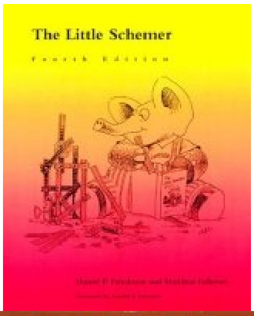
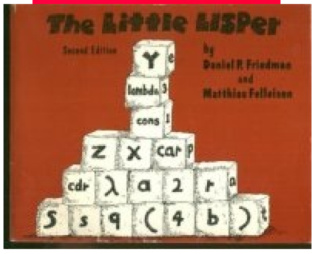
GTF - Great Teacher Friedman

Dan Friedman Indiana The Little SchemerThe Little Lisper) “” Lisp/Scheme



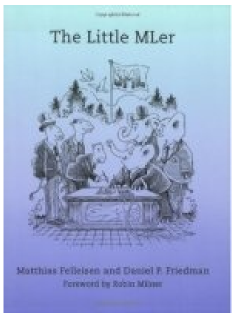


Friedman Scheme “”“”“”60

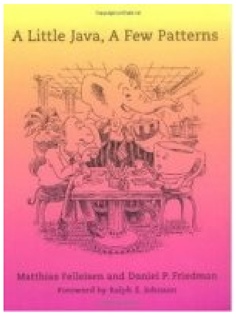
“” Friedman Haskell lazy evaluation 1976 David Wise “CONS should not Evaluate its Arguments”

 The Little Schemer Friedman Scheme ML

 ML Scheme Friedman The Little MLer



 Java A Little Java, A Few Patterns:


A Little Java, A Few Patterns
Matthias Felleisen and Daniel P. Friedman
Foreword by Ralph E. Johnson

Friedman “” IU Dan Friedman (Gandalf)

 Friedman "”“ Cornell ML Haskell Paul Graham On LispPeter Norvig Paradigms of Artificial Intelligence Programming, Richard Gabriel ……” “……”

Dan Friedman C311 IU “” C311 (miniKanren) Scheme C

Friedman miniKanren Friedman “Does it run backwards?”Prolog“” Friedman “Does it run backwards?”

Friedman “”—— (static type system) Scheme “”

 B621 Scheme ML Haskell Hindley-Milner type inference Cornell ML IU (abstract interpretation) Cornell

89“Does it run backwards? ”“……”“……”

Hindley-Milner :-)

miniCoq

 Dan Friedman miniKanren (logic programming language) The Reasoned Schemer Martin-Löf

“”(lightening talk)5 Friedman “5……”“ Curry-Howard correspondence Coq nnnnn x Coq miniCoq……”

miniCoq… “Dan Friedman miniCoq” IU

 Firedman JBob miniCoq The Little Prover C311 Coq “”

C311

 Cornell IU Dan Friedman B521 Cornell Friedman “ Cornell Cornell IU ” Amr Sabry B522 C311

“The Little SchemerEssentials of Programming Languages” Cornell closureCPS Cornell Cornell Friedman

 Scheme CPS ”” (register) CPS continuation (abstract machine)CPU JVM“” CPU Olivier Danvy CPS DNA……

 C311 miniKanren (logic programming language) Prolog Prolog The Reasoned Schemer miniKanren Prolog Prolog

Dan Friedman “” C311 B621

 CPS C311 C311 Friedman “”brain teaser CPS “ CPSer Scheme CPS ”“” CPS “”——

 CPS “” bug CPS 100

 Friedman Lindley HallIU “ brain teaser ”“”“”“”30 “Representing control: a study of the CPS transformation” Olivier Danvy Andrzej Filinski CPS Princeton Andrew Appel Compiling with ContinuationsAmr Sabry CPS ANF CPS 10 CPS

Friedman “”“ C311 ” Danvy Filinski 1991 1975 Gordon Plotkin Scheme lambda calculus Plotkin

 Friedman B621 “100”

 lambda calculus 30 10

```
(define cps
  (lambda (exp)
    (letrec
        ([trivs '(zero? add1 sub1)]
         [id (lambda (v) v)]
         [C~ (lambda (v) `(k ,v))]
         [fv (let ((n -1))
               (lambda ()
                 (set! n (+ 1 n))
                 (string->symbol (string-append "v" (number->string n)))))]
         [cps1
          (lambda (exp C)
            (pmatch exp
              [,x (guard (not (pair? x))) (C x)]
              [(lambda (,x) ,body)
               (C `(lambda (,x k) ,(cps1 body C~)))]
              [(,rator ,rand)
               (cps1 rator
                     (lambda (r)
                       (cps1 rand
                             (lambda (d)
                               (cond
                                [(memq r trivs)
                                 (C `(,r ,d))]
                                [(eq? C C~)         ; tail call
                                 `(,r ,d k)]
                                [else
                                 (let ([v* (fv)])
                                   `(,r ,d (lambda (,v*) ,(C v*))))])))))]))])
      (cps1 exp id))))
```

B621 Friedman

church numeral (predecessor) Stephen Kleene   Cornell Kleene Kleene lambda calculus

`λn w z. ((n λl h. h (l w)) (λd.z)) (λx.x)`

lambda calculus SKI combinator CPS Hindley-Milner

“” “”

ANF Amr Sabry CPSer ANF R. Kent Dybvig CPS Dybvig pass

“”(reinvention)

“” Dan Friedman