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A space lower bound for *st*-connectivity on node-named JAGs.

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Summary: Given a directed graph G and two of its nodes s and t, the directed st-connectivity problem (stcon) is to decide whether there is a directed path from s to t in G. Establishing a super-logarithmic space lower bound for stcon on a general computation model such as Turing machine or branching program has been a big challenge in complexity theory. As an intermediate step, *S. A. Cook* and *C. W. Rackoff* [SIAM J. Comput. 9, 636-652 (1980; Zbl 0445.68038)] introduce a structured model called JAG (jumping automaton for graphs) and prove a space lower bound of $\Omega(\log^2 n/\log\log n)$ on this model. *P. Berman* and *J. Simon* (Proc. 24th Annual Symp. on Foundations of Computer science, IEEE press, New York, Tucson, AZ, November 1983) show a similar lower bound for a probabilistic JAG. We take a step further by introducing a stronger model called NN-JAG (Node-named JAG) and obtain the same space lower bound of $\Omega(\log^2 n/\log\log n)$. On a probabilistic NNJAG, we show that $S = \Omega(\log^2 n/(\log\log n + \log\log T))$ where S is the space and T is the expected time used, respectively. This gives the best expected time lower bound on this model when the space S is $O(\log^2 n/\log\log n)$.

Keywords: graph; connectivity; lower bound; space; complexity
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