CPSC 323-03: Compilers and Languages

College of Engineering and Computer Science, Department of Computer Science

CATALOG DESCRIPTION

Basic concepts of programming languages and principles of translation. Topics include history of programming languages, various programming paradigms, language design issues and criteria, design of compilers for modern programming languages.

COURSE DESCRIPTION

Course Name	Compilers and Languages
Course Number	CPSC 323 - 03
Course Location	Hum 511 - Lecture Room
Class Timings	Monday and Wednesday 5:30 PM – 6:45 PM
Final Examination	Monday, May 15, 2023 5:00 PM - 6:50 PM
Course Term	Spring 2023

PREREQUISITES

CPSC 131, Computer Science or Computer Engineering major or minor; or Computer Science or Computer Engineering graduate standing or CPSC 301 passing score on Examination in Programming Proficiency; declared major/minor in CPSC, CPEN, or CPEI; if not met, you may be dropped by the department. If you have any concerns about the prerequisites, please contact the department immediately.

INSTRUCTOR INFORMATION:

Instructor Name	Miss Susmitha Padda
Email Address	spadda@fullerton.edu
Office Hours	By Zoom On Friday: 6:00 PM – 7:00 PM and Saturday 9:00 AM - 10:00 AM or by appointment
Zoom Link	https://fullerton.zoom.us/j/6261102204?pwd=WGE5c1h3N3gwRzBTcXFBQk5zV3REZz09
Meeting ID	626 110 2204
Passcode	Compilers3

If you have any problem with this course, please do not hesitate to contact me as soon as possible. I want the entire class to do well and for that I am willing to help as much as possible and as much as I can.

Office hours availability: During the final week the office hours will be held by appointment only.

Holidays: Monday, February 20 (President's Day) , the week of March 27 - April 2 (Spring Recess)

RESPONSE TIME

Except for weekends and holidays, the instructor usually responds to email questions and online assignments within **48 hours**.

COURSE COMMUNICATION

All course announcements and individual email are sent through Canvas, which only uses CSUF email accounts. Therefore, you MUST check your CSUF email on a regular basis (several times a week) for the duration of the course.

LEARNING GOALS

1. Understand how compilers translate human-readable language into a machine-executable language.
2. Identify the technical and social challenges of building a large software system such as a compiler.
3. Understand to write a compiler on your own

LEARNING OBJECTIVES

1. Reproduce and describe the major phases of a modern compiler
2. Develop and analyze formal descriptions of computer languages.
3. Apply finite automata theory to build recognizers (lexers) for regular languages.
4. Apply pushdown automata theory to build recognizers (parsers) for context-free languages.
5. Describe the algorithms and data structures that enable automated translation
6. Evaluate the role of static analysis in automated program translation.

7. Apply tree traversals to convert a syntax tree to low-level code.
8. Understand the limitations placed by an architecture or execution environment on the generation of machine code.
9. Describe common optimizations and evaluate the tradeoffs associated with good optimization.

TECHNICAL PROFICIENCY

Students are expected to be intimately familiar with their development platform of choice and be able to write and debug code in any of the programming languages like Python/C/C++/Java/ JavaScript/C# at a level of proficiency that corresponds to the prerequisites of the course. Specifically, students are expected to

1. Have basic computer competency which includes the ability to use

    a. a personal computer to locate, create, move, copy, delete, name, rename, and save files and folders on hard drives and on secondary storage devices such as floppy disks.

    b. a software program namely Python, C, C++, Java, JavaScript, C# that runs on a PC or Macintosh computer for their programming assignments.

    c. an electronic mail system to receive, create, edit, print, save, and send an email message with and without an attached file.

    d. an Internet browser to upload their assignments on Canvas

2. Have ongoing reliable access to a computer with Internet connectivity for regular course assignments

3. Maintain and access three times weekly a student email account

4. Apply his/her educational technology skills to complete expected competencies

5. Utilize other software applications as course requirements dictate

6. Utilize Canvas to access course materials and complete assignments

Student Technical support: (657) 278-8888

IMPORTANT DATES

CSUF's Academic Calendar is posted online at http://apps.fullerton.edu/AcademicCalendar/ . The Academic Calendar contains all the campus closures and holidays one should be aware of. CSUF's Admissions Calendar contains all the major dates with respect to adding, dropping, and withdrawing from classes and is posted online at http://www.fullerton.edu/admissions/Resources/Calendars.asp.

