CMSC330: Operational Semantics

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Last Updated:
Tue Oct 31 09:19:38 AM EDT 2023

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

Guest lecturer swinging by today to help with the presentation

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/