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Group Testing: An Information Theory Perspective

Matthew Aldridge  
University of Leeds  
m.aldridge@leeds.ac.uk

Oliver Johnson  
University of Bristol  
O.Johnson@bristol.ac.uk

Jonathan Scarlett  
National University of Singapore  
scarlett@comp.nus.edu.sg
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Group Testing: An Information Theory Perspective

Matthew Aldridge\textsuperscript{1}, Oliver Johnson\textsuperscript{2} and Jonathan Scarlett\textsuperscript{3}

\textsuperscript{1}University of Leeds; m.aldridge@bath.ac.uk
\textsuperscript{2}University of Bristol; O.Johnson@bristol.ac.uk
\textsuperscript{3}National University of Singapore; scarlett@comp.nus.edu.sg

ABSTRACT

The group testing problem concerns discovering a small number of defective items within a large population by performing tests on pools of items. A test is positive if the pool contains at least one defective, and negative if it contains no defectives. This is a sparse inference problem with a combinatorial flavour, with applications in medical testing, biology, telecommunications, information technology, data science, and more.

In this monograph, we survey recent developments in the group testing problem from an information-theoretic perspective. We cover several related developments: efficient algorithms with practical storage and computation requirements, achievability bounds for optimal decoding methods, and algorithm-independent converse bounds. We assess the theoretical guarantees not only in terms of scaling laws, but also in terms of the constant factors, leading to the notion of the rate of group testing, indicating the amount of information learned per test. Considering both noiseless and noisy settings, we identify several regimes where existing algorithms are provably optimal or near-optimal, as

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well as regimes where there remains greater potential for improvement.

In addition, we survey results concerning a number of variations on the standard group testing problem, including partial recovery criteria, adaptive algorithms with a limited number of stages, constrained test designs, and sublinear-time algorithms.
Notation

\( n \)  \hspace{1em} \text{number of items (Definition 1.1)}

\( k \)  \hspace{1em} \text{number of defective items (Definition 1.1)}

\( \mathcal{K} \)  \hspace{1em} \text{defective set (Definition 1.1)}

\( \mathbf{u} = (u_i) \)  \hspace{1em} \text{defectivity vector: } u_i = 1 (i \in \mathcal{K}), \text{shows if item } i \text{ is defective (Definition 1.2)}

\( \alpha \)  \hspace{1em} \text{sparsity parameter in the sparse regime } k = \Theta(n^\alpha) \hspace{1em} \text{(Remark 1.1)}

\( \beta \)  \hspace{1em} \text{sparsity parameter in the linear regime } k = \beta n \hspace{1em} \text{(Remark 1.1)}

\( T \)  \hspace{1em} \text{number of tests (Definition 1.3)}

\( \mathbf{X} = (x_{ti}) \)  \hspace{1em} \text{test design matrix: } x_{ti} = 1 \text{ if item } i \text{ is in test } t; \text{ } x_{ti} = 0 \text{ otherwise (Definition 1.3)}

\( \mathbf{y} = (y_t) \)  \hspace{1em} \text{test outcomes (Definition 1.4)}

\( \lor \)  \hspace{1em} \text{Boolean inclusive OR (Remark 1.2)}

\( \hat{\mathcal{K}} \)  \hspace{1em} \text{estimate of the defective set (Definition 1.5)}

\( \mathbb{P}(\text{err}) \)  \hspace{1em} \text{average error probability (Definition 1.6)}

\( \mathbb{P}(\text{suc}) \)  \hspace{1em} \text{success probability } = 1 - \mathbb{P}(\text{err}) \hspace{1em} \text{(Definition 1.6)}

\text{rate}  \hspace{1em} \log_2 \left( \frac{n^k}{k} \right) / T \hspace{1em} \text{(Definition 1.7)}

\( O, \, o, \, \Theta \)  \hspace{1em} \text{asymptotic ‘Big O’ notation}
Notation

\( R \) \hspace{1cm} \text{an achievable rate (Definition 1.8)}

\( \overline{R} \) \hspace{1cm} \text{maximum achievable rate (Definition 1.8)}

\( S(i) \) \hspace{1cm} \text{the support of column } i \text{ (Definition 1.9)}

\( S(\mathcal{L}) \) \hspace{1cm} \text{the union of supports } \bigcup_{i \in \mathcal{L}} S(i) \text{ (Definition 1.9)}

\( q \) \hspace{1cm} \text{proportion of defectives (Appendix to Chapter 1)}

\( \overline{k} \) \hspace{1cm} \text{average number of defectives (Appendix to Chapter 1)}

\( p \) \hspace{1cm} \text{parameter for Bernoulli designs: each item is in each test independently with probability } p \text{ (Definition 2.2)}

\( L \) \hspace{1cm} \text{parameter for near-constant tests-per-item designs: each item is in } L \text{ tests sampled randomly with replacement (Definition 2.3)}

\( \nu \) \hspace{1cm} \text{test design parameter: for Bernoulli designs, } p = \nu / k \text{ (Definition 2.2); for near-constant tests-per-item designs, } L = \nu T / k \text{ (Definition 2.3)}

\( h(x) \) \hspace{1cm} \text{binary entropy function: } h(x) = -x \log_2 x - (1 - x) \log_2 (1 - x) \text{ (Theorem 2.2)}

\( p(y \mid m, \ell) \) \hspace{1cm} \text{probability of observing outcome } y \text{ from a test containing } \ell \text{ defective items and } m \text{ items in total (Definition 3.1)}.

\( \rho, \varphi, \vartheta, \xi \) \hspace{1cm} \text{noise parameters in binary symmetric (Example 3.1), addition (Example 3.2), dilution/Z channel (Example 3.3, 3.4), and erasure (Example 3.5) models}

\( \overline{\vartheta}, \vartheta \) \hspace{1cm} \text{threshold parameters in threshold group testing model (Example 3.6)}

\( \Delta \) \hspace{1cm} \text{decoding parameter for NCOMP (Section 3.4)}
| Symbol | Description |
|--------|-------------|
| $\gamma$ | decoding parameter for separate decoding of items (Section 3.5) and information-theoretic decoder (Section 4.2) |
| $C_{\text{chan}}$ | Shannon capacity of communication channel (Theorem 3.1) |
| $m^{(r)}_{i \rightarrow t}(u_i)$, $\hat{m}^{(r)}_{i \rightarrow t}(u_i)$ | item-to-test and test-to-item messages (Section 3.3) |
| $\mathcal{N}(i), \mathcal{N}(t)$ | neighbours of an item node and test node (Section 3.3) |
| $X_K$ | submatrix of columns of $X$ indexed by $K$ (Section 4.2.2) |
| $X_K$ | a single row of $X_K$ (Section 4.2.2) |
| $V = V(X_K)$ | random number of defective items in the test indicated by $X$ (Section 4.2.2) |
| $P_{Y|V}$ | observation distribution depending on the test design only through $V$ (Equation (4.3)) |
| $S_0, S_1$ | partition of the defective set (Equation (4.4)) |
| $\iota$ | information density (Equation (4.6)) |
| $X_{0,\tau}, X_{1,\tau}$ | sub-matrices of $X$ corresponding to $(S_0, S_1)$ with $|S_0| = \tau$ (Equation (4.14)) |
| $X_{0,\tau}$, $X_{1,\tau}$ | sub-vectors of $X_K$ corresponding to $(S_0, S_1)$ with $|S_0| = \tau$ |
| $I_{\tau}$ | conditional mutual information $I(X_{0,\tau}; Y \mid X_{1,\tau})$ (Equation (4.16)) |
References

[1] Abasi, H. and N. H. Bshouty. 2018. “On learning graphs with edge-detecting queries”. arXiv: 1803.10639.

