

COMP 375: Computer Networks (Spring 2024)

Course Syllabus

Course Instructor

Dr. Sat Garcia¹

- **Office:** Guadalupe Hall (GH) 104
- **Email²:** sat@san Diego.edu

Course Meeting Times

Section 01

	Days	Time
Lectures	MWF	11:15am - 12:10pm
Labs	M	2:30 - 3:50pm

Section 02

	Days	Time
Lectures	MWF	1:25 - 2:20pm
Labs	W	2:30 - 3:50pm

Office Hours

Schedule

Day	Time
Monday	10 - 11am
Tuesday	3 - 4pm (Zoom Only)
Wednesday	10 - 11am 4 - 5pm

¹ Please feel free to call me Dr. Sat or Dr. Garcia. Please don't call me "Professor Garcia."

² I highly prefer to communicate via CampusWire. You are much more likely to quickly get an answer if you send questions through CampusWire. Read onward for details about CampusWire!

Day	Time
Thursday	By appointment only
Friday	3 - 4pm

I also welcome individual meetings by appointment. Send me a note or talk to me in class to schedule a time.

Locations:

- **In Person:** Guadalupe 104
- **Remote (Zoom):** [Dr. Sat's Meeting Room](#)

I will be holding hybrid office hours this semester. This means that some office hours will be in person while others will be remote-only.

Course Goal

Computer networks play a large role in today's society. While you've likely had plenty of experience using computer networks (and maybe even configuring them), what you may not understand is the tremendous complexity that is involved in designing a fully functional network. This class will introduce you to the design of computer networks, starting from the application's view before working down to the layer of physical devices. With this knowledge you will be able to design your own network-based applications and understand the factors that affect their performance and security.

Course Learning Outcomes

At the end of this course you should be able to...

1. Describe the role of each layer in the computer networking stack and provide examples of protocols used by each layer.
2. Select the best networking protocol to use given a set of requirements.
3. Design and implement applications that use sockets for network communication.
4. Utilize concurrency to write high-performance network applications and protocols.
5. Select the most appropriate protocol(s) to meet a given set of network application security requirements.
6. Use a network packet analyzer to identify bugs or vulnerabilities in network applications or protocols.

Online Course Components

Website: [Canvas](#)

Log in with your MySanDiego username and password. You will be able to find important announcements and monitor changes to the course through the website. Please check it often.

Discussion Site: [CampusWire](#)

CampusWire is a fantastic site that enables everyone in class to quickly ask and answer questions. Please make CampusWire your first stop for asking all class-related questions: it is much faster than waiting for me to reply to your emails and there is no better feeling than having the instructor endorse one of your answers to another student's question.

The more that everyone uses CampusWire, the more useful it becomes so please use it regularly. You may be intimidated to post to online forums, especially if you are afraid that your question is "silly." Have no fear though: you won't be judged as there are no silly questions. If you are still nervous, CampusWire has you covered: you can post anonymously.

CampusWire makes it much easier for me to keep track of "Unresolved questions" and therefore I highly prefer all course communication to go through there instead of email. Please don't be offended if I redirect your email questions to CampusWire: most questions are of interest to your classmates as well. If you don't want anyone but me to see your question, CampusWire allows you to make questions/notes as private so that only I can see them. You may also send me a direct message (DM) through CampusWire if you need to chat about anything.

CampusWire also has topical chatrooms, ranging from the serious (chat about your class assignments) to whimsical (share your favorite memes or comics in the meme chatroom). You can also create your own private chat rooms in case you and a group of classmates want to have a safe space to chat together. Unless I am invited, I will not be able to see anything you post in those private rooms.

Neither I nor your classmates will tolerate abusive online behavior so please keep your discussion civil.

Course Materials

Required Textbook: *Computer Networking: A Top-Down Approach*, 8th Ed., James F. Kurose and Keith W. Ross.

While there are a number of good computer network textbooks, this one has the advantage of starting from the *top* of the networking stack: the application layer. This means we'll start our discussion of networks with protocols you are familiar with but of which you likely don't know the details, e.g. the HTTP (i.e. web) and SMTP (i.e. email) protocols.

