1986: The Emergency-Facilities Location Problem

The township of Rio Rancho has hitherto not had its own emergency facilities. It has secured funds to erect two emergency facilities in 1986, each of which will combine ambulance, fire, and police services. **Figure 1** indicates the demand, or number of emergencies per square block, for 1985. The "L" region in the north is an obstacle, while the rectangle in the south is a part with a shallow pond. It takes an emergency vehicle an average of 15 seconds to go one block in the N–S direction and 20 seconds in the E–W direction. Your task it to locate the two facilities so as to minimize the total response time.

- Assume that the demand is concentrated at the center of the block and that the facilities will be located on corners.
- Assume that the demand is uniformly distributed on the streets bordering each block and that the facilities may be located anywhere on the streets.

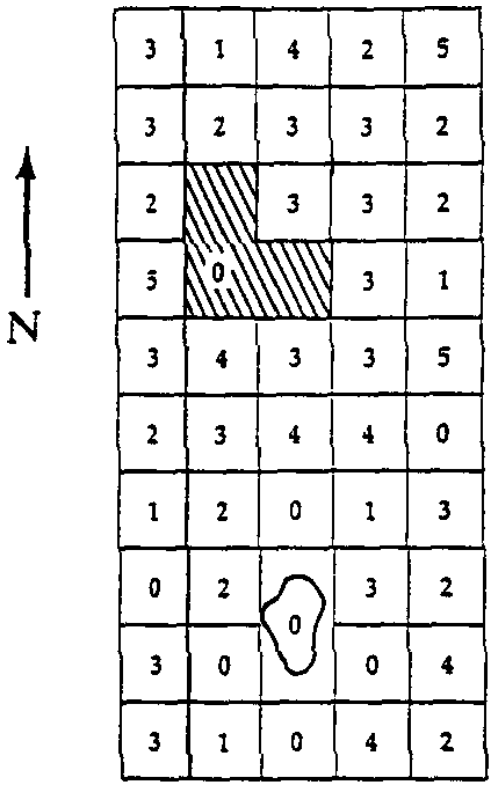

Figure 1. A map of Rio Rancho, with number of emergencies in 1985 indicated for each block.

Comments by the Contest Director

The problem was contributed by J.C. McGrew (Dept. of Geography and Regional Planning, Salisbury State College, Maryland). Originally, it had a stochastic aspect, but the Chief Judge (D.R. Morrison, Dept. of Computer Science, University of New Mexico) and I (Ben Fusaro) thought that it might be too much for three undergraduates on a weekend. How wrong we were! The approaches mainly took the form of an exhaustive search.

The Outstanding papers, by teams from Georgetown University, Harvey Mudd College, Grinnell College, and Washington University, together with commentaries, were published as follows:

Hardy, Maureen, Michael Irizarry, and Stephen Penrice. 1986. Help! To the rescue in Rio Rancho. *The UMAP Journal* 7 (4) (1986): 299–307.

Special Issue: Mathematical Competition in Modeling. 1986. *Mathematical Modeling: An International Journal* 7 (4): 595–652. This special issue contains all four Outstanding papers.