

California State University Stanislaus
Department of Computer Science
Syllabus

Instructor: Dr. Xuejun Liang

My Office: DBH 282

Office Hours: MWF 1:00 p.m. - 2:00 p.m.

Phone : (209) 667-3169, Email : xliang@cs.csustan.edu**Class Information:**

Classroom: DBH 103

Class Date & Time: TR 2:00 p.m. – 3:15 p.m.

Class Website: <https://www.cs.csustan.edu/~xliang/Courses2/CS4300-22F>

Class Server: wozniak.csustan.edu (You can use PuTTY to remote login.)

Catalog Description:

CS4300 Compiler Theory. (3 Units) Pre-requisites: CS 4100. Lexical, syntactic, and semantic analyses and syntax directed translation of programming languages. Includes symbol table construction, error diagnostics, and code generation.

Required Textbook:

[Compilers: Principles, Techniques, & Tools , 2/E](#), by Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, Addison Wesley, 2007. ISBN: 9-780-321-486-813

Reference Books:

1. Compiler Construction: Principles and Practice, by Kenneth C. Louden, PWS Publishing Company, 1997
2. flex & bison: Text Processing Tools, by John Levine, O'Reilly Media, Inc., 2009
3. Modern Compiler Implementation in Java, 2/E, by Andrew W. Appel and Jens Palsberg, Cambridge University Press, 2002
4. Modern Compiler Implementation in C, by Andrew W. Appel and Maia Ginsburg, Cambridge University Press, 2004
5. Advanced Compiler Design and Implementation, by Muchnick Steven, Morgan Kaufmann, 2008
6. Engineering a Compiler, 2nd Edition, by Keith Cooper and Linda Torczon, Addison Wesley, 2011

Handouts: (Available on Class Website)

1. Cool Reference Manual
2. Tour of Cool Support Code
3. Cool Runtime System

Reference Materials: (Available on Class Website)

4. [Bison manual](#)
5. [Java CUP manual](#)

Course Outcomes:

Students who successfully complete the course must be able to

1. Build a compiler for a (simplified) programming language
2. Utilize compiler construction tools, such as generators of scanners and parsers
3. Apply algorithms for lexical analysis
4. Apply algorithms for LL(1), LR(1), and LALR(1) parsing
5. Select an intermediate representation, translate expressions, and check types.
6. Describe how the compiler create and manage a run-time environment to support execution of its target programs.
7. Describe how the code generator perform instruction selection, register allocation and assignment, and instruction ordering.

Course Outline* (Major Topics and Weekly Schedule)

| Date | Topics Covered | |
|-------------------------|---|------|
| Week 1 8/23, 8/25 | Syllabus and Introduction of the class, The Structure of a Compiler, The Science of Building a Compiler, Compiler Technology, and Programming Language Basics. | Ch1 |
| Week 2 9/30, 9/1 | Introduction to Compiler Frontend: Syntax Definition, Syntax-Directed Translation, and Parsing. | Ch2 |
| Week 3 9/6, 9/8 | Introduction to Compiler Frontend: A Translator for Simple Expressions, Lexical Analysis, Symbol Tables, and Intermediate Code Generation COOL to prepare for PA1 | Ch2 |
| Week 4 9/13, 9/15 | Lexical Analysis: Specification of Tokens, Recognition of Tokens, and Lexical-Analyzer Generator: Lex and Flex. | Ch3 |
| Week 5 9/20, 9/22 | Lexical Analysis: Finite Automata, From Regular Expressions to Automata, Construct an NFA from a Lex Program, and From RE to DFA Directly Using lex/flex to prepare for PA2 | Ch3 |
| Week 6 9/27, 9/29 | Syntax Analysis: Context-Free Grammars, Writing a Grammar, Top-Down Parsing, and Bottom-Up Parsing | Ch 4 |
| Week 7 10/4, 10/4 | Syntax Analysis: Simple LR and More Powerful LR Parsers. Midterm Exam | Ch4 |
| Week 8: 10/11, 10/13 | Syntax Analysis: Using Ambiguous Grammars, Parser Generators Using yacc/bison to prepare for PA3 | Ch4 |
| Week 9 10/18, 10/20 | Syntax-Directed Translation: Syntax-Directed Definitions and Evaluation Orders for SDD's | Ch5 |
| Week 10 10/25, 10/27 | Syntax-Directed Translation: Applications of Syntax-Directed Translation and Syntax-Directed Translation Schemes. | Ch5 |
| Week 11 11/1, 11/3 | Semantic Analysis: Types and Declarations and Type Checking Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code | Ch6 |
| Week 12 11/8, 11/10 | Intermediate-Code Generation: Translation of Expressions, Control Flow, and Backpatching | Ch6 |
| Week 13 11/15, 11/17 | Run-Time Environments: Storage Organization, Stack Allocation of Space, and Access to Nonlocal Data on the Stack | Ch7 |
| | Thanksgiving | |

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|------------------------|---|-----|
| Week 14 11/29, 12/1 | Code Generation: Issues in the Design of a Code Generator, The Target Language, and Addresses in the Target Code | Ch8 |
| Week 15 12/6, 12/8 | Code Generation: Basic Blocks and Flow Graphs Review for the Final Exam | Ch8 |
| Week 16 12/13 | Final Examination Day: Tuesday, December 13 and Time: 2:00 p.m.-4:00 p.m. Fall 2022 Finals Schedule https://www.csustan.edu/class-schedule/finals-schedule/fall | |

*It is subject to change.

Grading Scale will be assigned on a standard scale as below

| | | | | |
|--------|-------|-------|-------|-----|
| A | B | C | D | F |
| 90-100 | 75-89 | 60-74 | 45-59 | <45 |

Clustering of grades may cause the grading scale to be lowered (to your benefit), but it will not be raised

Evaluation:

The overall course grade will be the weighted sum of the points earned in the following categories:

| | | | | |
|---------------|----------|----------|--------------|------------|
| Participation | Homework | Projects | Midterm Exam | Final Exam |
| 10% | 20% | 15% | 25% | 30% |

Other Policies:

1. I will accept the late assignments for maximum three days (including holidays) with the point deduction 20% per day.
2. There will be no makeup exams except in a verified emergency with immediate notification.

Academic Honesty:

The work you do for this course will be your own, unless otherwise specified. You are not to submit other people's work and represent it as your own. I consider academic honesty to be at the core of the University's activities in education and research. Academic honesty is expected at all times in this course.

Accommodations for Students with Disabilities

Students with disabilities seeking academic accommodations must first register with the Disability Resource Services (DRS) program, located in MSR 210, ph. (209) 667-3159. Students are encouraged to talk with the instructor regarding their accommodation needs after registering with DRS.