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Extremal combinatorics deals with the problem of determining or estimating the maximum or minimum possible value of an invariant of a combinatorial object that satisfies certain requirements. My research is on problems of extremal combinatorics motivated by applications in computer science, engineering, biology, and nanotechnology. The following is a sample of topics that I am currently interested in.

- Coding Theory: How to construct good codes that would protect against errors introduced by communication channesls when information is transmitted across them? Of particular interest are unconventional channels such as insertion/deletion channels, q-ary channels ($q > 2$), quantum transmission channels, and DNA storage channels.

- Electronic Design Automation: Power efficiency and signal integrity are two important design criteria in deep submicron VLSI. How do we design information transmission schemes that are power-efficient, and protects against interference at the deep submicron level?

- Group Testing: Nonadaptive group testing algorithms are useful when we want to trade resources for time, in identifying objects of a certain trait in large populations. What is the best tradeoff we can obtain?

- Nanotechnology: Nanometer-scale components are prone to manufacturing errors. What and how much redundancy must be introduced in the design of these components so that in the face of manufacturing defects, we can reconfigure via the redundancy introduced to render the component still useful?

Extremal combinatorial objects are often difficult to determine. Examples of such objects are optimal codes, combinatorial designs, Ramsey graphs, and various geometric packings and coverings. I am also interested in the design of practical algorithms for searching for extremal combinatorial objects, and whenever possible to enumerate them.

In general, I am interested in multidisciplinary problems, especially those lying in the intersection of discrete mathematics, computer science, and engineering.

Selected Publications

Y. M. Chee, S. H. Dau, A. C. H. Ling, and S. Ling, The sizes of optimal q-ary codes of weight three and distance four: a complete solution, *IEEE Transactions on Information Theory* **54** (2008), no. 3, 1291–1295.

Y. M. Chee and S. Ling, Improved lower bounds for constant GC-content DNA codes, *IEEE Transactions on Information Theory* **54** (2008), no. 1, 391–394.

Y. M. Chee and P. Kaski, An enumeration of graphical designs, *Journal of Combinatorial Designs* **16** (2008), no. 1, 70–85

Y. M. Chee and A. C. H. Ling, On extremal k-graphs without repeated copies of 2-intersecting edges, *SIAM Journal on Discrete Mathematics* **21** (2007), no. 3, 805–821.

Y. M. Chee, A. C. H. Ling, S. Ling, and H. Shen, The PBD-closure of constant-composition codes, *IEEE Transactions on Information Theory* **53** (2007), no. 8, 2685–2692.

Y. M. Chee and S. Ling, Constructions for q-ary constant-weight codes, *IEEE Transactions on Information Theory* **53** (2007), no. 1, 135–146.

Y. M. Chee, C. J. Colbourn, and A. C. H. Ling, Optimal memoryless encoding for low power off-chip data buses, in *ICCAD '06: Proceedings of the 2006 IEEE/ACM International Conference on Computer-Aided Design*, pp. 369–374, ACM Press, 2006.

Y. M. Chee and S. Ling, Highly symmetric expanders, *Finite Fields and Their Applications* **8** (2002), no. 3, 294–310.

Y. M. Chee, C. J. Colbourn, and A. C. H. Ling, Asymptotically optimal erasure-resilient codes for large disk arrays, *Discrete Applied Mathematics* **102** (2000), no. 1–2, 3–36.

Y. M. Chee, C. J. Colbourn, and A. C. H. Ling, Weakly union-free twofold triple systems, *Annals of Combinatorics* **1** (1997), no. 3, 215–225.

Y. M. Chee and S. S. Magliveras, A few more large sets of t-designs, *Journal of Combinatorial Designs* **6** (1998), no. 4, 293–308.

Y. M. Chee, A. Joux, and J. Stern, The cryptanalysis of a new public-key cryptosystem based on modular knapsacks, in *Advances in Cryptology – CRYPTO '91: 11th Annual International Cryptology Conference* (J. Feigenbaum, ed.), vol. 576 of Lecture Notes in Computer Science, pp. 204–212, 1992.