Distributed Algorithms 2022/2023
(lab exercise)

Leader election

Task 1 — Implement a simulator that allows you to test the leader election algorithm presented during the lecture for known number of nodes n and for a known upper bound u on the number of nodes n. You can use any programming language.

Task 2 — Let the random variable L denote the number of slots from the start of the algorithm until the leader is elected. Use the simulator from the previous task to draw the empirical distribution (histogram) of the random variable L for both considered scenarios. For a scenario with a known constraint u consider three cases: $n = 2$, $n = u/2$, $n = u$. Justify the results. (10p)

Task 3 — For a scenario with a known number of n nodes, use the simulator to estimate $\mathbb{E}[L]$ and $\mathbb{V}ar[L]$. Verify that the results are consistent with the theoretical results. (10p)

Task 4 — Consider a scenario with a known constraint u. Let $S_{L,n}$ be the event that in one round of the algorithm of length $L = \lceil \log_2 u \rceil$ a leader was elected if there are n nodes in the system. Suggest a suitable experiment and use a simulator to confirm the correctness of the theorem from the lecture that $Pr[S_{L,n}] \geq \lambda \approx 0.579$. (10p)