

Bibliography

- [1] L.M. Adleman and M. Huang. *Primality Testing and Abelian Varieties Over Finite Fields*. Springer-Verlag Lecture Notes in Computer Science (Vol. 1512), 1992. (Preliminary version in *19th ACM Symposium on the Theory of Computing*, 1987.)
- [2] W. Aiello and J. Håstad. Perfect Zero-Knowledge Languages Can Be Recognized in Two Rounds. In *28th IEEE Symposium on Foundations of Computer Science*, pages 439–448, 1987.
- [3] M. Ajtai. Generating Hard Instances of Lattice Problems. In *28th ACM Symposium on the Theory of Computing*, pages 99–108, 1996.
- [4] M. Ajtai, J. Komlos, and E. Szemerédi. Deterministic Simulation in LogSpace. In *19th ACM Symposium on the Theory of Computing*, pages 132–140, 1987.
- [5] W. Alexi, B. Chor, O. Goldreich, and C.P. Schnorr. RSA/Rabin Functions: Certain Parts Are as Hard as the Whole. *SIAM Journal on Computing*, Vol. 17, April, pages 194–209, 1988.
- [6] N. Alon and J.H. Spencer. *The Probabilistic Method*. Wiley, 1992.
- [7] T.M. Apostol. *Introduction to Analytic Number Theory*. Springer, 1976.
- [8] L. Babai. Trading Group Theory for Randomness. In *17th ACM Symposium on the Theory of Computing*, pages 421–420, 1985.
- [9] E. Bach. *Analytic Methods in the Analysis and Design of Number-Theoretic Algorithms*. ACM Distinguished Dissertation (1984). MIT Press, Cambridge, MA, 1985.
- [10] E. Bach and J. Shallit. *Algorithmic Number Theory. Vol. I: Efficient Algorithms*. MIT Press, Cambridge, MA, 1996.
- [11] D. Beaver. Foundations of Secure Interactive Computing. In *Crypto91*, Springer-Verlag Lecture Notes in Computer Science (Vol. 576), pages 377–391, 1992.
- [12] D. Beaver. Secure Multi-Party Protocols and Zero-Knowledge Proof Systems Tolerating a Faulty Minority. *Journal of Cryptology*, Vol. 4, pages 75–122, 1991.
- [13] M. Bellare. A Note on Negligible Functions. Tech. Rep. CS97-529, Department of Computer Science and Engineering, UCSD, March 1997.
- [14] M. Bellare, R. Canetti, and H. Krawczyk. Pseudorandom Functions Revisited: The Cascade Construction and Its Concrete Security. In *37th IEEE Symposium on Foundations of Computer Science*, pages 514–523, 1996.
- [15] M. Bellare, R. Canetti, and H. Krawczyk. Keying Hash Functions for Message Authentication. In *Crypto96*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1109), pages 1–15, 1996.

- [16] M. Bellare, A. Desai, D. Pointcheval, and P. Rogaway. Relations Among Notions of Security for Public-Key Encryption Schemes. In *Crypto98*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1462), pages 26–45, 1998.
- [17] M. Bellare and O. Goldreich. On Defining Proofs of Knowledge. In *Crypto92*, Springer-Verlag Lecture Notes in Computer Science (Vol. 740), pages 390–420, 1992.
- [18] M. Bellare, S. Halevi, A. Sahai, and S. Vadhan. Trapdoor Functions and Public-Key Cryptosystems. In *Crypto98*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1462), pages 283–298, 1998.
- [19] M. Bellare, R. Impagliazzo, and M. Naor. Does Parallel Repetition Lower the Error in Computationally Sound Protocols? In *38th IEEE Symposium on Foundations of Computer Science*, pages 374–383, 1997.
- [20] M. Bellare and S. Micali. How to Sign Given Any Trapdoor Function. *Journal of the ACM*, Vol. 39, pages 214–233, 1992.
- [21] M. Bellare and P. Rogaway. Random Oracles Are Practical: A Paradigm for Designing Efficient Protocols. In *1st Conference on Computer and Communications Security*, ACM, pages 62–73, 1993.
- [22] M. Bellare and P. Rogaway. The Exact Security of Digital Signatures: How to Sign with RSA and Rabin. In *EuroCrypt96*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1070), pp. 399–416, 1996.
- [23] M. Bellare and M. Yung. Certifying Permutations: Noninteractive Zero-Knowledge Based on Any Trapdoor Permutation. *Journal of Cryptology*, Vol. 9, pages 149–166, 1996.
- [24] S. Ben-David, B. Chor, O. Goldreich, and M. Luby. On the Theory of Average Case Complexity. *Journal of Computer and System Science*, Vol. 44, No. 2, April, pages 193–219, 1992.
- [25] M. Ben-Or, O. Goldreich, S. Goldwasser, J. Håstad, J. Kilian, S. Micali, and P. Rogaway. Everything Provable Is Probable in Zero-Knowledge. In *Crypto88*, Springer-Verlag Lecture Notes in Computer Science (Vol. 403), pages 37–56, 1990.
- [26] M. Ben-Or, S. Goldwasser, J. Kilian, and A. Wigderson. Multi-Prover Interactive Proofs: How to Remove Intractability. In *20th ACM Symposium on the Theory of Computing*, pages 113–131, 1988.
