

CS 1337 Course Syllabus

Course title: Computer Organization and Architecture

Prerequisite: CS 1181

Required text: Computer Systems: A Programmer's Perspective, 3/E (aka CS:APP3e) (ISBN-13: 978-0134092669)

Instructor: Paul Bodily ([office hours and contact information](#))

TAs: [Natalia Castaneda \(nataliacastaneda@isu.edu\)](#), [Calvin Condie \(calvincondie@isu.edu\)](#).

Course Overview

So you know how to program. But how does a computer actually work to be able to run that program? In this class we will dispel the magic behind how a computer is organized, examining the architectural features that are common across modern computer systems. Understanding the basic concepts underlying computer systems will make you a more efficient, effective, and secure programmer. Here are just a few examples:

1. *Ints vs integers*. It turns out that due to the finite limitations of computers, there are important distinctions between numbers as we normally think about them and their bit-level representations.
2. *Assembly language*. You may never write in assembly. But understanding the behavior of a program--especially when things go wrong--requires knowing what's under the hood.
3. *Memory matters*. Computer memory is finite. It has to be allocated and managed. It is important to understand the different types of memory and their strengths and weaknesses.
4. *Constant speedups*. We tend to hyperfocus on asymptotic complexity. But constant factors also matter. We'll learn some of the systematic ways to evaluate and improve program performance.
5. *Secure software*. Some of the vulnerabilities that cyber threats commonly exploit can only be understood in terms of the interaction between the software and the hardware.

These and other low-level topics we will cover will provide a solid foundation for the Secure Systems and Networks course and for other courses you will encounter in future semesters.

Learning Objectives

1. Binary Computations: Ability to perform simple computations in binary
2. Translating C code to Assembly: Ability to describe how a compiler translates C code to assembly
3. Boolean Logic: Perform computations using Boolean logic
4. Translate Boolean: Translate Boolean logic to transistor circuitry
5. Computer Operation: Ability to describe the operation of a computer at the micro-architectural level
6. Circuitry: Use combinational and sequential circuitry to implement an instruction set architecture

7. C Programming: Ability to program in C
8. Assembly Programming: Ability to program in assembly
9. Computer Architecture: Ability to describe the high level organization and operation of a computer, e.g. the von Neumann model

Course Requirements

Final grade percentage will be computed as a function of the following requirements:

Type	Percentage
Daily Quizzes	8%
Homework	30%
Labs	38%
Midterm	12%
Final Exam	12%
Course Evaluations	1% (extra credit)

Attendance & Participation

Your participation in the course will consist of these forms of activity:

1. Attending and/or viewing the recorded lectures
2. Seeking help as needed from the course TA.
3. Doing homework and lab assignments.
4. Reading the text and completing reading quizzes.
5. Taking exams.

Attendance will not be taken at lectures, but you are considered responsible for all material presented in lecture.

Readings

The text for the class is Computer Systems: A Programmer's Perspective, 3/E (CS:APP3e), by Randal E. Bryant and David R. O'Hallaron at Carnegie Mellon University (one of the topmost CS programs internationally). **Please make sure you have the 3rd edition of the text and that it is not the global edition. Check the ISBN number above.** This is a commonly used textbook for teaching Computer Organization and Architecture courses and comes highly recommended. I hope that you will find it an accessible and valuable resource. We will cover much of the text following the provided schedule. You are responsible for reading the material for a given day prior to that day's lecture. Because class time is limited, we may not cover everything in the text. However, except where specifically noted otherwise, you are responsible for the entire text. There will be a daily quiz (consisting of 4-6 multiple choice questions) over the reading to

be completed via Moodle before class. This is both to encourage and reward coming to class prepared. The lowest 3 quizzes will be dropped.

The textbook contains both practice problems within the chapter and homework problems at the end of each chapter. The intention is that you work on the practice problems *as you are reading the book*. **The answers to these problems are at the end of each chapter.** Trying out the the concepts on simple examples is important to making the ideas more concrete.

Homework Assignments

There will be a few homework assignments towards the beginning of the semester focused on helping you to get up and running with Linux, Vim, and C. These are due via Moodle by 11 pm on the date the assignment is listed on the schedule. Specifications for these assignments are on Moodle. It is very important to stay current in this class and the schedule is designed to help you do so. **All assignments should be submitted via Moodle per the specific assignment specification.** In the interest of deterring academic dishonesty please keep any code you develop for these projects out of the public domain (e.g., make any github repos private).

Communicating clearly and concisely what you have to say is an important skill you will use throughout your career. All written assignments are to be neat and professional. If you cannot clearly communicate something, there is a good chance that you do not yet understand it well. **Good writing, grammar, punctuation, etc. are important and can affect your grade.**

Labs

There will be 6 individual programming projects throughout the semester. These labs are frequently cited as being students' favorite part of this course. Some labs are short while others are more ambitious. Be sure to start early! Note that labs are weighted differently according to their level of difficulty.

