

SCUPI CS0449 Introduction to Systems Software (Spring, 2023-2024)
Syllabus

1 General Information

Lectures: **01-Thursday** 19:20-21:55 PI 212
 02-Friday 08:15-11:00 PI 212

Instructor: Dr. CHEN Yanru, chenyanru@scu.edu.cn

Office: Rm **317B**, Zone 3, Liberal Arts Building at Jiangan Campus

Office hours: Available every Friday 11:00 to 17:00 (**Please check BB for any updates**);
 Feel free to reach out at any time!

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2 Course Information

2.1 Description

The Introduction to Systems Software (CS0449) course is designed to teach you the vital concepts underlying computer systems as computer scientists, engineers, and programmers. It aims to enhance the understanding of how hardware, operating systems, compilers, and networks interact and influence the performance and correctness of application programs. Unlike traditional courses, this course focuses on high-level models of modern out-of-order processors, offering comprehensive insights into system software without delving into low-level architecture. This course provides a strong foundation for both programming and system development, adaptable for a 17-week semester.

2.2 Prerequisite:

CS 0445 Data Structures; CREQ: CS 0447 Computer Organization and Assembly Language

2.3 Course Objectives

This course begins with the creation of executable programs in the C programming language. We will then explore the resultant program as it is stored on disk and as it is loaded for execution. Next, we will examine the interactions between our code and the code provided via libraries or the operating system to facilitate common, low-level tasks. Finally, we will look at the abstractions and resource management undertaken by the OS and its drivers to facilitate communication and hardware interaction.

2.4 Learning outcomes for this course:

- Learning C programming. C is the most common language used for systems software.
- Exploring the layout of an executable programs code and data both as stored on disk and loaded into memory.
- Interacting with the abstractions that libraries and the operating system provide.
- Implementing our own abstractions and managing hardware resources through device drivers.

3 Textbooks

3.1 Primary Reading

- **CSAPP3e**: Randal E. Bryant and David R. O'Hallaron, Computer Systems: A Programmer's Perspective, Third Edition (CS:APP3e), Pearson, 2016.

3.2 Supplementary Reading

- **Practical C:** Oualline, Steve. Practical C Programming. O'Reilly, Sebastopol, CA, 1997. ISBN: 1-56592-306-5.
- **K&R:** Kernighan, Brian W. and Ritchie, Dennis M. C Programming Language. 2nd Ed. Prentice Hall PTR, 1988.
- **Misurda:** Jonathan Misurda. Introduction to Systems Software (online). https://people.cs.pitt.edu/~jmisurda/teaching/cs449/cs449_latest.pdf
- **ALP:** Mark Mitchell, Jeffrey Oldham, and Alex Samuel, Advanced Linux Programming (online). <https://ia800700.us.archive.org/22/items/ost-computer-science-advanced-linux-programming/Advanced%20Linux%20Programming.pdf>
- **LDD3:** Jonathan Corbet, Alessandro Rubini, and Greg Kroah-Hartman, Linux Device Drivers, Third Edition (online). <https://lwn.net/Kernel/LDD3/>
- **C Notes for Professionals:** The C Notes for Professionals book is compiled from Stack Overflow Documentation by GoalKicker.com (online). <https://goalkicker.com/CBook/>

4 Schedule

The weekly topics may be adjusted based on class progress. They serve as a guide for your primary reading and supplementary reading, helping you to concentrate on specific concepts.