- [27] M. Ben-Or, S. Goldwasser, and A. Wigderson. Completeness Theorems for Non-Cryptographic Fault-Tolerant Distributed Computation. In *20th ACM Symposium on the Theory of Computing*, pages 1–10, 1988.
- [28] E.R. Berlekamp. Factoring Polynomials over Large Finite Fields. *Mathematics of Computation*, Vol. 24, pages 713–735, 1970.
- [29] E.R. Berlekamp, R.J. McEliece, and H.C.A. van Tilborg. On the Inherent Intractability of Certain Coding Problems. *IEEE Transactions on Information Theory*, 1978.
- [30] M. Blum. How to Exchange Secret Keys. *ACM Trans. Comput. Sys.*, Vol. 1, pages 175–193, 1983.
- [31] M. Blum. Coin Flipping by Phone. In *24th IEEE Computer Conference (CompCon)*, February, pages 133–137, 1982. (See also *SIGACT News*, Vol. 15, No. 1, 1983.)
- [32] L. Blum, M. Blum, and M. Shub. A Simple Secure Unpredictable Pseudo-Random Number Generator. *SIAM Journal on Computing*, Vol. 15, pages 364–383, 1986.
- [33] M. Blum, A. De Santis, S. Micali, and G. Persiano. Non-interactive Zero-Knowledge Proof Systems. *SIAM Journal on Computing*, Vol. 20, No. 6, pages 1084–1118, 1991. (Considered the journal version of [34].)
- [34] M. Blum, P. Feldman, and S. Micali. Non-Interactive Zero-Knowledge and Its Applications. In *20th ACM Symposium on the Theory of Computing*, pages 103–112, 1988. (See [33].)
- [35] M. Blum and S. Goldwasser. An Efficient Probabilistic Public-Key Encryption Scheme

- which Hides All Partial Information. In *Crypto84*, Springer-Verlag Lecture Notes in Computer Science (Vol. 196), pages 289–302, 1985.
- [36] M. Blum and S. Micali. How to Generate Cryptographically Strong Sequences of Pseudo-Random Bits. *SIAM Journal on Computing*, Vol. 13, pages 850–864, 1984. (Preliminary version in *23rd IEEE Symposium on Foundations of Computer Science*, 1982.)
- [37] R. Boppana, J. Håstad, and S. Zachos. Does Co-NP Have Short Interactive Proofs? *Information Processing Letters*, Vol. 25, May, pages 127–132, 1987.
- [38] J.B. Boyar. Inferring Sequences Produced by Pseudo-Random Number Generators. *Journal of the ACM*, Vol. 36, pages 129–141, 1989.
- [39] G. Brassard. A Note on the Complexity of Cryptography. *IEEE Transactions on Information Theory*, Vol. 25, pages 232–233, 1979.
- [40] G. Brassard, D. Chaum, and C. Crépeau. Minimum Disclosure Proofs of Knowledge. *Journal of Computer and System Science*, Vol. 37, No. 2, pages 156–189, 1988. (Preliminary version by Brassard and Crépeau in *27th IEEE Symposium on Foundations of Computer Science*, 1986.)
- [41] G. Brassard and C. Crépeau. Zero-Knowledge Simulation of Boolean Circuits. In *Crypto86*, Springer-Verlag Lecture Notes in Computer Science (Vol. 263), pages 223–233, 1987.
- [42] G. Brassard, C. Crépeau, and M. Yung. Constant-Round Perfect Zero-Knowledge Computationally Convincing Protocols. *Theoretical Computer Science*, Vol. 84, pages 23–52, 1991.
- [43] E.F. Brickell and A.M. Odlyzko. Cryptanalysis: A Survey of Recent Results. In *Proceedings of the IEEE*, Vol. 76, pages 578–593, 1988.
- [44] R. Canetti. *Studies in Secure Multi-Party Computation and Applications*. Ph.D. thesis, Department of Computer Science and Applied Mathematics, Weizmann Institute of Science, Rehovot, Israel, June 1995. (Available from <http://theory.lcs.mit.edu/~tcryptol/BOOKS/ran-phd.html>.)
- [45] R. Canetti. Security and Composition of Multi-party Cryptographic Protocols. *Journal of Cryptology*, Vol. 13, No. 1, pages 143–202, 2000.
- [46] R. Canetti, O. Goldreich, and S. Halevi. The Random Oracle Methodology, Revisited. In *30th ACM Symposium on the Theory of Computing*, pages 209–218, 1998.
- [47] R. Canetti, O. Goldreich, S. Goldwasser, and S. Micali. Resettable Zero-Knowledge. In *32nd ACM Symposium on the Theory of Computing*, pages 235–244, 2000.
- [48] E.R. Canfield, P. Erdos, and C. Pomerance. On a Problem of Oppenheim Concerning “factorisatio numerorum.” *Journal of Number Theory*, Vol. 17, pages 1–28, 1983.
- [49] L. Carter and M. Wegman. Universal Hash Functions. *Journal of Computer and System Science*, Vol. 18, pages 143–154, 1979.
- [50] D. Chaum. Blind Signatures for Untraceable Payments. In *Crypto82*, pages 199–203, Plenum Press, New York, 1983.
- [51] D. Chaum, C. Crépeau, and I. Damgård. Multi-party Unconditionally Secure Protocols. In *20th ACM Symposium on the Theory of Computing*, pages 11–19, 1988.