As with any computer science textbook, it is important you approach the textbook with the right mindset. Here is some general advice for getting the most from the textbook:

- Don't fall into the trap of using ineffective study techniques. Among the **worst** practices are highlighting/underlining and rereading. See [this Time Magazine article](#) that describes a major 2013 report from the Association for Psychological Science about which study techniques are effective and those that aren't.
- Speaking of study techniques, I highly recommend the [SQ3R](#) approach to reading comprehension. SQ3R is a highly effective study technique that improves retention and will reduce the stress typically experienced near quizzes and exams.
- Break your reading up into short bursts and take a nap after reading. Many studies show that you can greatly increase your ability to remember things by taking a 10-20 minute nap after reading³.

Classroom Clicker: We will be using clickers to enhance learning during class meeting times. Clickers allow me to instantly receive feedback from you and your classmates, helping me to tailor each class to address misunderstandings. For this class, you may use either the iClicker Student App **or** a physical clicker device (iClicker+ or iClicker2). The app works either as a mobile app (Android and iOS) or as a webapp through any browser. The app has the advantage of being slightly cheaper (\$15 vs \$25 for the semester) but it also makes it easier to get distracted in class, which will harm your learning.

You will receive participation credit for answering clicker questions so please make sure you have the app or a physical clicker available during all classes.

Tentative Schedule of Course Topics

Below is a list of topics that I expect to cover during the course. It is tentative and subject to change based on how we progress throughout the semester.

1. Layered Network Model
2. HTTP: Hypertext Transfer Protocol (Web)
3. SMTP: Simple Mail Transport Protocol (Email)
4. DNS: Internet Directory Service
5. Peer-to-Peer (P2P) Applications
6. UDP: University Datagram Protocol
7. TCP: Transmission Control Protocol
8. Network Congestion Control
9. The Internet Protocol (IPv4 / IPv6)
10. Routing Algorithms
11. Error Detection & Correction

³ See ([Simon, 2012](#)). Another interesting study showed that you can improve your memory by taking a nature walk or simply by looking at pictures of natural landscapes ([Berman et al, 2008](#)). Isn't evolutionary psychology amazing?

12. Public Key Cryptography
13. Message Integrity / Digital Signatures
14. Authentication
15. Network Security

A detailed schedule that will be updated regularly is available [here](#).

Grading Overview

The university forces me to give out grades at the end of the semester⁴. I would like to make the grading process as painless as possible and as such I have tried to develop a grading system that is both fair and transparent. Towards this end, this course will use what is called *specifications grading*. You may remember this grading system from my COMP 280 or COMP 300 courses.

Rather than grading based on points, each grade level has a set of associated requirements that must be completed in order to earn that grade. To earn a “D” (the lowest passing grade in this course), you will need to meet some minimum set of requirements. For each grade level above that, you will have additional requirements. It is essentially up to you to decide the grade that you want and to work on meeting the specified requirements for that grade.

Below is the set of requirements for each grade level. In the following sections, more detail will be given about each of the types of requirements.

Please keep in mind that you must meet **all** of the requirements for each level in order to obtain that grade. Failure to meet one of the requirements for a given grade level will result in you receiving the grade level for which you did meet all of the requirements. Note that this may not be the next lowest grade level (e.g. failing to meet one requirement for C+ does not necessarily mean you will get a C). Failure to meet *any* of the requirements for a **D** will result in you receiving an F for the semester.

For a **D** in this course you **must**:

- Pass project #1.
- Pass **2** of the 4 mini projects.
- Achieve a mean grade of **50%** or above across all exams.
- Achieve a mean grade of **50%** or above across all in-class quizzes.
- Miss no more than **9** lecture sessions. Be on time and prepared for all other sessions.
- Miss no more than **3** lab sessions. Be on time and prepared for all other sessions.

For a **C-** in this course you **must**:

- Complete **all** requirements of the D level.

⁴ This is probably my least favorite part of being a professor.