There will be One midterm exam and one final exam.

Tentative:

Exam	Week
Mid Term 1:	Week 7
Final Exam:	Week 16

ATTENDANCE POLICY

Administrative drops: Any student who misses the first-class meeting may be dropped from the class, unless they contact the instructor or Computer Science department within 24 hours.

Religious Holidays: If one will miss a class or an exam due to observance of a religious holiday, please notify the instructor by email (spadda@fullerton.edu) in the first week of class.

Attendance: Attending lectures is mandatory. You are expected to attend all lectures unless any emergency Attendance will be recorded after the first class. Students are responsible for all course material and announcements regardless of whether they are present or absent. A student must be physically present to take exams. You are responsible for missed work if you are absent. Please arrange with a friend to pick up any assignments or handouts.

REQUIRED TEXTBOOK

Thomas W. Parsons, Introduction to Compiler Construction, W.H. Freeman, and Co, 1992, ISBN 0-7167-8261-8.

RECOMMENDED TEXTBOOK

Robert W. Sebesta, Concepts of Programming Languages, 11th ed, Addison Wesley, 2016

ASSIGNMENT DESCRIPTION

Projects: There will be two Project assignments, each takes **about 2-3 weeks.** One/Groups needs to submit own files for each project. One may work in groups of **up to three** on projects. Each project will involve designing, implementing, and analyzing a substantial program. Projects will be on writing a lexicon analyzer, a syntax analyzer, or on writing a code generator.

Assignments: Suggested homework assignments will be given periodically and will count towards the final grade. They will be useful for understanding the course material. It is strongly recommended that you try them out.

In Class Hands-on:

Following the lecture, you may/ will be given a related problem/sum or an exercise that is not graded (depending on the time constraint) but is only for practice, and you can complete it right away and ask questions if you have any.

Collaboration:

Collaboration is not allowed on any exam. Projects may be done in groups of **up to three,** but the student must make their own submission which includes all group members' names. One may work freely with fellow group members, but must limit the input gotten from sources outside his/her group:

● Students may help each other understand the assignment and brainstorm general solutions, but each group must develop and submit their own distinct work.

● Technical support, e.g., troubleshooting, installing the compiler or logging in to compiler is OK.

● One must separate to develop own detailed solution to the problem, and type in own source code and project report.

● Given these requirements, any submissions with identical excerpts, or excerpts that are identical up to superficial rearrangements, will be considered highly suspect of **plagiarism.**

ALTERNATIVE PROCEDURE FOR SUBMITTING WORK

In case of technical difficulties with submissions, the instructor will communicate with students directly through CSUF email, and assignments can be sent through email, faxed, or mailed to the professor or the Department of Computer Science. In the case email does not work, students should call the department coordinator at 657-278-3700 for further direction.

GRADING POLICY

Exams: One midterm and one final exam will be given; closed book; no external source of information or collaboration is allowed. If you miss a midterm exam and you do not have a documented exceptional circumstance, you will receive 0 for the exam grade. If you miss a midterm exam and you have a documented exceptional circumstance, then the final exam will increase its weight toward the final grade.

Assignments: 15 % all together will count towards the final grade.

Projects: There will be two projects spaced at least three weeks apart. Every project score is weighted equally, regardless of the number of points available on each project. late assignments will be accepted, however there will be deductions. There will be a 20% deduction for the first day you are late, and 1% deduction each additional day you are late. For example, if you are late by one week, the total deduction will be 20 % (first day) + 6 % (6 additional days) = 26 %; if the project is maximum 10 points, you can receive up to 7.4 points. A zero score will be given to:

- Email submissions originating from emails other than the CSUF-supplied email account.
- Input/output that is falsified.
- Submissions that are plagiarized or otherwise violate the collaboration guidelines

Extra Credit Policy Extra credit is only available, based upon the performance in class.

