MODULE *SetUtils*

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EXTENDS *TLC*
LOCAL INSTANCE *Naturals*

Pick an element from the set S.

$Pick(S) \triangleq$ CHOOSE $s \in S$: TRUE

Pick an element that is not in the set S.

$PickNone(S) \triangleq$ CHOOSE $s : s \notin S$

RECURSIVE $SetReduce(\_, \_, \_)$
$SetReduce(Op(\_, \_), S, value) \triangleq$
  IF $S = \{\}$
  THEN $value$
  ELSE LET $s \triangleq Pick(S)$
    IN $SetReduce(Op, S \setminus \{s\}, Op(s, value))$

This version will report an error if the operation applied is not commutative as required.

RECURSIVE $SetReduceSafe(\_, \_, \_)$
$SetReduceSafe(Op(\_, \_), S, value) \triangleq$
  IF $S = \{\}$
  THEN $value$
  ELSE LET $s \triangleq Pick(S)$
    IN IF $Op(s, value) = Op(value, s)$
      THEN $SetReduceSafe(Op, S \setminus \{s\}, Op(s, value))$
      ELSE $Assert(\text{FALSE}, \text{“Op is not commutative.”})$

$Sum(S) \triangleq$
  LET $sum(a, b) \triangleq a + b$
  IN $SetReduce(sum, S, 0)$

$IsMin(set, min) \triangleq$
  $\land\ min \in set$
  $\land\ (\forall\, x \in set : min \leq x)$

$IsMax(set, max) \triangleq$
  $\land\ max \in set$
  $\land\ (\forall\, x \in set : max \geq x)$

$MinOfSet(set) \triangleq$ CHOOSE $min \in set : (\forall\, x \in set : min \leq x)$

$MaxOfSet(set) \triangleq$ CHOOSE $max \in set : (\forall\, x \in set : max \geq x)$

* Modification History
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