CS 461

Programming Language Concepts

Gang Tan
Computer Science and Engineering
Penn State University

Final Exam Format

- Final exam Time and Place
  - May 1st, 2:30-4:20pm (110 minutes)
  - Location: Forum Bld 108
  - Closed book and notes
- Covers everything we have taught in the semester; biased toward materials after the second exam
- Office hours: Apr 30th 12:30-2:30pm

Types of Questions

- True/false
- Choice questions
- Short answer questions
- Versions of in-class exercise/homework problems
- You will be expected to be able to read and write small Scheme, Java, and C programs
- Note: Reviews for the other two exams are in Canvas

Purity and Side Effects

- Functional programming vs. imperative programming
  - Pure functional programming: no side effects
  - Imperative programming: mutating the state
- Purity gives you referential transparency
  - Calling the same function with the same input produce the same result
  - Does not depend on where the function is called or the evaluation order
  - Enable advanced techniques such as memoization
- Scheme constructs with side effects: set!, set-car!, set-cdr!
- Possible questions: true/false, choice questions, short-answer questions

Ch7 Types

- Types
  - A collection of values and a set of operations on those values
- Type errors: undefined operations
- Static vs. dynamic typing
- Type safety
- Scheme is dynamically typed
- Type equivalence
- Possible kinds of questions
  - Yes/no questions, choice questions

Memory Management

- The heap: memory manager
- Two routines: p=new(n); delete(p)
- Two ways of mem management in PLs
  - Manual memory management
  - GC
- Scheme's way of memory allocation
  - cons and atom cells
- Def. of garbage
- GC algorithms: mark-and-sweep; reference counting; copy collection
  - How does each one work
  - Strength and weakness

Memory Management: Possible Questions

- Draw the memory layout after running a program (e.g., Scheme)
- Figure out the result after running GC

Ch10 OO Programming

- OO program: a collection of objects that communicate by message passing
  - objects; class
- OO concepts
  - Dynamic lookup
  - Method overloading
  - Subclassing
  - Inheritance
  - Method overriding

OO Programming: Possible Questions

- Figure out results of programs, which may contain OO features:
  - Dynamic lookup; method overloading; method overriding; subclassing; inheritance; class attributes; data attributes; …

Language Interoperation

- Allow components in PLs to interoperate
- C/C++ as the lingua franca
- JNI
  - Allows Java methods to be implemented in C/C++
  - Interface determined by native method signature
  - Tools generate C interfaces and marshaling code
  - References are treated abstractly, which facilitates memory management
  - Environment pointer provides access to JVM services such as object creation and method invocation