

CMPSC 461: Programming Language Concepts

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338H IST Building

Office hours: Mon. 1:30PM-2:30PM

Wed. 2:30PM-3:30PM

CMPSC 461 ***IS NOT***

- C/C++/Java/Python/Scheme/... programming
- Compiler construction (471)
- Object-oriented programming
- Data structures

CMPSC 461

Explores ***fundamental principles and paradigms*** of programming languages.

Studies features found in many different languages and examine how they work and how they interact with each other.

Why CMPSC 461?

Programming languages facilitate communication of ideas

- Between people
- Between people and computers

This course explores the **fundamental principles** of programming languages, to facilitate communication in your future study/career

Why CMPSC 461?

Programming languages is a powerful tool once you master the principles

Example: use **type systems** to build secure software

```
Int i =0;  
boolean b=true;  
b = i; // incompatible types: int  
       // cannot be converted to boolean
```

Why CMPSC 461?

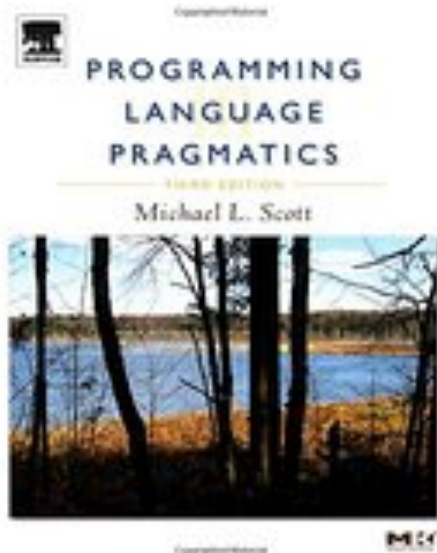
Example: use **type systems** to build secure software

```
Secret s =0;  
Public p=1;  
p = s; // type error: cannot assign  
        // secret value to public variable
```

Designing new languages for building secure software is an active research area

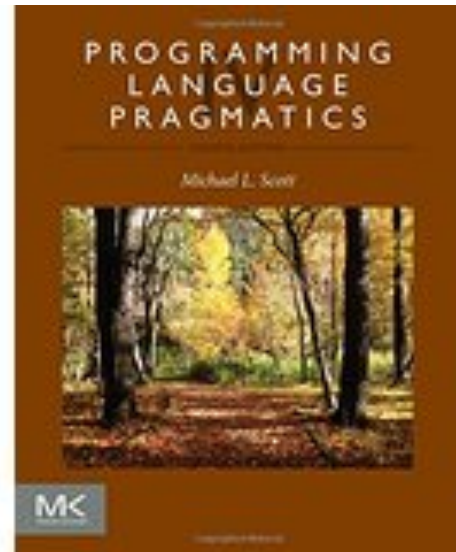
Textbook

- Required
Programming Language Pragmatics



3rd Edition

OR



4th Edition

Textbook

- Recommended

Programming Languages Principles and Paradigms

Allen Tucker and Robert Noonan

Concepts of Programming Languages

Robert Sebesta

Administration

Assignments

- Written and programming
- No final projects

Late policy

- 1 day late: -20%
- 2 days late: -50%
- >2 days late: -100%

Exams: 2 midterms and 1 final (TBD)

Administration

Grading policy

- 25% assignments
- 40% midterm exams
- 35% final exam

Letter grades

A: [93-100] A-: [90-93) B+: [87-90) B: [83-87)
B-: [80-83) C+: [77-80) C: [70-77) D: [60-70)
F: [0-60)

Ways to Fail

- Ignore assignments
- Never show up in lectures & office hours
- Skim through slides
- Memorize assignments and practice questions before exams
- Miss exams (and their make-ups)

Ways to get an A? avoid all of the above!