- Achieve a mean grade of **55%** or above across all exams.
- Achieve a mean grade of **55%** or above across all in-class quizzes.
- Pass **50%** or more of the reading comprehension quizzes.

For a **C** in this course you **must**:

- Complete **all** requirements of the C- level.
- Pass **1** project from the “Additional” project bundle.
- Achieve a mean grade of **65%** or above across all exams.
- Achieve a mean grade of **60%** or above across all in-class quizzes.
- Pass **65%** or more of the reading comprehension quizzes.
- Miss no more than **6** lecture sessions. Be on time and prepared for all other sessions.

For a **C+** in this course you **must**:

- Complete **all** requirements of the C level.
- Pass **3** of the 4 mini projects.
- Achieve a mean grade of **65%** or above across all in-class quizzes.

For a **B-** in this course you **must**:

- Complete **all** requirements of the C+ level.
- Achieve a mean grade of **70%** or above across all exams.
- Pass **2** projects from the “Additional” project bundle.
- Pass **75%** or more of the reading comprehension quizzes.
- Miss no more than **5** lecture sessions. Be on time and prepared for all other sessions.
- Miss no more than **2** lecture sessions. Be on time and prepared for all other sessions.

For a **B** in this course you **must**:

- Complete **all** requirements of the B- level.
- Achieve a mean grade of **70%** or above across all in-class quizzes.

For a **B+** in this course you **must**:

- Complete **all** requirements of the B level.
- Pass **all 4** of the mini projects.
- Achieve a mean grade of **75%** or above across all exams.

For an **A-** in this course you **must**:

- Complete **all** requirements of the B+ level.
- Pass **3** projects from the “Additional” project bundle.
- Achieve a mean grade of **75%** or above across all in-class quizzes.
- Pass **80%** or more of the reading comprehension quizzes.
- Miss no more than **4** lecture sessions. Be on time and prepared for all other sessions.

For an **A** in this course you **must**:

- Complete **all** requirements of the A- level
- Achieve a mean grade of **80%** or above across all exams.

As much as I hate to admit it I do occasionally make grading mistakes. If you happen upon such an error (e.g. incorrect or missing grade), let me know in writing within a week of posting and I will fix the error⁵. After one week the grade will become *immutable*.

Grading Details

This section contains details about the various components of grading in the course.

Projects

I have selected projects that will provide an opportunity to acquaint yourself with a variety of protocols in the network stack, from top to bottom. Projects will require systems programming in a Linux environment using several different programming languages (C, C++, and Python).

I've also tried to choose projects that are interesting and—dare I say it—*fun*! I would love to hear your feedback on how you enjoy each project and welcome your ideas for other fun, interesting projects.

A word of warning: each of the projects will require a **significant** time commitment to complete. You should think carefully about whether you are prepared to invest the time necessary to pass a project before starting it. A few of these projects may be the most difficult programs you have ever had to develop.

The assigned projects will exercise the skills you developed in COMP 280, especially debugging with GDB and Valgrind. If you are having a tough time remembering how to use those programs, check out my COMP280 [lab 02](#) and [lab 03](#), where I first introduce those tools.

Project Categories

Projects have been bundled into two separate categories: “Core” and “Additional.” Completing the “Core” bundle will provide you the minimum background needed to be considered competent in this subject area. Projects in “Additional” bundle will exercise some skills that are not part of the “Core” projects while delving deeper into some of the skills that were part of the core.

Below is a list of the projects that are part of each bundle.

Core Bundle:

- Project 1: Reverse Engineer a Network Application

⁵ Please be nice about it: my ego will probably be bruised from realizing I made a mistake.

Additional Bundle:

- Project 2: ToreroServer (A Lean Web Server)
- Project 3: Iterative DNS Resolver
- Project 4: Reliable Data Transport
- Project 5: Internet Jukebox

Mini Projects

Throughout the semester, there will be several mini projects. These projects are designed to be completed mostly within one lab session, and will focus on developing distributed (i.e. networked) software. They will be due one week after the lab in which they were first released.

