Algorithm – Consensus in the Fail-Stop Model

Algorithm 1 Hierarchical Consensus

Implements:

Consensus, **instance** c.

Uses:

BestEffortBroadcast, **instance** beb.

PerfectFailureDetector, **instance** P.

1: **upon event** $\langle\ Init\ \rangle$ **do**
2:     $detectedranks := \emptyset$
3:     $round := 1$
4:     $proposal := \perp$
5:     $proposer := 0$
6:     $\forall_{p \in \Pi}\ delivered[p] := \text{FALSE}$
7:     $broadcast := \text{FALSE}$
8: **upon event** $\langle\ P, Crash \mid p\ \rangle$ **do**
9:     $detectedranks := detectedranks \cup \{\text{RANK}(p)\}$
10: **upon event** $\langle\ c, Propose \mid v\ \rangle$ **do**
11:     **if** $proposal = \perp$ **then**
12:         $proposal := v$
13: **upon event** $\langle\ beb, Deliver \mid p, [\text{DECIDED}, v]\ \rangle$ **do**
14:     $r := \text{RANK}(p)$
15:     **if** $r < \text{RANK}(self) \wedge r > proposer$ **then**
16:         $proposal := v$
17:         $proposer := r$
18:     $delivered[p] := \text{TRUE}$

19: **upon event** $\langle\ round = \text{RANK}(self) \wedge proposal \neq \bot \wedge \neg broadcast\ \rangle$ **do**
20:     $broadcast := \text{TRUE}$
21:     **trigger** $\langle\ beb, Broadcast\ \vert\ [\text{DECIDED}, proposal]\ \rangle$
22:     **trigger** $\langle\ c, Decide\ \vert\ proposal\ \rangle$
23: **upon event** $\langle\ round \in detectedranks \vee delivered[\text{RANK}^{-1}(round)]\ \rangle$ **do**
24:     $round := round + 1$

Note: Where RANK^{-1} be the inverse function to RANK (which exists since RANK is a bijection between Π and $\{1, \ldots, |\Pi|\} \subseteq \mathbb{N}$).

Algorithm 2 Hierarchical Uniform Consensus
Implements:
UniformConsensus, **instance** uc.
Uses:
BestEffortBroadcast, **instance** beb.
ReliableBroadcast, **instance** beb.
PerfectPointToPointLinks, **instance** $pp2p$.
PerfectFailureDetector, **instance** P.
1: **upon event** $\langle\ Init\ \rangle$ **do**
2:     $detectedranks := \emptyset$
3:     $ackranks := \emptyset$
4:     $round := 1$
5:     $proposal := \bot$
6:     $decision := \bot$
7:     $\forall_{p \in \Pi}\ proposed[p] := \bot$
8: **upon event** $\langle\ P, Crash\ \vert\ p\ \rangle$ **do**
9:     $detectedranks := detectedranks \cup \{\text{RANK}(p)\}$
10: **upon event** $\langle\ uc, Propose\ \vert\ v\ \rangle$ **do**
11:     **if** $proposal = \bot$ **then**
12:         $proposal := v$

13: **upon event** $\langle$ *beb*, *Deliver* $\mid p, [\text{PROPOSAL}, v] \rangle$ **do**

14:     $proposed[p] := v$

15:     **if** $\text{RANK}(p) \geq round$ **then**

16:         **trigger** $\langle$ *pp2p*, *Send* $\mid$ p, $\text{ACK} \rangle$

17: **upon event** $\langle$ *pp2p*, *Deliver* $\mid p, \text{ACK} \rangle$ **do**

18:     $ackranks := ackranks \cup \{\text{RANK}(p)\}$

19: **upon event** $\langle$ *rb*, *Deliver* $\mid p, [\text{DECIDED}, v] \rangle$ **do**

20:     **if** $decision \neq \bot$ **then**

21:         $decision := v$

22:         **trigger** $\langle$ *uc*, *Decide* $\mid decision \rangle$

23: **upon event** $\langle$ $round = \text{RANK}(self) \wedge proposal \neq \bot \wedge decision = \bot$ $\rangle$ **do**

24:     **trigger** $\langle$ *beb*, *Broadcast* $\mid [\text{PROPOSAL}, proposal] \rangle$

25: **upon event** $\langle$ $round \in detectedranks$ $\rangle$ **do**

26:     **if** $proposed[\text{RANK}^{-1}(round)] \neq \bot$ **then**

27:         $proposal := proposed[\text{RANK}^{-1}(round)]$

28:     $round := round + 1$

29: **upon event** $\langle$ $detectedranks \cup ackranks = \{1, \dots, |\Pi|\}$ $\rangle$ **do**

30:     **trigger** $\langle$ *rb*, *Broadcast* $\mid [\text{DECIDED}, proposal] \rangle$