Lecture 10: Pegboard Puzzles

Problem Sets
- Not just meant to review stuff you should already know
  - Get you to explore new ideas
  - Motivate what is coming up in the class
- The main point of the PSs is learning, not evaluation
  - Don't give up if you can't find the answer in the book (you won't solve many problems this way)
  - Do discuss with other students

PS2: Question 3
Why is
(define (higher-card? card1 card2)
  (> (card-rank card1) (card-rank card2))
better than
(define (higher-card? card1 card2)
  (> (car card1) (car card2)))
)?

PS2: Question 8, 9
- Predict how long it will take
- Identify ways to make it faster

Can we do better?
(define (find-best-hand hole-cards community-cards)
  (car (sort (possible-hands hole-cards community-cards) higher-hand?)))
Hmmm....

(define (find-closest goal lst closeness)
  (if (= 1 (length lst))
      (car lst)
      (pick-closest closeness goal (car lst)
       (find-closest goal (cdr lst) closeness))))

(define (pick-closest closeness goal num1 num2)
  (if (< (closeness goal num1)
         (closeness goal num2))
      num1
      num2))

find-bestest

(define (find-bestest lst bestiness)
  (if (= 1 (length lst))
      (car lst)
      (pick-bestier bestiness
       (car lst)
       (find-bestest goal (cdr lst) bestiness))))

(define (pick-bestier bestiness num1 num2)
  (if (< (bestiness num1)
         (bestiness num2))
      num1
      num2))

(find-best-hand

(define (find-best-hand lst)
  (find-bestest lst higher-hand?))

Next week: how much better is this?

PS3: Lindenmayer System Fractals

L-Systems

CommandSequence ::= ( CommandList )
CommandList ::= Command CommandList
CommandList ::= Command
Command ::= F
Command ::= R Angle
Command ::= O CommandSequence

L-System Rewriting

Start: (F)
Rewrite Rule:
  F → (F O(R30 F) F O(R-60 F) F)

Work like BNF replacement rules, except replace all instances at once!

Why is this a better model for biological systems?
Lecture 10: Pegboard Puzzle

The Great Lambda Tree of Ultimate Knowledge and Infinite Power
(Level 5 with color)

Pegboard Puzzle

1,1 2,1 2,2 3,1 3,2 3,3 4,1 4,2 4,3 4,4 5,1 5,2 5,3 5,4 5,5

Solving the Pegboard Puzzle

- How to represent the state of the board?
  - Which holes have pegs in them
- How can we simulate a jump?
  - board state, jump positions \( \rightarrow \) board state
- How can we generate a list of all possible jumps on a given board?
- How can we find a winning sequence of jumps?
Removing a Peg

;; remove-peg evaluates to the board you get by removing a peg at posn from the passed board (removing a peg adds a hole)

(define (remove-peg board posn)
  (make-board (board-rows board)
              (cons posn (board-holes board))))

Adding a Peg

;; add-peg evaluates to the board you get by adding a peg at posn to board (adding a peg removes a hole)

(define (add-peg board posn)
  (make-board (board-rows board)
              (remove-hole (board-holes board) posn)))

Remove Hole

(define (remove-hole lst posn)
  (if (same-position (car lst) posn)
      (cdr lst)
      (cons (car lst) (remove-hole (cdr lst) posn))))

Filter

(define (filter proc lst)
  (if (null? lst)
      null
      (if (proc (car lst)) ; proc is true, keep it
        (cons (car lst) (filter proc (cdr lst)))
        (filter proc (cdr lst)))))) ; proc is false, drop it

> (filter (lambda (x) (> x 0)) (list 1 4 -3 2))
(1 4 2)

Filter Remove

(define (filter proc lst)
  (if (null? lst)
      null
      (if (proc (car lst)) ; proc is true, keep it
        (cons (car lst) (filter proc (cdr lst)))
        (filter proc (cdr lst)))))) ; proc is false, drop it

(define (remove-hole lst posn)
  (filter (lambda (pos)
            (not (same-position pos posn)))
          lst))

Solving the Peg Board Game

• Try all possible moves on the board
• Try all possible moves from the positions you get after each possible first move
• Try all possible moves from the positions you get after trying each possible move from the positions you get after each possible first move
• ...

...
Charge

- Next class: we’ll finish a pegboard puzzle solver and find out if how hard it is to be “genius”
- I have office hours now
- Make progress on PS3