

Constructive Lower Bounds on Ramsey Numbers

by

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1 Introduction

Frankl & Wilson [8]

Barrington, Beigel, & Rudick [4]

Chung, Cleve, & Dagum [6]

Alon [1]

Grolmusz [10]

Trevisan [18]

Alon & Pudlák [2]

Grolmusz [11]

Pudlák, & Rödl [16] (unpublished, might be subsumed later)

Barak et al. [3]

Pudlák [17]

Kostochka, Pudlák, & Rödl [12]

Xu, Shao, & Radziszowski [19]

Gopalan [9]

Chattopadhyay & Zuckerman [5]

Cohen [7]

Li [13]

Li [14]

Li [15]

References

- [1] N. Alon. The shannon capacity of a union. *Combinatorica*, 18(3):301–310, 1998.
<https://doi.org/10.1007/PL00009824>.
- [2] N. Alon and P. Pudlak. Constructive lower bounds for off-diagonal Ramsey numbers. *Israel Journal of Mathematics*, 2001.
<https://link.springer.com/content/pdf/10.1007/BF02809902.pdf>.
- [3] B. Barak, A. Rao, R. Shaltiel, and A. Wigderson. 2-source dispersers for sub-polynomial entropy and Ramsey graphs beating the frankl-wilson construction. In J. M. Kleinberg, editor, *Proceedings of the 38th Annual ACM Symposium on Theory of Computing, Seattle, WA, USA, May 21-23, 2006*, pages 671–680. ACM, 2006.
<https://doi.org/10.1145/1132516.1132611>.

- [4] D. A. M. Barrington, R. Beigel, and S. Rudich. Representing boolean functions as polynomials modulo composite numbers. *Comput. Complex.*, 4:367–382, 1994.
<https://doi.org/10.1007/BF01263424>.
- [5] E. Chattopadhyay and D. Zuckerman. Explicit two-source extractors and resilient functions. In D. Wichs and Y. Mansour, editors, *Proceedings of the 48th Annual ACM SIGACT Symposium on Theory of Computing, STOC 2016, Cambridge, MA, USA, June 18-21, 2016*, pages 670–683. ACM, 2016.
<https://doi.org/10.1145/2897518.2897528>.
- [6] F. R. K. Chung, R. Cleve, and P. Dagum. A note on constructive lower bounds for the Ramsey numbers $R(3,t)$. *J. Combinatorial Theory B*, 57(1):150–155, 1993.
<https://doi.org/10.1006/jctb.1993.1013>.
- [7] G. Cohen. Two-source dispersers for polylogarithmic entropy and improved ramsey graphs. *SIAM J. Comput.*, 50(3), 2021.
<https://doi.org/10.1137/16M1096219>.
- [8] P. Frankl and R. Wilson. Intersection theorems with geometric consequences. *Combinatorica*, 1:357–368, 1981. <http://www.springer.com/new+%26+forthcoming+titles+%28default%29/journal/493>.
- [9] P. Gopalan. Constructing Ramsey graphs from boolean function representations. *Combinatorica*, 34(2):173–206, 2014.
<https://doi.org/10.1007/s00493-014-2367-1>.
- [10] V. Grolmusz. Superpolynomial size set-systems with restricted intersections mod 6 and explicit Ramsey graphs. *Combinatorica*, 20(1):71–86, 2000.
<https://doi.org/10.1007/s004930070032>.
- [11] V. Grolmusz. Constructing set systems with prescribed intersection sizes. *Journal of Algorithms*, 44(2):321–337, 2002.
- [12] A. V. Kostochka, P. Pudlák, and V. Rödl. Some constructive bounds on Ramsey numbers. *Journal of Combinatorial Theory B*, 100(5):439–445, 2010.
<https://doi.org/10.1016/j.jctb.2010.01.003>.
- [13] X. Li. Improved non-malleable extractors, non-malleable codes and independent source extractors. In H. Hatami, P. McKenzie, and V. King, editors, *Proceedings of the 49th Annual ACM SIGACT Symposium on Theory of Computing, STOC 2017, Montreal, QC, Canada, June 19-23, 2017*, pages 1144–1156. ACM, 2017.
<https://doi.org/10.1145/3055399.3055486>.
- [14] X. Li. Non-malleable extractors and non-malleable codes: Partially optimal constructions. In A. Shpilka, editor, *34th Computational Complexity Conference, CCC 2019*,

- July 18-20, 2019, New Brunswick, NJ, USA, volume 137 of *LIPICs*, pages 28:1–28:49. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2019.
<https://doi.org/10.4230/LIPICs.CCC.2019.28>.
- [15] X. Li. Two source extractors for asymptotically optimal entropy, and (many) more. In *64th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2023, Santa Cruz, CA, USA, November 6-9, 2023*, pages 1271–1281. IEEE, 2023.
<https://doi.org/10.1109/FOCS57990.2023.00075>.
- [16] A. Podelski and A. Rybalchenko. A complete method for the synthesis of linear ranking functions. In *Verification, model checking, and abstract interpretation*, volume 2937 of *Lecture Notes in Computer science*, pages 239–251, New York, 2004. Springer. <http://www7.in.tum.de/~rybal/papers/>.
- [17] P. Pudlák. *Topics in Discrete Mathematics Dedicated to Nešetřil’s 60th Birthday*, volume 26, chapter On explicit Ramsey graphs and estimates of the number of sums and products. Springer, 2006.
https://www.cs.umd.edu/~gasarch/TOPICS/const_ramsey/sumprod.pdf.
- [18] L. Trevisan. Extractors and pseudorandom generators. *J. ACM*, 48(4):860–879, 2001.
<https://doi.org/10.1145/502090.502099>.
- [19] X. Xu, Z. Shao, and S. P. Radziszowski. More constructive lower bounds on classical ramsey numbers. *SIAM J. Discret. Math.*, 25(1):394–400, 2011.
<https://doi.org/10.1137/10080868X>.