```lisp
(defpackage :runr (:use :cl))
(in-package :runr)
(defvar *help* "
runr: simple lisp
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USAGE: lisp runr.lisp [OPTIONS]

OPTIONS:
  -h  help    show help            = nil
  -g  action  start up action      = none
  -p  p       distance coeffecient  = 2
  -s  seed    random number seed    = 10019")

(defvar *egs* nil)
(defvar *settings* nil)
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(defun l() (load "runr"))

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(defmacro ! (s)
  "convenience function to access access settings"
  `(getf (car (member ',s *settings* :key (lambda (x) (getf x :key)) :test #'equal))
         :value))

(defmacro aif (test then &optional else)
  `(let ((it ,test))
     (if it ,then ,else)))

(defmacro ? (s x &rest xs)
  "recursive slot-value access"
  (if (null xs) `(slot-value ,s ',x) `(? (slot-value ,s ',x) ,@xs)))

(defmacro geta (x lst &optional (init 0))
  "ensure that `lst` includes a cell (x num) and return that cell"
  `(cdr (or (assoc ,x ,lst :test #'equal)
            (car (setf ,lst (cons (cons ,x ,init) ,lst))))))

(defmacro defstruct+ (x doco &body body)
  "Creates %x for constructor, enables pretty print, hides slots with '_' prefix."
  (let* ((slots (mapcar    (lambda (x) (if (consp x) (car x) x))            body))
         (show  (remove-if (lambda (x) (eq #\_ (char (symbol-name x) 0))) slots)))
    `(progn
       (defstruct (,x (:constructor ,(intern (format nil "%MAKE-~a" x)))) ,doco ,@body)
       (defmethod print-object ((self ,x) str)
         (labels ((fun (y) (format nil ":~(~a~) ~a" y (slot-value self y))))
           (format str "~a" (cons ',x (mapcar #'fun ',show))))))))

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(defun charn (s c &optional (n 0))
  "is `s` a string holding `c` at position `n`?"
  (if (stringp s)
    (if (< n 0)
      (charn s c (+ (length s) n))
      (and (>= n 0) (< n (length s)) (eql c (char s n))))))

(defun trim (s)
 "kill leading,trailing whitespace"
  (string-trim '(#\Space #\Tab #\Newline) s))

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(defun thing (s &aux (s1 (trim s)))
  "coerce `s` into a number or string or t or nil or #\?"
  (cond ((equal s1 "?") #\?)
        ((equal s1 "t") t)
        ((equal s1 "nil") nil)
        (t (let ((n (read-from-string s1 nil nil)))
             (if (numberp n) n s1)))))

(defun words (s &optional (char #\,) (filter #'thing) (here 0))
  "generate words, filtered, from`s`"
  (let* ((there (position char s :start here))
         (word  (funcall filter (subseq s here there))))
    (labels ((tail () (if there (words s char filter (1+ there)))))
      (if (equal word "") (tail) (cons word (tail))))))

(defun with-lines (file fun)
  "Call `fun` for each line in `file`"
  (with-open-file (s file)
    (loop (funcall fun (or (read-line s nil) (return))))))

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; These randoms let reset the seed.
(defvar *seed* 10013)
(defun rand (&optional (n 2))
  "Random float 0.. < n"
  (setf *seed* (mod (* 16807.0d0 *seed*) 2147483647.0d0))
  (* n (- 1.0d0 (/ *seed* 2147483647.0d0))))

(defun rint (&optional (n 2) &aux (base 10000000000.0))
  "Random int 0..n-1"
  (floor (* n (/ (rand base) base))))

(defun settings (s)
  "for lines like '  -Key Flag ..... Default', return (KEY flag (thing Default))"
  (loop :for (flag key . lst)
        :in  (words s #\NewLine (lambda (s1) (words s1 #\Space #'trim)))
        :if  (charn flag #\-)
        :collect (list :key (intern(string-upcase key)) :value (thing(car (last lst))) :flag flag)))

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(defun cli (settings &optional (args #+clisp ext:*args*
                                     #+sbcl sb-ext:*posix-argv*))
  "update settings from command-line;  non-boolean settings expect a value after the flag
 while boolean settings just expect a flag (and, if used on command line, this flips the default)"
  (dolist (setting settings settings)
    (aif (member (getf setting :flag) args :test 'equal)
         (let* ((b4  (getf setting :value))
                (now (cond ((eq b4 t) nil)
                           ((eq b4 nil) t)
                           (t (second it)))))
           (setf (getf setting :value) now)))))
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(defmacro eg (what fun)
  "define an example"
  `(push (list :name ',what :fun ,fun) *egs*))

(defun egs ()
  "run 'all' actions or just the (! action) action
 (resetting random seed and other setting before each action)"
  (let ((fails 0)
        (b4 (copy-list *settings*)))
    (dolist (eg (reverse *egs*))
      (let ((name (getf eg :name)))
        (when (or (equal (! action) name)
                  (equal (! action) "all"))
          (setf *settings* b4
                *seed* (! seed))
          (format t "TESTING ~a " name)
          (cond ((funcall (getf eg :fun)) (format t "PASS âM-^\M-^E~%"))
                (t                         (format t "FAIL âM-^]M-^L~%")
                                           (incf fails))))))
    #+clisp (ext:exit fails)
    #+sbcl  (sb-ext:exit :code fails)))
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(defun about ()
  "show the help string (built from *help* and the doc strings from *egs*"
  (format t "~a~%~%ACTIONS:~%" *help*)
  (dolist (eg (reverse *egs*))
    (format t " ~10a : ~a~%" (getf eg :name) (documentation (getf eg :fun) 'function))))

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(defun isNum    (s) (and (> (length s) 1) (upper-case-p (char s 0))))
(defun isGoal   (s) (or (isKlass s) (isLess s) (isMore s)))
(defun isIgnore (s) (charn s #\X -1))
(defun isKlass  (s) (charn s #\! -1))
(defun isLess   (s) (charn s #\- -1))
(defun isMore   (s) (charn s #\+ -1))

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(defstruct+ sym (at 0) (txt "") (n 0) has (w 1) mode (most 0))
(defun make-sym (&optional (at 0) (txt ""))
  "summarizes streams of numbers"
  (%make-sym :at at :txt txt :w (if (isLess txt) -1 1)))

(defmethod add ((i sym) x)
  (with-slots (n has mode most) i
    (unless (eq x #\?)
