

```

1 |----- MODULE CASPaxosH -----|
  | CASPaxos spec with the “history” variable. |
6 | EXTENDS CASPaxos, Sequences |
7 |-----|
8 | Event  $\triangleq$  [type : {“invocation”, “response”}, bal : Ballot] |
9 |-----|
10 | VARIABLES history |
12 | varsH  $\triangleq$   $\langle vars, history \rangle$  |
13 |-----|
14 | TypeOKH  $\triangleq$ 
15 |    $\wedge$  TypeOK
16 |    $\wedge$  history  $\in$  Seq(Event) |
17 |-----|
18 | InitH  $\triangleq$ 
19 |    $\wedge$  Init
20 |    $\wedge$  history =  $\langle \rangle$  |
21 |-----|
22 | Phase1aH(b)  $\triangleq$ 
23 |    $\wedge$  Phase1a(b)
24 |   Every CAS operation has an “invocation” event.
25 |    $\wedge$  history' = Append(history, [type  $\mapsto$  “invocation”, bal  $\mapsto$  b]) |
27 | Phase1bH(a)  $\triangleq$ 
28 |    $\wedge$  Phase1b(a)
29 |    $\wedge$  UNCHANGED  $\langle history \rangle$  |
31 | Phase2aH(b, v)  $\triangleq$ 
32 |    $\wedge$  Phase2a(b, v)
33 |    $\wedge$  UNCHANGED  $\langle history \rangle$  |
35 | Phase2bH(a)  $\triangleq$ 
36 |    $\wedge$  Phase2b(a)
37 |    $\wedge$  UNCHANGED  $\langle history \rangle$  |
39 | RespondH(b)  $\triangleq$ 
40 |    $\wedge$  Respond(b)
41 |   Not all CAS operations have a “response” event. Some do not terminate.
42 |    $\wedge$  history' = Append(history, [type  $\mapsto$  “response”, bal  $\mapsto$  b]) |
43 |-----|
44 | NextH  $\triangleq$ 
45 |    $\vee \exists b \in$  Ballot :
46 |      $\vee$  Phase1aH(b)
47 |      $\vee \exists v \in$  Value : Phase2aH(b, v)
48 |      $\vee$  RespondH(b)
49 |    $\vee \exists a \in$  Acceptor :

```

```

50       $\vee Phase1bH(a)$ 
51       $\vee Phase2bH(a)$ 
53   $SpecH \triangleq InitH \wedge \Box[NextH]_{varsH}$ 
54  ┌───────────────────────────────────────────────────────────────────────────────────┐
    \ * Modification History
    \ * Last modified Wed Jul 27 09:23:18 CST 2022 by hengxin
    \ * Created Tue Jul 26 23:30:04 CST 2022 by hengxin

```