Project Grading

Projects will be graded as pass/fail. For a project to pass, it must successfully meet **all** of the specified requirements. These requirements may include not only specific features (e.g. your program must print X when Y is input) but also software engineering and design guidelines (e.g. code must be adequately commented).

A small number of minor problems (e.g. small bugs) will be tolerated. However, missing features or requirements will result in a failing grade for the project.

Project Deadlines

We will work at a brisk pace in this course so it is important for you to stay on top of your assignments and submit them on time. Late submissions will **not** be accepted.

I realize that you likely have a full schedule of classes and sometimes it is not possible to submit everything on time. To accommodate your sometimes hectic schedule I will give you 5 “comp375 bucks” to spend throughout the semester. You can spend a course buck on projects in one of two ways: to extend a project deadline by one week **OR** to receive a one week period to resubmit a project that failed. The resubmission option will **only** be available when your original submission failed only a few requirements, with the one week deadline starting after the project has been graded.

Note that if you spend one buck to receive a deadline extension, you do not also need to spend a buck to resubmit if it failed (again, only a few requirements). In other words, at most you will only ever need to spend one buck on any given project.

IMPORTANT: comp375 bucks may not be spent on mini projects, which will have a hard deadline of one week after the lab in which they are assigned.

Collaboration

Most of the projects will *require* you to work with a partner. For these projects you are expected to employ the “pair programming” methodology. Pair programming does not mean, “You do this project and I’ll do the next one.” Pair programming means actively

working together on a single problem in the same room, using the same computer. In pair programming one person is the *driver* while the other is the *navigator*. The driver operates the keyboard and mouse while the navigator checks what the driver is doing and offers input about what to do next. These two roles should switch periodically with equal time spent on each role. Here is a somewhat [cheesy video](#) that provides an overview on pair programming, including some tips for making it work effectively for you.

Please remember that it is your responsibility to understand all of the code that you submit. Several projects may include an interview component that will require both group members to demonstrate their mastery of the group's work. If it is apparent that one person did most or all of the work, I will penalize **all** group members.

You should **never** share code with anyone except with your partner on partner-based assignments, doing so is a breach of academic integrity. Sharing code is not limited to sending a file: it also includes letting them examine your code while its on your screen and dictating to them the code that they should use. You should however feel free to discuss important course concepts with your classmates as long as you do not give away solutions for an assignment. If you are unsure whether it is OK to discuss a particular topic, please contact me but err on the side of caution until you receive a definitive answer.

Seeking Help

I will try to include links to useful outside resources (e.g. tutorials on websites) for each project. In general you should limit yourself to these resources. If you still feel like you need help with specific aspects of a project, the following is a list of suggested resources.

1. **CampusWire:** Someone may have already asked a question about the same problem. If not, please ask a new question.
2. **Office Hours:** I will gladly provide more guidance on the projects if you come see me during office hours.
3. **Classmates:** As noted in the collaboration section above, you may discuss *high level* details of the projects with your classmates.
4. **StackOverflow:** StackOverflow is a useful site for working professionals and but can be problematic when it comes to use in class. Feel free to use it to help you decipher error messages you are getting, but if you find yourself copying code from there without understanding what it is doing, you are only harming yourself (and likely your partner).
5. **Google/Misc. Websites:** ***ONLY USE THIS IF YOU HAVE EXHAUSTED ALL OTHER RESOURCES! See note below.*** In the spirit of openness, you **MUST** disclose any online resources you use. If you found a website particularly useful in helping you understand a concept, share it with your classmates by making a new post about it in CampusWire.

Under no circumstances should you consult outside resources that contain solutions, tutorials, guides, or tips on how to complete a specific project or portion of a project. Use of

these types of resources is considered a breach of academic integrity and will be handled accordingly.

Exams

There will be three major exams in this course: two midterm exams and a final exam. The midterm exams are *tentatively* scheduled for Monday, March 4 and Monday, April 15, both during our regularly scheduled class meeting time. The final will be in our normal meeting room and is *definitively* scheduled for the following times:

- **Section 01:** Friday, May 17, 11:00am - 1:00pm
- **Section 02:** Friday, May 17, 2:00 - 4:00pm

Each exam may cover all learning objectives up to (and including) the class session before the exam. For exams, you will usually be allowed to use a limited amount of handwritten or printed material. Unless explicitly authorized in writing by the instructor, you may not receive any kind of external help on an exam.

