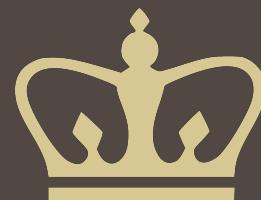


# PROGRAMMING LANGUAGES & TRANSLATORS

# Instructor: Baishakhi Ray

Fall 2023

# COMS 4115: Trivia



# Instructor

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Prof. Baishakhi Ray

Associate Professor

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<https://rayb.info>

Office Hours: Thursday 3:00 pm - 4:00 pm

Location: CEPSR 6LE1



# PLT 4115

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- Lectures:
  - Tuesday and Thursday, 11:40 AM-12:55 PM @ CSB 451
  - September 5 – December 12
- Get all the class updates in the website
- We will use Ed Discussion for class communication
  - See your coursework tab option

# Programming Language & Translators

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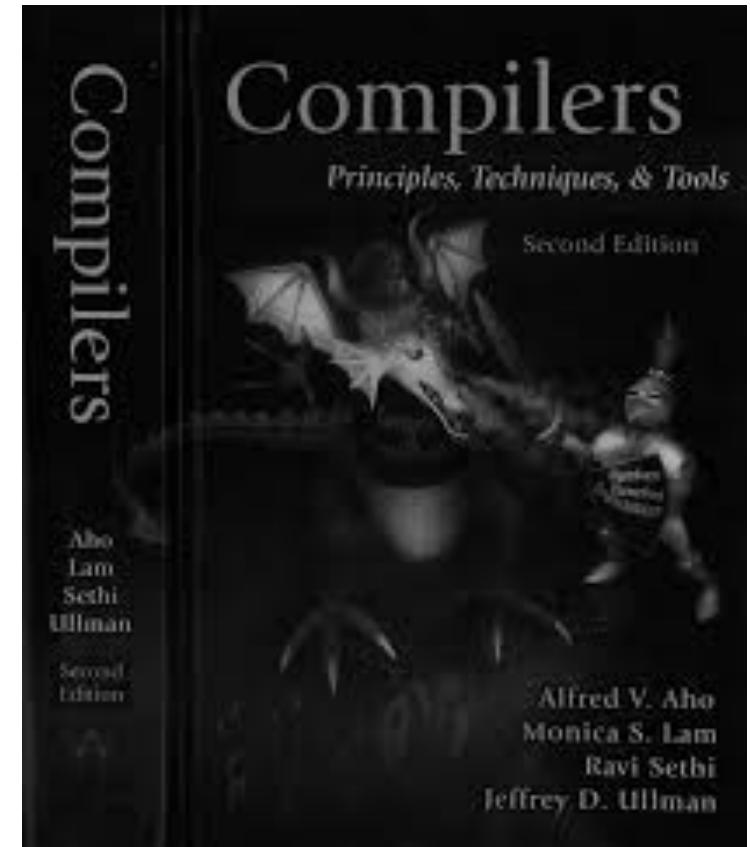
How can a computer program written in a high-level **programming language** (e.g., C, Python) be **translated** to a lower-level language (e.g., assembly language or machine code) to create an executable program?

# Recommended Text

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- Compilers: Principles, Techniques, and Tools
  - By Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman.
  - 2<sup>nd</sup> Edition
  - Addison-Wesley, 2006
- We will follow this book, but not line-by-line/section-by-section



# This Class

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- Theory: Learn different phases of a compiler design (50%)
- Practice: Implement different phases of compilers (50%)
  - Implement modules on top of an existing compiler (Clang/LLVM)

	Lectures	Programming
1	Introduction	
2	Lexical Analysis	Prog1
3	Syntax Analysis	Prog2
4	Semantic Analysis	Prog3
5	Run-Time Environment	
6	Code Generation	Prog4
7	Optimization	Prog5, Prog6

Theory deliverables:

- Written assignments
- Midterm
- Final

Programming deliverables:  
6 prog assignments

All are individual assignments

# Assignments and Grading

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• Programming Assignments	50%
• Written Assignments	10%
• Midterm	20%
• Final	20%
• Extra Credit	10%

- Programming assignments are most important, but most students do well on it. Grades for tests often vary more.

