

SER321 Principles of Distributed Software Systems

Catalog Description

Design and implementation of distributed software components; process and memory management underlying software applications; sockets, protocols, threads, XML, serialization, reflection, security, and events. (3 credits)

General Information:

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|-----------------------------|---|
| Instructor | Alexandra Mehlhase, a.mehlhase@asu.edu, (480) 727-4671(email preferred) |
| Office Hours | on appointment please send me a message on Slack |
| Schedule Line Number | 44672-44671 |
| Class Website | Canvas |
| Communication | Slack (Synchronous hours same as office hours.) |
| Final Exam Date | Jul 8-10th, 2023 via HonorLock |

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|---------------------------|---|
| Course Coordinator | Alexandra Mehlhase, a.mehlhase@asu.edu, (480) 727-4671(email preferred) |
| Office Hours | Mo/Wed 12-1pm |

Course Outcomes:

The outcomes of this course are the following:

1. Students are able to design and develop distributed applications that apply the concepts of concurrency, asynchronous behavior, threads, and shared data synchronization using software engineering best practices. Program Student Outcome supported: SER2.
2. Students are able to use the fundamental program development tools available on Linux: (1) Command-line interpreter, (2) compiler, (3) debugger, and (4) build-tools to develop, test, and deploy distributed applications. Program Student Outcome supported: SER1.
3. Students are able to develop distributed applications consisting of multiple classes, multiple programs, such as client-server, and utilizing pre-existing libraries/frameworks (such as JSON, TCP/IP Sockets, and Threads). Program Student Outcome supported: SER1.
4. Students can apply serialization: (1) binary and text based (1) language built-in, (2) Understand the role serialization plays in distributed applications; are able to utilize serialization in developing distributed applications. Program Student Outcome supported: SER1.
5. Students are able to apply common distribution paradigms appropriately for solving problems requiring distribution, such as client-server, service-oriented, and peer-to-peer. Program Student Outcome supported: SER1.

Prerequisites

- Ser222 Design and Analysis of Data Structures and Algorithms,
- Pre, or Co-requisite: Ser334 Operating Systems and Networks.
- A desire to learn and participate in class.

It is your responsibility to know the background material defined by the outcomes of these courses. If you did not take these courses recently (as defined by the SE major map), or you did not do well when you took them, you will need to spend time to review the material.

This course will require a lot of programming effort in Java, it is expected that you are proficient in Java.

Please review ASU's Academic Calendar (<https://students.asu.edu/academic-calendar>) for details on important Registrar dates such as: adding/dropping/withdrawing from courses, etc.

You are required to complete the Academic Integrity Agreement quiz on Canvas by the due date or you may be dropped from the course at the instructor's discretion.

Course Structure:

The material in this course is separated into modules. Each module is comprised of instruction (lectures or videos), followed by an individual assignment (to cement the basics). **You are expected to engage using the following flow: Instruction → Analyse/Text Java example code →Assignment**

Course Content

There is significant Java software development required to complete Ser321. Also, the course is structured so you must use fundamental Linux program development tools for program development, testing, and submission. You may not submit an IDE project as the solution to any assignments in this course. The programming and the use of alternative development and build tools requires a significant effort on the part of students. Despite the formal pre-requisites. Version control like Git will also be extremely helpful in this course. Good Java programming skills are required. Budget your time accordingly. For most Software Engineering students, this is the first course that expects students to learn and utilize programming languages without prior formal (in-class) training.

Topics Covered (still subject to change)

1. Prerequisite review and introduction to course objectives.
2. Module 1: OSI Model - Lower/middle layer
 - (a) Distributed Systems: An introduction
 - (b) The OSI Model
 - (c) Lower and Middle Layer of OSI Model
3. Module 2: OSI Model - Upper layer
 - (a) Application layer protocols
 - (b) HTTP, HTTPs, SMTP, FTP
4. Module 3: Sockets
 - (a) Client/Server
 - (b) Serialization
5. Module 4: Threads
 - (a) Multi process
 - (b) Multi threads
6. Module 5: Distributed Algorithms
 - (a) Consensus algorithm
7. Module 6: Distributed Systems
 - (a) Middleware

Course Materials:

Optional Readings Material:

Java Network Programming 4th Edition(O'Reilly) (Links to an external site.) by Elliotte Rusty Harold. This book is commonly available online in pdf format. Java Network Programming & Distributed Com-

puting (Links to an external site.) by David Reilly and Michael Reilly. This book is commonly available online in pdf format.

Slides:

Lecture slides and videos will be made available on Canvas. It is expected that you take notes when watching the videos.

Sample solutions:

Sample solutions and additional material might be provided on Canvas or Slack for discussion.

Sample repository

A GitHub repository with sample programs will be provided, it is expected that you go through these examples and understand them before you proceed to the assignments.