GRADING STANDARDS AND CRITERIA

Grades will be based on following:

- **Assignment's 15%**
    1. Assignment 1 – 5%
    2. Assignment 2 – 5%
    3. Assignment 3 - 5%
- **Projects 30%** (15% each project)
    1. Project 1- 15%
    2. Project 2- 15%
- **Examinations - Midterm 20%**
    1. Mid Term - 20%
- **Final Exam 30%**
- **Class Participation 5%**

If you miss a midterm with a valid excuse, the final will have increased weight from 40% to 70%. A missing final exam will be dealt with according to the university regulations on the incomplete and withdrawals.

Each student's weighted numerical average into letter grade, shown next. **Over 100% is A+.**

GRADING SCALE							
Grade	**Percentage**		**Grade**	**Percentage**		**Grade**	**Percentage**
A	95-100%		B-	80-83%		D	60-69%
A-	90-94%		C+	77-79%		F	below 59%
B+	87-89%		C	74-76%			
B	84-86%		C-	70-73%			

Keep all assignments and exams returned so that any discrepancies can be easily and fairly straightened out.

POLICY ON RETENTION OF STUDENT WORK

Work is submitted through the Canvas and shall be retained on the course website for a reasonable time after the semester is completed (see UPS 320.005).

UNIVERSITY INFORMATION

CANVAS

Each registered student is enrolled in Canvas.

Problems? Contact the student help desk at (657) 278-8888 or email StudentITHelpDesk@fullerton.edu.

ADA Accommodations for Students with Special Needs

Please inform the instructor during the first week of classes about any disability or special needs that one may have that may require specific arrangements related to attending class sessions, carrying out class assignments, or writing papers or quizzes, tests, or examinations.

Any student who, because of a disability, may require special arrangements to meet course requirements must contact the instructor and the Office of Disability Support Services as soon as possible to make the necessary arrangements. The instructor may request verification of need from the Dean of Students Office. Students are encouraged to contact the Office of Disability Support Services within the first week of the semester to best ensure that the appropriate accommodations are implemented in a timely fashion. The Office of Disability Support Services' website is http://www.fullerton.edu/DSS/ . They can be reached by phone at 657-278-3117 or TDD at 657-278-2786 or email dsservices@fullerton.edu . Their office is in University Hall, room 101. The instructor may request verification of need from the Dean of Students Office.

Ms. Lindsay O'Neill in the Pollak Library <jloneill@Exchange.FULLERTON.EDU> will be able to answer technical questions about accessibility of specific library-provided resources.

Academic Dishonesty Policy

By submitting work for evaluation, the student acknowledges that he/she has adhered to the spirit of the university's academic honesty policy and that his/her submission is an original work done by the student unless otherwise directed to work in groups. It is the student responsibility to be aware of and follow the spirit of CSU Fullerton's academic honesty policy found at http://www.fullerton.edu/senate/publications_policies_resolutions/ups/UPS%20300/UPS%20300.021.pdf . Academic dishonesty includes such things as cheating, inventing false information or citations, plagiarism, and helping someone else commit an act of academic dishonesty. It usually involves an attempt by a student to show a possession of a level of knowledge or skill, which he/she in fact does not possess.

Cheating is defined as the act of obtaining or attempting to obtain credit for work by the use of any dishonest, deceptive, fraudulent or unauthorized means. Examples of cheating include but are not limited to using notes or aids or help of other students on tests and examinations in the ways other than those expressly permitted by the

instructor, plagiarism as defined below, tampering with grading procedure, and collaborating with others on any assignment where such collaboration is expressly forbidden by the instructor. Plagiarism is defined as the act of taking the specific substance of another and offering it as one's own without giving credit to the source (e.g., copying another person's program). When sources are used, acknowledgment of the original author or source must be made following standard scholarly practice. **You are not allowed any material from any website that provides solutions to the assignments given in class for a fee or free of charge.** Failure to follow the spirit of the academic honesty policy will result in a severely negative evaluation of the work in question. Each offense will be reported to the Department Chair and to the Dean of Students office, Student Conduct. A first offense will result in a zero score on the offending assignment. A subsequent offense will result in an F in the course.

Library Support

The Pollak Library has many services to offer students. Assistance available for online students includes online instruction guidelines available on the library website.

University Learning Center

The goal of the University Learning Center is to provide all CSUF students with academic support in an inviting and contemporary environment. The staff of the University Learning Center is carefully selected and trained to assist students with their academic assignments, general study skills, and computer user needs. The ULC is in the Pollak Library North, 2nd Floor. The services that the ULC provide to the CSUF students include an open computer lab, tutoring, workshops, online tutoring, and collaborative learning. The online tutoring option allows students to submit their paper for constructive feedback. More information can be found on the University Learning Center website.