[2] Agarwal, A., S. Jaggi, and A. Mazumdar. 2018. “Novel impossibility results for group-testing”. arXiv: 1801.02701.

[3] Aigner, M. 1986. “Search problems on graphs”. Discrete Applied Mathematics. 14(3): 215–230. DOI: 10.1016/0166-218X(86)90026-0.

[4] Aigner, M. and E. Triesch. 1988. “Searching for an edge in a graph”. Journal of Graph Theory. 12(1): 45–57. DOI: 10.1002/jgt.3190120106.

[5] Aksoylar, C., G. K. Atia, and V. Saligrama. 2017. “Sparse signal processing with linear and nonlinear observations: A unified Shannon-theoretic approach”. IEEE Transactions on Information Theory. 63(2): 749–776. DOI: 10.1109/TIT.2016.2605122.

[6] Aldridge, M. 2011. “Interference mitigation in large random wireless networks”. PhD thesis. University of Bristol. arXiv: 1109.1255.

[7] Aldridge, M. 2017a. “On the optimality of some group testing algorithms”. In: IEEE International Symposium on Information Theory (ISIT). 3085–3089. DOI: 10.1109/ISIT.2017.8007097.
References

[8] Aldridge, M. 2017b. “The capacity of Bernoulli nonadaptive
group testing”. IEEE Transactions on Information Theory. 63(11):
7142–7148. DOI: 10.1109/TIT.2017.2748564.

[9] Aldridge, M. 2019a. “Individual testing is optimal for nonadap-
tive group testing in the linear regime”. IEEE Transactions on
Information Theory. 65(4): 2058–2061. DOI: 10.1109/TIT.2018.
2873136.

[10] Aldridge, M. 2019b. “Rates for adaptive group testing in the
linear regime”. arXiv: 1901.09687.

[11] Aldridge, M., L. Baldassini, and K. Gunderson. 2017. “Almost
separable matrices”. Journal of Combinatorial Optimization.
33(1): 215–236. DOI: 10.1007/s10878-015-9951-1.

[12] Aldridge, M., L. Baldassini, and O. T. Johnson. 2014. “Group
testing algorithms: Bounds and simulations”. IEEE Transactions
on Information Theory. 60(6): 3671–3687. DOI: 10.1109/TIT.
2014.2314472.

[13] Allemann, A. 2013. “An efficient algorithm for combinatorial
group testing”. In: Information Theory, Combinatorics, and
Search Theory: In Memory of Rudolf Ahlswede. Ed. by H. Ay-
dinian, F. Cicalese, and C. Deppe. Springer. 569–596. DOI: 10.
1007/978-3-642-36899-8_29.

[14] Ambainis, A., A. Belovs, O. Regev, and R. De Wolf. 2016. “Effi-
cient quantum algorithms for (gapped) group testing and junta
testing”. In: Proceedings of the 27th Annual ACM-SIAM Sympo-
sium On Discrete Algorithms (SODA). 903–922. DOI: 10.1137/1.
9781611974331.ch65.

[15] Ash, R. B. 1990. Information Theory. Dover Publications Inc.,
New York.

[16] Atia, G. K., S. Aeron, E. Ermis, and V. Saligrama. 2008. “On
throughput maximization and interference avoidance in cognitive
radios”. In: 5th IEEE Consumer Communications and Network-
ing Conference (CCNC). 963–967. DOI: 10.1109/ccnc08.2007.222.

[17] Atia, G. K. and V. Saligrama. 2012. “Boolean compressed sensing
and noisy group testing”. IEEE Transactions on Information
Theory. 58(3): 1880–1901. See also [18]. DOI: 10.1109/TIT.2011.
2178156.
[18] Atia, G. K., V. Saligrama, and C. Aksoylar. 2015. “Correction to ‘Boolean compressed sensing and noisy group testing’”. IEEE Transactions on Information Theory. 61(3): 1507–1507. DOI: 10.1109/TIT.2015.2392116.

[19] Atıcı, A. and R. A. Servedio. 2007. “Quantum algorithms for learning and testing juntas”. Quantum Information Processing. 6(5): 323–348. DOI: 10.1007/s11128-007-0061-6.

[20] Baldassini, L., O. T. Johnson, and M. Aldridge. 2013. “The capacity of adaptive group testing”. In: IEEE International Symposium on Information Theory (ISIT). 2676–2680. DOI: 10.1109/ISIT.2013.6620712.

[21] Balding, D. J., W. J. Bruno, D. C. Torney, and E. Knill. 1996. “A comparative survey of non-adaptive pooling designs”. In: Genetic Mapping and DNA Sequencing. Ed. by T. Speed and M. S. Waterman. Springer. 133–154. DOI: 10.1007/978-1-4612-0751-1_8.

[22] Berger, T. and V. I. Levenshtein. 2002. “Asymptotic efficiency of two-stage disjunctive testing”. IEEE Transactions on Information Theory. 48(7): 1741–1749. DOI: 10.1109/TIT.2002.1013122.

[23] Berger, T., N. Mehravari, D. Towsley, and J. Wolf. 1984. “Random multiple-access communication and group testing”. IEEE Transactions on Communications. 32(7): 769–779. DOI: 10.1109/TCOM.1984.1096146.

[24] Blais, E. 2010. “Testing juntas: A brief survey”. In: Property Testing: Current research and surveys. Ed. by O. Goldreich. Springer. 32–40. DOI: 10.1007/978-3-642-16367-8_4.

[25] Bloom, B. H. 1970. “Space/time trade-offs in hash coding with allowable errors”. Communications of the ACM. 13(7): 422–426. DOI: 10.1145/362686.362692.

[26] Bondorf, S., B. Chen, J. Scarlett, H. Yu, and Y. Zhao. 2019. “Sublinear-time non-adaptive group testing with $O(k \log n)$ tests via bit-mixing coding”. arXiv: 1904.10102.

[27] Bshouty, N. H. 2009. “Optimal algorithms for the coin weighing problem with a spring scale”. In: Conference on Learning Theory. URL: https://www.cs.mcgill.ca/~colt2009/papers/004.pdf.
[28] Bshouty, N. H. 2018. “Lower bound for non-adaptive estimate the number of defective items.” In: Electronic Colloquium on Computational Complexity (ECCC). TR18-053. url: https://eccc.weizmann.ac.il/report/2018/053/.