- [52] B. Chor, S. Goldwasser, S. Micali, and B. Awerbuch. Verifiable Secret Sharing and Achieving Simultaneity in the Presence of Faults. In *26th IEEE Symposium on Foundations of Computer Science*, pages 383–395, 1985.
- [53] R. Cleve. Limits on the Security of Coin Flips When Half the Processors Are Faulty. In *18th ACM Symposium on the Theory of Computing*, pages 364–369, 1986.
- [54] J.D. Cohen and M.J. Fischer. A Robust and Verifiable Cryptographically Secure Election Scheme. In *26th IEEE Symposium on Foundations of Computer Science*, pages 372–382, 1985.
- [55] A. Cohen and A. Wigderson. Dispensers, Deterministic Amplification, and Weak Random

- Sources. In *30th IEEE Symposium on Foundations of Computer Science*, pages 14–19, 1989.
- [56] R. Cramer and I. Damgård. New Generation of Secure and Practical RSA-based Signatures. In *Crypto96*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1109), pages 173–185, 1996.
 - [57] R. Cramer and V. Shoup. A Practical Public-Key Cryptosystem Provably Secure Against Adaptive Chosen Ciphertext Attacks. In *Crypto98*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1462), pages 13–25, 1998.
 - [58] I. Damgård. Collision Free Hash Functions and Public Key Signature Schemes. In *EuroCrypt87*, Springer-Verlag Lecture Notes in Computer Science (Vol. 304), pages 203–216, 1988.
 - [59] I. Damgård. A Design Principle for Hash Functions. In *Crypto89*, Springer-Verlag Lecture Notes in Computer Science (Vol. 435), pages 416–427, 1990.
 - [60] I. Damgård. Concurrent Zero-Knowledge Is Easy in Practice. Theory of Cryptography Library, 99-14, June 1999. <http://philby.ucsd.edu/cryptolib>.
 - [61] I. Damgård, O. Goldreich, T. Okamoto, and A. Wigderson. Honest Verifier vs Dishonest Verifier in Public Coin Zero-Knowledge Proofs. In *Crypto95*, Springer-Verlag Lecture Notes in Computer Science (Vol. 963), pages 325–338, 1995.
 - [62] Y. Desmedt and Y. Frankel. Threshold Cryptosystems. In *Crypto89*, Springer-Verlag Lecture Notes in Computer Science (Vol. 435), pages 307–315, 1990.
 - [63] W. Diffie and M.E. Hellman. New Directions in Cryptography. *IEEE Transactions on Information Theory*, IT-22 (Nov.), pages 644–654, 1976.
 - [64] D. Dolev, C. Dwork, and M. Naor. Non-malleable Cryptography. In *23rd ACM Symposium on the Theory of Computing*, pages 542–552, 1991. (Full version available from authors.)
 - [65] D. Dolev and A.C. Yao. On the Security of Public-Key Protocols. *IEEE Transactions on Information Theory*, Vol. 30, No. 2, pages 198–208, 1983.
 - [66] C. Dwork, U. Feige, J. Kilian, M. Naor, and S. Safra. Low Communication Perfect Zero Knowledge Two Provers Proof Systems. In *Crypto92*, Springer-Verlag Lecture Notes in Computer Science (Vol. 740), pages 215–227, 1992.
 - [67] C. Dwork and M. Naor. An Efficient Existentially Unforgeable Signature Scheme and its Application. *Journal of Cryptology*, Vol. 11, No. 3, pages 187–208, 1998.
 - [68] C. Dwork, M. Naor, and A. Sahai. Concurrent Zero-Knowledge. In *30th STOC*, pages 409–418, 1998.
 - [69] S. Even and O. Goldreich. On the Security of Multi-party Ping-Pong Protocols. In *24th IEEE Symposium on Foundations of Computer Science*, pages 34–39, 1983.
 - [70] S. Even, O. Goldreich, and A. Lempel. A Randomized Protocol for Signing Contracts. *CACM*, Vol. 28, No. 6, pages 637–647, 1985.
 - [71] S. Even, O. Goldreich, and S. Micali. On-line/Off-line Digital Signatures. *Journal of Cryptology*, Vol. 9, pages 35–67, 1996.
 - [72] S. Even, A.L. Selman, and Y. Yacobi. The Complexity of Promise Problems with Applications to Public-Key Cryptography. *Information and Control*, Vol. 61, pages 159–173, 1984.
 - [73] S. Even and Y. Yacobi. Cryptography and NP-Completeness. In *Proceedings of 7th ICALP*, Springer-Verlag Lecture Notes in Computer Science (Vol. 85), pages 195–207, 1980. (See [72].)
 - [74] U. Feige. Error Reduction by Parallel Repetition – The State of the Art. Technical Report CS95-32, Computer Science Department, Weizmann Institute of Science, Rehovot, Israel, 1995.
 - [75] U. Feige, A. Fiat, and A. Shamir. Zero-Knowledge Proofs of Identity. *Journal of Cryptology*, Vol. 1, pages 77–94, 1988.

- [76] U. Feige, D. Lapidot, and A. Shamir. Multiple Non-Interactive Zero-Knowledge Proofs under General Assumptions. *SIAM Journal on Computing*, Vol. 29, No. 1, pages 1–28, 1999.