Additional Readings:

Required or optional reading material might be added on Canvas and it will be clearly marked.

Special Instructions:

You will need a second device in this course so we can create distributed systems. We advise using an AWS EC2 instance (free tier should not cost anything) since it will allow everything we will need. There will be explanations how to setup the instance.

Instructor specific rules – these are still subject to change

Communication

This class uses a communication tool called Slack to manage course communications. Please make Slack the first place you look for new information regarding the course. It is expected you will check Slack at least once every day, as will the instructional staff. Do not expect that we will be on Slack outside of office hours, though we may occasionally pop-in to provide help and see how you are doing. Staff will be accessible synchronously on Slack as stated on the Contact Information page on Canvas. In general, office hours will be offered simultaneously face to face, and on Slack/Zoom. During office hours, students across all communication platforms will be assisted in FIFO order. For email and Slack messages outside of office hours, please allow 24 business hours for a response. If you do not get an answer in 24h please send another ping.

Canvas Note: do not use the comment feature on any submission, we do not use it because Canvas does not have a way to track what has been answered. Use Slack or email if you have questions.

Late Policy

All assignments submissions are due at 11:59:00pm (Arizona Time).

Assignment due dates follow Arizona Standard time. Click the following link to access the Time Converter (<http://www.thetimezoneconverter.com/>) to ensure you account for the difference in Time Zones. Note: Arizona does not observe daylight savings time.

Quizzes are due by the given due date no late submissions .

Assignments: Submissions later than 24 hours after the official due date will not be accepted (0 points) not even with the late pass (see later). Submissions after the due date but in the 24hours late range will lead to a 10% point reduction for the assignment. There is one late pass available, which will waive the 10% deduction for a 24h late submission.

Students choosing to submit on the final day of the deadline are fully responsible for any technical issues (including but not limited to: computer, internet, Canvas) that occur.

Late submissions are not given for technical issues. Students are encouraged to submit assignments several days in advance of any deadline. It is also highly suggested that students double check that they have submitted the correct files - students who submit incorrect files will receive a grade based on what they submitted, which is likely to be a zero. Extensions are not permitted only when there is a significant, and documented, event (e.g., illness or personal emergency) that prevents the student from completing the assignment. A notice must be submitted to the instructor before the due date or as soon as circumstances

allow and should also show that the student did not start too late on the assignment and would not have been able to finish it anyway.

No late submissions at all for the last assignment of the course!

Late Pass: A late pass waives the 10% penalty you get when you submit 24 hours late. It does not extend the due date even further. You have ONE (1) late pass that you may use during the semester. To use a late pass you simply write that you want to use the late pass into the comment box on Canvas. We will not apply it without you mentioning it. Submissions later than 24 hours after the initial due date will still not be accepted and will lead to 0 points.

The late pass may NOT be applied to the last assignment in this course.

Grading:

Performance will be assessed by assignments, quizzes and one exam. Their weights are:

| Assessment | Percentage of final grade |
|------------|---------------------------|
| Assignment | 60% |
| Quizzes | 10% |
| Exam | 30% |

The final letter grade will be determined according to the points obtained as follows:

| E | D | C | C+ | B- | B | B+ | A- | A | A+ |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <65% | ≥ 65% | ≥ 70% | ≥ 77% | ≥ 80% | ≥ 84% | ≥ 87% | ≥ 90% | ≥ 94% | ≥ 97% |

I will not round percentages, you get the grade with the percentages as calculated by Canvas.

Extra Credit

Assignments, Projects, Quizzes etc. might include extra credit points but there is no guarantee for it.

Homework Drops

No homework will be dropped.

Assignment Policies

All assignments are individual assignments unless explicitly specified by the instructor.

Read the PDF file on the Assignment page on Canvas for specifics on what your submissions should look like. In addition:

- Double check your submissions to ensure they contain all needed source files (e.g. .java) and that every file requested is attached. It is your responsibility to make sure you submit all the necessary files. If I have to ask you to resubmit something, since it was missing, you automatically lose 10% of the assignment grade and you need to prove that the work was completed before the due date and I reserve the right to not accept the missing files at all.
- We can only grade what we see and what compiles and runs, if it does not then that is on you.

- Additional comments about your submission and mentioning your late pass in case you want to use it, should be added into the comment box during your submission.
- You are allowed unlimited submissions, **only the newest submission will be graded. Make sure ALL files are always included in this submission.** If you try to view the assignment after submitting it from the assignment page rather than Grades, you may cause a new submission to be made. This will override your proper submission!
- You will receive 0 points if your submission does not compile and run (you will receive partial points if parts of the assignments compile). They need to run as specified in the assignment.