[29] Bshouty, N. H., V. E. Bshouty-Hurani, G. Haddad, T. Hashem, F. Khoury, and O. Sharafy. 2018. “Adaptive group testing algorithms to estimate the number of defectives”. In: Proceedings of Algorithmic Learning Theory. Vol. 83. Proceedings of Machine Learning Research. 93–110. url: http://proceedings.mlr.press/v83/bshouty18a.html.

[30] Bshouty, N. H. and A. Costa. 2018. “Exact learning of juntas from membership queries”. Theoretical Computer Science. 742: 82–97. Algorithmic Learning Theory. DOI: 10.1016/j.tcs.2017.12.032.

[31] Busschbach, P. 1984. “Constructive methods to solve problems of $s$-surjectivity, conflict resolution, coding in defective memories”. Rapport Interne ENST 84 D005.

[32] Cai, S., M. Jahangoshahi, M. Bakshi, and S. Jaggi. 2017. “Efficient algorithms for noisy group testing”. IEEE Transactions on Information Theory. 63(4): 2113–2136. DOI: 10.1109/TIT.2017.2659619.

[33] Chan, C. L., P. H. Che, S. Jaggi, and V. Saligrama. 2011. “Non-adaptive probabilistic group testing with noisy measurements: Near-optimal bounds with efficient algorithms”. In: 49th Annual Allerton Conference on Communication, Control, and Computing. 1832–1839. DOI: 10.1109/ALLERTON.2011.6120391.

[34] Chan, C. L., S. Jaggi, V. Saligrama, and S. Agnihotri. 2014. “Non-adaptive group testing: Explicit bounds and novel algorithms”. IEEE Transactions on Information Theory. 60(5): 3019–3035. DOI: 10.1109/TIT.2014.2310477.

[35] Chen, C. L. and W. H. Swallow. 1990. “Using group testing to estimate a proportion, and to test the binomial model”. Biometrics. 46(4): 1035–1046. DOI: 10.2307/2532446.

[36] Chen, H.-B. and F. K. Hwang. 2008. “A survey on nonadaptive group testing algorithms through the angle of decoding”. Journal of Combinatorial Optimization. 15(1): 49–59. DOI: 10.1007/s10878-007-9083-3.
[37] Chen, H.-B. and F. K. Hwang. 2007. “Exploring the missing link among $d$-separable, $\bar{d}$-separable and $d$-disjunct matrices”. *Discrete Applied Mathematics*. 155(5): 662–664. DOI: 10.1016/j.dam.2006.10.009.

[38] Cheng, Y. 2011. “An efficient randomized group testing procedure to determine the number of defectives”. *Operations Research Letters*. 39(5): 352–354. DOI: 10.1016/j.orl.2011.07.001.

[39] Cheraghchi, M., A. Karbasi, S. Mohajer, and V. Saligrama. 2012. “Graph-constrained group testing”. *IEEE Transactions on Information Theory*. 58(1): 248–262. DOI: 10.1109/TIT.2011.2169535.

[40] Cheraghchi, M. 2009. “Noise-resilient group testing: Limitations and constructions”. In: *International Symposium on Fundamentals of Computation Theory*. 62–73. DOI: 10.1007/978-3-642-03409-1_7.

[41] Cheraghchi, M. 2010. “Derandomization and group testing”. In: *48th Allerton Conference on Communication, Control, and Computing*. 991–997. DOI: 10.1109/ALLERTON.2010.5707017.

[42] Cheraghchi, M. 2013. “Improved constructions for non-adaptive threshold group testing”. *Algorithmica*. 67(3): 384–417. DOI: 10.1007/s00453-013-9754-7.

[43] Chvatal, V. 1979. “A greedy heuristic for the set-covering problem”. *Mathematics of Operations Research*. 4(3): 233–235. DOI: 10.1287/moor.4.3.233.

[44] Cicalese, F., P. Damaschke, and U. Vaccaro. 2005. “Optimal group testing algorithms with interval queries and their application to splice site detection”. *International Journal of Bioinformatics Research and Applications*. 1(4): 363–388. DOI: 10.1504/IJBRA.2005.008441.

[45] Clifford, R., K. Efremenko, E. Porat, and A. Rothschild. 2010. “Pattern matching with don’t cares and few errors”. *Journal of Computer and System Sciences*. 76(2): 115–124. DOI: 10.1016/j.jcss.2009.06.002.

[46] Coja-Oghlan, A., O. Gebhard, M. Hahn-Klimroth, and P. Loick. 2019a. “Information-theoretic and algorithmic thresholds for group testing”. arXiv: 1902.02202.
References

[47] Coja-Oghlan, A., O. Gebhard, M. Hahn-Klimroth, and P. Loick. 2019b. “Optimal non-adaptive group testing”. arXiv: 1911.02287.

[48] Cormen, T. H., C. E. Leiserson, R. L. Rivest, and C. Stein. 2009. Introduction to Algorithms. 3rd edition. The MIT Press.

[49] Cormode, G. and S. Muthukrishnan. 2005. “What’s hot and what’s not: Tracking most frequent items dynamically”. ACM Transactions on Database Systems (TODS). 30(1): 249–278. DOI: 10.1145/1061318.1061325.

[50] Cover, T. M. and J. A. Thomas. 2006. Elements of Information Theory. 2nd edition. Wiley-Interscience. DOI: 10.1002/047174882X.

[51] Csiszár, I. and J. Körner. 2011. Information Theory: Coding theorems for discrete memoryless systems. 2nd edition. Cambridge University Press. DOI: 10.1017/CBO9780511921889.

[52] Curnow, R. N. and A. P. Morris. 1998. “Pooling DNA in the identification of parents”. Heredity. 80(1): 101–109. DOI: 10.1038/sj.hdy.6882420.

[53] D’yachkov, A. G. 2004. “Lectures on designing screening experiments”. Lecture Note Series 10, POSTECH. arXiv: 1401.7505.

[54] D’yachkov, A. G. and V. V. Rykov. 1982. “Bounds on the length of disjunctive codes”. Problemy Peredachi Informatsii. 18(3): 7–13. Translation: Problems of Information Transmission. 18(3): 166–171. URL: https://www.researchgate.net/publication/268498029_Bounds_on_the_length_of_disjunctive_codes.

[55] D’yachkov, A. G. and V. V. Rykov. 1983. “A survey of superimposed code theory”. Problems of Control and Information Theory. 12(4): 1–13. URL: https://www.researchgate.net/publication/235008674_Survey_of_Superimposed_Code_Theory.

[56] Damaschke, P. 2006. “Threshold group testing”. In: General Theory of Information Transfer and Combinatorics. Springer. 707–718. DOI: 10.1007/11889342_45.

[57] Damaschke, P. 2016. “Adaptive group testing with a constrained number of positive responses improved”. Discrete Applied Mathematics. 205: 208–212. DOI: 10.1016/j.dam.2016.01.010.
[58] Damaschke, P. and A. S. Muhammad. 2010a. “Bounds for non-adaptive group tests to estimate the amount of defectives”. In: *Combinatorial Optimization and Applications (COCOA)*. 117–130. DOI: 10.1007/978-3-642-17461-2_10.

