

San José State University
Computer Engineering Department
CmpE 152, *Compiler Design*, Section 1, Fall 2009

Instructor:	Dr. M. Robinson
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Office Hours:	M 1:30-3:20, TR 1:30-2:50 (subject to furlough restrictions)
Class Days/Time:	(Lecture) TR 1500-1550 (Lab) TR 1600-1730
Classroom:	(Lecture) Eng 327 (Lab) Eng 206
Prerequisites:	CmpE 126, CmpE 102 (both with grade of "C" or better)

Faculty Web Page and Yahoo Group

Web page:	www.engr.sjsu.edu/mrobins
Yahoo group:	cmpe152f2009-subscribe@yahoo.com

Course Description

Principles of lexical analysis, finite state automata and parsing; issues of variable declarations, variable types, control statements, function calls, nested scopes and efficient assembler target code.

Course Goals and Student Learning Objectives

1. General role of compilers in computer system design and implementation
2. Appreciation of the relation of a high-level language to its assembler and microprocessor underpinnings.
3. Working skills with Unix tools, editors, debuggers, compilers, etc.
4. Working ability in theory and application of finite state machines
5. Working ability in theory and application of recursive descent, production rules & LALR parsing
6. Ability to design, implement, debug and test a small machine translator
7. Appreciation of optimization strategies in compilers

Course Content Learning Outcomes

1. General role of compilers in computer system design and implementation. **(a, e, I, II)**
2. Appreciation of the relation of a high-level language to its assembler and microprocessor underpinnings. **(k, I, II)**
3. Working skills in theory and application of finite state machines, recursive descent, production rules, parsing, and language semantics. **(a, c, k, I, II)**

Required Texts/Readings

Textbooks

Keith Cooper and Linda Torczon, *Engineering a Compiler*, Morgan-Kaufman 2004, ISBN 1-55860-698-X

William Barrett, *Compiler Design*, 2005 (available on-line)

Niklaus Wirth, *Compiler Construction*. Addison-Wesley, 1996 (out of print, available on-line)

There are lecture notes on the [companion website](http://www.mkp.com) for the text. It has a very long URL. Go to www.mkp.com and search on the authors.

Other Readings

The lecture notes used in class will be posted on the class Yahoo group. There will also be additional reading material posted on the class Yahoo group.

Suggestions for supplemental reading will be posted on the class Yahoo group.

Classroom Protocol

Please be considerate of your fellow students and minimize distractions during the lecture. Do not bring food and drinks into the lab. Do not unplug the network connection on the lab systems—these systems are used remotely by other students.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. [Information on add/drops are available at http://info.sjsu.edu/web-dbg/enarr/soc-fall/rec-324.html](http://info.sjsu.edu/web-dbg/enarr/soc-fall/rec-324.html) . [Information about late drop is available at http://www.sjsu.edu/sac/advising/latedrops/policy/](http://www.sjsu.edu/sac/advising/latedrops/policy/) . Students should be aware of the current deadlines and penalties for adding and dropping classes.

Assignments and Grading Policy

Projects: Software projects should be developed and made ready for demonstration and source file viewing on the lab computers. Some lab exercises call for modifying compiler software to meet new requirements. Others require designing, writing, and debugging original source code.

Lab projects must be completed individually.

You must submit certain project source code files. To avoid creating a cheating incident, write original source code. Do not "borrow" source code from other students or prior semester's work. You may incorporate portions of source code provided with the lab project assignment, or from the course textbook, or other reference work, but such material must be cited.

Lab Reports: None of the labs will not be considered complete until you have written a lab report. Your report should be in good form, prepared on a word processor and available for submission as a file, if so requested. The report need not be complete, and should not exceed 5 pages in length. Do not fill up your report with source code that you've written or have incorporated from the lab assignment. Make sure that each figure and table is labeled and referred to in your report. Divide the report into coherent sections, with meaningful section titles. Write a short introductory paragraph about the purpose of the lab.

Examinations: Notice that the midterms and final exams comprise almost 80% of your course grade. To pass this course, you need to read the texts, work out all the drill exercises, and do all the lab projects to your own satisfaction.

Quizzes: Short quizzes may be given in the lab period. These may be written or short programming assignments. (These assignments differ from the lab exercises in that they are short and should be completed within the lab period itself.)

Homework: The homework assignments will appear on the course Yahoo group and will be announced in class. You must check the Yahoo group regularly to pick up the homework assignments.

Drill exercises to prepare students for examination questions will be posted, but need not be turned in. Solutions to the drill exercises will be given in class or posted on the class Yahoo group. Any questions on the drill exercises should be raised in the lab period.

Graded homework will involve individual research and written analysis.

Late homework will not be accepted.

The grading percentages will be approximately as follows. Any category may be changed by $\pm 10\%$ at the discretion of the instructor.

