03/01/19 Recitation Notes

17-355/17-665/17-819: Program Analysis (Spring 2019)
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1   Reminders

- Homework 6 is due **Tuesday, March 5, 2019 at 11:59pm**. Instructions can be found on the course website

- The Midterm Exam will be next **Thursday, March 7, 2019**.

2   Midterm Exam Topics & Sample Questions

- **Program Representation & Semantics (grammar, rules, program traces)**

    - **Sample questions:** simulate program execution, write a rule for a new construct

- **Dataflow Analysis Formal Definitions**

    - Abstraction functions, flow functions, lattices (top, bottom, partial order, and joins), initial dataflow information
    - **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
    - **Sample question:** simulate an analysis using the worklist algorithm with the strongly-connected component and reverse postorder heuristics

- **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

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- **Definitions: Soundness, Local Soundness, and Monotonicity**

  - **Sample question:** prove that a flow function is locally sound or monotonic, or show that it is not

- **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: 0-CFA Analysis**

  - **Sample question:** simulate this analysis