

COMP 3440 – Programming Language Concepts

Calendar Description: An introduction to major concepts involved in the design of modern programming languages. The imperative, functional, and logical families and differences between them. Facilities for high level data and control structures, modular programming, data typing, and other topics will be covered.

Prerequisite: COMP 2140

Outline

- 1) Programming paradigms (1/2 week)
Imperative, functional, and logical programming, examples and comparisons
- 2) History, evaluation, and comparison of languages (1/2 week)
History from FORTRAN to the present, properties of historically important languages, features that make a “good” language
- 3) Syntax and Semantics (1 week)
EBNF, ambiguity, static semantics, attribute grammars, operational, denotational, and axiomatic semantics, preconditions and postconditions
- 4) Language implementation (1/2 week)
Compilation, interpretation, hybrid approaches, relation to language features
- 5) Identifiers and bindings (1 week)
Types, scopes, lifetimes, semi-static, static, and dynamic languages and their run-time operation, static and dynamic links
- 6) Data types (1 ½ weeks)
All standard scalar and structured types, type checking, coercion, type equivalence, subtypes, pointers and garbage collection
- 7) Control flow (1 week)
Iteration types, dangling else, parameter types (name, copy, reference, keyword), coroutines, exceptions, concurrency, semaphores, monitors
- 8) Pure functional programming - FP (1 week)
Fundamental components of functional languages, the FP language, examples of functional programming
- 9) LISP (2 ½ weeks)
All the basics of LISP, data and list representation, evaluation, basic functions, functional definition, higher-level functions (lambda, #', mapcar, funcall, etc.)
- 10) Prolog (2 ½ weeks)
Terms, rule bases, queries, proof of goals (substitution, unification, instantiation), lists and data structures, predicates, numeric data (“is” and comparisons), writing flexible directionless predicates.
- 11) Overhead (1 week)
Midterms, holidays, reviews, etc.

Text: Robert Sebesta, *Concepts of Programming Languages*, Addison-Wesley