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1  ---------- MODULE AdditionalSetOperators ----------
   Copyright: https://www.learntla.com/libraries/sets/
5  EXTENDS Naturals, TLC

   Pick an element from the set S.
10 Pick(S) ≜ CHOOSE s ∈ S : TRUE

   Pick an element that is not in the set S.
15 PickNone(S) ≜ CHOOSE s : s ∉ S

17 RECURSIVE SetReduce(_, _, _)
18 SetReduce(Op(_, _), S, value) ≜
19     IF S = {}
20      THEN value
21      ELSE LET s ≜ Pick(S)
22           IN  SetReduce(Op, S \ {s}, Op(s, value))

   This version will report an error if the operation applied is not commutative as required.
28 RECURSIVE SetReduceSafe(_, _, _)
29 SetReduceSafe(Op(_, _), S, value) ≜
30     IF S = {}
31      THEN value
32      ELSE LET s ≜ Pick(S)
33           IN  IF Op(s, value) = Op(value, s)
34                THEN SetReduceSafe(Op, S \ {s}, Op(s, value))
35                ELSE Assert(FALSE, "Op is not commutative.")

37 Sum(S) ≜
38      LET sum(a, b) ≜ a + b
39      IN  SetReduce(sum, S, 0)

41 IsMin(set, min) ≜
42     ∧ min ∈ set
43     ∧ (∀ x ∈ set : min ≤ x)

45 IsMax(set, max) ≜
46     ∧ max ∈ set
47     ∧ (∀ x ∈ set : max ≥ x)

49 Min(set) ≜ CHOOSE min ∈ set : (∀ x ∈ set : min ≤ x)

51 Max(set) ≜ CHOOSE max ∈ set : (∀ x ∈ set : max ≥ x)
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   \* Modification History
   \* Last modified Fri Jul 06 13:39:14 CST 2018 by hengxin
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