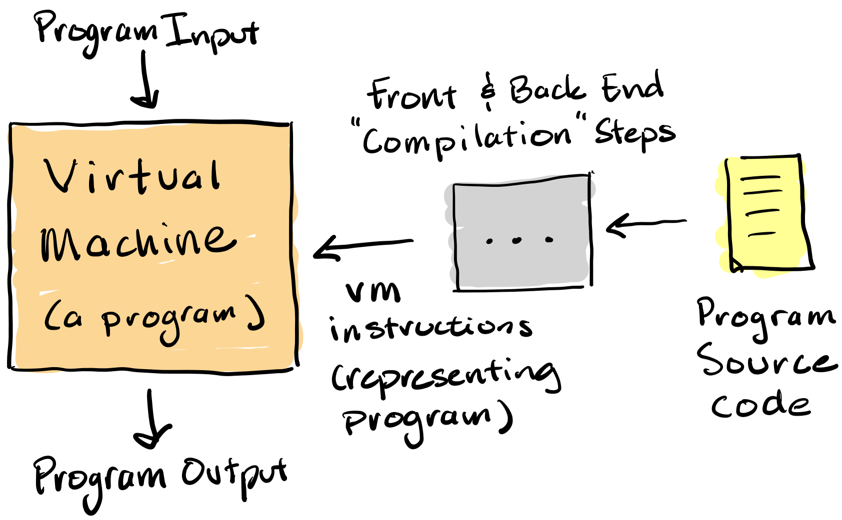
Lecture 22:

- MyPL Virtual Machine

Announcements:

- Proj Part 1 due
- HW-4 out

"Virtual Machines" (VMs) for PL Interpretation



Implements an "**abstract (computing) machine**"

- similar to computer hardware (but in software) ...
- like a computer, consists of memory, instruction set, etc.
- instructions often similar to assembly (but often simpler and higher level)
- e.g., load, store, add, jump, etc.

A "**bytecode**" VM

- encodes instructions in binary as a sequence of bytes (e.g., `.class` files)
- e.g., `ADD 3 4` might be encoded for the VM as $\underbrace{0\,1\,1\,0}_{\text{"opcode"}}\underbrace{0\,0\,1\,1}_{\text{"3"}}\underbrace{0\,1\,0\,0}_{\text{"4"}}$
- keeps programs smaller and less effort to "parse" input programs

MyPL VM for HW-5 and HW-6

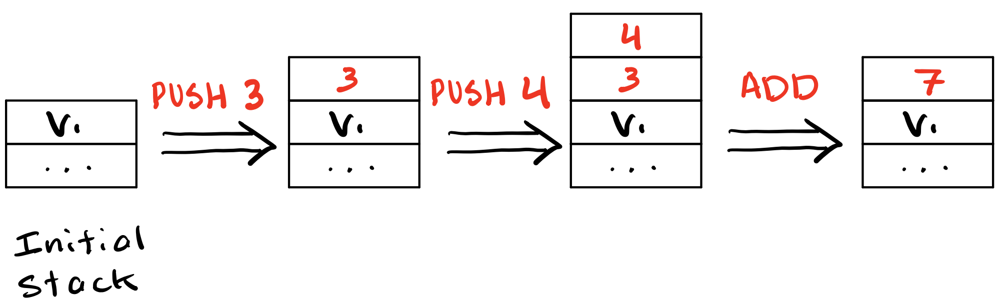
- Based loosely on the JVM architecture (stack machine, stack frames)
- Via API calls instead of using bytecode encoding/decoding
- Takes some short cuts, tailored to MyPL
- Performs minimal error checking (except for runtime program errors)

(1) Data Types/Values

- Uses Python types to represent values and assumes programs are well typed
- Uses Python `None` value for representing MyPL `null` values

(2) Abstract Stack Machine

- instead of registers, uses an "operand stack"



The VM components include: ... more later

- operand stack (see above)
- memory for storing local variables ... list of values/objects
- struct heap storage ... oid → {field:value}
- array heap storage ... oid → [value]
- function-call stack (stack of call "frames")