Each exam will be weighted equally when calculating your exam average. You will be able to use your “comp375 bucks” to submit exam corrections for the midterm exams. Details will be given after each exam is graded.

A serious illness, a death in the family, and other traumatic events are unfortunately part of life. If you contact me within 24 hours with documentation, I will make an arrangement to make up for your missed exam. This arrangement may include taking the exam later or re-weighting other components of your grade to compensate for the missed exam. Otherwise, exams must be taken on time.

Quizzes

We will have a quiz approximately once per week. The quizzes will be announced *at least* one day before they occur, but a tentative date for all quizzes is given on our detailed course schedule. The quizzes will give you a chance to test what you have learned over the past week. They will also help you prepare for the exams.

Quizzes are scheduled to take place at the beginning of lecture but depending on circumstances, they may also be administered asynchronously.

As with class participation, I realize that occasionally you will not be able to attend class. **Your lowest quiz grade of the semester will be dropped** so if you miss one quiz this semester, it will not count against you. Missing more than one quiz may lead to you falling behind so you should talk to me if that occurs.

You will be able to use your “comp375 bucks” to “redo” a quiz at the end of the semester. A redo will cover the same content as the original quiz but with modified questions. Details will be given later in the semester.

Class Participation

The course will be taught using *peer instruction*, a pedagogical technique that relies heavily on active participation by all students during lecture. Lectures are designed to illuminate common misconceptions with the material and not just to summarize/rephrase what is in the textbook. Attending every class and actively participating puts you in a strong position to succeed in this course.

I realize that smartphones are now ubiquitous and that you likely have one with you at all times. Resist the urge to use your phone in class⁶. Not only does it hurt you—many studies have shown students who text in class get lower grades than those that don't—it is also disrespectful to both your classmates and me. If I notice that you are ignoring classmates during discussion in favor of using your phone, I may ask you to leave.

I will try to record all lecture meetings, so you can view them later if needed. If you are experience cold, flu, or COVID-like symptoms, you should stay home and watch the recordings later. You may also contact me in advance of lecture and I will try to arrange for you to watch the lecture live via Zoom.

Participation Credit

One of the grading requirements involves participating by answering multiple choice questions in class. You will receive credit for each class where you answer *at least* 75% of all clicker questions, regardless of whether your answers were correct or not.

Occasionally events arise that make it so that you cannot attend class. If such an extenuating circumstance arises, please send me a DM on [CampusWire](#) before class to let me know you will not be in attendance. If you miss more than two consecutive classes without telling me, I will get worried and likely reach out to you to check on your well-being.

Each grade level has different attendance requirements, from up to **6** missed lecture sessions allowed for the C level down to only **3** absences allowed for A- and above. Any more than **6** missed lecture sessions (or **3** lab sessions) is an indication that you are not regularly taking part in class and therefore will receive a failing grade.

In-class Collaboration

You will be working closely with your classmates during lecture. You should expect them to fully participate in group activities so please offer them the same courtesy. This will require that both you and they perform all the assigned pre-class activities (e.g. readings). You may find that many times you are unsure of the correct answer. This is 100% expected so please don't let it discourage you from letting others know what you are thinking: you likely have a lot more to contribute than you believe.

⁶ If you need a distraction, you can always do what I did as a student: draw some doodles.

Working in a group can be intimidating, especially if you feel you are not at the same level as other students. Please remember that the other students are probably feeling the same way: one of my goals in getting you to work in groups is to realize that other students are having similar struggles and that you can overcome them by working together. On the flip side: if one of your classmates seems particularly shy, do your best to support them and encourage them to participate.

Reading Comprehension Quizzes

As part of the *peer instruction* teaching style, I will expect you to come to class having demonstrated proficiency in some basic knowledge gained from assigned readings or videos. This will allow us to *actively work* on the most difficult aspects of the material during our meeting times.

