Introduction to Compiler Construction
Course Mechanics
Website

https://www.swamiiyer.net/cs451

What's on the Site?

• Announcements (landing page)
• Course Info
• Calendar
• Lecture Material
• Assignments
• Resources
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Goal

Theory:
• Scan a program into a stream of tokens
• Parse a program making its syntactic structure explicit
• Analyze and generate code for various programming constructs
• Allocate physical registers to a program expressed in terms of virtual registers

Practice:
• Develop a compiler called j-- targeting the stack-based Java Virtual Machine (JVM)
• Develop a compiler called iota targeting the register-based Marvin machine
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Prerequisites

CS310 (Advanced Data Structures and Algorithms) and
CS420 (Intro. to the Theory of Computation) or
CS622 (Theory of Formal Languages); or
Permission of the instructor
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Instructor

Name: Swami Iyer (Senior Lecturer, Computer Science Department)

Academic Interests: Evolutionary dynamics on complex networks, coding, pedagogy

Contact Information:

• Office: M-3-201-14
• Email: siyer@cs.umb.edu (start subject line with [CS451])

Office Hours:

• Tue Thu 9:30 AM – 10:30 AM and 2:30 PM – 3:30 PM (in-person)
• Wed 10:00 AM – 12:00 PM (remote)
Instructor

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Lectures

When: Tue Thu 4:00 PM – 5:15 PM
Where: W-2-0158
<table>
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<th>When</th>
<th>Where</th>
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<td>Tue Thu 4:00 PM – 5:15 PM</td>
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Introduction to
Compiler Construction
in a Java World

Bill Campbell
Swami Iyer
Bahar Akbal-Delibas

CRC Press
Grading Scheme

Assessment % of Final Grade

- Programming Assignments (best 4 of 1, 2, 3, 4, and 6; and 5) 40%
- Exams (1 and 2) 50%
- Quizzes (5 lowest scores will be dropped) 10%

Programming assignment: enhance the functionality of the base j-- and iota compilers

Exam (Oct 31 and Dec 12): theoretical aspects of a compiler

Quiz: material covered in class

Up to 1% extra points for unused late days

Up to 0.01x% extra points if x% of the class completes the end-of-semester course evaluation

If overall score is within 0.5% of a higher grade, it will be elevated to that grade
Grading Scheme

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<tr>
<th>Assessment</th>
<th>% of Final Grade</th>
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<tr>
<td>Programming Assignments (best 4 of 1, 2, 3, 4, and 6; and 5)</td>
<td>40</td>
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<tr>
<td>Exams (1 and 2)</td>
<td>50</td>
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<tr>
<td>Quizzes (5 lowest scores will be dropped)</td>
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Software

iClicker

Piazza

Gradescope

Programming environment

Zoom
Policies

Classroom

Piazza

Makeup Exam

Late Days

Regrade Request

Collaboration

Accommodations for students with disabilities

Campus Closure
Immediate Action Items

- Sign up for iClicker
- Sign up for Piazza
- Sign up for Gradescope
- Setup the programming environment
- Fill out the questionnaire available on Gradescope
- Sign up for CS account
- Command-line primer
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Topics Covered

Chapter 1: Compilation
• Preliminaries
• Overview of the j-- to JVM Compiler
• Overview of the iota to Marvin Compiler

Chapter 2: Scanning
• Preliminaries
• Handcrafting a Scanner
• Generating a Scanner
• JavaCC Scanner for j--

Chapter 3: Parsing
• Preliminaries
• Top-down Recursive Descent Parsing
• Top-down LL(1) Parsing
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Chapter 4: Type Checking
- Preliminaries
- Pre-analysis of $j--$ Programs
- Analysis of $j--$ Programs

Chapter 5: JVM Code Generation
- Preliminaries
- Classes and their Members
- Control, Message, Field Selection, and Array Access Expressions
- Assignment, String Concatenation, Cast, and Other Operations

Chapter 6: Marvin Code Generation
- Preliminaries
- High-level Intermediate Representation (HIR)
- Low-level Intermediate Representation (LIR)
- Register Allocation