Overview of Languages

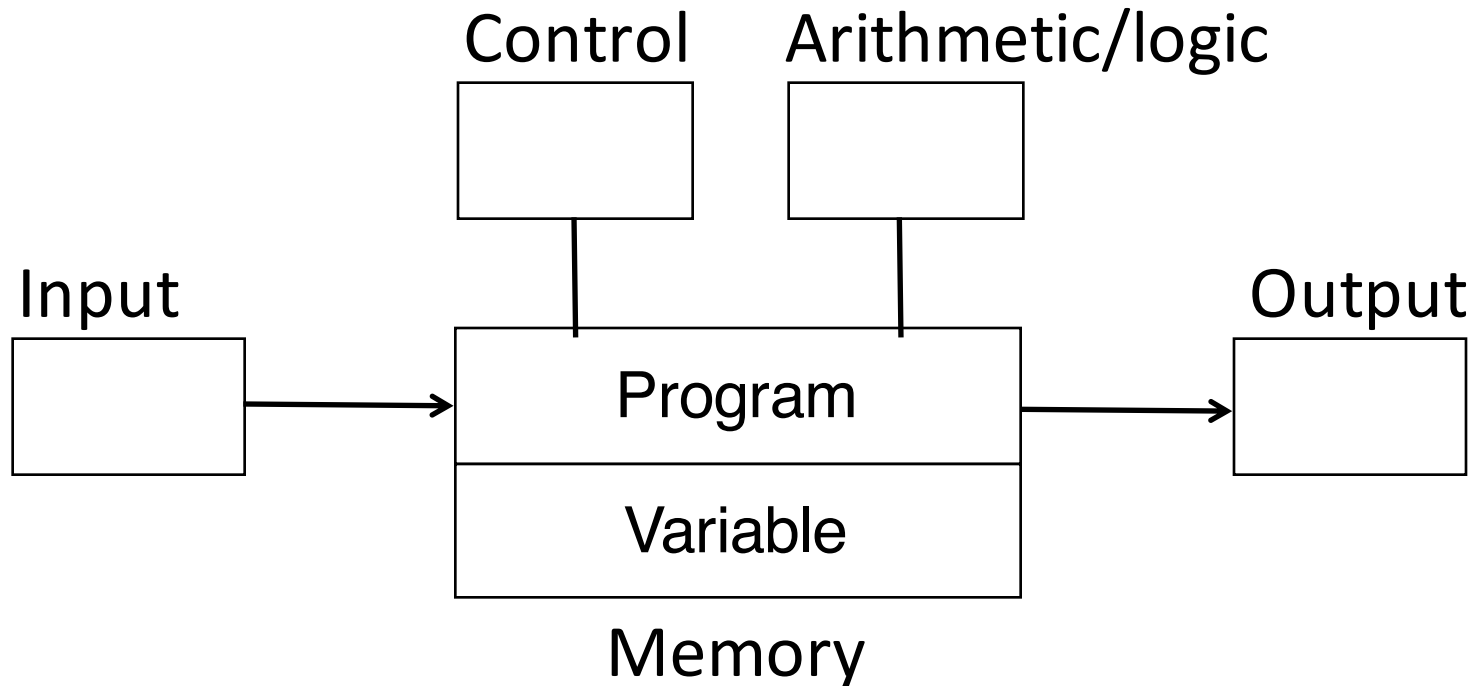
CMPSC 461

Programming Language Concepts

Penn State University

Fall 2016

The Origin of Imperative Lang.



The von Neumann-Eckert Model, 1945

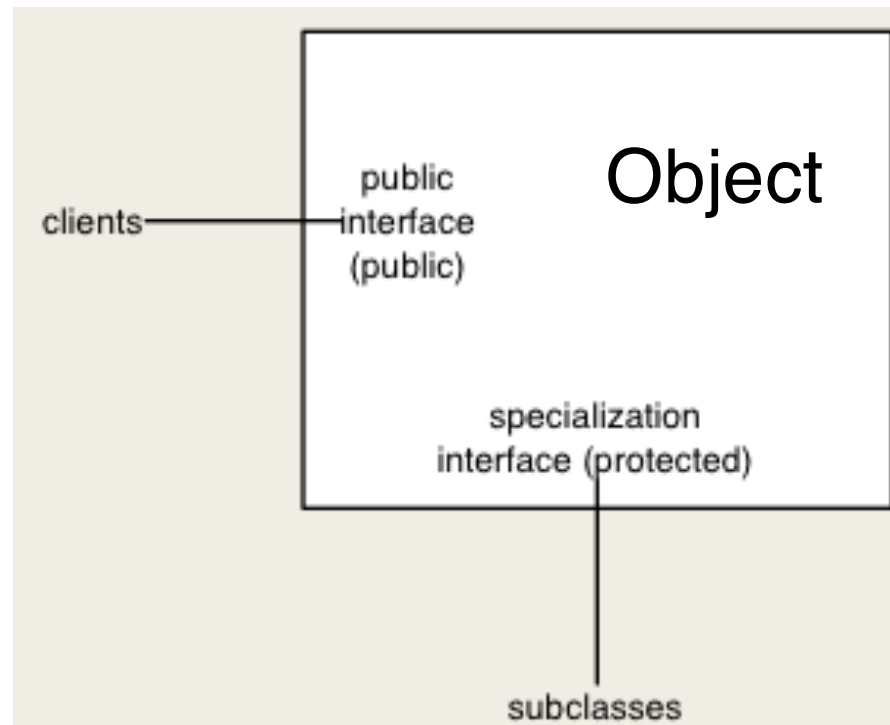
Imperative: program is updates to variables