Late submissions: For assignments (not project or in class exercises) there is a grace period of 24 hours after the due date in which you can still submit but receive a 10% deduction on the assignment. ONE late pass is available, which allows you to submit up to 24 hours after the due date without penalty. You need to mention that you want to use your late pass in your Canvas submission comment, we will not apply it if you do not mention it. With or without late pass: if you submit later than 24 hours after the due date you receive 0 points (unless there is an emergency which needs to be proven with documentation to the instructor)!

Standard deductions:

- If your program fails to compile out-of-the-box, you will receive 0 points for the programming part. We will not debug your code. You might be allowed to re-submit your code with a bug fix on a case by case bases with a 10% standard deduction.
- If part of the program does not run you will not receive points for the part that does not run, we will not debug and try to make it run. We will only follow our process based on the requirements stated in the assignments.
- If you do not follow the file submission standards/requirement (e.g., the submission contains project files, lacks a proper header, wrong file types, wrong file naming, files submitted in a different format or anything specifically mentioned in the assignment or class), we will deduct 10% off of the project/assignment total.
- If you are not including all the files required we will deduct for this part of the assignment.

Submission through GitHub: You have the option to submit your assignment via GitHub. Your GitHub repository needs to be **private** and you need to invite the grading team (ser316asu). Your repository needs to be called as specified in the assignment with the correct structure. If your repository does not fulfill the above criteria our scripts will not pull it and you will not receive points on it.

It is your responsibility to check that all files that are needed to run the program are on GitHub even if not specified in the assignment. When I clone the repository it needs to compile and run as is.

The collaborator ser316asu needs to be kept as collaborator on this repository and the repository is not to be deleted. In case of appeals or Academic Integrity cases it is required that we have access to the original repository even after classes have ended.

Student Expectations and Responsibilities

A separate Course Policy document will be posted at the beginning of the course which will state some additional expectations and your responsibilities in detail. Please read it carefully. In general I expect:

- students to spend approximately 20 hours a week on this course. This is if you understand the material and have the Java skills required at this level
- students to be able to debug, problem solve and understand their own computer
- students to ask if they need clarifications or help – we cannot help if we do not know you are struggling
- students to submit on time and put in the work

- students to be good team players and be polite helpful during discussions

I expect students to watch the videos. If something is mentioned in the videos but not in writing then I still expect you to take note of it. It is your responsibility to make sure you go through all the content, pay attention and take notes. I advise you to remind each other of important things as well.

Grade Appeals

Students may appeal a scored assessment within **one week** of the grade's posting online, or by the deadline specified by the grade release announcement, whichever is sooner. Appeals are in written form only via the Slack bot /sparky_appeal feature or via email to the instructor. Grade appeals via direct message on Slack might be discarded by the instructor. Appeals must point to specific evidence of why the grade should be revised. Arbitrary "please regrade because I want a higher score" queries will be discarded without a response. The instructor reserves the right to assign a lower score on appeal. For additional information on ASU's grade appeal policy, see <https://catalog.asu.edu/appeal>.

Appeals will only be accepted via the Slack bot /sparky_appeal feature or via email to the instructor (do not contact the TA or Grader).

ASU and Course specific rules

Absence & Make-Up Policies

Students unable to attend class, take exams, or complete assignments due to a medical condition must present a doctor's signed excuse and notify the instructor as soon as the condition affects the student's work.

Accommodations will be made for religious observances provided that students *notify the instructor at the beginning of the semester concerning those dates*. Students who expect to miss class due to officially university-sanctioned activities should *inform the instructor early in the semester*. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences. Please see ACD 304-04, "Accommodation for Religious Practices" and ACD 304-02, "Missed Classes Due to University-Sanctioned Activities" for more information.

Per SSM 201-02, an instructor may drop a face to face student for nonattendance during the first week of the semester. For an online course, a drop may be initiated for students who do not log into the course shell during the first week.

1. excused absences related to religious observances/practices that are in accord with ACD 304-04, "Accommodation for Religious Practices"
2. excused absences related to university sanctioned events/activities that are in accord with ACD 304-02, "Missed Classes Due to University-Sanctioned Activities"
3. Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304-11, "Missed Class Due to Military Line-of-Duty Activities," and SSM 201-18, "Accommodating Active Duty Military"

Classroom Behavior

Cell phones and pagers must be turned off during class to avoid causing distractions. Exceptions may be accommodated for personal reasons with advance approval of the instructor. The use of recording devices is NOT permitted during class.

Students are expected to participate in the educational process and not be a disruptive element with regard to the learning of others. Safety, self-discipline and respect for others are necessary elements in the

educational processes employed in this course. All students should be familiar with the Student Code of Conduct, which can be found at <http://www.asu.edu/studentlife/judicial/>.

Until further notified, per ASU policy, faculty, staff, students and visitors, are required to wear face coverings in classrooms, labs, offices and community spaces.