- [77] U. Feige and A. Shamir. Zero-Knowledge Proofs of Knowledge in Two Rounds. In *Crypto89*, Springer-Verlag Lecture Notes in Computer Science (Vol. 435), pages 526–544, 1990.
- [78] U. Feige and A. Shamir. Witness Indistinguishability and Witness Hiding Protocols. In *22nd ACM Symposium on the Theory of Computing*, pages 416–426, 1990.
- [79] W. Feller. *An Introduction to Probability Theory and Its Applications*. Wiley, New York, 1968.
- [80] A. Fiat and A. Shamir. How to Prove Yourself: Practical Solution to Identification and Signature Problems. In *Crypto86*, Springer-Verlag Lecture Notes in Computer Science (Vol. 263), pages 186–189, 1987.
- [81] M. Fischer, S. Micali, C. Rackoff, and D.K. Wittenberg. An Oblivious Transfer Protocol Equivalent to Factoring. Unpublished manuscript, 1986. (Preliminary versions were presented in *EuroCrypt84* and in the *NSF Workshop on Mathematical Theory of Security*, Endicott House (1985).)
- [82] R. Fischlin and C.P. Schnorr. Stronger Security Proofs for RSA and Rabin Bits. In *EuroCrypt97*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1233), pages 267–279, 1997.
- [83] L. Fortnow. The Complexity of Perfect Zero-Knowledge. In *19th ACM Symposium on the Theory of Computing*, pages 204–209, 1987.
- [84] A.M. Frieze, J. Håstad, R. Kannan, J.C. Lagarias, and A. Shamir. Reconstructing Truncated Integer Variables Satisfying Linear Congruences. *SIAM Journal on Computing*, Vol. 17, pages 262–280, 1988.
- [85] O. Gaber and Z. Galil. Explicit Constructions of Linear Size Superconcentrators. *Journal of Computer and System Science*, Vol. 22, pages 407–420, 1981.
- [86] M.R. Garey and D.S. Johnson. *Computers and Intractability: A Guide to the Theory of NP-Completeness*. Freeman, San Francisco, 1979.
- [87] P.S. Gemmell. An Introduction to Threshold Cryptography. In *CryptoBytes* (RSA Laboratories), Vol. 2, No. 3, 1997.
- [88] R. Gennaro and L. Trevisan. Lower Bounds on the Efficiency of Generic Cryptographic Constructions. *ECCC*, TR00-022, May 2000.
- [89] O. Goldreich. Two Remarks Concerning the GMR Signature Scheme. In *Crypto86*, Springer-Verlag Lecture Notes in Computer Science (Vol. 263), pages 104–110, 1987.
- [90] O. Goldreich. Towards a Theory of Software Protection and Simulation by Oblivious RAMs. In *19th ACM Symposium on the Theory of Computing*, pages 182–194, 1987.
- [91] O. Goldreich. *Foundation of Cryptography – Class Notes*. Preprint, spring 1989. (Superseded by the current book in conjunction with [92].)
- [92] O. Goldreich. *Lecture Notes on Encryption, Signatures and Cryptographic Protocol*. (Extracts from [91]. Available from <http://theory.lcs.mit.edu/~oded/ln89.html>. Superseded by the combination of [99], [100], and [98].)
- [93] O. Goldreich. A Note on Computational Indistinguishability. *Information Processing Letters*, Vol. 34, May, pages 277–281, 1990.
- [94] O. Goldreich. A Uniform Complexity Treatment of Encryption and Zero-Knowledge. *Journal of Cryptology*, Vol. 6, No. 1, pages 21–53, 1993.
- [95] O. Goldreich. *Foundation of Cryptography – Fragments of a Book*. February 1995. (Available from <http://theory.lcs.mit.edu/~oded/frag.html>. Superseded by the current book in conjunction with [99].)

- [96] O. Goldreich. Notes on Levin's Theory of Average-Case Complexity. *ECCC*, TR97-058, December 1997.
- [97] O. Goldreich. *Modern Cryptography, Probabilistic Proofs and Pseudorandomness*. Algorithms and Combinatorics Series (Vol. 17), Springer-Verlag, 1999.
- [98] O. Goldreich. *Secure Multi-Party Computation*. (In preparation, 1998. Working draft available from <http://theory.lcs.mit.edu/~oded/gmw.html>.)
- [99] O. Goldreich. *Encryption Schemes – Fragments of a Chapter*. (December 1999. Available from <http://www.wisdom.weizmann.ac.il/~oded/foc-book.html>.)
- [100] O. Goldreich. *Signature Schemes – Fragments of a Chapter*. (May 2000. Available from <http://www.wisdom.weizmann.ac.il/~oded/foc-book.html>.)
- [101] O. Goldreich, S. Goldwasser, and S. Halevi. Collision-Free Hashing from Lattice Problems. *ECCC*, TR95-042, 1996.
- [102] O. Goldreich, S. Goldwasser, and S. Micali. How to Construct Random Functions. *Journal of the ACM*, Vol. 33, No. 4, pages 792–807, 1986.
- [103] O. Goldreich, S. Goldwasser, and S. Micali. On the Cryptographic Applications of Random Functions. In *Crypto84*, Springer-Verlag Lecture Notes in Computer Science (Vol. 263), pages 276–288, 1985.
- [104] O. Goldreich, R. Impagliazzo, L.A. Levin, R. Venkatesan, and D. Zuckerman. Security Preserving Amplification of Hardness. In *31st IEEE Symposium on Foundations of Computer Science*, pages 318–326, 1990.