## **Extra Credit:**

- 10% of earned (extra credit/total extra credit) will be added with the original 100% from other assignments/exams
  - If you earn 50 out of 100 in extra credit, 5 will be added with your total (100%) achievement.

# Assignments Policy

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- Hard Deadline

- There will be no extension unless you produce medical certificate or permission from school authorities
- The instructor or TAs will not reply to such email requests.
- Plan ahead so that you can finish the assignments on time.
  - There can be challenges that you have not anticipated

- Written Assignments will be submitted through Gradescope

- We will share Gradescope entry code
- Type your submission

- Programming Assignments will be submitted through Github Classroom

- TAs will send you detailed instructions

# Assignments Policy

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- Work individually
- Programming assignments: work individually.
  - You can discuss with TAs/Instructor/Classmate
- Written assignments: do by yourself.
  - No discussion
  - Only clarification questions are allowed on Ed Discussion
  - TAs/Instructors will not respond to individual email
- DO NOT USE AI-Assisted Tool.
  - You will not learn
  - We will check for plagiarism

# Submission Policy

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Don't be a cheater (e.g., copy from each other).  
If I catch you cheating I will send you to the dean.

- Read the CS Department's Academic Honesty Policy: <https://www.cs.columbia.edu/education/honesty/>
- **OK:** Discussing lecture content
- **Not OK:** Solving a homework problem with classmates
- **OK:** Doing programming assignments together
- **Not OK:** Copying from others' solutions.
- **Not OK:** Posting any homework questions or solutions.
- **Not OK:** Use AI-assisted tools to find the answers.

# Exam Policy

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- Exams: Open book

- Follow CU honor code.

- In-Class Participations

- Class participation is important

- **Every Thursday (starting next week), there will be an in-class quiz**

- 10% of extra credit will come from in-class quiz

# Prerequisites

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1. Advanced Programming on C/C++
2. Computer Science Theory
  1. Regular languages and expressions
  2. Context-free grammars
  3. Finite automata (NFAs and DFAs)
3. Fundamentals Of Computer Systems
  1. Memory layout
  2. Register
  3. Instruction Set
  4. Performance Analysis

We will give a HW0 to check your basic knowledge of the above topics.

## Exam Schedule

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- Midterm: October 24
- Final: December 12

# Submission Links

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- **Written Assignments** : [gradescope](#)  
Entry Code will be posted in Coursework
- **Programming Assignments** : [github classroom](#)  
Details will be posted in Coursework

Q&A

# Programming Assignments/Projects

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- We will implement some compiler functionalities through out the semester
- Three projects -- you can pick any one of the following three options
  - Dead-code elimination
  - Finding resource leak
  - Finding uninitialized variables
- We will implement the compiler functionalities step-by-step to achieve the final goal.
  - There will be 6 programming assignments that will help you to reach the goal

# Programming Assignments

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- 6 programming assignments
- We should have a good knowledge of C/C++
- Linux is preferred operating system
  - All the instructions will be given based on Linux

# Programming Assignments

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- The assignments will be done on top of LLVM infrastructure
  - LLVM is a state-of-the art compiler (default compiler in MAC)
  - Some of the assignments are inter-dependent
  - We will provide Google cloud resource for LLVM related assignments
- Each student will be provided with google cloud resource for programming assignment.

# Programming Assignments

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- In all the assignments, some partial code will be given.
- Based on the instructions, you have to finish the rest.
- Scripts to setup the environment and run the code will also be provided.
- Each assignment will come with a bunch of test cases
  - Your goal is to pass all the test cases.
  - However, passing all the test cases do not mean the program is correct.
- Submit all programming assignments through GitHub Classroom.

# Written Assignments

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- After every topic, there will be a written assignment
  - Q&A
  - Multiple Choice
  - Problem Solving
- Midterm and Finals will follow written assignments patterns

## TA

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- Ziyuan Zhong (Office hour: TBD)
- Ira Ceka TBD
- Marcus Min TBD

Q&A