[59] Damaschke, P. and A. S. Muhammad. 2010b. “Competitive group testing and learning hidden vertex covers with minimum adaptivity”. *Discrete Mathematics, Algorithms and Applications*. 2(03): 291–311. DOI: 10.1142/S179383091000067X.

[60] Damaschke, P. and A. S. Muhammad. 2012. “Randomized group testing both query-optimal and minimal adaptive”. In: *International Conference on Current Trends in Theory and Practice of Computer Science*. 214–225. DOI: 10.1007/978-3-642-27660-6_18.

[61] De Bonis, A., L. Gasieniec, and U. Vaccaro. 2005. “Optimal two-stage algorithms for group testing problems”. *SIAM Journal on Computing*. 34(5): 1253–1270. DOI: 10.1137/S0097539703428002.

[62] De Bonis, A. and U. Vaccaro. 1998. “Improved algorithms for group testing with inhibitors”. *Information Processing Letters*. 67(2): 57–64. DOI: 10.1016/S0020-0190(98)00088-X.

[63] De Bonis, A. and U. Vaccaro. 2003. “Constructions of generalized superimposed codes with applications to group testing and conflict resolution in multiple access channels”. *Theoretical Computer Science*. 306(1-3): 223–243. DOI: 10.1016/S0304-3975(03)00281-0.

[64] De Bonis, A. and U. Vaccaro. 2017. “ε-almost selectors and their applications to multiple-access communication”. *IEEE Transactions on Information Theory*. 63(11): 7304–7319. DOI: 10.1109/TIT.2017.2750178.

[65] Dorfman, R. 1943. “The detection of defective members of large populations”. *The Annals of Mathematical Statistics*. 14(4): 436–440. DOI: 10.1214/aoms/1177731363.

[66] Du, D.-Z. and F. Hwang. 1999. *Combinatorial Group Testing and Its Applications*. 2nd edition. World Scientific. DOI: 10.1142/4252.

[67] Du, D.-Z. and F. K. Hwang. 2006. *Pooling Designs and Non-adaptive Group Testing: Important tools for DNA sequencing*. World Scientific. DOI: 10.1142/6122.
[68] Emad, A. and O. Milenkovic. 2014a. “Poisson group testing: A probabilistic model for nonadaptive streaming Boolean compressed sensing”. In: IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2014. 3335–3339. doi: 10.1109/ICASSP.2014.6854218.

[69] Emad, A. and O. Milenkovic. 2014b. “Semiquantitative group testing”. IEEE Transactions on Information Theory. 60(8): 4614–4636. doi: 10.1109/TIT.2014.2327630.

[70] Emad, A., K. R. Varshney, and D. M. Malioutov. 2015. “A semiquantitative group testing approach for learning interpretable clinical prediction rules”. In: Signal Processing with Adaptive Sparse Structured Representations (SPARS). url: https://krvarshney.github.io/pubs/EmadVM_spars2015.pdf.

[71] Erdős, P. and A. Rényi. 1961. “On a classical problem of probability theory”. A Magyar Tudományos Akadémia Matematikai Kutató Intézetének Közleményei. 6: 215–220. url: http://www.renyi.hu/~p_erdos/1961-09.pdf.

[72] Erdős, P. and A. Rényi. 1963. “On two problems of information theory”. A Magyar Tudományos Akadémia Matematikai Kutató Intézetének Közleményei. 8: 229–243. url: https://www.renyi.hu/~p_erdos/1963-12.pdf.

[73] Erlich, Y., A. Gordon, M. Brand, G. Hannon, and P. Mitra. 2010. “Compressed genotyping”. IEEE Transactions on Information Theory. 56(2): 706–723. doi: 10.1109/TIT.2009.2037043.

[74] Erlich, Y., A. Gilbert, H. Ngo, A. Rudra, N. Thierry-Mieg, M. Wootters, D. Zielinski, and O. Zuk. 2015. “Biological screens from linear codes: Theory and tools”. bioRxiv. doi: 10.1101/035352.

[75] Falahatgar, M., A. Jafarpour, A. Orlitsky, V. Pichapati, and A. T. Suresh. 2016. “Estimating the number of defectives with group testing”. In: IEEE International Symposium on Information Theory (ISIT). 1376–1380. doi: 10.1109/ISIT.2016.7541524.

[76] Farach, M., S. Kannan, E. Knill, and S. Muthukrishnan. 1997. “Group testing problems with sequences in experimental molecular biology”. In: Proceedings of Compression and Complexity of SEQUENCES 1997. 357–367. doi: 10.1109/SEQUEN.1997.666930.
References

[77] Feinstein, A. 1954. “A new basic theorem of information theory”. *Transactions of the IRE Professional Group on Information Theory*, 4(4): 2–22. DOI: 10.1109/TIT.1954.1057459.

[78] Feller, W. 1968. *An Introduction to Probability Theory and Its Applications*. 3rd edition. Vol. I. John Wiley & Sons.

[79] Finucan, H. M. 1964. “The blood testing problem”. *Journal of the Royal Statistical Society Series C (Applied Statistics)*: 43–50. DOI: 10.2307/2985222.

[80] Fischer, P., N. Klasner, and I. Wegenera. 1999. “On the cut-off point for combinatorial group testing”. *Discrete Applied Mathematics*. 91(1): 83–92. DOI: 10.1016/S0166-218X(98)00119-X.

[81] Foucart, S. and H. Rauhut. 2013. *A Mathematical Introduction to Compressive Sensing*. Birkhäuser. DOI: 10.1007/978-0-8176-4948-7.

[82] Freidlina, V. L. 1975. “On a design problem for screening experiments”. *Teoriya Veroyatnostei i ee Primeneniya*. 20(1): 100–114. Translation: *Theory of Probability & Its Applications*. 20(1): 102–115. DOI: 10.1137/1120008.

[83] Füredi, Z. 1996. “On r-cover-free families”. *Journal of Combinatorial Theory, Series A*. 73(1): 172–173. DOI: 10.1006/jcta.1996.0012.

[84] Furon, T., A. Guyader, and F. Cérou. 2012. “Decoding fingerprints using the Markov Chain Monte Carlo method”. In: *IEEE International Workshop on Information Forensics and Security (WIFS)*. 187–192. DOI: 10.1109/WIFS.2012.6412647.

[85] Furon, T. 2018. “The illusion of group testing”. *Tech. rep.* No. RR-9164. Inria Rennes Bretagne Atlantique. URL: https://hal.inria.fr/hal-01744252.

[86] Gandikota, V., E. Grigorescu, S. Jaggi, and S. Zhou. 2016. “Nearly optimal sparse group testing”. In: *54th Annual Allerton Conference on Communication, Control, and Computing*. 401–408. DOI: 10.1109/ALLERTON.2016.7852259.

[87] Ganesan, A., S. Jaggi, and V. Saligrama. 2015a. “Learning immune-defectives graph through group tests”. In: *IEEE International Symposium on Information Theory (ISIT)*. 66–70. DOI: 10.1109/ISIT.2015.7282418.
[88] Ganesan, A., S. Jaggi, and V. Saligrama. 2015b. “Non-adaptive group testing with inhibitors”. In: 2015 IEEE Information Theory Workshop (ITW). 1–5. DOI: 10.1109/ITW.2015.7133108.

