

CMSC245 Syllabus — Fall 2009

Part I: Languages and Language Implementations (3 lectures)

Textbook Chapter 1, Chapter 10.3 “Review/Overview of Scheme”, Chapter 5.1-5.3

- Paradigms, Languages, “Core Language System” (interpreters, compilers, etc)
- Expressing algorithms in Scheme, C++, and Assembly language (contrast with Python)
- Expressing data structures in Scheme, and C++ (contrast with Python)
- (Occasional Discussions of History and of Language Design Goals)

Labs 0 and 1: Programming (and data structures) in Scheme, C++, and HERA

Part II: Lexical and Syntactic Analysis, Parse Trees and Abstract Syntax Trees (4 lectures)

Chapter 2.1, 2.3 through end of 2.3.1 plus pages 77-80, skim 2.2

- Lexical scanners and Parsers
- Derivations, Parse Trees, and Abstract Syntax Trees
- Ambiguity, Associativity, and Precedence
- Parsers and Classes of Grammars, Predictive Parsing (First and Follow sets)

Review Questions: 2.1, 2.7, 2.9b, 2.13, 2.15

Lab 2: Predictive parser/translator

Part III: Scoping, Symbol Tables, Translation of Simple Expressions and Variables (4 lectures)

Chapter 3 through the end of 3.4, Chapter 6.1-6.5

- Translation of Arithmetic Expressions
- Variables, Variable Attributes, Scope, and Lifetime
- Symbol Tables and Symbol Table Data Structures
- Environments, Storage Allocation, and access to Local, Global, “Semi-local” Variables
- Side Effects and Order of Evaluation, Defining Language Semantics

Review Questions: 3.2, 3.5, 3.9, 3.13, 3.16, 3.18 (*skip shallow-binding questions in 2009*)

Lab 3: Scoping rules

Lab 4: Symbol tables

Part IV: Data Types, Data Abstraction (3 lectures)

Chapter 7.1-7.4, 7.10

- Types: Built-in and Constructed; Concrete and Abstract
- Recursive Types (Functions, Records, Pointers)
- Type Equivalence, Type Checking, Type Conversion
- Data Abstraction
- Overloading, Polymorphism, and Type Parameters

Review Questions: 7.1, 7.19, 7.20, 7.21, 7.23

Midterm Exam (Parts I - IV) five days starting Friday of the 7th week of class.

Part V: Parameter Passing and Storage Management (3 lectures?)

Chapter 7.7, 7.8, 8-8.5

- Parameter Passing and Result Returning Mechanisms
- Garbage Collection
- Exception Handling

Review Questions: 8.3, 8.4, 8.8, 8.9, 8.10, 8.13, 8.14, 9.19

Lab 5: Reference Counting

Part VI: Pure Functional Programming (3 lectures?)

Chapter 10

- Review of Basic Functional Programming Techniques (including tail recursion)
- “Currying”, Continuation-Passing-Style, other interesting parts of the Functional Paradigm
- Higher Order Functions and Implementation Thereof (closures)
- Defining Evaluation in Pure Functional Languages
- Mathematics of Functional Programming (time permitting)

Review Questions: 10.3, 10.7, 10.6, 10.10, 10.14 (with mergesort)

Lab 6: Advanced Functional Programming

Part VII: Object-Oriented Programming (3 lectures?)

Chapter 9

- Subtyping and Inheritance as a Type Hierarchy
- Inheritance as mixed Type/Implementation Hierarchy
- Single vs. Multiple Inheritance
- Method Lookup and Dynamic Binding
- Class-based vs. Object-based Languages

Review Questions: 9.2, 9.3, 9.16, 9.17, 9.18, 9.20, M.E.D. questions to be emailed

Lab 7: Object-Oriented AST

Part VIII: Language Support for Concurrent Programming (3 lectures?)

Chapter 12

- Implicit vs. Explicit Concurrency; Automatic Parallelization
- Shared vs. Distributed Memory Models in Languages and Computer Hardware
- Coroutines vs. True Concurrency; Generators and Filters
- Language support for Messages, Semaphores, Monitors, Initialize&Publish, Transactions

Review Questions: 12.1, 12.3, 12.18 for those who have taken CMSC356

Course review — the “same fringe” problem (1 lecture)