Please keep 6 feet apart from instructor and from your peers.

Academic Integrity and Copyright Laws

Students in this class must adhere to ASU's academic integrity policy, which can be found at <https://provost.asu.edu/ac>. Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. All engineering students are expected to adhere to the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All work submitted for the course cannot have been submitted for any other course or any previous section of this same course. Student academic integrity violations are reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains record of all violations and has access to academic integrity violations committed in all other ASU college/schools. Specific academic integrity announcements for this class are: The Student Academic Integrity Policy of Arizona State University requires each student to act with honesty and integrity and to respect the rights of others in carrying out all academic assignments. There are a number of actions that constitute a violation of the policy. These actions in this course include, but are not limited to:

1. practicing any form of academic deceit;
2. referring to materials or sources or employing devices (e.g., audio recorders, crib sheets, calculators, solution manuals, or commercial research services) not specifically authorized by the instructor for use during tests, quizzes, homework, and class activities;
3. acting as a substitute for another person in any academic evaluation or using a substitute in any academic evaluation;
4. possessing, buying, selling, or otherwise obtaining or using, without appropriate authorization, a copy of any materials intended to be used for academic evaluation in advance of its administration;
5. depending on the aid of others to the extent that the work is not representative of the student's abilities, knowing or having good reason to believe that this aid is not authorized by the instructor;
6. providing inappropriate aid to another person, knowing or having good reason to believe the aid is not authorized by the instructor;
7. submitting the ideas or work of another person or persons without customary and proper acknowledgment of sources (i.e., engaging in plagiarism);
8. permitting one's own ideas or work to be submitted by another person without the instructor's authorization; or attempting to influence or change any academic evaluation or record for reasons having no relevance to class achievement.
9. exchanging solutions with peers
10. turning in work/code done by someone else or another pair/group
11. copying work/code done by someone else or another pair/group
12. writing code/text together with someone else or with another pair/group (unless expressly allowed by the instructor)
13. submitting work you have done for a previous course (same or different course)

A common question in programming courses is the use of code that is "googled" or found on popular sites such as StackOverflow. Items 5 and 7 pertain to this situation. Most programmers use reference examples, found in print or online. This is fine as a practice but is not acceptable in situations where you are using code to proxy your understanding of the coding concepts applied in that assessment (i.e. lab or in-class activity). First, if you are uncertain if it is allowable or not, verify directly with the instructor before

submitting the assignment. Second, if it is allowable, you are still required to a) adhere to all originating author's constraints on the use and licensing of the code, and b) provide proper attribution (full URL to the code snippet or bibliographic reference to a print item). Failure to do so constitutes a violation of this Academic Integrity Policy.

Students may be allowed to work in small teams on assignment and in-class assessments this will be communicated clearly. Students will also work on a semester long group project. You are to work with your partners and only your partners as directed by the instructor; receiving assistance from anyone else other than your partners, the graders, teaching assistants, approved tutors or the instructor is considered a violation of this Academic Integrity Policy. Further, on any paired/group assessments you remain individually responsible for the entire solution. From an ethics standpoint, you have a professional responsibility to your partner(s) to give your best effort on each assignment/project deliverable. Failure to do so will be considered an ethics violation. Students are expected to communicate to their team and to their instructor if they cannot participate in the team due to an illness (or similar). Not informing your group and just not being available, not contacting them is also seen as ethical violation.

The penalty for an Academic Integrity Violation (cheating) on an in-class assessment or lab/assignment will be a reduction of a course letter grade for the first offense, and failure of the course for a second offense. The penalty for an Academic Integrity Violation (cheating) on an exam is immediate failure of the course. The penalty for an ethics violation will be a zero for the assessment. All violations will be referred to the Dean's Office of the Ira A. Fulton Schools of Engineering.

Students should not release (to GitHub, friends, etc.) any of their completed assignments, in order to ensure that they do not cause an AIP violation during a future semester. If a student in a later class submits your work, you and they will be held accountable.

Student CopyrightResponsibilities

The contents of this course, including lectures and other instructional materials are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions by students is prohibited, except as part of an accommodation approved by the Disability Resource Center. (see ACD 304-06, "Commercial Note Taking Services" and ABOR Policy 5-308F.14for more information) You may not post any course material (including but not limited to slides, exercises, and assignments), even excerpts, to an external site without the instructor's written permission. If this occurs, you may be penalized for Academic Dishonesty or IP infringement.

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy against threatening behavior, per the Student Services Manual, SSM 104–02

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services. Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU disabilities resource Center and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in sufficient time for it to be properly arranged.

See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities.

Harassment and Sexual Discrimination:

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at .

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling> is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, .

Change Notice:

Any information in this syllabus may be subject to change with reasonable advance notice.