Principles of Distributed Computing
Exercise 13

1 Determining the Median

Consider a radio packet network with \( n \) nodes and without collision detection. Furthermore, assume that each node has a token of size \( \mathcal{O}(\log n) \) (a number) and is equipped with memory of size \( \mathcal{O}(\log n) \). Present a uniform algorithm which allows the nodes to determine the median in \( \mathcal{O}(n) \) time slots w.h.p.

Hint: You can assume that \( n \) is odd and each token is unique.

Hint: Initializing first and then trying to determine the median simplifies the task.

Hint: With a memory of size \( \mathcal{O}(\log n) \) the nodes can count up to \( n \).

2 Maximum

Assume a uniform wireless network with collision detection in which every node is given a number. Give a \( \mathcal{O}(\log^2 n) \) algorithm that finds the highest number w.h.p.

Hint: Use the fast Leader Election with CD algorithm from the script.

Hint: Use the ideas in the proof of the fast Leader Election with CD algorithm and the union bound to prove that your algorithm succeeds w.h.p.