

# Teaching mathematics with games and puzzles

Brett Stevens  
School of Mathematics and Statistics  
Carleton University  
1125 Colonel By Dr.  
Ottawa ON K1S 5B6  
[brett@math.carleton.ca](mailto:brett@math.carleton.ca)

Lights-Out: [6, 7, 8, 9, 11, 13, 17]  
Shannon Switching Game: [15, 22]  
Sudoku: [1, 4, 18, 19, 20]  
Tower of Hanoi: [14, 16, 21, 23]  
Sliding tiles and rubiks cube: [5, 12, 17, 24]  
Magic trick: [3, 10]  
Tic-Tac-Toe: [2]

## References

- [1] Lars Døvling Andersen and A. J. W. Hilton. Symmetric Latin square and complete graph analogues of the Evans conjecture. *J. Combin. Des.*, 2(4):197–252, 1994.
- [2] Maureen T. Carroll and Steven T. Dougherty. Tic-tac-toe on a finite plane. *Math. Mag.*, 77(4):260–274, 2004.
- [3] F. Chung, P. Diaconis, and R. Graham. Universal cycles for combinatorial structures. *Discrete Math.*, 110:43–59, 1992.
- [4] C. J. Colbourn and J. H. Dinitz, editors. *The CRC Handbook of Combinatorial Designs*. CRC Press, Boca Raton, 1996.
- [5] Alexander H. Frey, Jr. and David Singmaster. *Handbook of cubik math*. Enslow Publishers, Hillside, N.J., 1982.
- [6] John Goldwasser and William Klostermeyer. Maximization versions of “lights out” games in grids and graphs. In *Proceedings of the Twenty-eighth Southeastern International Conference on Combinatorics, Graph*

*Theory and Computing* (Boca Raton, FL, 1997), volume 126, pages 99–111, 1997.

- [7] John Goldwasser, William Klostermeyer, and George Trapp. Characterizing switch-setting problems. *Linear and Multilinear Algebra*, 43(1-3):121–135, 1997.
- [8] John Goldwasser, William Klostermeyer, and Henry Ware. Fibonacci polynomials and parity domination in grid graphs. *Graphs Combin.*, 18(2):271–283, 2002.
- [9] John L. Goldwasser and William F. Klostermeyer. Parity dominating sets in grid graphs. *Congr. Numer.*, 172:79–95, 2005. 36th Southeastern International Conference on Combinatorics, Graph Theory, and Computing.
- [10] Solomon W. Golomb and Guang Gong. *Signal design for good correlation*. Cambridge University Press, Cambridge, 2005. For wireless communication, cryptography, and radar.
- [11] Markus Hunziker, António Machiavelo, and Jihun Park. Chebyshev polynomials over finite fields and reversibility of  $\sigma$ -automata on square grids. *Theoret. Comput. Sci.*, 320(2-3):465–483, 2004.
- [12] David Joyner. *Adventures in group theory*. Johns Hopkins University Press, Baltimore, MD, 2002. Rubik’s cube, Merlin’s machine and other mathematical toys.
- [13] William F. Klostermeyer and John L. Goldwasser. Odd and even dominating sets with open neighborhoods. unpublished.
- [14] Donald E. Knuth. *The art of computer programming. Vol. 4, Fasc. 2*. Addison-Wesley, Upper Saddle River, NJ, 2005. Generating all tuples and permutations.
- [15] Alfred Lehman. A solution of the Shannon switching game. *J. Soc. Indust. Appl. Math.*, 12:687–725, 1964.
- [16] Frank Ruskey. Combinatorial optimization server. <http://theory.cs.uvic.ca/root.html> , 2006.

- [17] Jaap Scherphuis. Jaap's puzzle page. <http://www.geocities.com/jaapsch/puzzles/>, 2006.
- [18] Bohdan Smetaniuk. A new construction on Latin squares. I. A proof of the Evans conjecture. *Ars Combin.*, 11:155–172, 1981.
- [19] B. Stevens. Problems and Solutions: Problem 11192. *Amer. Math. Monthly*, 112(10):930, 2005.
- [20] brett stevens. An extension of sudoku. unpublished; available upon request.
- [21] Eric W. Weisstein. Tower of hanoi. From MathWorld—A Wolfram Web Resource. <http://mathworld.wolfram.com/TowerofHanoi.html>, 2006.
- [22] D. B. West. *Introduction to Graph Theory*. Prentice Hall, Upper Saddle River, 1996.
- [23] Wikipedia. Tower of hanoi – wikipedia. [http://en.wikipedia.org/wiki/Tower\\_of\\_Hanoi](http://en.wikipedia.org/wiki/Tower_of_Hanoi), 2006.
- [24] Richard M. Wilson. Graph puzzles, homotopy, and the alternating group. *J. Combinatorial Theory Ser. B*, 16:86–96, 1974.