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┌──────────────────────────── MODULE Op ────────────────────────────┐
  Model checking basic operations on strings (i.e., list of characters).
EXTENDS Naturals, Sequences, AdditionalSequenceOperators
├──────────────────────────────────────────────────────────────────┤
CONSTANTS   Char,
            MaxPos,
            MaxPr,
            MaxLen

ASSUME  ∧ MaxPos ∈ Nat \ {0}   WARNING: index from 1
        ∧ MaxPr ∈ Nat \ {0}
        ∧ MaxLen ∈ Nat \ {0}
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 List ≜ Seq(Char) \* The set of all lists.
List ≜ UNION {[1 . . m → Char] : m ∈ 0 . . MaxLen}

  The set of all operations. In this specification, we will focus on "Ins" and "Del".
Op ≜   [type: {"Rd"}] ∪ \* a read specifies no arguments
      [type : {"Del"}, pos : 1 . . MaxPos] ∪  a deletion specifies a position
      [type : {"Ins"}, pos  : 1 . . MaxPos, ch : Char, pr : 1 . . MaxPr]  an insertion specifies a position, a character, a

Nop ≜ CHOOSE v : v ∉ Op   Nop: an operation representing "doing nothing"
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  Some operations for test.
Del1 ≜ [type ↦ "Del", pos ↦ 1]
Del2 ≜ [type ↦ "Del", pos ↦ 2]
Del3 ≜ [type ↦ "Del", pos ↦ 3]
Del4 ≜ [type ↦ "Del", pos ↦ 4]
Ins1  ≜ [type ↦ "Ins", pos  ↦ 1, ch ↦ "a", pr ↦ 1]
Ins2  ≜ [type ↦ "Ins", pos  ↦ 2, ch ↦ "b", pr ↦ 2]
Ins3  ≜ [type ↦ "Ins", pos  ↦ 3, ch ↦ "c", pr ↦ 3]
Ops  ≜ ⟨Ins2, Del3, Ins1, Del2, Ins3, Del1⟩
├──────────────────────────────────────────────────────────────────┤
  The "Apply" operator which applies an operation op on the list l.
Apply(op, l) ≜
    LET len ≜ Len(l)
        pos ≜ op.pos
    IN  CASE op = Nop → l
          □    op.type = "Del" → DeleteElement(l, pos)
          □    op.type = "Ins"  → Append(SubSeq(l, 1, pos − 1), op.ch) ∘ SubSeq(l, pos, len)

  The "ApplyOps" operator which applies an operation sequence ops on the list l.
RECURSIVE ApplyOps(_, _)
ApplyOps(ops, l) ≜
    IF ops = ⟨⟩
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        THEN l
        ELSE Apply(Last(ops), ApplyOps(AllButLast(ops), l))
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