[89] Garey, M. R. and F. K. Hwang. 1974. “Isolating a single defective using group testing”. Journal of the American Statistical Association. 69(345): 151–153. DOI: 10.2307/2285514.

[90] Gastwirth, J. L. and P. A. Hammick. 1989. “Estimation of the prevalence of a rare disease, preserving the anonymity of the subjects by group testing: Application to estimating the prevalence of AIDS antibodies in blood donors”. Journal of Statistical Planning and Inference. 22(1): 15–27. DOI: 10.1016/0378-3758(89)90061-X.

[91] Gebhard, O., M. Hahn-Klimroth, D. Kaaser, and P. Loick. 2019. “Quantitative group testing in the sublinear regime”. arXiv: 1905.01458.

[92] Gilbert, A. C., B. Hemenway, A. Rudra, M. J. Strauss, and M. Wootters. 2012. “Recovering simple signals”. In: 2012 Information Theory and Applications Workshop (ITA). 382–391. DOI: 10.1109/ITA.2012.6181772.

[93] Gilbert, A. C., M. J. Strauss, J. A. Tropp, and R. Vershynin. 2006. “Algorithmic linear dimension reduction in the $\ell_1$ norm for sparse vectors”. In: Allerton Conference on Communication, Control, and Computing. URL: https://web.eecs.umich.edu/~martinjs/papers/GSTV06-allerton.pdf.

[94] Gilbert, A. C., M. J. Strauss, J. A. Tropp, and R. Vershynin. 2007. “One sketch for all: Fast algorithms for compressed sensing”. In: Proceedings of the Thirty-ninth Annual ACM Symposium on Theory of Computing (STOC ’07). 237–246. DOI: 10.1145/1250790.1250824.

[95] Gilbert, A. C., M. A. Iwen, and M. J. Strauss. 2008. “Group testing and sparse signal recovery”. In: 2008 42nd Asilomar Conference on Signals, Systems and Computers. 1059–1063. DOI: 10.1109/ACSSC.2008.5074574.

[96] Gille, C., K. Grade, and C. Coutelle. 1991. “A pooling strategy for heterozygote screening of the $\Delta F 508$ cystic fibrosis mutation”. Human Genetics. 86(3): 289–291. DOI: 10.1007/BF00202411.
[97] Goldie, C. and R. Pinch. 1991. *Communication Theory*. Cambridge University Press. doi: 10.1017/CBO9781139172448.

[98] Goodrich, M. T., M. J. Atallah, and R. Tamassia. 2005. “Indexing information for data forensics”. In: *Applied Cryptography and Network Security*. 206–221. doi: 10.1007/11496137_15.

[99] Goodrich, M. T. and D. S. Hirschberg. 2008. “Improved adaptive group testing algorithms with applications to multiple access channels and dead sensor diagnosis”. *Journal of Combinatorial Optimization*. 15(1): 95–121. doi: 10.1007/s10878-007-9087-z.

[100] Han, T. S. 2003. *Information-Spectrum Methods in Information Theory*. Springer–Verlag. doi: 10.1007/978-3-662-12066-8.

[101] Harvey, N. J., M. Patrascu, Y. Wen, S. Yekhanin, and V. W. Chan. 2007. “Non-adaptive fault diagnosis for all-optical networks via combinatorial group testing on graphs”. In: *26th IEEE International Conference on Computer Communications (INFOCOM)*. IEEE. 697–705. doi: 10.1109/INFCOM.2007.87.

[102] Hayes, J. F. 1978. “An adaptive technique for local distribution”. *IEEE Transactions on Communications*. 26(8): 1178–1186. doi: 10.1109/TCOM.1978.1094204.

[103] Hong, E. S. and R. E. Ladner. 2002. “Group testing for image compression”. *IEEE Transactions on Image Processing*. 11(8): 901–911. doi: 10.1109/TIP.2002.801124.

[104] Hong, Y.-W. and A. Scaglione. 2004. “Group testing for sensor networks: The value of asking the right questions”. In: *38th Asilomar Conference on Signals, Systems and Computers*. Vol. 2. 1297–1301. doi: 10.1109/ACSSC.2004.1399362.

[105] Hu, M. C., F. K. Hwang, and J. K. Wang. 1981. “A boundary problem for group testing”. *SIAM Journal on Algebraic Discrete Methods*. 2(2): 81–87. doi: 10.1137/0602011.

[106] Huleihel, W., O. Elishco, and M. Médard. 2019. “Blind group testing”. *IEEE Transactions on Information Theory*. 65(8): 5050–5063. doi: 10.1109/TIT.2019.2906607.

[107] Hwang, F. K. 1972. “A method for detecting all defective members in a population by group testing”. *Journal of the American Statistical Association*. 67(339): 605–608. doi: 10.1080/01621459.1972.10481257.
[108] Hwang, F. K. 1975. “A generalized binomial group testing problem”. *Journal of the American Statistical Association*. 70(352): 923–926. DOI: 10.1080/01621459.1975.10480324.

[109] Inan, H. A., P. Kairouz, M. Wootters, and A. Ozgur. 2018. “On the optimality of the Kautz–Singleton construction in probabilistic group testing”. arXiv: 1808.01457.

[110] Indyk, P. 1997. “Deterministic superimposed coding with applications to pattern matching”. In: *38th Annual Symposium on Foundations of Computer Science (FOCS)*. 127–136. DOI: 10.1109/SFCS.1997.646101.

[111] Indyk, P., H. Q. Ngo, and A. Rudra. 2010. “Efficiently decodable non-adaptive group testing”. In: *21st Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 1126–1142. DOI: 10.1137/1.9781611973075.91.

[112] Johann, P. 2002. “A group testing problem for graphs with several defective edges”. *Discrete Applied Mathematics*. 117(1-3): 99–108. DOI: 10.1016/S0166-218X(01)00181-0.

[113] Johnson, O. T. 2017. “Strong converses for group testing from finite blocklength results”. *IEEE Transactions on Information Theory*. 63(9): 5923–5933. DOI: 10.1109/TIT.2017.2697358.

[114] Johnson, O. T., M. Aldridge, and J. Scarlett. 2019. “Performance of group testing algorithms with near-constant tests-per-item”. *IEEE Transactions on Information Theory*. 65(2): 707–723. DOI: 10.1109/TIT.2018.2861772.

[115] Kahng, A. B. and S. Reda. 2006. “New and improved BIST diagnosis methods from combinatorial group testing theory”. *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*. 25(3): 533–543. DOI: 10.1109/TCAD.2005.854635.

[116] Kainkaryam, R. M. and P. J. Woolf. 2009. “Pooling in high-throughput drug screening”. *Current Opinion on Drug Discovery and Development*. 12(3): 339. URL: https://www.ncbi.nlm.nih.gov/pubmed/19396735.