Exams

There will be one mid-term and one final (both administered in class). Exams are closed book except for half page, single-sided of notes (i.e., half of 8.5" x 11"). Exams will consist of written problems similar to those encountered on the homework. If you put in the time to understand the homework and programming assignments, the tests should not be too difficult. Explicitly, the final will only deal with material not covered on the midterms; however, it will be implicitly comprehensive in that it will assume you understand the material covered throughout the course.

Grading

Final grades are assigned on the following absolute scale:

90.0	<=	A
86.0	<=	A- < 90.0
83.0	<=	B+ < 86.0
80.0	<=	B < 83.0
76.0	<=	B- < 80.0
73.0	<=	C+ < 76.0
70.0	<=	C < 73.0
67.0	<=	C- < 70.0
64.0	<=	D+ < 67.0
60.0	<=	D < 64.0
57.0	<=	D- < 60.0
		F < 57.0

Exceptions will be made at the sole discretion of the instructor. Scores and grades will be maintained on Moodle.

COVID-19

Pursuant to our goals as an institution of higher learning, Idaho State University expects all students and faculty to adhere to [CDC guidelines](#). Please observe the current university COVID-19 requirements as indicated on [ISU's Roaring Back page](#).

The University also strongly encourages all individuals to [receive a COVID-19 vaccine](#). Students who are experiencing COVID-19-like illness should NOT come to class and should contact the COVID Health Committee at COVID@health.isu.edu or (208) 282-2705. All confirmed cases of COVID-19 should be provided to the COVID Health Committee on the [self-reporting form](#). All students are required to fully participate in the university's contact tracing process and follow all instructions related to quarantine and isolation.

Questions and forum

Questions on how to do homework and projects should be asked using the class discord server (link available from Moodle) where other students can benefit from and possibly provide help on your questions in addition to help provided by the professor. Please see section below on "Academic integrity" for clarification on what types of help may or may not be appropriate. Score and grade questions should be addressed directly to the instructor via [email](#).

Getting Help

TA information can be found atop the Moodle page for this course. A tutoring lab is also available for students enrolled in any CS course. Note that not all tutors may have taken the course you need help with,

so you may need to try a few different tutors. The schedule and location is available [here](#). Students can also get help from the professor outside of class as needed.

Writing

Like it or not, much of your future success depends heavily on your skills as a communicator. Whether in project reports or service learning proposals, any work (including emails and forum posts) should exhibit a professional standard of writing. Like it or not, potential and actual employers will judge you based on your ability to communicate. I will happily give feedback on your writing, but it will be of greatest benefit to you if you are making your best effort. Points may be taken off for poor grammar, spelling, etc.

A **free writing center** is available on both the Pocatello and IF campuses that offers face-to-face, online chat, and online written feedback.

Late work policy

No late homework or projects are accepted. This means that if you turn an assignment in one minute after it's due you'll receive a zero. Daily quizzes and exams cannot be made up. Exceptions are on a case-by-case basis and are only granted for religious holy days (must have prior approval), documented illness, or documented emergencies.

It is in your best interest to submit whatever you can before deadlines. Probably the best way to make sure you are not unpleasantly surprised is to submit incrementally: submit what you have early, and then continue to improve your work and resubmit as you make improvements, up until the deadline.

Note that the schedule is carefully designed to give you plenty of time between when we discuss in class the concepts needed for a project and when it is due. Please start early and make use of that time to do a good job. If you do not get the entire project completed by the deadline, make sure you submit what you have.

In my experience, one key to success, in class, in our profession, and in life in general, is being organized and meeting deadlines. The no-late-work-policy is in large part to help you be successful and be able to continue progressing and focusing on new material. Please submit your work on time!

Letters of Recommendation

Not infrequently do students ask me to write them a letter of recommendation. I am generally very happy and willing to do so. I will paint you in the best light possible, but I will be honest and transparent. Make it easy for me to give you a good recommendation. I suggest that whenever asking someone to write a letter of recommendation (including myself) that you ask specifically if they are willing and able to write a **good** recommendation.

Academic integrity

You may work together with other members of the class; in fact, you are strongly encouraged to do so; however, do NOT turn in other people's work. There is a fine line that may require some judgment on your part. Unless explicitly stated otherwise, all work is to be done individually. Helping each other through discussion is permitted. You may consult the internet for questions related to programming projects (not homeworks), but you may not copy code from the internet or any other source except for the course textbook. **Projects may not be done in groups unless the instructor explicitly says otherwise.** Homework may be discussed in groups, but students should be careful to develop individual mastery of the problems and solutions. Exams are closed book except for half page, single-sided of notes (i.e., half of 8.5" x 11").

Academic integrity is expected of all students. Academic dishonesty, including cheating or plagiarism, is unacceptable. The Idaho State University academic dishonesty policy allows an instructor to impose one of several penalties for cheating that range from a warning up to assigning a failing grade for the course or dismissal from the University. ANY use of an electronic device or other form of unauthorized materials during an exam or other assessment will be considered cheating. For more information, please see the [ISU Policies and Procedures Policy 5000 \(Student Conduct Code\)](#).

