1985: The Animal Population Problem

Choose a fish or mammal for which appropriate data are available to model it accurately. Model the animal's natural interactions with its environment by expressing population levels of different groups in terms of the significant parameters of the environment. Then adjust the model to account for harvesting in a form consistent with the actual method by which the animal is harvested. Include any outside constraints imposed by food or space limitations that are supported by the data. Consider the value of the various quantities involved, the number harvested, and the population size itself, in order to devise a numerical quantity that represents the overall value of the harvest. Find a harvesting policy in terms of population size and time that optimizes the value of the harvest over a long period of time. Check that the policy optimizes this value over a realistic range of environmental conditions.

Comments by the Contest Director

The problem was contributed by Ervin Y. Rodin (Dept. of Systems Science and Mathematics, Washington University, St. Louis, MO). The animals chosen by the Outstanding teams were North American white-tailed deer (Harvey Mudd College), grizzly bears in Yellowstone Park (Mt. St. Mary's College), salmon (Southern Methodist University), and the Peruvian anchovy (Washington University). The Outstanding papers were published as follows:

Caulfield, Michael, John Kent, and Daniel McCaffrey. 1986. Harvesting a grizzly bear population. *College Mathematics Journal* 17 (1) (January 1987): 34–46.

Caulkins, Jonathan, Rob Marrett, and Andrew Yates. 1985. *The UMAP Journal* 6 (3) (1985): 27–49.

Special Issue: Mathematical Competition in Modeling. 1985. *Mathematical Modeling: An International Journal* 6 (6): 487–548. This special issue contains all four Outstanding papers.