

# CMSC330: Operational Semantics

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# Logistics

## Reading

TBD

## Goals

- ▶ Notation and Mechanics of Operational Semantics
- ▶ A few Applications

## Assignments

- ▶ Project 5 Due 30-Oct
- ▶ Project 6 up soon
- ▶ In-Person Quiz 3 on Fri 03-Nov

# Announcements

None

# Semantics Informally and Formally

*semantics (noun): The branch of linguistics and logic concerned with meaning. There are a number of branches and subbranches of semantics, including formal semantics, which studies the logical aspects of meaning,*

## Natural Languages

- ▶ Populations of humans ascribe a shared meaning to words
- ▶ Meanings vary according to population and period

# Programming Language Semantics

*What does the following syntax DO in language X?*

## Informal Semantics

- ▶ Creator of Language X describes in words what its syntax does
- ▶ Write a parser + interpreter / compiler that reflects that meaning
- ▶ May add features, update, alter semantics

*Python 2005: `print "Hello!"` prints Hello!*

*Python 2009: `print "Hello!"` prints Syntax Error*

## Formal Semantics

- ▶ Attempts to describe with some mathematical rigor the meaning of Programming language statements
- ▶ Comes in several flavors, equipped with jargon / notation
- ▶ Useful to quickly describe to humans small features of languages for comparison
- ▶ Used by some in proofs about properties of languages and programs in those languages

# Operational Semantics

- ▶ Several flavors of Formal Semantics exist of which **Operational Semantics (OpSem)** is one
- ▶ OpSem focuses on relating syntax of language to behavior of an abstract machine
- ▶ High variance on which machine to target, how machine operations are described, etc.
  - ▶ Provide actual assembly instructions
  - ▶ Describe instructions in an abstract machine
  - ▶ Describe what would happen in another PL
  - ▶ Describe in English sentences what is happening
- ▶ The persistent character is usually the **notation** used which is new and takes some getting used to

# OpSem Notation

- ▶ Specifics of notation for OpSem vary
- ▶ Will turn to some standing slides for CMSC330 for the moment to ensure compatibility with Prof Bakalian's treatment