**Cons versus List**

(cons 1
  (cons (+ 2 3)
    (cons (* 2 3)
      nil)))

can also be written

(list 1 (+ 2 3) (* 2 3)).
Elements versus Nodes

There are 3 elements in:

(cons 1
  (cons (cons 2 3)
    (cons 4
      nil)))

aka

(list 1 (cons 2 3) 4)
Represent Stacks

Pick a representation for stacks. Define `push` so that `(push i stk)` pushes the item `i` onto the stack represented by `stk`.

Define `top` to take a non-empty stack and return the topmost item.

Define `pop` to take a non-empty stack and return the stack obtained by removing the topmost item.
Programming Note

The symbols push and pop are already defined in the standard ACL2 symbol package.

To define these functions in an ACL2 session we have to create a new package, which we’ll call the “M1” package.

I’ll show you the incantation for that later.
Accessing List Elements

Define \texttt{nth} so that \((\texttt{nth } i \ x)\) returns the \(i^{th}\) (0-based) element of list \(x\). You may assume \(x\) has at least \(i+1\) elements.
Updating List Elements

Define update-nth so that
(update-nth i v x)
“changes” the list x so that the i^{th} (0-based) element is v. It leaves the other elements unchanged. Actually, it returns a new list; you can’t modify an object in ACL2. You may assume x has at least i+1 elements.
M1 Package

(defpkg "M1"
  '(T NIL QUOTE IF EQUAL AND OR
    NOT IMPLIES IFF CONS CAR CDR CONSP ENDP
    LIST LIST* ATOM SYMBOLP + - * / EXPT
    FLOOR MOD NATP INTEGERP NFIX ZP < <=
    > >= LET LET* COND CASE OTHERWISE DEFUN
    DEFTHM THM DEFCONST DEFMACRO PROGN &REST
    MUTUAL-RECURSION IN-PACKAGE DECLARE
    IGNORE XARGS IN-THEORY ENABLE DISABLE
    E/D INCLUDE-BOOK LD I-AM-HERE PBT PCB
    PCB! PE PE! PF PL PR PR! PUFF U UBT UBT!
    0-P 0< ACL2-COUNT INTERN-IN-PACKAGE-OF-SYMBOL
    COERCES SYMBOL-NAME STRING CONCATENATE
    STRIP-CARS ASSOC PAIRLIS$ PAIRLIS-X2
    SYNTAXP QUOTE))

(in-package "M1")
(defpkg "M1"
  '(T NIL QUOTE IF EQUAL AND OR
    NOT IMPLIES IFF CONS CAR CDR CONSP ENDP
    LIST LIST* ATOM SYMBOLP + - * / EXPT
    FLOOR MOD NATP INTEGERP NFIX ZP < <=
    > >= LET LET* COND CASE OTHERWISE DEFUN
    DEFTHM THM DEFCONST.DEFMACRO PROGN &REST
    MUTUAL-RECURSION IN-PACKAGE DECLARE
    IGNORE XARGS IN-THEORY ENABLE DISABLE
    E/D INCLUDE-BOOK LD I-AM-HERE PBT PCB
    PCB! PE PE! PF PL PR PR! PUFF U UBT UBT!
    0-P 0< ACL2-COUNT INTERN-IN-PACKAGE-OF-SYMBOL
    COERCE SYMBOL-NAME STRING CONCATENATE
    STRIP-CARS ASSOC PAIRLIS$ PAIRLIS-X2
    SYNTAXP QUOTE))

(in-package "M1")

Note that PUSH (i.e., M1::PUSH) is undefined in this package!
The only ACL2 functions you can use are those listed above!