

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
- ▶ Posted as “Reference Slides”, come from Spring 2021 Offering of CMSC330 with other materials here:
<https://www.cs.umd.edu/class/spring2021/cmsc330/>