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Tight bounds for scattered black hole search in a ring.

Kosowski, Adrian (ed.) et al., Structural information and communication complexity. 18th international colloquium, SIROCCO 2011, Gdańsk, Poland, June 26–29, 2011. Proceedings. Berlin: Springer (ISBN 978-3-642-22211-5/pbk). Lecture Notes in Computer Science 6796, 186-197 (2011).

Summary: We study the problem of locating a particularly dangerous node, the so-called black hole in a synchronous anonymous ring network with mobile agents. A black hole destroys all mobile agents visiting that node without leaving any trace. Unlike most previous research on the black hole search problem which employed a colocated team of agents, we consider the more challenging scenario when the agents are identical and initially scattered within the network. Moreover, we solve the problem with agents that have constant-sized memory and carry a constant number of identical tokens, which can be placed at nodes of the network. In contrast, the only known solutions for the case of scattered agents searching for a black hole, use stronger models where the agents have non-constant memory, can write messages in whiteboards located at nodes or are allowed to mark both the edges and nodes of the network with tokens. We are interested in the minimum resources (number of agents and tokens) necessary for locating all links incident to the black hole. In fact, we provide matching lower and upper bounds for the number of agents and the number of tokens required for deterministic solutions to the black hole search problem, in oriented or unoriented rings, using movable or unmovable tokens.

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