[117] Karp, R. M. 1972. “Reducibility among combinatorial problems”. In: *Complexity of Computer Computations*. Springer US. 85–103. DOI: 10.1007/978-1-4684-2001-2_9.
References

[118] Katholi, C. R., L. Toé, A. Merriweather, and T. R. Unnasch. 1995. “Determining the prevalence of *Onchocerca volvulus* infection in vector populations by polymerase chain reaction screening of pools of black flies”. *Journal of Infectious Diseases*. 172(5): 1414–1417. DOI: 10.1093/infdis/172.5.1414.

[119] Katona, G. O. H. 1973. “Combinatorial search problems”. In: *A Survey of Combinatorial Theory*. Ed. by J. N. Srivastava. North-Holland. 285–308. DOI: 10.1016/B978-0-7204-2262-7.50028-4.

[120] Kautz, W. and R. Singleton. 1964. “Nonrandom binary superimposed codes”. *IEEE Transactions on Information Theory*. 10(4): 363–377. DOI: 10.1109/TIT.1964.1053689.

[121] Kealy, T., O. Johnson, and R. Piechocki. 2014. “The capacity of non-identical adaptive group testing”. In: 52nd Annual Allerton Conference on Communication, Control, and Computing. 101–108. DOI: 10.1109/ALLERTON.2014.7028442.

[122] Khan, S. A., P. Chowdhury, P. Choudhury, and P. Dutta. 2017. “Detection of West Nile virus in six mosquito species in synchrony with seroconversion among sentinel chickens in India”. *Parasites and Vectors*. 10(1): 13. DOI: 10.1186/s13071-016-1948-9.

[123] Khattab, S., S. Gobriel, R. Melhem, and D. Mosse. 2008. “Live baiting for service-level DoS attackers”. In: *27th IEEE International Conference on Computer Communications (INFOCOM)*. 171–175. DOI: 10.1109/INFOCOM.2008.43.

[124] Knill, E., A. Schliep, and D. Torney. 1996. “Interpretation of pooling experiments using the Markov chain Monte Carlo method”. *Journal of Computational Biology*. 3: 395–406. DOI: 10.1089/cmb.1996.3.395.

[125] Komlos, J. and A. Greenberg. 1985. “An asymptotically fast nonadaptive algorithm for conflict resolution in multiple-access channels”. *IEEE Transactions on Information Theory*. 31(2): 302–306. DOI: 10.1109/TIT.1985.1057020.

[126] Laarhoven, T. 2015. “Asymptotics of fingerprinting and group testing: Tight bounds from channel capacities”. *IEEE Transactions on Information Forensics and Security*. 10(9): 1967–1980. DOI: 10.1109/TIFS.2015.2440190.
[127] Lee, K., R. Pedarsani, and K. Ramchandran. 2015. “SAFFRON: A fast, efficient, and robust framework for group testing based on sparse-graph codes”. arXiv: 1508.04485.

[128] Li, C. H. 1962. “A sequential method for screening experimental variables”. Journal of the American Statistical Association. 57(298): 455–477. DOI: 10.1080/01621459.1962.10480672.

[129] Li, T., C. L. Chan, W. Huang, T. Kaced, and S. Jaggi. 2014. “Group testing with prior statistics”. In: IEEE International Symposium on Information Theory (ISIT). 2346–2350. DOI: 10.1109/ISIT.2014.6875253.

[130] Li, X., S. Pawar, and K. Ramchandran. 2015. “Sub-linear time compressed sensing using sparse-graph codes”. In: IEEE International Symposium on Information Theory (ISIT). 1645–1649. DOI: 10.1109/ISIT.2015.7282735.

[131] Li, Z., M. Fresacher, and J. Scarlett. 2019. “Learning Erdős–Rényi random graphs via edge detecting queries”. arXiv: 1905.03410.

[132] Lo, C., M. Liu, J. P. Lynch, and A. C. Gilbert. 2013. “Efficient sensor fault detection using combinatorial group testing”. In: IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS), 199–206. DOI: 10.1109/DCOSS.2013.57.

[133] Luo, J. and D. Guo. 2008. “Neighbor discovery in wireless ad hoc networks based on group testing”. In: 46th Annual Allerton Conference on Communication, Control, and Computing. 791–797. DOI: 10.1109/ALLERTON.2008.4797638.

[134] Ma, L., T. He, A. Swami, D. Towsley, K. K. Leung, and J. Lowe. 2014. “Node failure localization via network tomography”. In: Proceedings of the 2014 Conference on Internet Measurement Conference (IMC). 195–208. DOI: 10.1145/2663716.2663723.

[135] MacKay, D. J. C. 2003. Information Theory, Inference and Learning Algorithms. Cambridge University Press. DOI: 10.2277/0521642981.
[136] Macula, A. J. 1998. “Probabilistic nonadaptive and two-stage group testing with relatively small pools and DNA library screening”. *Journal of Combinatorial Optimization*. 2(4): 385–397. DOI: 10.1023/A:1009732820981.

[137] Macula, A. J. 1999. “Probabilistic nonadaptive group testing in the presence of errors and DNA library screening”. *Annals of Combinatorics*. 3(1): 61–69. DOI: 10.1007/BF01609876.

[138] Macula, A. J. and L. J. Popyack. 2004. “A group testing method for finding patterns in data”. *Discrete Applied Mathematics*. 144(1): 149–157. DOI: 10.1016/j.dam.2003.07.009.

[139] Madej, T. 1989. “An application of group testing to the file comparison problem”. In: *9th International Conference on Distributed Computing Systems*. 237–243. DOI: 10.1109/ICDCS.1989.37952.

[140] Malioutov, D. M. and M. Malyutov. 2012. “Boolean compressed sensing: LP relaxation for group testing”. In: *2012 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. 3305–3308. DOI: 10.1109/ICASSP.2012.6288622.

[141] Malioutov, D. M. and K. R. Varshney. 2013. “Exact rule learning via Boolean compressed sensing”. In: *Proceedings of the 30th International Conference on Machine Learning*. Vol. 28. *Proceedings of Machine Learning Research*. No. 3. 765–773. URL: http://proceedings.mlr.press/v28/malioutov13.html.

[142] Malioutov, D. M., K. R. Varshney, A. Emad, and S. Dash. 2017. “Learning interpretable classification rules with Boolean compressed sensing”. In: *Transparent Data Mining for Big and Small Data*. Ed. by T. Cerquitelli, D. Quercia, and F. Pasquale. Springer. 95–121. DOI: 10.1007/978-3-319-54024-5_5.

[143] Malyutov, M. B. 1978. “The separating property of random matrices”. *Matematicheskie Zametki*. 23(1): 155–167. Translation: *Mathematical Notes of the Academy of Sciences of the USSR*. 23(1): 84–91. DOI: 10.1007/BF01104893.

[144] Malyutov, M. B. 2013. “Search for sparse active inputs: A review”. In: *Information Theory, Combinatorics, and Search Theory: In Memory of Rudolf Ahlswede*. Ed. by H. Aydinian, F. Cicalese, and C. Deppe. Springer. 609–647. DOI: 10.1007/978-3-642-36899-8_31.
[145] Malyutov, M. B. and P. S. Mateev. 1980. “Planning of screening experiments for a nonsymmetric response function”. Matematicheskie Zametki. 27(1): 109–127. Translation: Mathematical Notes of the Academy of Sciences of the USSR. 27(1): 57–68. doi: 10.1007/BF01149816.

