1 ────────────────────── MODULE *SetUtils* ──────────────────────

5 EXTENDS *TLC*
6 LOCAL INSTANCE *Naturals*

Pick an element from the set S.

11 $Pick(S) \triangleq$ CHOOSE $s \in S :$ TRUE

Pick an element that is not in the set S.

15 $PickNone(S) \triangleq$ CHOOSE $s : s \notin S$

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

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

27 RECURSIVE $SetReduceSafe(\_, \_, \_)$
28 $SetReduceSafe(Op(\_, \_), S, value) \triangleq$
29   IF $S = \{\}$
30   THEN $value$
31   ELSE LET $s \triangleq Pick(S)$
32   IN IF $Op(s, value) = Op(value, s)$
33   THEN $SetReduceSafe(Op, S \setminus \{s\}, Op(s, value))$
34   ELSE $Assert($FALSE, "Op is not commutative." $)$

36 $Sum(S) \triangleq$
37   LET $sum(a, b) \triangleq a + b$
38   IN $SetReduce(sum, S, 0)$

40 $IsMin(set, min) \triangleq$
41      $\wedge min \in set$
42      $\wedge (\forall x \in set : min \leq x)$

44 $IsMax(set, max) \triangleq$
45      $\wedge max \in set$
46      $\wedge (\forall x \in set : max \geq x)$

48 $MinOfSet(set) \triangleq$ CHOOSE $min \in set : (\forall x \in set : min \leq x)$

50 $MaxOfSet(set) \triangleq$ CHOOSE $max \in set : (\forall x \in set : max \geq x)$

51 └──

\ * Modification History
\ * *Last* modified *Tue Dec* 04 19:43:16 *CST* 2018 by *hengxin*
\ * Created *Fri Jul* 06 13:21:26 *CST* 2018 by *hengxin*