analyze and perform tradeoffs between the cost, performance, and reliability of alternative computer architectures.
- Understand, analyze, and design digital logic structures for the basic combinational and sequential circuits.
- Understand the alternative binary internal representation of information (such as sign-magnitude, one's complement, two's complement, and floating point) along with their optimizations and tradeoffs.
- Be able to perform basic mathematical operations (add, multiply) in the various Boolean number representation schemes.
- Understand the operation of, and be able to analyze from a cost/performance standpoint, certain optimized hardware structures.
- Appreciate the need to use a memory hierarchy and understand how locality of memory referencing in typical programs can be leveraged to perform effective memory architecture management.
- Understand and emulate the various mapping, replacement, and dynamic memory allocation algorithms for cache and virtual memory management.
- Understand the rationale and philosophy behind both complex instruction set computers (CISC) and reduced instruction set computers (RISC), and the tradeoffs between the two architectures.
- Understand how pipelining and parallel processing are cost-effective methods of increasing hardware performance.
- Appreciate how computer-aided design tools and hardware description languages can be used to verify and measure the performance of hardware designs.

### **Required Texts/Readings**

#### **Textbook**

COMPUTER ORGANIZATION and DESIGN – The Hardware/Software Interface | Edition: 5  
Authors: David A. Patterson,  
John L. Hennessy  
ISBN: 978-0-12-407726-3

Publication Date: 10/10/2013

Publisher: ELSEVIER

### Other Readings

COMPUTER ARCHITECTURE | Edition: 5TH 12

Author: HENNESSY ISBN: 9780123838728

Publication Date: 09/29/2011

Publisher: ELSEVIER

COMPUTER ORGANIZATION and ARCHITECTURE | Edition: 10TH

Author: STALLINGS ISBN: 9780134101613

Publication Date: 01/12/2015

Publisher: PEARSON

VERILOG HDL-W/CD | Edition: 2ND 03

Author: PALNITKAR ISBN: 9780130449115

Publication Date: 03/10/2003

Publisher: PEARSON

### Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in [University Policy S12-3](http://www.sjsu.edu/senate/docs/S12-3.pdf) at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

**Problem sets:** There will be 6 problem sets (including projects). Each problem set may contain theory questions and/or hands-on assignments (programming, software installation, etc). Students may form a team of 2 to 3 persons to work on each problem set.

**Midterm Exam:** Middle of the semester (before Spring recess)

**Final Exam:** University final exam schedule (Wednesday May 18, 17:15-19:30)

Class participation is more than class attendance. It should also include interactive discussions, such as initiation of questions/answers, contributions to in-class quizzes, participation in email discussions, etc. Your participation in the classes is not only an important part of the learning process, but also makes the classes more interesting.

NOTE that [University policy F69-24](http://www.sjsu.edu/senate/docs/F69-24.pdf) at <http://www.sjsu.edu/senate/docs/F69-24.pdf> states that “Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading.”

### Grading Policy

Your individual class grade will be weighted as follows:

Problem sets: 50%

Midterm Exam: 20%  
Final Exam: 20%  
Class participation: 10%

Class participation include interactive discussions, such as initiation of questions/answers, contributions to in-class quizzes, participation in email discussions, etc. Your participation in the classes is not only an important part of the learning process, but also makes the classes more interesting.

Final individual class letter grades will be assigned based on the class curve.

Note that “All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades.” See [University Policy F13-1](http://www.sjsu.edu/senate/docs/F13-1.pdf) at <http://www.sjsu.edu/senate/docs/F13-1.pdf> for more details.

## Course Schedule

Please check the [faculty web page](http://www.cs.sjsu.edu/~jia/CS147-S2016/Spring2016-CS147.htm) for continual updates: <http://www.cs.sjsu.edu/~jia/CS147-S2016/Spring2016-CS147.htm>

## Classroom Protocol

- The pre-requisites to this course will be monitored.
- No make-up exams will be given and no late homework will be accepted.
- To encourage participation from students, no recording is allowed.
- Students are responsible for all materials distributed and discussed in the class.
- Most handouts are available on the web; hard copy distribution will be kept minimized.
- Attendance is crucial to doing well on assignments and examinations.
- Office hours are on a 90% basis; they may be rescheduled or canceled due to conflicting department/university or other professional meetings.
- Cheating will not be tolerable; a ZERO will be given to any cheated assignment/exam, and will be reported to the Department and the University.

## University Policies

### General Expectations, Rights and Responsibilities of the Student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU’s policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See [University Policy S90–5](http://www.sjsu.edu/senate/docs/S90-5.pdf) at <http://www.sjsu.edu/senate/docs/S90-5.pdf>. More detailed information on a variety of related topics is available in the [SJSU catalog](http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html), at <http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html>. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

### Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester’s [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars](#)

[webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at [http://www.sjsu.edu/provost/services/academic\\_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

Note that for the Spring 2016 semester the last day to **drop** without consequence is *Tuesday, February 9, 2016*, and the last day to **add** is *Tuesday, February 16, 2016*. After these dates it becomes very difficult to drop or add a class, so be sure you are in good shape before these dates arrive!

### **Consent for Recording of Class and Public Sharing of Instructor Material**

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course and the following items to be included in the syllabus:

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor’s permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
  - It is suggested that the greensheet include the instructor’s process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
  - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

### **Academic integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2.pdf) at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

### **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at [http://www.sjsu.edu/president/docs/directives/PD\\_1997-03.pdf](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.