Week	Date	Topic	Primary Reading	Assignment Timetable
1	0229/ 0301	Intro to the Course	CSAPP3e: Chap 1	
2	0307/ 0308	Representing and Manipulating Information 1	CSAPP3e: Chap 2.1-2.2	Assignment 1 release
3	0314/ 0315	Representing and Manipulating Information 2	CSAPP3e: Chap 2.3-2.5	
4	0321/ 0322	Machine-Level Representation of Programs 1	CSAPP3e: Chap 3.1-3.5	
5	0328/ 0329	Machine-Level Representation of Programs 2	CSAPP3e: Chap 3.6-3.7	
6	0404/ 0405	Review		A1 due on 0403, Assignment 2 release
7	0411/ 0412	Machine-Level Representation of Programs 3	CSAPP3e: Chap 3.8-3.12	
8	0418/ 0419	Optimizing Program Performance	CSAPP3e: Chap 5	
9	0425/ 0426	Midterm Exam (to be determined...)		
10	0502/ 0503	Review		A2 due on 0501, Assignment 3 release
11	0509/ 0510	The Memory Hierarchy 1	CSAPP3e: Chap 6.1-6.3	
12	0516/ 0517	The Memory Hierarchy 2	CSAPP3e: Chap 6.4-6.7	
13	0523/ 0524	Linking	CSAPP3e: Chap 7	
14	0530/ 0531	Exceptional Control Flow	CSAPP3e: Chap 8	A3 due on 0529, Assignment 4 release
15	0606/ 0607	Virtual Memory 1	CSAPP3e: Chap 9.1-9.3	
16	0613/ 0614	Virtual Memory 2	CSAPP3e: Chap 9.4-9.12	A4 (Group Assignment)
17	0620/ 0621	Final exam (to be determined...)		

5 Grading Policy

5.1 Grading Structure

- Attendance: 5%
- Recitation: 15%
- Assignment: 30% (4 assignments; We will drop your lowest score, counting the best 3.)
- Midterm Exam: 20%
- Final Exam: 30% (The course includes two exams: a midterm and a final, with both being closed book and notes. For each exam, you're allowed one double-sided A4 size sheet of notes, which must be in English and exclude pre-worked problems. Calculators and electronic aids such as smart watch and phones are not permitted.)

5.2 Bonus Points

While attendance only constitutes 5% in grading structure, it can still positively influence your grade. We will selectively raise individual grades as bonus points based on factors like class interaction & participation, individual improvement throughout the semester, & special roles like course representation. For example, we will have random in-class quiz, providing an opportunity for students who want to boost their grades. Therefore, attending classes is highly recommended.

5.3 Grade Rebuttal

Regrading requests are permitted, but they involve reevaluating the entire work, potentially altering the grade up or down. Requests must include the work and a typewritten paragraph explaining the perceived error, citing relevant references. It has to be made in a physical hardcopy, not via verbal, emails or digital social media. These must be made within one week of receiving the grade, with no exceptions to this deadline. This policy is designed to correct honest grading mistakes and prevent unnecessary requests, maintaining fairness across the class.

5.4 Late Submissions

- Assignments are due by 11:59pm on due date, and only the latest submission is graded.
- Late submissions face a 10% penalty per day.
- You have 3 grace days for the entire course to accommodate emergencies like computer issues, personal matters or high workload periods. We advise conserving them for more challenging tasks later in the semester. Grace day usage is as follows:
 - Grace days are automatically applied until depleted.
 - If you submit 1 day late with grace days left, you'll use 1 grace day automatically & avoid penalties. Submissions beyond grace days incur a 10% daily penalty.
 - No submissions are accepted 5 days overdue or after answer is given in tutorial.
 - If you encounter a significant, ongoing personal issue like long-term hospitalization where 3 grace days cannot help, please promptly inform your advisor and instructor *before the deadline*, as such situations often affect performance in all courses.

6 Academic Integrity

Students are expected to maintain honesty and ethical standards in academic work. Violations will be addressed and lead to disciplinary actions under University's Academic Integrity Policy. Regarding exams, cheating is absolutely forbidden. This includes using unauthorized materials, plagiarism, or viewing others' solutions. Regarding assignments & recitations, copying is not allowed. While you may study together, discuss & share insights with friends, but it is prohibited from copying others' work. It's crucial that you work *independently* with original submissions. Any uncertainties about what constitutes cheating should be clarified with instructor. Thanks you!