Statement of Research Experience and Interests

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My primary mathematical interests are in geometry and combinatorics. Over the past few years, I have worked on several problems including a couple funded in part by a Fulbright scholarship. I also participated in a statistics problem in industry. My research often includes computational aspects.

Recently I have been researching problems in discrete geometry. In particular I have been studying arrangements of points and lines. Erdös once posed the following problem in projective geometry: Show that n non-collinear points in the real plane determine at least n connecting lines. The equivalent problem in affine geometry is: Show that n non-collinear points in the real affine plane determine at least $n-1$ distinct slopes. This problem was first considered by P. R. Scott [**?**] and finally solved by Peter Ungar [**?**]. After Ungar proved this conjecture, research has centered on two areas: finding and characterizing configurations achieving the minimum number of slopes, which are called *slope critical configurations*, and answering the question in other settings such as higher dimensions and finite planes.

My research has been in finding and characterizing critical configurations. The techniques that I have used involve algebraic systems of equations, geometric conditions, and allowable sequences—a combinatorial technique developed by Goodman and Pollack [**?**]. In this research I have made extensive use of Maple to generate and test examples.

Additionally, I am doing research on sum covers, which arose from the study of the slope problem over finite planes [**?**]. A sum cover is a subset S of an Abelian group $(A,+)$ provided every element $x \in A$ can be expressed in at least one way as a sum $x = s + t$ where s and t are in S.

The questions that I have investigated involve minimum sum covers over $\mathbb{Z}_n$. My research efforts have centered on finding bounds for the minimum cardinality and discovering constructions that produce near minimum covers. One of the products of my work is a complete catalog of minimum sum covers up to modulo 54, obtained by a search algorithm written in C.

I have also participated in research for Lucent Technology concerning a production problem. This research was performed as part of a grant with statistics and operations research faculty at Clemson University. My responsibilities included interacting with Lucent employees to learn about the production process, participating in meetings to determine a good model for the process, creating a computer simulation, analyzing the data, and presenting the results to Lucent engineers. In addition to talking with employees, I also analyzed data from Lucent's SQL database to learn about the process. I wrote the computer simulation in C to take statistics from the data and produce possible results. Part of this research has been published in a volume on mathematical modeling [**?**].

The research description attached gives a brief introduction to my research.

References

[1] Clark, Edwin and Robert E. Jamison, *Generating all slopes in $AG(2, q)$ with a minimum number of points*, in preparation.

[2] Goodman, Jacob, Richard Pollack, *On the Combinatorial Classification of non-degenerate Configurations in the Plane*, Journal of Combinatorial Theory (A), 29 (1980), pp. 220-235.

[3] Scott, P. R., *On the Sets of Directions Determined by n Points*, American Mathematical Monthly, 77, pp. 502-505.

[4] Senter, Herman, P. M. Dearing, and Mark Fitch, "Inventory Replenishment Policies and Production Strategies," *Applied Mathematical Modeling: A Multidisciplinary Approach*, Douglas R. Shier and K. T. Wallenius (Eds.), CRC Press, Boca Raton, FL, 1999.

[5] Ungar, P. *2N Non-collinear Points Determine at Least 2N Directions*, Journal of Combinatorial Theory (A), 33, pp. 343-347.