CS 432 Midterm Study Guide

Fall 2021

You are expected to be able to perform the following tasks on the exam:

- List various passes of a modern compiler and describe the advantages, disadvantages, and complications arising from front-end/back-end separation.
- List and describe formal components of deterministic and non-deterministic automata with application to particular instances.
- Compare and contrast regular vs. context-free languages, descriptions, and automata.
- Compare and contrast deterministic vs. non-deterministic finite automata.
- Compare and contrast finite vs. pushdown automata.
- Analyze and synthesize regular expressions.
- Analyze, synthesize, and manipulate finite automata:
  - Thompson's construction
  - Subset construction
  - Minimization (Hopcroft's)
- Analyze, synthesize, and manipulate grammars:
  - Derivations
  - Ambiguity
  - Associativity
  - Precedence
  - FIRST and FOLLOW sets
  - Left recursion elimination
  - Left factoring
  - LL(1) conversion
- Discuss space and time costs for finite automata conversion and execution.
- Compare and contrast top-down vs. bottom-up parsing.

- Build a shift-reduce parser for an SLR(1) grammar.
  - Construct LR(0) item sets and automata.
  - Construct SLR(1) parsing tables (ACTION and GOTO).
  - Trace an SLR(1) parser for a concrete example.
- Discuss various static analysis considerations relevant to compilers.
  - Describe the visitor design pattern and how it can help during the construction of a compiler.
  - Write a simple AST visitor using the framework from our semester-long project.
  - Explain the benefits and costs of static and dynamic type checking.
- Analyze Decaf programs.
  - Construct symbol tables.
  - Perform type inference and type checking.
  - Derive type safety proofs.
- Define and discuss specific terms or vocabulary related to any of the above concepts, including a detailed description of why and how they are relevant to the construction of a compiler.