

Final Exam Review

Concepts

1. Operational semantics

- Big-step + Small-step — defs, notation (\Downarrow vs. \rightarrow)
- Rules of inference — defs, semantics
 - Interpreting / Applying (e.g., for IMP) — will be given!
 - Deriving proofs * proof tree for programs in B.S./S.S.
- Connection to interpreters — $\Downarrow \equiv \text{eval}$

Concepts

know "common" fns: id, fet, apply, rec, ...

2. λ -Calculus

- syntax + semantics (review precedence rules)

- ASTs — draw/interpret

- free vars + var capture

α -equivalence?

- α -conversions, β -reduction

* reduce λ -expr — to normal form or to show equivalence

- Normal form — use / necessity?

- Applicative-order vs. Normal-order

e.g., more church nums?

- Data representation: Booleans + Church numerals

Concepts

3. Continuations / CPS

- definitions

- use cases / pros + cons

- as tail-call everything

- explicit control flow

- first-class continuations

$O(1)$ time / space?

evaluate a simple call/cc e.g.

Concepts

4. Axiomatic Semantics + Hoare Logic

- definitions
- Hoare triple + assertions $\{P\} C \{Q\}$ (partial correctness)
 - strong vs. weak assertions $\text{lang of. } \sigma \models P$
 - ranking assertions in rel to \rightarrow
- IMP-related rules $\frac{1}{2}$ rule of consequence \rightarrow determine valid assertions
- deriving (weakest) preconditions \star \rightarrow derive P for non-looping prog (e.g. if/else)
- loop invariants \star \rightarrow derive loop invariant.