



## 4th Credit hour project

- ▶ For students registered for 4 hours
- ▶ Can work in groups of up to 3 people
- ▶ Potential projects detailed on course web page
- ▶ Fairly flexible – you should pick something you are interested in, to make it more fun
- ▶ Project proposals are due by **June 14**, but can be in earlier if you want to get a head start
- ▶ 1/2 page (per project) status reports due every 2 weeks via e-mail

## What is a programming language?

- ▶ A notation for software designs (**syntax**)
- ▶ A definition of what this notation means/how programs behave (**semantics**)
- ▶ How are languages defined?
  - ▶ Sometimes they're defined precisely, using math as a meta-language (e.g., "*The Definition of Standard ML*").
  - ▶ More often they're defined loosely, which leads to ambiguities and complexity (e.g., C++).
- ▶ How do you make a *good* programming language definition?

## Kinds of languages

- ▶ Assembly (x86, MIPS, PowerPC, ...)
- ▶ Imperative (C, Pascal, ...)
- ▶ Object-Oriented (C++, Java, Smalltalk, ...)
- ▶ Functional (**OCaml**, Scheme, Haskell, ...)
  - ▶ *Functions* as first-class objects
  - ▶ Programs generally behave as functions: same inputs ⇒ same outputs
- ▶ Declarative Logic Programming (Prolog, Maude, ...)
  1. Define a logical system (equations, inference rules, etc.)
  2. Pose a query
  3. Programming system solves for a result

## What kinds of software tools are out there?

- ▶ Covered in this class:
  - ▶ Compilers
  - ▶ Interpreters
  - ▶ Type checkers
  - ▶ Code generators
- ▶ Also:
  - ▶ Debuggers
  - ▶ Static analysis tools
  - ▶ Model checkers
  - ▶ Theorem provers

## A bit of history

THEORY	lambda calculus	type systems	verification	CS 421				
COMBINATORIAL LOGIC	combinatory logic	semantics	verification	CS 421				
1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
PRACTICE	computers	LISP	Simula	FORTRAN	C	ML	Web	CS 421
						C++	Java	

Note: this is an approximate timeline, many things are left out.

## Reading assignment

- ▶ Look this stuff up online (Wikipedia, etc.)
- ▶ Read the supplementary notes on the course website: <http://www.cs.uiuc.edu/class/su07/cs421/lectures/>.