Probabilistic Communication Complexity of Boolean Relations

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Abstract

In [KW] it was proved that for every boolean function f there exist a communication complexity game R_f such that the minimal circuit-depth of f exactly equals to the communication complexity of R_f. If f is monotone then there also exists a game R_f^m with communication complexity exactly equals to the monotone depth of f. It was also proved in [KW] that the communication complexity of $R_{st-connectivity}^m$ is $\Omega(log^2 n)$, or equivalently that the monotone depth of the st-connectivity functions is $\Omega(log^2 n)$.

In this paper we consider the games R_f and R_f^m in a probabilistic model of communication complexity, and prove that the communication complexity of $R_{st-connectivity}^m$ is $\Omega(log^2 n)$ even in the probabilistic case. We also prove that in every $NC1$ circuit for $s-t$connectivity at least a constant fraction of all input variables must be negated.