[146] Malyutov, M. and H. Sadaka. 1998. “Maximization of ESI. Jaynes principle in testing significant inputs of linear model”. Random Operators and Stochastic Equations. 6(4): 311–330. doi: 10.1515/rose.1998.6.4.311.

[147] Mazumdar, A. 2016. “Nonadaptive group testing with random set of defectives”. IEEE Transactions on Information Theory. 62(12): 7522–7531. doi: 10.1109/TIT.2016.2613870.

[148] McDiarmid, C. 1989. “On the method of bounded differences”. In: Surveys in Combinatorics 1989: Invited Papers at the Twelfth British Combinatorial Conference. Ed. by J. Siemons. Cambridge University Press. 148–188. doi: 10.1017/CBO9781107359949.008.

[149] Mézard, M., M. Tarzia, and C. Toninelli. 2008. “Group testing with random pools: Phase transitions and optimal strategy”. Journal of Statistical Physics. 131(5): 783–801. doi: 10.1007/s10955-008-9528-9.

[150] Mézard, M. and C. Toninelli. 2011. “Group testing with random pools: Optimal two-stage algorithms”. IEEE Transactions on Information Theory. 57(3): 1736–1745. doi: 10.1109/TIT.2010.2103752.

[151] Mossel, E., R. O’Donnell, and R. A. Servedio. 2004. “Learning functions of $k$ relevant variables”. Journal of Computer and System Sciences. 69(3): 421–434. Special Issue on STOC 2003. doi: 10.1016/j.jcss.2004.04.002.

[152] Mourad, R., Z. Dawy, and F. Morcos. 2013. “Designing pooling systems for noisy high-throughput protein-protein interaction experiments using Boolean compressed sensing”. IEEE/ACM Transactions on Computational Biology and Bioinformatics. 10(6): 1478–1490. doi: 10.1109/TCBB.2013.129.
References

[153] Nebenzahl, E. and M. Sobel. 1973. “Finite and infinite models for generalized group-testing with unequal probabilities of success for each item”. In: Discriminant Analysis and Applications. Elsevier. 239–289. DOI: 10.1016/B978-0-12-154050-0.50020-4.

[154] Ngo, H. Q., E. Porat, and A. Rudra. 2011. “Efficiently decodable error-correcting list disjunct matrices and applications”. In: Automata, Languages and Programming (ICALP). 557–568. DOI: 10.1007/978-3-642-22006-7_47.

[155] Polyanskiy, Y., H. V. Poor, and S. Verdú. 2010. “Channel coding rate in the finite blocklength regime”. IEEE Transactions on Information Theory. 56(5): 2307–2359. DOI: 10.1109/TIT.2010.2043769.

[156] Porat, E. and A. Rothschild. 2011. “Explicit nonadaptive combinatorial group testing schemes”. IEEE Transactions on Information Theory. 57(12): 7982–7989. DOI: 10.1109/TIT.2011.2163296.

[157] Reeves, G. and H. D. Pfister. 2019. “Understanding phase transitions via mutual information and MMSE”. arXiv: 1907.02095.

[158] Riccio, L. and C. J. Colbourn. 2000. “Sharper bounds in adaptive group testing”. Taiwanese Journal of Mathematics. 4(4): 669–673. DOI: 10.11650/twjm/1500407300.

[159] Richardson, T. and R. Urbanke. 2008. Modern Coding Theory. Cambridge University Press. DOI: 10.1017/CBO9780511791338.

[160] Ruszinkó, M. 1994. “On the upper bound of the size of the r-cover-free families”. Journal of Combinatorial Theory, Series A. 66(2): 302–310. DOI: 10.1016/0097-3165(94)90067-1.

[161] Scarlett, J. 2019a. “An efficient algorithm for capacity-approaching noisy adaptive group testing”. In: IEEE International Symposium on Information Theory (ISIT).

[162] Scarlett, J. 2019b. “Noisy adaptive group testing: Bounds and algorithms”. IEEE Transactions on Information Theory. 65(6): 3646–3661. DOI: 10.1109/TIT.2018.2883604.

[163] Scarlett, J. and V. Cevher. 2016a. “Converse bounds for noisy group testing with arbitrary measurement matrices”. In: IEEE International Symposium on Information Theory (ISIT). 2868–2872. DOI: 10.1109/ISIT.2016.7541823.
[164] Scarlett, J. and V. Cevher. 2016b. “Phase transitions in group testing”. In: 27th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA). 40–53. DOI: 10.1137/1.9781611974331.ch4.

[165] Scarlett, J. and V. Cevher. 2017a. “How little does non-exact recovery help in group testing?” In: IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP). 6090–6094. DOI: 10.1109/ICASSP.2017.7953326.

[166] Scarlett, J. and V. Cevher. 2017b. “Limits on support recovery With probabilistic models: An information-theoretic framework”. IEEE Transactions on Information Theory. 63(1): 593–620. DOI: 10.1109/TIT.2016.2606605.

[167] Scarlett, J. and V. Cevher. 2017c. “Phase transitions in the pooled data problem”. In: Advances in Neural Information Processing Systems 30 (NIPS 2017). 377–385. URL: https://papers.nips.cc/paper/6641-phase-transitions-in-the-pooled-data-problem.

[168] Scarlett, J. and V. Cevher. 2018. “Near-optimal noisy group testing via separate decoding of items”. IEEE Journal of Selected Topics in Signal Processing. 2(4): 625–638. DOI: 10.1109/JSTSP.2018.2844818.

[169] Scarlett, J. and O. T. Johnson. 2018. “Noisy non-adaptive group testing: A (near-)definite defectives approach”. arXiv: 1808.09143.

[170] Schliep, A., D. C. Torney, and S. Rahmann. 2003. “Group testing with DNA chips: Generating designs and decoding experiments”. In: IEEE Bioinformatics Conference. 84–91. DOI: 10.1109/CSB.2003.1227307.

[171] Sebô, A. 1985. “On two random search problems”. Journal of Statistical Planning and Inference. 11(1): 23–31. DOI: 10.1016/0378-3758(85)90022-9.

[172] Sejdić, D. and O. T. Johnson. 2010. “Note on noisy group testing: Asymptotic bounds and belief propagation reconstruction”. In: 48th Annual Allerton Conference on Communication, Control, and Computing. 998–1003. DOI: 10.1109/ALLERTON.2010.5707018.
[173] Sham, P., J. S. Bader, I. Craig, M. O’Donovan, and M. Owen. 2002. “DNA pooling: A tool for large-scale association studies”. Nature Reviews Genetics. 3(11): 862–871. DOI: 10.1038/nrg930.

[174] Shangguan, C. and G. Ge. 2016. “New bounds on the number of tests for disjunct matrices”. IEEE Transactions on Information Theory. 62(12): 7518–7521. DOI: 10.1109/TIT.2016.2614726.

[175] Shannon, C. 1956. “The zero error capacity of a noisy channel”. IRE Transactions on Information Theory. 2(3): 8–19. DOI: 10.1109/TIT.1956.1056798.