- [105] O. Goldreich and A. Kahan. How to Construct Constant-Round Zero-Knowledge Proof Systems for NP. *Journal of Cryptology*, Vol. 9, No. 2, pages 167–189, 1996. (Preliminary versions date to 1988.)
- [106] O. Goldreich and H. Krawczyk. On the Composition of Zero-Knowledge Proof Systems. *SIAM Journal on Computing*, Vol. 25, No. 1, February, pages 169–192, 1996.
- [107] O. Goldreich and H. Krawczyk. On Sparse Pseudorandom Ensembles. *Random Structures and Algorithms*, Vol. 3, No. 2, pages 163–174, 1992.
- [108] O. Goldreich, H. Krawczyk, and M. Luby. On the Existence of Pseudorandom Generators. *SIAM Journal on Computing*, Vol. 22, No. 6, pages 1163–1175, 1993.
- [109] O. Goldreich and E. Kushilevitz. A Perfect Zero-Knowledge Proof for a Decision Problem Equivalent to Discrete Logarithm. *Journal of Cryptology*, Vol. 6, No. 2, pages 97–116, 1993.
- [110] O. Goldreich and L.A. Levin. Hard-Core Predicates for Any One-Way Function. In *21st ACM Symposium on the Theory of Computing*, pages 25–32, 1989.
- [111] O. Goldreich and B. Meyer. Computational Indistinguishability – Algorithms vs. Circuits. *Theoretical Computer Science*, Vol. 191, pages 215–218, 1998.
- [112] O. Goldreich, S. Micali, and A. Wigderson. Proofs that Yield Nothing but Their Validity or All Languages in NP Have Zero-Knowledge Proof Systems. *Journal of the ACM*, Vol. 38, No. 1, pages 691–729, 1991. (Preliminary version in *27th IEEE Symposium on Foundations of Computer Science*, 1986.)
- [113] O. Goldreich, S. Micali, and A. Wigderson. How to Play Any Mental Game – A Completeness Theorem for Protocols with Honest Majority. In *19th ACM Symposium on the Theory of Computing*, pages 218–229, 1987.
- [114] O. Goldreich, N. Nisan, and A. Wigderson. On Yao's XOR-Lemma. *ECCC*, TR95-050, 1995.
- [115] O. Goldreich and Y. Oren. Definitions and Properties of Zero-Knowledge Proof Systems. *Journal of Cryptology*, Vol. 7, No. 1, pages 1–32, 1994.
- [116] O. Goldreich and E. Petrank. Quantifying Knowledge Complexity. *Computational Complexity*, Vol. 8, pages 50–98, 1999.

- [117] O. Goldreich, R. Rubinfeld, and M. Sudan. Learning Polynomials with Queries: The Highly Noisy Case. To appear in *SIAM Journal on Discrete Mathematics*.
- [118] O. Goldreich, A. Sahai, and S. Vadhan. Honest-Verifier Statistical Zero-Knowledge Equals General Statistical Zero-Knowledge. In *30th ACM Symposium on the Theory of Computing*, pages 399–408, 1998.
- [119] O. Goldreich and M. Sudan. Computational Indistinguishability: A Sample Hierarchy. *Journal of Computer and System Science*, Vol. 59, pages 253–269, 1999.
- [120] O. Goldreich and S. Vadhan. Comparing Entropies in Statistical Zero-Knowledge with Applications to the Structure of SZK. In *14th IEEE Conference on Computational Complexity*, pages 54–73, 1999.
- [121] S. Goldwasser and J. Kilian. Primality Testing Using Elliptic Curves. *Journal of the ACM*, Vol. 46, pages 450–472, 1999. (Preliminary version in *18th ACM Symposium on the Theory of Computing*, 1986.)
- [122] S. Goldwasser and L.A. Levin. Fair Computation of General Functions in Presence of Immoral Majority. In *Crypto90*, Springer-Verlag Lecture Notes in Computer Science (Vol. 537), pages 77–93, 1991.
- [123] S. Goldwasser and S. Micali. Probabilistic Encryption. *Journal of Computer and System Science*, Vol. 28, No. 2, pages 270–299, 1984. (Preliminary version in *14th ACM Symposium on the Theory of Computing*, 1982.)
- [124] S. Goldwasser, S. Micali, and C. Rackoff. The Knowledge Complexity of Interactive Proof Systems. *SIAM Journal on Computing*, Vol. 18, pages 186–208, 1989. (Preliminary version in *17th ACM Symposium on the Theory of Computing*, 1985.)
- [125] S. Goldwasser, S. Micali, and R.L. Rivest. A Digital Signature Scheme Secure Against Adaptive Chosen-Message Attacks. *SIAM Journal on Computing*, April, pages 281–308, 1988.
- [126] S. Goldwasser, S. Micali, and P. Tong. Why and How to Establish a Private Code in a Public Network. In *23rd IEEE Symposium on Foundations of Computer Science*, pages 134–144, 1982.
- [127] S. Goldwasser, S. Micali, and A.C. Yao. Strong Signature Schemes. In *15th ACM Symposium on the Theory of Computing*, pages 431–439, 1983.
- [128] S. Goldwasser and M. Sipser. Private Coins versus Public Coins in Interactive Proof Systems. *Advances in Computing Research: A Research Annual*, Vol. 5 (*Randomness and Computation*, S. Micali, ed.), pages 73–90, 1989.