Writing Center

The Writing Center offers all registered CSUF students the opportunity to receive writing assistance. In half hour-long tutorials, the students who come to the Writing Center will work with a tutor to create and/or improve specific assignments and, more importantly, to improve their overall writing skills. Students can expect to engage in conversation about their assigned topics, the point or thesis of their writing, ways to organize and develop ideas, or how to improve sentence structure and mechanics to convey the intended meaning of the essay. The Writing Center is in MH 45, the basement of McCarthy Hall, on the campus of California State University, Fullerton; 657-278-3650. More information can be found on the Writing Center webpage.

EMERGENCY PROCEDURES

Each student is expected to read and understand the guidelines published at http://prepare.fullerton.edu/campuspreparedness/ . Should an emergency occur, follow the instructions given by faculty, staff, and public safety officials, or contact the University Police at (657) 278-3333. An emergency information recording is available by calling the Campus Operation and Emergency Closure line at 657-278-4444.

To keep our campus community informed and to comply with the California State Education Code, Chapter 16, of the Donahoe Higher Education Act, Section 67380; the California State University, Fullerton Police Department prepares the California Campus Safety Plan annually. The plan can be found on the University Police website under the Jeanne Clery-Crime Prevention tab or by clicking on this link http://police.fullerton.edu/documents/CaliforniaCampusSafetyPlan.pdf.

RECORDING & TRANSCRIPTION OF CLASS CONTENT

Recording class content is governed by UPS 330.230,
http://www.fullerton.edu/senate/publications_policies_resolutions/ups/UPS%20300/UPS%20330.230.pdf .
The instructor permits class content to be recorded or transcribed by students when mandated to do so by the Americans with Disabilities Act or by other federal or state laws. Any recording of class content is for private use and study and shall not be made publicly accessible without the written consent of the instructor and students in the class.

COURSE RULES & CLASSROOM MANAGEMENT

Unless an agreement or accommodation is reached between the student and the instructor, these rules must be followed.

1. Attendance of **75%** at all regularly scheduled lectures and discussion sections is mandatory.
2. Eating and drinking is allowed unless it doesn't affect the class.
3. Portable computer use is not allowed in lectures except for taking notes.
4. The student is responsible to be aware of any course announcements including changes to due dates and requirements.
5. Third party work (code, artwork, etc.) may not be used in student work without prior instructor consent. Failure to gain and document instructor consent will be construed as willful academic dishonesty.
6. When a third party's work is incorporated into student work after gaining instructor consent, failure to wholly document the work's origin, copyright and license will be construed as willful academic dishonesty.
7. Photographs are not permitted unless the instructor gives permission.

WEEKLY SCHEDULE - TENTATIVE

Week	Material	Textbook sections, Additional Materials
1	Class schedule and information presentation. Syllabus. Introduction. Levels of Programming languages and History of compilers.	Ch 1
2	Lexical analysis (tokens; lexemes) Defining Syntax Analyzer and Parse tree. Finite-state automata DFA; NFA; regular expressions; finite-state machines).	Ch 2
3	Lexical analysis (pumping lemma; application to lexical analysis)	Ch 2
4	Syntax analysis (grammars; top-down parsers)	Ch 3
5	Syntax analysis (recursive-descent parsing)	Ch 4
6	Syntax analysis (bottom-up parsing)	Ch 4
7	*Review and Mid Term*	*Exam : Ch 1- 4 (first half), programming assignments*
8	Syntax analysis (LR parser), Syntax analysis (LALR parser)	Ch 4, Project 1
9	Syntax analysis (LALR parser)	Ch 4
Spring Recess		
10	Intermediate Code Generation	Ch 5
11	Optimization	Ch 6
12	Symbol Table Object Code Generation	Ch 8.1 Ch 7 (Generating Machine Language from 3AC) and Project 2
13	Object Code Generation	Ch 7 (Context-sensitive translation)
14	Lex, Yacc	Appendix B
15	Other topics Review for final exam	Ch 4-7, 8.1, programming assignments, Appendix B
16.	*Final Exam*	*Exam*