[176] Shannon, C. E. 1957. “Certain results in coding theory for noisy channels”. Information and Control. 1(1): 6–25. DOI: 10.1016/S0019-9958(57)90039-6.

[177] Sharma, A. and C. R. Murthy. 2014. “Group testing-based spectrum hole search for cognitive radios”. IEEE Transactions on Vehicular Technology. 63(8): 3794–3805. DOI: 10.1109/TVT.2014.2305978.

[178] Shental, N., A. Amir, and O. Zuk. 2010. “Identification of rare alleles and their carriers using compressed se(que)nsing”. Nucleic Acids Research. 38(19): e179. DOI: 10.1093/nar/gkq675.

[179] Shi, M., T. Furon, and H. Jégou. 2014. “A group testing framework for similarity search in high-dimensional spaces”. In: Proceedings of the ACM International Conference on Multimedia. 407–416. DOI: 10.1145/2647868.2654895.

[180] Sobel, M. and R. Elashoff. 1975. “Group testing with a new goal, estimation”. Biometrika: 181–193. DOI: 10.2307/2334502.

[181] Sobel, M. and P. A. Groll. 1959. “Group testing to eliminate efficiently all defectives in a binomial sample”. Bell Labs Technical Journal. 38(5): 1179–1252. DOI: 10.1002/j.1538-7305.1959.tb03914.x.

[182] Sobel, M. and P. A. Groll. 1966. “Binomial group-testing with an unknown proportion of defectives”. Technometrics. 8(4): 631–656. DOI: 10.1080/00401706.1966.10490408.

[183] Spielman, D. A. 1996. “Linear-time encodable and decodable error-correcting codes”. IEEE Transactions on Information Theory. 42(6): 1723–1731. DOI: 10.1109/18.556668.
Stan, M. R., P. D. Franzon, S. C. Goldstein, J. C. Lach, and M. M. Ziegler. 2003. “Molecular electronics: From devices and interconnect to circuits and architecture”. Proceedings of the IEEE. 91(11): 1940–1957. DOI: 10.1109/JPROC.2003.818327.

Sterrett, A. 1957. “On the detection of defective members of large populations”. The Annals of Mathematical Statistics. 28(4): 1033–1036. DOI: 10.1214/aoms/1177706807.

Swallow, W. H. 1985. “Group testing for estimating infection rates and probabilities of disease transmission”. Phytopathology. 75(8): 882–889. DOI: 10.1094/Phyto-75-882.

Thompson, K. H. 1962. “Estimation of the proportion of vectors in a natural population of insects”. Biometrics. 18(4): 568–578. DOI: 10.2307/2527902.

Tilghman, M., D. Tsai, T. P. Buene, M. Tomas, S. Amade, D. Gehlbach, S. Chang, C. Ignacio, G. Caballero, S. Espitia, S. May, E. V. Noormahomed, and D. Smith. 2015. “Pooled nucleic acid testing to detect antiretroviral treatment failure in HIV-infected patients in Mozambique”. Journal of Acquired Immune Deficiency Syndromes. 70(3): 256. DOI: 10.1097/QAI.0000000000000724.

Tsfasman, M. A., S. G. Vlădut, and T. Zink. 1982. “Modular curves, Shimura curves, and Goppa codes, better than Varshamov-Gilbert bound”. Mathematische Nachrichten. 109(1): 21–28. DOI: 10.1002/mana.19821090103.

Tu, X. M., E. Litvak, and M. Pagano. 1995. “On the informativeness and accuracy of pooled testing in estimating prevalence of a rare disease: Application to HIV screening”. Biometrika: 287–297. DOI: 10.2307/2337408.

Varanasi, M. K. 1995. “Group detection for synchronous Gaussian code-division multiple-access channels”. IEEE Transactions on Information Theory. 41(4): 1083–1096. DOI: 10.1109/18.391251.

Vazirani, V. V. 2001. Approximation Algorithms. Springer. DOI: 10.1007/978-3-662-04565-7.
[193] Wadayama, T. 2017. “Nonadaptive group testing based on sparse pooling graphs”. *IEEE Transactions on Information Theory*. 63(3): 1525–1534. See also [194]. DOI: 10.1109/TIT.2016.2621112.

[194] Wadayama, T. 2018. “Comments on ‘Nonadaptive group testing based on sparse pooling graphs’”. *IEEE Transactions on Information Theory*. 64(6): 4686–4686. DOI: 10.1109/TIT.2018.2827463.

[195] Walter, S. D., S. W. Hildreth, and B. J. Beaty. 1980. “Estimation of infection rates in populations of organisms using pools of variable size”. *American Journal of Epidemiology*. 112(1): 124–128. DOI: 10.1093/oxfordjournals.aje.a112961.

[196] Wang, C., Q. Zhao, and C.-N. Chuah. 2018. “Optimal nested test plan for combinatorial quantitative group testing”. *IEEE Transactions on Signal Processing*. 66(4): 992–1006. DOI: 10.1109/TSP.2017.2780053.

[197] Wang, J., E. Lo, and M. L. Yiu. 2013. “Identifying the most connected vertices in hidden bipartite graphs using group testing”. *IEEE Transactions on Knowledge and Data Engineering*. 25(10): 2245–2256. DOI: 10.1109/TKDE.2012.178.

[198] Wolf, J. K. 1985. “Born again group testing: Multiaccess communications”. *IEEE Transactions on Information Theory*. 31(2): 185–191. DOI: 10.1109/TIT.1985.1057026.

[199] Wu, S., S. Wei, Y. Wang, R. Vaidyanathan, and J. Yuan. 2014. “Achievable partition information rate over noisy multi-access Boolean channel”. In: *IEEE International Symposium on Information Theory (ISIT)*. 1206–1210. DOI: 10.1109/ISIT.2014.6875024.

[200] Wu, S., S. Wei, Y. Wang, R. Vaidyanathan, and J. Yuan. 2015. “Partition information and its transmission over Boolean multi-access channels”. *IEEE Transactions on Information Theory*. 61(2): 1010–1027. DOI: 10.1109/TIT.2014.2375211.

[201] Xu, W., M. Wang, E. Mallada, and A. Tang. 2011. “Recent results on sparse recovery over graphs”. In: *45th Asilomar Conference on Signals, Systems and Computers*. 413–417. DOI: 10.1109/ACSSC.2011.6190031.
[202] Xuan, Y., I. Shin, M. T. Thai, and T. Znati. 2010. “Detecting application denial-of-service attacks: A group-testing-based approach”. *IEEE Transactions on Parallel and Distributed Systems*. 21(8): 1203–1216. doi: 10.1109/TPDS.2009.147.

[203] Zaman, N. and N. Pippenger. 2016. “Asymptotic analysis of optimal nested group-testing procedures”. *Probability in the Engineering and Informational Sciences*. 30(4): 547–552. doi: 10.1017/S0269964816000267.

[204] Zhang, W. and L. Huang. 2017. “On OR many-access channels”. In: *IEEE International Symposium on Information Theory (ISIT)*. 2638–2642. doi: 10.1109/ISIT.2017.8007007.