      (incf n)
      (incf (geta x has))
      (when (> (geta x has) most)
        (setf most (geta x has)
              mode x)))))

(defmethod mid ((i sym)) (? i mode))
(defmethod div ((i sym))
  "Diversity (entropy)."
  (with-slots (has n) i (labels ((fun (p) (* -1 (* p (log p 2)))))
                          (loop for (_ . n1) in has sum (fun (/ n1 n))))))

(defmethod dist ((i sym) x y)
  (cond ((and (equal x #\?) (equal x #\?)) 1)
        (t                    (if (equal x y) 0 1))))

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(defstruct+ num (at 0) (txt "") (n 0) (mu 0) (m2 0) (w 1) (lo 1E31) (hi -1E21))
(defun make-num (&optional  (at 0) (txt ""))
  "summarizes streams of numbers"
  (%make-num :at at :txt txt :w (if (isLess txt) -1 1)))

(defmethod add ((i num) x) ;;; Add one thing, updating 'lo,hi'
  (with-slots (n lo hi mu m2) i
    (unless (eq x #\?)
      (incf n)
      (let ((d (- x mu)))
        (incf mu (/ d n))
        (incf m2 (* d (- x mu)))
        (setf lo (min x (? i lo))
              hi (max x (? i hi))))))))

(defmethod mid ((i num)) (? i mu))
(defmethod div ((i num))
  (with-slots (n m2) i (if (<= n 1) 0 (sqrt (/ m2 (- n 1))))))

(defmethod norm ((i num) x) ;;; Map 'x' 0..1 (unless unknown, unless too small)
  (with-slots (lo hi) i
    (if (eq x #\?) x (/ (- x lo) (- hi lo 1e-32)))))

(defmethod dist ((i num) x y)
  (if (and (equal x #\?) (equal x #\?))
    1
    (let ((x (norm i x))
          (y (norm i y)))
      (if (eq x #\?) (setf x (if (< y .5) 1 0)))
      (if (eq y #\?) (setf y (if (< x .5) 1 0)))
      (abs (- x y)))))

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(defstruct+ cols all x y klass)
(defun make-cols (lst &aux (i (%make-cols)) (at -1))
  (with-slots (all x y klass) i
    (dolist (txt lst i)
      (let ((col (funcall (if (isNum txt) #'make-num #'make-sym) (incf at) txt)))
        (push col all)
        (when (not (isIgnore txt))
          (if (isGoal txt) (push col y) (push col x))
          (if (isKlass txt) (setf klass col)))))))

(defmethod add ((i cols) row)
  (with-slots (x y) i
  (dolist (cols (list  x y)  row)
    (dolist (col cols)
      (add col (elt (? row cells) (? col at)))))))

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(defstruct+ data rows cols)
(defun make-data (&optional src  (i (%make-data)))
  "create data from either a file called 'src' or a list 'src'"
  (labels ((update (x) (add i x)))
    (if (stringp str) (csv #'update) (mapc #'update src))))

(defmethod add ((i data) x)
  "make `cols` (if currently missing) or update the cols and rows"
  (with-slots (cols rows) i
    (if cols
      (push (add cols (if (row-p x) row (make-row x))) rows)
      (setf cols (cols x)))))

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(eg "err" (lambda ()
            "crash"
            (/ 2 0)))

(eg "my"  (lambda ()
            "show options"
            (print 2) t))

(eg "ls"  (lambda ()
            "show options"
            (print *settings*) t))

(eg "geta" (lambda (&aux (lst '((b . 100))))
             "test adaptive alist"
             (incf (geta 'a lst))
             (incf (geta 'a lst))
             (incf (geta 'a lst))
             (equal 3 (cdr (assoc 'a lst)))))

(eg "num" (lambda (&aux (n (make-num 10  "num")))
            "test number"
            (dolist (i '(1 1 1 1 2 2 3)) (add n i))
            (and (equalp 11/7 (mid n)) (equalp 0.7867958 (div n)))))

(eg "sym" (lambda (&aux (s (make-sym 10 "age")))
            "test symbols"
            (dolist (i '(a a a a b b c)) (add s i))
            (and (equalp 'a (mid s)) (equalp 1.3787835 (div s)))))

(eg "cols" (lambda ()
             (print (make-cols '("Aas" "state" "Weight-")) t)))

;function eg.sym(    sym)
 ; sym=SYM()
 ; for _,x in pairs{"a","a","a","a","b","b","c"} do sym:add(x) end
  ;return "a"==sym:mid() and 1.379 == rnd(sym:div())end

(setf *settings* (cli (settings *help*)))
(if (! help) (about) (egs))
```