Some examples of dishonest behavior include, but are not limited to

- Copying material from a source without attributing the source.
- Allowing another student to copy your work and then submit it as his/her own.
- Allowing someone else to complete your assignments for you and then passing off the work as your own.
- Bringing unauthorized material or devices to an exam. Note that you do not have to be caught using them – just having them is an offense.
- Copying from another student's exam.
- Communicating with someone other than the professor during an exam.
- Removing the exam from the classroom.
- Acquiring exam or assignment answers or questions.
- Taking an exam for someone else or having someone take an exam for you.
- Finding and using another student's solution to a similar project.
- Performing any act designed to give unfair advantage to a student or the attempt to commit such acts.

I prosecute cheating cases to the full extent. I have a general policy that I adhere to in isolated instances. When addressing academic dishonesty my policy is to submit a report to the registrar's office (two such reports across any courses at ISU can result in expulsion from the university). Besides this report, I give students two choices. The student can simply fail all assignments/exams where academic dishonesty was an issue and then continue to work through the course. The second option is to fail and repeat the course. Simply withdrawing after having been caught for academic dishonesty is not a viable option. If you choose to stay in the course, you will receive a 0 on all assignments where academic honesty was an issue (based on your integrity in letting me know or based on me finding evidence of dishonesty). I do not mean to sound gruff. I do not wish to discourage students from learning, growing, and moving on from such experiences. I will support students however they wish to proceed. Incidents with academic dishonesty do not change my eagerness to support your learning and your success.

CoSE X grade policy

In the College of Science & Engineering, a student who earns a failing grade via course work (exams, homework, etc.) and has unexcused absences that total more than 30% of class meetings will receive a grade of "X".

Classroom Etiquette

To facilitate a productive learning atmosphere, it is expected that students will be punctual, regularly attend class, maintain a positive attitude, use appropriate language, and show respectfulness to other students and the professor. Students are expected to come to class prepared, participate in activities and discussions, and treat others with respect in the classroom, which includes listening interactively to classmates and the professor, and respecting others' viewpoints. Students should expect frequent and personal invitations to participate in course lectures.

Open laptops and phones are not allowed except for the purpose of taking notes. Please do not text, check social media sites, or eat meals during class.

Students are expected to arrive for class and be in their seats by the scheduled beginning of class. Repeatedly coming to class late disrupts the teaching/learning environment in the classroom and adversely affects the other students in the class.

Accessibility

Our program is committed to all students achieving their potential. If you have a disability or think you have a disability (physical, learning disability, hearing, vision, psychiatric) which may need a reasonable accommodation, please contact Disability Services located in the Rendezvous Complex, Room 125, 282-3599 as early as possible.

Personal Health and Well-Being

Success in this course depends heavily on your personal health and wellbeing. Recognize that stress is an expected part of the college experience, and it often can be compounded by unexpected setbacks or life changes outside the classroom. I encourage you to reframe challenges as an unavoidable pathway to success. Reflect on your role in taking care of yourself throughout the term, before the demands of exams and projects reach their peak. Please feel free to reach out to me about any difficulty you may be having that may impact your performance in this course. If you are experiencing stress in other areas of your campus life, I am happy to help you get in contact with other resources on campus that stand ready to assist you. In addition to your academic advisor, I strongly encourage you to contact the many other support services on campus that are available.

Counseling and Testing Service

ISU Counseling and Testing Services (CATS) would like to remind all students who are enrolled in the current semester (part-time or full-time) they are eligible for free, confidential counseling services. CATS offers individual, group, and couples counseling, as well as Biofeedback Training. We also offers crisis intervention services Monday through Friday from 8-5.

To establish services:

- Pocatello: Call 208-282-2130, Monday – Friday from 8am – 4pm. Office is located at Graveley Hall, 3rd floor of the south side. Walk-ins are welcome Monday-Friday from 8am - 4pm.
- Idaho Falls: Bennion Student Union, 2nd floor, Room 223. Please call 208-282-7750 to schedule an appointment.
- Meridian: Counseling services are available to Meridian students through the ISU Counseling Department. Please call 208-373-1719 to schedule an appointment.
- Out of State ISU Students: ISU Counseling and Testing Service has partnered with LifeWorks, Inc. to bring the MySSP tool to ISU students while they are physically out of the state of Idaho. Through MySSP, students can access health assessments, real-time chat support, and free counseling from licensed mental health professionals. Connect with My SSP by calling 1-866-743-7732 or visiting us.myissp.com. If calling from outside North America: 001.416.380.6578. Download "My SSP" from the app store to use on your phone.

Preventing & Responding to Sexual Misconduct

In accordance with Title IX of the Education Amendments of 1972, Idaho State University prohibits unlawful sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment—including sexual violence—committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university.

University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator (visit <https://www.isu.edu/aaction/title-ix-notice-of-non-discrimination> for contact and other information).

Academic Freedom and Responsibility

In carrying out its educational mission, Idaho State University is committed to adhering to the values articulated in Idaho State Board of Education Policy III.B. Membership in the academic community imposes on administrators, faculty members, other institutional employees, and students an obligation to respect the dignity of others, to acknowledge the right of others to express differing opinions, and to foster

and defend intellectual honesty, freedom of inquiry and instruction, and free expression on and off the campus of an institution.

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