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Online and Distributed Algorithms

Exercise Session 6

1. *Asynchronous Blackhole Search with a Sense of Direction:* If the scheduler is asynchronous, prove that, independently of the type of sense of direction available, the worst case cost for locating a blackhole in arbitrary networks with 2 agents is at least $\Omega(n^2)$.

2. *Asynchronous Blackhole Search with Topological Ignorance:*

   (a) If the scheduler is asynchronous, prove that $\Delta + 1$ agents are necessary under topological ignorance for locating a blackhole in arbitrary networks.

   (b) If the scheduler is asynchronous, prove that, under topological ignorance, the worst case cost for locating a blackhole in arbitrary networks with $\Delta + 1$ agents is at least $\Omega(n^2)$.

3. *Even/Odd Sort in Grids:* Modify the Even/Odd Sort protocol so that it sorts arbitrary values in an $n \times n$ grid with $O(n^2)$ moves, where $v_{i,j} \leq v_{i,j+1}$ and $v_{i,n} \leq v_{i+1,1}$ (values are sorted at each line from leftmost to rightmost, in a non-decreasing way, and the rightmost value of a line is at most equal to the leftmost value of the next line), $1 \leq i, j \leq n$.