- [129] J. Håstad, R. Impagliazzo, L.A. Levin, and M. Luby. Construction of a Pseudorandom Generator from Any One-Way Function. *SIAM Journal on Computing*, Vol. 28, No. 4, pages 1364–1396, 1999. (Preliminary versions by Impagliazzo et al. in *21st ACM Symposium on the Theory of Computing* (1989) and Håstad in *22nd ACM Symposium on the Theory of Computing* (1990).)
- [130] J. Håstad, A. Schifft, and A. Shamir. The Discrete Logarithm Modulo a Composite Hides $O(n)$ Bits. *Journal of Computer and System Science*, Vol. 47, pages 376–404, 1993.
- [131] R. Impagliazzo and M. Luby. One-Way Functions are Essential for Complexity Based Cryptography. In *30th IEEE Symposium on Foundations of Computer Science*, pages 230–235, 1989.
- [132] R. Impagliazzo and M. Naor. Efficient Cryptographic Schemes Provable as Secure as Subset Sum. *Journal of Cryptology*, Vol. 9, pages 199–216, 1996.
- [133] R. Impagliazzo and S. Rudich. Limits on the Provable Consequences of One-Way Permutations. In *21st ACM Symposium on the Theory of Computing*, pages 44–61, 1989.
- [134] R. Impagliazzo and A. Wigderson. $P=BPP$ if E Requires Exponential Circuits:

- Derandomizing the XOR Lemma. In *29th ACM Symposium on the Theory of Computing*, pages 220–229, 1997.
- [135] R. Impagliazzo and D. Zuckerman. How to Recycle Random Bits. In *30th IEEE Symposium on Foundations of Computer Science*, pages 248–253, 1989.
- [136] R. Impagliazzo and M. Yung. Direct Zero-Knowledge Computations. In *Crypto87*, Springer-Verlag Lecture Notes in Computer Science (Vol. 293), pages 40–51, 1987.
- [137] A. Juels, M. Luby, and R. Ostrovsky. Security of Blind Digital Signatures. In *Crypto97*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1294), pages 150–164, 1997.
- [138] J. Justesen. A Class of Constructive Asymptotically Good Algebraic Codes. *IEEE Transactions on Information Theory*, Vol. 18, pages 652–656, 1972.
- [139] N. Kahale. Eigenvalues and Expansion of Regular Graphs. *Journal of the ACM*, Vol. 42, No. 5, pages 1091–1106, 1995.
- [140] J. Kahn, M. Saks, and C. Smyth. A Dual Version of Reimer’s Inequality and a Proof of Rudich’s Conjecture. In *15th IEEE Conference on Computational Complexity*, 2000.
- [141] B.S. Kaliski. Elliptic Curves and Cryptography: A Pseudorandom Bit Generator and Other Tools. Ph.D. thesis, LCS, MIT, Cambridge, MA, 1988.
- [142] J. Katz and M. Yung. Complete Characterization of Security Notions for Probabilistic Private-Key Encryption. In *32nd ACM Symposium on the Theory of Computing*, pages 245–254, 2000.
- [143] J. Kilian. A Note on Efficient Zero-Knowledge Proofs and Arguments. In *24th ACM Symposium on the Theory of Computing*, pages 723–732, 1992.
- [144] J. Kilian and E. Petrank. An Efficient Non-Interactive Zero-Knowledge Proof System for NP with General Assumptions. *Journal of Cryptology*, Vol. 11, pages 1–27, 1998.
- [145] J.C. Lagarias and A.M. Odlyzko. Solving Low-Density Subset Sum Problems. *Journal of the ACM*, Vol. 32, pages 229–246, 1985.
- [146] D. Lapidot and A. Shamir. Fully Parallelized Multi-prover Protocols for NEXP-Time. *Journal of Computer and System Science*, Vol. 54, No. 2, April, pages 215–220, 1997.
- [147] A. Lempel. Cryptography in Transition. *Computing Surveys*, Vol. 11, No. 4, pages 285–303, December 1979.
- [148] A.K. Lenstra, H.W. Lenstra, and L. Lovász. Factoring Polynomials with Rational Coefficients. *Mathematische Annalen*, Vol. 261, pages 515–534, 1982.
- [149] L.A. Levin. Average Case Complete Problems. *SIAM Journal on Computing*, Vol. 15, pages 285–286, 1986.
- [150] L.A. Levin. One-Way Function and Pseudorandom Generators. *Combinatorica*, Vol. 7, pages 357–363, 1987.
- [151] L.A. Levin. Randomness and Non-determinism. *Journal of Symbolic Logic*, Vol. 58, No. 3, pages 1102–1103, 1993.
- [152] M. Li and P. Vitanyi. *An Introduction to Kolmogorov Complexity and Its Applications*. Springer-Verlag, 1993.
- [153] J.H. van Lint. *Introduction to Coding Theory*. Graduate Texts in Mathematics (Vol. 88), Springer-Verlag, 1982.
- [154] A. Lubotzky, R. Phillips, and P. Sarnak. Ramanujan Graphs. *Combinatorica*, Vol. 8, pages 261–277, 1988.
- [155] M. Luby. *Pseudorandomness and Cryptographic Applications*. Princeton University Press, 1996.
