CS 135 — L16: Local and Application

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Local Definition

🐳 **Info** —

```
(local
  [(define ...)]
  [(define ...)]
  [(define ...)]
  ...
  (local scope code)
)
```

Example:

Heron's Formula

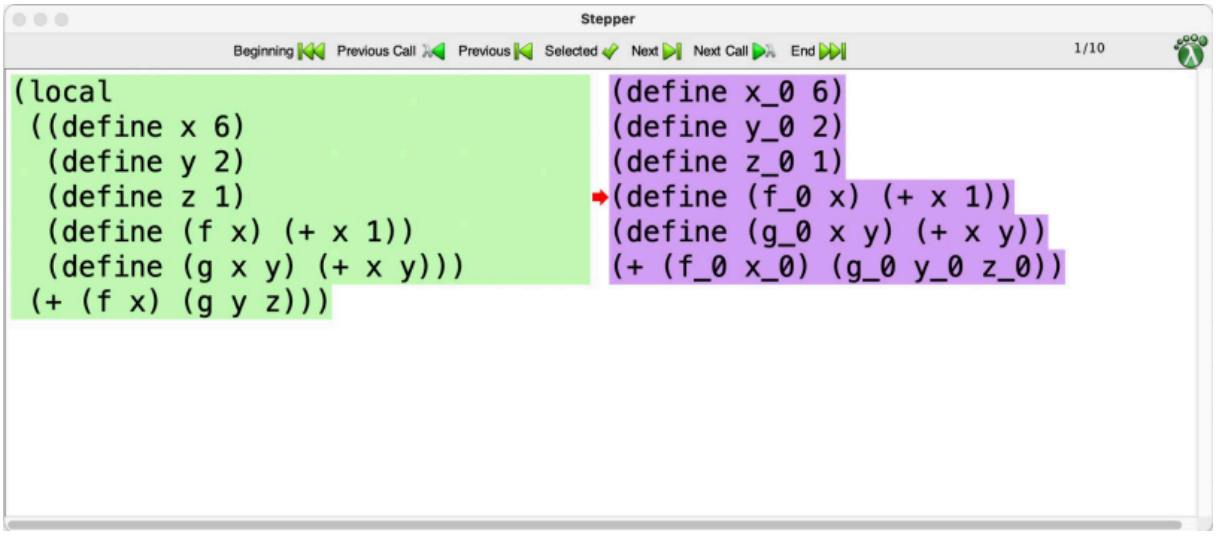
```
define (heron a b c)
 (local [(define s (/ (+ a b c) 2))]
 (sqrt (* s (- s a) (- s b) (- s c)))))
```

⚠️ **Warning** — Functions under `local` cannot be checked with `check-expect`

α Conversion

1. Choose a fresh name for each definition in the `local`.
2. Substitute that fresh name everywhere it is used in the local.
3. Lift the definition to the top level.
4. Replace `(local [...] expression)` with just the expression.

Stepper example:



Benefits of Local

1. Clarity: Naming subexpressions
2. Encapsulation: Hiding stuff
3. Scope: Reusing names
4. Efficiency: Avoiding recomputation

Encapsulation

Encapsulation describes the general programming principle that we should "encapsulate" (or hide away) implementation details that are not relevant to how a the function is used ("information hiding").

Local bindings are not visible, and have no effect outside the local expression. Thus, they can "hide" information from other parts of a program.

Example:

```
(define (rev lst)
 (local
   [(define (rev/accumulate lst accumulator)
     (cond [(empty? lst) accumulator]
           [else (rev/accumulate (rest lst) (cons (first lst) accumulator))]))]
   (rev/accumulate lst empty)))

(check-expect (rev '(d c b a)) '(a b c d))
```

Efficiency

Serve as memoization/DP/caching

Binary Tree Example

```
(define (bt-path label bt)
 (cond [(empty? bt) empty]
       [(= (get-label bt) label) (list 'found)]
       [else
         (local
          [(define lpath (bt-path label (get-left bt)))]
            (cond [(empty? lpath)
              (local
               [(define rpath (bt-path label (get-right bt)))]
                 (cond [(empty? rpath) empty]
                   [else (cons 'right rpath)]))]
             [else (cons 'left lpath)]))]))
```

Stepper Rule

Examples:/

```
(local [(define x 10) (define y (+ x 5))] (* x y))

(define x_0 10)
(define y_0 (+ x_0 5))
(* x_0 y_0)
```

```
(define x_0 10)
(define y_0 (+ 10 5))
(* x_0 y_0)
```

```
(define x_0 10)
(define y_0 15)
(* 10 y)
(* 10 15)
```

```
150
```

```
(local [(define z 3)] (+z (local [define z 7] (* z 2))))
```

```
(define z_0 3)
(+ z_0 (define z_1 7) (* z_1 2)))
```

```
(define z_0 3)
(define z_1 7)
(+ 3 (* z_1 2)))
```

```
(define z_0 3)
(define z_1 7)
(+ 3 (* 7 2))
```

```
(+ 3 14)
```

```
17
```