Assigned reading will usually be accompanied by a reading comprehension quiz. This quiz will test your proficiency in the material introduced in the assigned reading. These quizzes will assume you have actively engaged in the reading, not simply read the section headings and/or scanned for keywords. I recommend the [SQ3R](#) technique for reading comprehension.

The reading quizzes will be made available on the course website and must be completed by the announced deadline.

Academic Integrity

In this class we will strive to create a supportive environment for all students. As such, you are encouraged to help each other out throughout the semester. However, any assistance you give or receive must abide by the following principle: *all involved parties should grow academically from the assistance*.

Here are a few scenarios that go **against** this principle.

- A student shares their code with someone outside of their assigned group.
- A student helps a student while looking at their own code (or having looked at it within the past 5 minutes).
- A student writes (or dictates) code for another person or group for a non-trivial portion of an assignment.
- A student completes a *significant* portion of a partner-based assignment on their own (e.g. because their partner was sick or was very busy).

Violations of this principle are considered a major violation of academic integrity.

The following are also considered major violations of academic integrity:

- Using generative AI (e.g. ChatGPT) in a way that goes against class policy, as described in the following section.

- Using and/or remixing a solution or walk-through from an external resource such as a website or former student.
- Communicating with others during quizzes or exams.

Most of the time, academic integrity violations are a result of students not managing their time well or dealing with unforeseen events in their lives. It's no fun when I have to report academic integrity violations—and I do report them—so if you feel like you cannot complete something by the deadline or solve a problem, reach out to me. I will do my best to make special arrangements so you can grow and succeed.

Use of Generative AI

Generative AI programs such as ChatGPT are exciting new tools that have the potential to improve our lives in many ways. Just like any tool though, they can be misused to the detriment of ourselves and others. It is therefore important to understand their limitations and potential uses.

While these systems can write code and answer programming related questions, they are subject to frequent “hallucinations”, resulting in incorrect/made up answers. A recent study⁷ found that ChatGPT incorrectly answered software engineering-related questions over 50% of the time and its responses overly verbose. In other words: don't trust the programming-related answers that it gives you.

Also note that these generative AI systems often generate code that will be inscrutable to you because it uses advanced syntax or techniques that are not covered in this class. This will make it nearly impossible for you to debug or even integrate into the rest of your code.

If you do use these systems to help with programming assignments, note the following important limitations:

1. You are **required** to indicate which lines of code were either directly or indirectly generated by AI, using comments inside of your code. By indirectly, I mean using AI to generate code and using that code as a template/guide/model for your own code. Failure to cite the use of generative AI is considered plagiarism.
2. You may **not** use *any* code that uses language features or libraries that were not discussed in class.
3. *No more than* 15% of your submitted code may be AI-generated *or* based on code that was AI-generated.
4. You must be able to adequately explain any code that you submit that is either directly or indirectly generated by AI. This ensures that you are using AI to help you understand how to do something, rather than simply using it to generate solutions.

⁷ [ChatGPT answers more than half of software engineering questions incorrectly](#)

Note that you are **not** permitted to use generative AI to produce answers to reading quizzes or any other non-programming assignments.

Additional Information

The last day to select the pass/fail option is Monday, April 8. The last day to withdraw from the course *without* a W is Wednesday, February 7. The last day to withdraw from the course is Wednesday, April 10.

A grade of incomplete will be assigned only if there is a serious, documented reason that prevents you from completing the requirements of the course. Getting a low grade or falling behind is not a sufficient reason.

The only exceptions to the rules regarding no late assignments are extended absences (one week or more) due to verifiable extraordinary circumstances, and absences due to official USD activity travel. In the case of absences due to a USD activity travel, you must give me as soon as it is available a list of your travel dates.

If because of a disability you need special consideration from me in this class, contact disability services (Phone (619) 260-4655, Saints Hall 300) as soon as possible and bring me the authorization paperwork you receive.

Changes to Syllabus

It is possible that the course will evolve in exciting and unexpected ways, resulting in a need to modify the syllabus during the semester. I will make announcements about any non-trivial changes within a day of the changes.