- [156] M. Luby and C. Rackoff. How to Construct Pseudorandom Permutations from Pseudorandom Functions. *SIAM Journal on Computing*, Vol. 17, pages 373–386, 1988.
- [157] C. Lund, L. Fortnow, H. Karloff, and N. Nisan. Algebraic Methods for Interactive Proof Systems. *Journal of the ACM*, Vol. 39, No. 4, pages 859–868, 1992.

- [158] A.J. Menezes, P.C. van Oorschot, and S.A. Vanstone. *Handbook of Applied Cryptography*. CRC Press, Boca Raton, FL, 1996.
- [159] R.C. Merkle. Secure Communication over Insecure Channels. *CACM*, Vol. 21, No. 4, pages 294–299, 1978.
- [160] R.C. Merkle. Protocols for Public Key Cryptosystems. In *Proceedings of the 1980 IEEE Symposium on Security and Privacy*, pages 122–134, 1980.
- [161] R.C. Merkle. A Digital Signature Based on a Conventional Encryption Function. In *Crypto87*, Springer-Verlag Lecture Notes in Computer Science (Vol. 293), pages 369–378, 1987.
- [162] R.C. Merkle. A Certified Digital Signature Scheme. In *Crypto89*, Springer-Verlag Lecture Notes in Computer Science (Vol. 435), pages 218–238, 1990.
- [163] R.C. Merkle and M.E. Hellman. Hiding Information and Signatures in Trapdoor Knapsacks. *IEEE Transactions on Information Theory*, Vol. 24, pages 525–530, 1978.
- [164] S. Micali, C. Rackoff, and B. Sloan. The Notion of Security for Probabilistic Cryptosystems. *SIAM Journal on Computing*, Vol. 17, pages 412–426, 1988.
- [165] S. Micali and P. Rogaway. Secure Computation. In *Crypto91*, Springer-Verlag Lecture Notes in Computer Science (Vol. 576), pages 392–404, 1992.
- [166] G.L. Miller. Riemann's Hypothesis and Tests for Primality. *Journal of Computer and System Science*, Vol. 13, pages 300–317, 1976.
- [167] R. Motwani and P. Raghavan. *Randomized Algorithms*. Cambridge University Press, 1995.
- [168] National Bureau of Standards. *Federal Information Processing Standards*, Publ. 46 (DES 1977).
- [169] National Institute for Standards and Technology. Digital Signature Standard (DSS). *Federal Register*, Vol. 56, No. 169, August 1991.
- [170] M. Naor. Bit Commitment Using Pseudorandom Generators. *Journal of Cryptology*, Vol. 4, pages 151–158, 1991.
- [171] M. Naor, R. Ostrovsky, R. Venkatesan, and M. Yung. Zero-Knowledge Arguments for NP Can Be Based on General Assumptions. *Journal of Cryptology*, Vol. 11, pages 87–108, 1998.
- [172] M. Naor and O. Reingold. Synthesizers and Their Application to the Parallel Construction of Pseudo-Random Functions. In *36th IEEE Symposium on Foundations of Computer Science*, pages 170–181, 1995.
- [173] M. Naor and O. Reingold. On the Construction of Pseudo-Random Permutations: Luby-Rackoff Revisited. *Journal of Cryptology*, Vol. 12, No. 1, pages 29–66, 1999.
- [174] M. Naor and O. Reingold. From Unpredictability to Indistinguishability: A Simple Construction of Pseudorandom Functions from MACs. In *Crypto98*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1464), pages 267–282, 1998.
- [175] M. Naor and M. Yung. Universal One-Way Hash Functions and Their Cryptographic Application. In *21st ACM Symposium on the Theory of Computing*, pages 33–43, 1989.
- [176] M. Naor and M. Yung. Public-Key Cryptosystems Provably Secure Against Chosen Ciphertext Attacks. In *22nd ACM Symposium on the Theory of Computing*, pages 427–437, 1990.
- [177] N. Nisan and D. Zuckerman. Randomness Is Linear in Space. *Journal of Computer and System Science*, Vol. 52, No. 1, pages 43–52, 1996.
- [178] A.M. Odlyzko. The Future of Integer Factorization. *CryptoBytes* (RSA Laboratories), Vol. 1, No. 2, pages 5–12, 1995. (Available from <http://www.research.att.com/~amo.>)
- [179] A.M. Odlyzko. Discrete Logarithms and Smooth Polynomials. In *Finite Fields: Theory, Applications and Algorithms*, G.L. Mullen and P. Shiue, eds., Contemporary Mathematics,

- Vol. 168, American Mathematical Society, pages 269–278, 1994. (Available from <http://www.research.att.com/~amo>.)
- [180] T. Okamoto. On Relationships between Statistical Zero-Knowledge Proofs. In *28th ACM Symposium on the Theory of Computing*, pages 649–658, 1996.
 - [181] R. Ostrovsky and A. Wigderson. One-Way Functions Are Essential for Non-Trivial Zero-Knowledge. In *2nd Israel Symposium on Theory of Computing and Systems*, IEEE Comp. Soc. Press, pages 3–17, 1993.
 - [182] R. Ostrovsky and M. Yung. How to Withstand Mobile Virus Attacks. In *10th ACM Symposium on Principles of Distributed Computing*, pages 51–59, 1991.
