Irrevocable Consensus

Exercise II.1

1. Does the Santoro and Widmayer's theorem apply when the set of agents V is fixed (in particular, the network size is known)?
2. Does the Santoro and Widmayer's theorem apply when agents have unique identifiers (non-anonymous networks)?

Exercise II.2

1. To which classes of networks in Exercise I.3 does the Santoro and Widmayer's theorem apply?
2. Does the Santoro and Widmayer's theorem apply to the class of networks $\mathbb{G} = (V, \mathbb{E})$ such that
$$\Big| \bigcap_{i \in V,\ t \in \mathbb{N}^*} \mathrm{In}_i(t) \Big| \geqslant |V| - 1.$$
3. Does the answer to the previous question still hold when the set of agents V is fixed?

Exercise II.3 Let us consider the following weakening of the validity condition:

> *Non-uniformity:* S_V contains two sequences y^0 and y^1 in which 0 and 1 are decided, respectively, i.e., that admit suffixes of the form $\big((-,0),\cdots,(-,0)\big)^\omega$ and $\big((-,1),\cdots,(-,1)\big)^\omega$.

Prove that, when replacing validity by non-uniformity in the specification of irrevocable consensus, the Santoro and Widmayer's theorem still holds.

Exercise II.4 Give more general conditions on the classes of networks where the impossibility result of Santoro and Widmayer still holds.

Exercise II.5

1. Design a consensus algorithm similar to the *FloodSet* algorithm but where the condition for i to decide at round t is
$$|HO_i(t-1)| = |HO_i(t)|$$
and prove its correctness.
2. In what sense this algorithm is better than the *FloodSet* algorithm?