

# Midterm Topics (part 1)

- Semantics of While3Addr (rules, program traces)
  - Sample questions: simulate program execution, write a rule for a new construct
- Formal definitions
  - Abstraction functions, flow functions, lattices (top, bottom, precision order, and joins)
  - Sample question: define all of the above for a new analysis
- The worklist algorithm
  - Differences in assumptions at procedure entry vs. back edges of loops
  - The Kleene fixed-point theorem explaining why we initially assume bottom
- Analyses: zero analysis, constant propagation, reaching definitions, live variables, interval
  - Sample questions: simulate one of these analyses, define an additional flow function for one of them
- Definition of ascending chain and its height; termination criteria for the worklist algorithm
  - Sample question: give the height of the lattice, argue why an analysis will or will not terminate
- Definitions: soundness, local soundness, and monotonicity
  - Sample question: prove that a flow function is locally sound or monotonic, or show that it is not

# Midterm Topics (part 2)

- Collecting semantics
  - Sample question: use one of the collecting semantics defined in class, or sketch a collecting semantics approach for a new analysis
- Widening
  - Properties of the widening operator, use of widening in the worklist algorithm, widening for interval analysis
  - Sample question(s): explain how widening is used; define widening for a new analysis
- Interprocedural analysis approaches
  - Default assumptions, annotations/specifications, interprocedural control flow graph, context-sensitive analysis with input-based contexts
  - Sample question(s): simulate one of the above approaches
- Termination of interprocedural analysis
  - Sample question: explain how to ensure a particular interprocedural analysis will terminate
- Interprocedural analysis techniques: handling global variables
  - Sample question: show how to handle global variables when simulating an analysis
- pointer analysis: Andersen's, Steensgaard's
  - Sample question: simulate each of these analyses, compare precision
- OO call graph construction: class hierarchy analysis, rapid type analysis, 0-CFA analysis
  - Sample question: simulate each of these analyses, compare precision