

# CSE 341: Programming Languages

Autumn 2005

Lecture 23 — `define-struct` & `misc`

## A Few Miscellaneous Scheme Topics

---

In DrScheme, you can use square brackets as well as parenthesis. (You need to match left parentheses with right parentheses, left square brackets with right square brackets.) Suggestion: use not at all, or sparingly for readability.

' is a macro — 'x and '(a b c) are equivalent to (quote x) and (quote (a b c)).

Scheme functions can take a variable number of arguments.

```
(define (squid a b . c)
  (print a)
  (print b)
  (print c))
```

squid requires at least 2 arguments. Any remaining arguments (perhaps 0) are put into a list, which is bound to c.

# Data in Scheme

---

Recall ML's approach to each-of, one-of, and self-referential types.

Pure Scheme's approach:

- There is One Big Datatype with built-in predicates.
- Use pairs (lists) for each-of types.
- Primitives implicitly raise errors for “wrong variant”
- Use helper functions like `caddr` and your own.

## define-struct

---

MzScheme extends Scheme with `define-struct`, e.g.:

```
(define-struct square (x y))  
(define-struct piece (squares))
```

Semantics:

- Binds constructors (`make-square`, `make-piece`) that take arguments and make values.
- Binds predicates (`square?`, `piece?`) that take one argument and return `#t` only for values built from the right constructor.
- Binds accessors (`square-x`, `square-y`, `piece-squares`) that take one argument, return the appropriate field, and call `error` for values not built from the right constructor.
- Binds mutators (`set-square-x!`, `set-square-y!`, `set-piece-squares!`).

## define-struct is special

---

define-struct creates a new variant for the One Big Datatype.

Claim: define-struct is not a function.

Claim: define-struct is not a macro.

It could be a macro except for one key bit of its semantics: Values built from the constructor cause every *other* predicate (including all built-in ones) to return #f.

Advantage: abstraction

Disadvantage: Can't write "generic" code that has a case for every possible variant in every Scheme program.

## Idiom for ML datatypes

---

Instead of a datatype with  $n$  constructors, you just use `define-struct`  $n$  times.

That “these  $n$  go together” is just convention.

Instead of `case`, you have a `cond` with  $n$  predicates and one “catch-all” error case.