

# CS 135 — L17 - First Class Functions

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## Filter

### Info — filter

```
(filter pred? lst)
```

Filter function is equivalent to keep function.

```
(define (keep pred? lst)
  (cond [(empty? lst) empty]
        [(pred? (first lst)) (cons (first lst) (keep pred? (rest lst)))]
        [else (keep pred? (rest lst))])
  )
)
```

Time Complexity:  $O(n)$

Example Template:

```
(define function lst)
  (local [(define (pred? ...))])
  (filter pred? lst))
```

## Producing Functions

### Info — Adders

Adders increment the given  $n$  by a  $m$  (i.e. (add1  $n$ ) is an adder with  $m = 1$ )

```
define (make-adder n)
  (local
    [(define (f m) (+ n m))])
  f))
```

## List of Functions

Evaluation of Expression Tree

### Approach 1

```
;; translate: Sym -> (list (Num Num -> Num) Num)
(define (translate op)
  (local[(define (nothing x y) 0)
        (define operations (list (list '+ (list + 0)) (list '* (list * 1))))
        (define (lookup op lst)
          (cond [(empty? lst) (list nothing 0)]
                [(symbol=? op (first (first lst)))(second (first lst))]
                [else (lookup op (rest lst))])])
    (lookup op operations)))
```

```

;; apply an operator to a list of arithmetic expressions
;; apply-exp: Sym (listof AExp) -> Num
(define (apply-exp op el)
  (local [(define operation (translate op))])
  (cond [(empty? el) (second operation)]
        [else ((first operation)(eval (first el))
      (apply-exp op (rest el))))]))

```

## Approach 2

This requires a slight modification on the expression tree to directly store the operation as the first element of the list

```

;; evaluate an arithmetic expression
;; eval: AExp -> Num
(define (eval exp)
  (cond [(number? exp) exp]
        [else (apply-exp (first exp) (rest exp))]))

;; apply an operator to a list of arithmetic expressions
;; apply-exp: (Num Num -> Num) (listof AExp) -> Num
(define (apply-exp op args)
  (cond [(empty? args) (op)]
        [else (op (eval (first args))
      (apply-exp op (rest args))))]))

```