

Is detecting more cliques harder?

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Abstract

Shannon's counting argument [1] shows that many functions are hard to compute. However, it is nonconstructive, and so doesn't explicitly state a hard-to-compute function. Attempts have been made to apply counting arguments to other problems such as CLIQUE [2], without success. Here, we define a random walk on a d -regular graph whose vertices are sets of cliques. We state a (huge) integer programming problem which appears to bound the circuit complexity of CLIQUE. We show solutions of that problem (for *tiny* cases – $n = 7, k = 3$).

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1 Graphs with more vertices require more gates, *on average*

References

- [1] Claude E Shannon. The synthesis of two-terminal switching circuits. *Bell System Technical Journal*, 28(1):59–98, 1949.
- [2] Josh Burdick. How hard is it to detect *some* cliques? *SIGACT News*, 55(2):38–52, Jun 2024.