Tracking Rumors

Suppose that we want to track gossip in a rumor mill
Tracking Rumors

Simplifying assumption: each person tells at most two others
Representing Rumor Mills

Is a rumor mill simply a list of people?
No, because there are relationships among people
Representing Rumor Mills

How about this?:

; A person is
; (make-person image person person)

No, because some people don’t gossip to anyone else—or they gossip to an empty rumor mill...
Representing Rumor Mills

How about this?:

; A rumor-mill is either
;   - empty
;   - (make-gossip image rumor-mill rumor-mill)
(define-struct gossip (who next1 next2))

This looks promising...
Example Rumor Mills

; A rumor-mill is either
;   - empty
;   - (make-gossip image rumor-mill rumor-mill)

empty
Example Rumor Mills

; A rumor-mill is either
;   - empty
;   - (make-gossip image rumor-mill rumor-mill)

(make-gossip empty empty)

Joseph
Example Rumor Mills

; A rumor-mill is either
;   - empty
;   - (make-gossip image rumor-mill rumor-mill)

(make-gossip
   empty

   (make-gossip
      empty empty))
Example Rumor Mills

; A rumor-mill is either
; - empty
; - (make-gossip image rumor-mill rumor-mill)

(make-gossip
  (make-gossip empty empty)
  (make-gossip
    (make-gossip empty
      (make-gossip empty empty)))

(mike)
  (amir)
  (seichi)
  (lindsay)
  (joseph)
  (derrick)
Example Using Constants

\[
\begin{align*}
&\text{(define joseph-mill} \\
&\quad \text{(make-gossip} \quad \text{empty empty})) \\
&\text{(define amir-mill} \quad \text{empty joseph-mill}) \\
&\text{(define derrick-mill} \\
&\quad \text{(make-gossip} \quad \text{empty empty})) \\
&\text{(define lindsey-mill} \\
&\quad \text{(make-gossip} \quad \text{amir-mill derrick-mill}) \\
&\text{(define mike-mill} \\
&\quad \text{(make-gossip} \quad \text{empty empty})) \\
&\text{(define seiichi-mill} \\
&\quad \text{(make-gossip} \quad \text{mike-mill lindsey-mill})
\end{align*}
\]
Programming with Rumors

; A rumor-mill is either
;   - empty
;   - (make-gossip image rumor-mill rumor-mill)

(define (func-for-rumor-mill rm)
  (cond
    [(empty? rm) ...]
    [(gossip? rm)
      ... (gossip-who rm)
      ... (func-for-rumor-mill (gossip-next1 rm))
      ... (func-for-rumor-mill (gossip-next2 rm)) ...])))
Rumor Program Examples

Implement the function `informed?` which takes a person image and a rumor mill and determines whether the person is part of the rumor mill.

Implement `rumor-delay` which takes a rumor mill and determines the maximum number of days required for a rumor to reach everyone, assuming that each person waits a day before passing on a rumor.

Implement `add-gossip` which takes a rumor mill and two person images — one new and one old — and adds the new person to the rumor mill, receiving rumors from the old person; the old person must not already have two next persons.

Implement `rumor-chain` which takes a person image and a rumor mill and returns a list of person images representing everyone who must pass on the rumor for it to reach the given person; return `false` if the given person is never informed.
More Pipes

A pipeline has faucets (opened or closed), straight parts (copper or lead), and branches
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A pipeline has faucets (opened or closed), straight parts (copper or lead), and branches

; A pipeline is either
;   - bool
;   - (make-straight sym pipeline)
;   - (make-branch pipeline pipeline)
(define-struct straight (kind next))
(define-struct branch (next1 next2))
Example Pipelines

; A pipeline is either
;   - bool
;   - (make-straight sym pipeline)
;   - (make-branch pipeline pipeline)

false
Example Pipelines

; A pipeline is either
;  - bool
;  - (make-straight sym pipeline)
;  - (make-branch pipeline pipeline)

true
Example Pipelines

; A pipeline is either
; - bool
; - (make-straight sym pipeline)
; - (make-branch pipeline pipeline)

(make-straight 'copper false)
Example Pipelines

; A pipeline is either
;  - bool
;  - (make-straight sym pipeline)
;  - (make-branch pipeline pipeline)

(make-straight 'copper
    (make-straight 'lead false))
Example Pipelines

; A pipeline is either
;   - bool
;   - (make-straight sym pipeline)
;   - (make-branch pipeline pipeline)

(make-branch
  (make-branch (make-straight 'copper true)
                false)
  (make-branch false
               false))
Programming with Pipelines

; A pipeline is either
;  - bool
;  - (make-straight sym pipeline)
;  - (make-branch pipeline pipeline)

(define (func-for-pipeline pl)
  (cond
   [(boolean? pl) ...]
   [(straight? pl)
    ... (straight-kind pl)
    ... (func-for-pipeline (straight-next pl)) ...]
   [(branch? pl)
    ... (func-for-pipeline (branch-next1 pl))
    ... (func-for-pipeline (branch-next2 pl)) ...])))
Pipeline Examples

Implement the function `water-running?` which takes a pipeline and determines whether any faucets are open

Implement the function `modernize` which takes a pipeline and converts all 'lead straight pipes to 'copper

Implement the function `off` which takes a pipeline and turns off all the faucets

Implement the function `twice-as-long` which takes a pipeline and inserts a 'copper straight pipe before every existing piece of the pipeline