 - [183] B. Pfitzmann. *Digital Signature Schemes (General Framework and Fail-Stop Signatures)*. Springer-Verlag Lecture Notes in Computer Science (Vol. 1100), 1996.
 - [184] V. Pratt. Every Prime Has a Succinct Certificate. *SIAM Journal on Computing*, Vol. 4, pages 214–220, 1975.
 - [185] M.O. Rabin. Probabilistic Algorithm for Testing Primality. *Journal of Number Theory*, Vol. 12, pages 128–138, 1980.
 - [186] M.O. Rabin. Digitalized Signatures. In *Foundations of Secure Computation*, R.A. DeMillo et al., eds. Academic Press, 1977.
 - [187] M.O. Rabin. Digitalized Signatures and Public Key Functions as Intractable as Factoring. TR-212, LCS, MIT, Cambridge, MA, 1979.
 - [188] M.O. Rabin. How to Exchange Secrets by Oblivious Transfer. Tech. Memo. TR-81, Aiken Computation Laboratory, Harvard University, 1981.
 - [189] R. Richardson and J. Kilian. On the Concurrent Composition of Zero-Knowledge Proofs. In *EuroCrypt99*, Springer-Verlag Lecture Notes in Computer Science (Vol. 1592), pages 415–413, 1999.
 - [190] R. Raz. A Parallel Repetition Theorem. *SIAM Journal on Computing*, Vol. 27, No. 3, pages 763–803, 1998.
 - [191] R. Rivest, A. Shamir, and L. Adleman. A Method for Obtaining Digital Signatures and Public Key Cryptosystems. *CACM*, Vol. 21, pages 120–126, 1978.
 - [192] J. Rompel. One-Way Functions Are Necessary and Sufficient for Secure Signatures. In *22nd ACM Symposium on the Theory of Computing*, pages 387–394, 1990.
 - [193] A. Sahai. Non-Malleable Non-Interactive Zero Knowledge and Achieving Chosen-Ciphertext Security. In *40th IEEE Symposium on Foundations of Computer Science*, pages 543–553, 1999.
 - [194] A. Sahai and S. Vadhan. A Complete Promise Problem for Statistical Zero-Knowledge. In *38th IEEE Symposium on Foundations of Computer Science*, pages 448–457, 1997.
 - [195] C.P. Schnorr and H.H. Horner. Attacking the Chor-Rivest Cryptosystem by Improved Lattice Reduction. In *EuroCrypt95*, Springer-Verlag Lecture Notes in Computer Science (Vol. 921), pages 1–12, 1995.
 - [196] A. Shamir. How to Share a Secret. *CACM*, Vol. 22, pages 612–613, 1979.
 - [197] A. Shamir. A Polynomial-Time Algorithm for Breaking the Merkle-Hellman Cryptosystem. In *23rd IEEE Symposium on Foundations of Computer Science*, pages 145–152, 1982.
 - [198] A. Shamir. $IP = PSPACE$. *Journal of the ACM*, Vol. 39, No. 4, pages 869–877, 1992.
 - [199] A. Shamir, R.L. Rivest, and L. Adleman. Mental Poker. Report TM-125, LCS, MIT, Cambridge, MA, 1979.
 - [200] C.E. Shannon. Communication Theory of Secrecy Systems. *Bell Systems Technical Journal*, Vol. 28, pages 656–715, 1949.
 - [201] M. Sipser. A Complexity Theoretic Approach to Randomness. In *15th ACM Symposium on the Theory of Computing*, pages 330–335, 1983.
 - [202] M. Sipser. *Introduction to the Theory of Computation*. PWS Publishing, Boston, MA, 1997.

BIBLIOGRAPHY

- [203] R. Solovay and V. Strassen. A Fast Monte-Carlo Test for Primality. *SIAM Journal on Computing*, Vol. 6, pages 84–85, 1977. (Addendum in *SIAM Journal on Computing*, Vol. 7, page 118, 1978.)
- [204] M. Sudan. Decoding of Reed-Solomon Codes beyond the Error-Correction Bound. *Journal of Complexity*, Vol. 13, No. 1, pages 180–193, 1997.
- [205] M. Tompa and H. Woll. Random Self-Reducibility and Zero-Knowledge Interactive Proofs of Possession of Information. In *28th IEEE Symposium on Foundations of Computer Science*, pages 472–482, 1987.
- [206] S. Vadhan. A Study of Statistical Zero-Knowledge Proofs. Ph.D. thesis, Department of Mathematics, MIT, Cambridge, MA, 1999.
- [207] A. Vardi. Algorithmic Complexity in Coding Theory and the Minimum Distance Problem. In *29th ACM Symposium on the Theory of Computing*, pages 92–108, 1997.
- [208] U.V. Vazirani and V.V. Vazirani. Efficient and Secure Pseudo-Random Number Generation. In *25th IEEE Symposium on Foundations of Computer Science*, pages 458–463, 1984.
- [209] M. Wegman and L. Carter. New Hash Functions and Their Use in Authentication and Set Equality. *Journal of Computer and System Science*, Vol. 22, pages 265–279, 1981.
- [210] A.C. Yao. Theory and Application of Trapdoor Functions. In *23rd IEEE Symposium on Foundations of Computer Science*, pages 80–91, 1982.
- [211] A.C. Yao. How to Generate and Exchange Secrets. In *27th IEEE Symposium on Foundations of Computer Science*, pages 162–167, 1986.