Functional Language

$$\text{Output} = f(\text{Input})$$

Functional: program is a mathematical function

Object-Oriented Programming



Programming Paradigms

Imperative: program is updates to variables

Functional: program is a mathematical function

Object-Oriented: program is a collection of objects

Logic: program describes the outcome, not how

Levels



Focus of this
course

Higher-order language

Machine independent, e.g., $y = x + 1$

Compiler

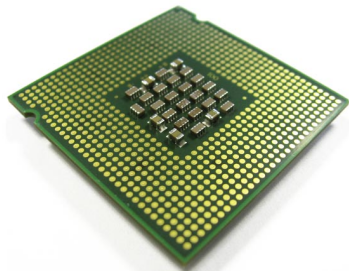
Assembly language

Processor instructions, e.g., MOV EAX, 1

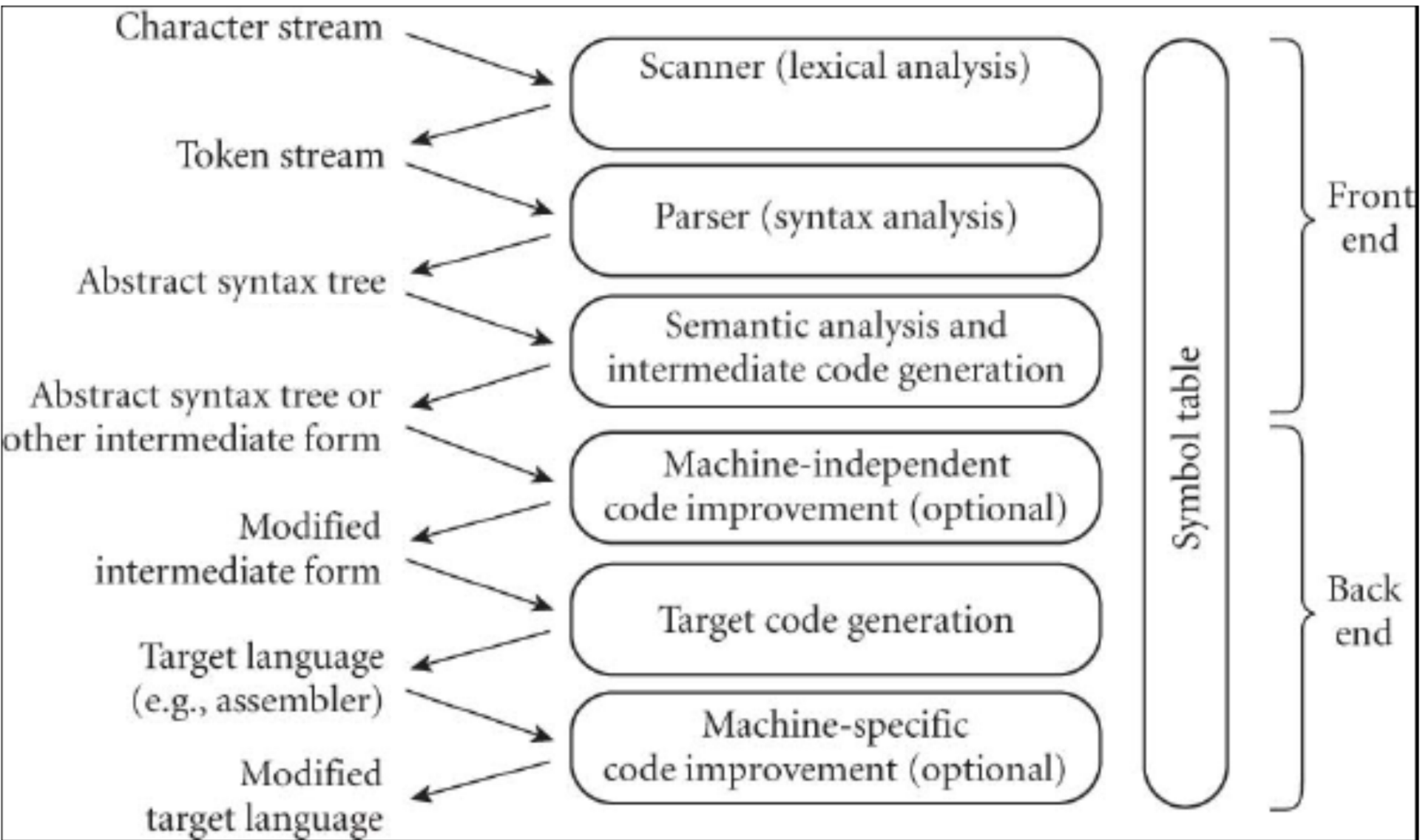
Assembler

Machine language

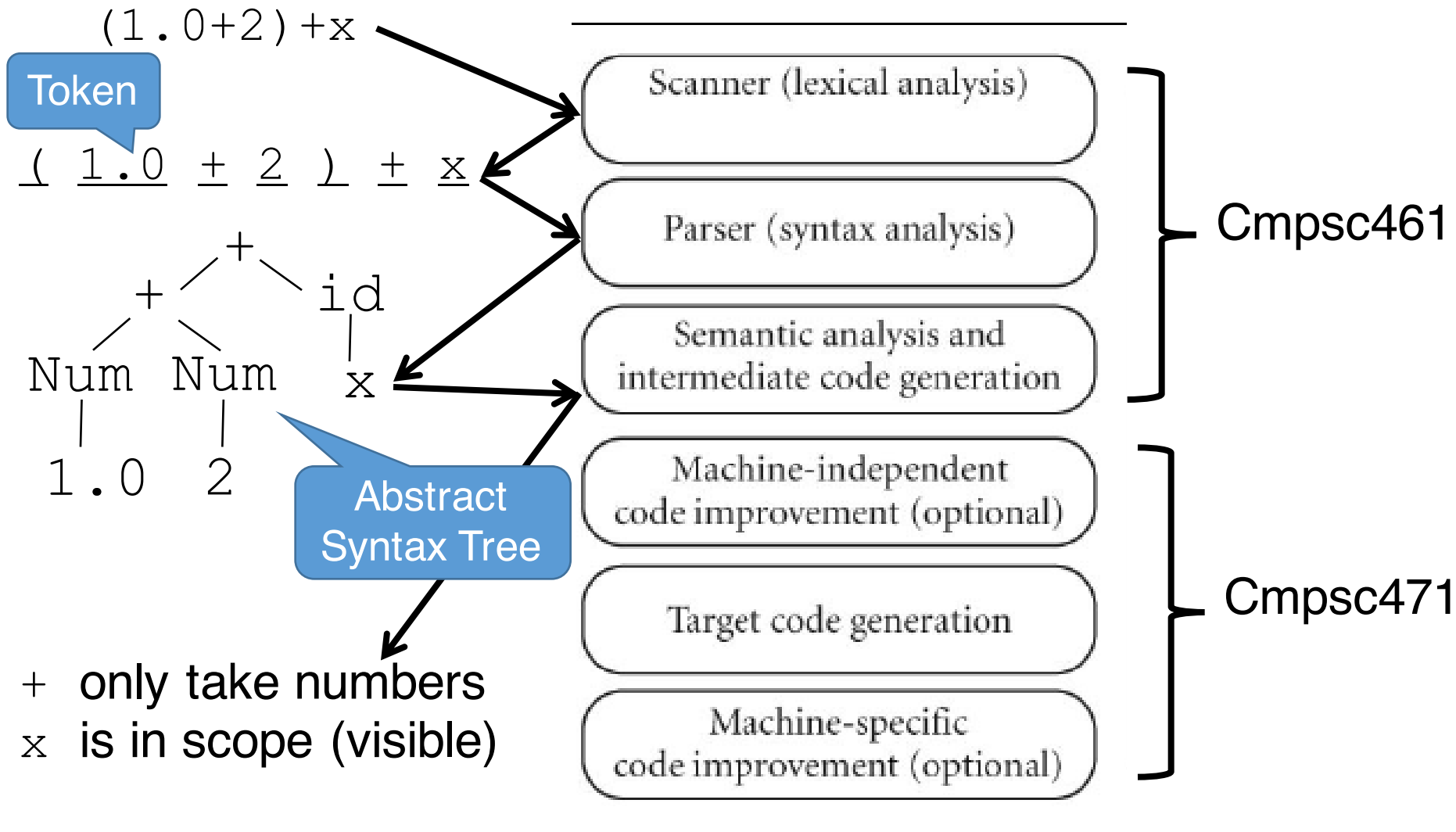
Patterns of bits, e.g., 00000101



Source Code to Target Code



Source Code to Target Code



Course Overview

Language principals

- Syntax
- Names
- Types
- Semantics
- Functions
- Memory management
- Language implementation
- Correctness

Homework

Register the Piazza discussion group
(<https://www.piazza.com/psu/fall2016/cmpsc461>)