Lab Projects	15%
Homework & Quizzes	10%
2 Midterm Exams	40%
Final Exam	35%
Total	100%

- **Note 1:** A late lab project review will receive a discounted grade per week.
- **Note 2:** The lab projects have different weights according to the amount of work required.
- **Note 3:** Late homework will NOT be accepted.
- **Note 4:** A makeup exam for a midterm and/or the final exam will not be available except for exceptional and extenuating circumstances. If possible, you should notify Dr. Robinson promptly by phone or email in advance if you are unable to be present for a midterm or final exam. There will be no make-ups for quizzes.
- **Note 5:** In order to receive a PASSING GRADE from this course, students must complete all the laboratory projects. Partial credit will be given for work completed.
- **Note 6:** In order to receive a PASSING GRADE from this course, students must document all their laboratory projects according to the specifications provided.

Grading calculations

Final scores are evaluated with respect to your peers, although absolute standards will be imposed as well. There are several conditions that will result in receiving a FAILING GRADE in this course:

- Not receiving a sufficiently high score, calculated as shown above.
- Not having completed the required prerequisite courses before taking the course.
- Not having completed the laboratory assignments to an acceptable degree.
- Not having documented the laboratory assignments to an acceptable degree.
- Academic dishonesty (see below).

University Policies

Academic integrity

Students should know that the University's [Academic Integrity Policy is available at http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf](http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf). Your own commitment to learning, as evidenced by your enrollment at San Jose State University and the University's integrity policy, require you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The website for [Student Conduct and Ethical Development is available at http://www.sa.sjsu.edu/judicial_affairs/index.html](http://www.sa.sjsu.edu/judicial_affairs/index.html).

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include in your assignment any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy F06-1 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the DRC (Disability Resource Center) to establish a record of their disability.

CmpE 152, Compiler Design, Fall 2009 Course Schedule

The schedule is subject to change with fair notice via the Yahoo group. This schedule may be changed due to university policies that have not been fully determined at the time of writing.

Lec	Date	Topic	Reading	Lab
1	25 Aug..	Introduction	C&T 1, B 1, W 1	1. MIPS
2	27	The view from 35,000 feet	C&T 1, B 1, W 1	<i>HLL</i>
3	1 Sept.	Scanning, recognizers, regular expressions	C&T 2.1-2.3, B 2, W 2, 3	
4	3	Scanning, recognizers, finite automata	C&T 2.4-2.5, B 2, W 3	
5	8	DFA minimization	C&T 2.4-2.6, B 2-3, W 3	1. due
6	10	Intro to CFGs, parsing, derivations, precedence, & ambiguity	C&T 3.2 B 4-5, W 2	2. lex
7	15	Expression semantics	C&T 3.2, B 4-5, W 2	
8	17	Syntax diagrams	B 8	
9 ¹	22	Top-down parsing: backtracking, removing left recursion	C&T 3.3, B 7-8, W 4.1	<i>First sets</i>
10	24	Top-down parsing: recursive descent and LL(1) parsers	C&T 3.3, B 7-8, W 4.1-4.2	2. due
11	29	Bottom-up parsing: Shift-reduce parsing	C&T 3.4, B 9, W 4.3	3. TDP
12	1 Oct.	Bottom-up parsing: LR table-based parser	C&T 3.4, 3.6, B 9, W 4.3	
13	6	Bottom-up parsing: Building an LR(0) parser	C&T 3.5, B 9, W 4.3	<i>LR(1)</i>
14	8	Bottom-up parsing: SLR, LR(1) and LALR parsers	C&T 3.6, 3.7	<i>Review</i>
15	13	Midterm Exam 1		
16	15	Types & type checking	C&T 4.1,4.2,4.4, B 12, W 5, 8	<i>yacc</i>
17	20	Intermediate representations	C&T 4.4, 5.1-5.6	3. due
18	22	Symbol table	C&T 5.7, B 12, W 8	4. ST
19	27	The procedure abstraction	C&T 6.1-6.6, B 13, W 12,15	
20	29	Memory management	C&T 6.7, 7.1, 7.2, 7.5-7.7, 7.10, B 12, W 8	
21	3 Nov.	Code generation: code for expressions, assignment	C&T 7.3-7.4, W10	
22	5	Code generation: Boolean and relational operators, conditionals & control flow, inheritance	C&T 7.8-7.10, B 14, W11	<i>Review</i>
23	10	Midterm Exam 2		
24	12	Introduction to optimization: principles	C&T 8.1, 8.2, B 11, W 16	4. due
25	17	Optimization: redundant expressions, value numbering	C&T 8.3-8.5	5. CG
26	19	Introduction to data-flow analysis	C&T 8.6, 8.7, 9.1, 9.2	
27	24	Loop optimization	C&T 10	
	26	<i>No class—Thanksgiving</i>		
28	1 Dec.	Loop scheduling	C&T 10.3, 12	
29	3	Other optimization techniques	C&T 10.3, 11.4, 12.4, 13	
30	8	Review		5. due
Final exam	10	Eng 327, 1445-1700		

¹ Faculty furlough day designated by the President. No class.