PERSPECTIVES
IN COMPUTING

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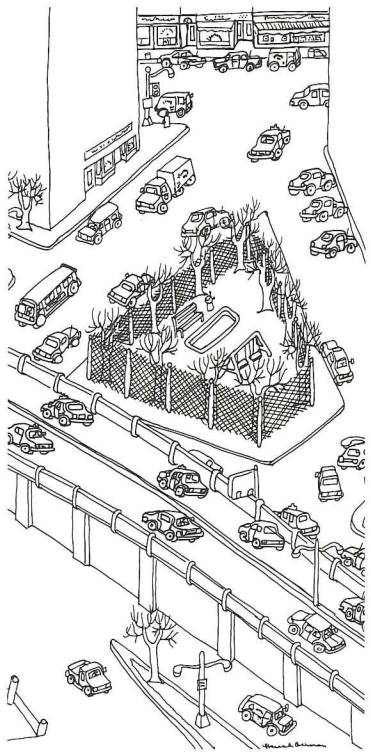

Perspectives in Computing is a multidisciplinary publication designed to demonstrate a variety of problem-solving computer applications in research and education. Intended primarily for the academic community, the magazine is published four times a year by International Business Machines Corporation.

Perspectives in Computing deals principally with computer applications involving IBM products and services, but our editorial policy is to emphasize the problem-solving techniques used in those applications, rather than details of computer hardware or software. We hope our readers will find the techniques applicable in their own fields of interest.

Inquiries about the work described in a particular article should be addressed to the author. All other correspondence, including inquiries about the submission of manuscripts, should be addressed to Editor, *Perspectives in Computing*, IBM Corporation, 44 South Broadway, White Plains, New York 10601.

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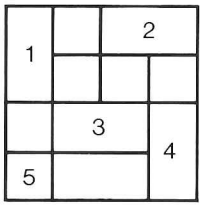

Cover **1** The Bettmann Archive, Inc.; **2** Four By Five; **3** Richard Steedman/The Image Bank; **4** Hannah Berman; **5** Christian Musgrave, age 5. **Page 4, 5, 6, 7, 8, 9, 10** The Bettmann Archive, Inc.; **12** Noel Malsberg from photo by Jay Leonard; **16** Richard Steedman/The Image Bank; **17, 39, 49** (right) Jim Mulligan, Westgroup Photo-technical Services, Inc.; **20, 22, 40** Four by Five; **24** Hannah Berman; **25** H. Armstrong Roberts, Inc.; **28, 29, 30, 32, 34** Christian Musgrave, age 5; **36, 37** Larry Lee/The Image Bank; **46, 49** (left and center) Elizabeth Franco.

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Foreword

Perhaps, as Dryden wrote, "Shakespeare's magic could not copied be"—but at Penn State University two professors of English found that they *could* copy, if not Shakespeare's "magic," at least a raft of information about it. The information, obtained from correspondents around the world, is being accumulated in a bibliographic data base which, when finished, will be a major international resource for scholarly research. It will contain about 100 000 citations relating to Shakespeare scholarship and dramatic productions. Harrison Meserole and John Smith, in the lead article in this issue of *Perspectives in Computing*, discuss their bibliography project in the context of the problem-solving and planning processes that have gone into it. "One of the most important things we have learned about project design," the authors conclude, "is that clear decisions often lie at the end of winding and littered paths."

In the second article, entitled "The moving seacoast," Jay Leonard of Rensselaer Polytechnic Institute (RPI) asks "Why study beaches?" Answering his own question, he points out that "beach sand is constantly shifting because of wave action, currents, and winds, and people have tried to stabilize this dynamic area..." but "in the long term, nature wins out." Yet "a reasonable prediction of future shoreline geometry" can minimize risk to lives and property. Researchers at RPI are seeking information on which a "reasonable prediction" can be based. Their work involves both macroscale and microscale studies—computer modeling of ocean waves as they approach the shore, and computer processing of data from sensors that measure velocities of water movement and concentrations of sand in suspension. "With the power of modern high-speed computers," concludes Leonard, "many problems on all levels of scale can be approached for the first time."

When fuel is consumed to produce energy, some form of pollution is almost always an unwanted by-product—a notable example being the exhaust gas of internal combustion engines. Arvind Varma of the University of Notre Dame, in "Catalytic converters for automotive exhausts," discusses research aimed at producing a dynamic mathematical model to simulate the action of three-way catalysts in converting exhaust pollutants into harmless gases. The model is being developed to aid in designing a catalytic device that will meet increasingly stringent government standards. "Our goal," writes Varma, "is to construct a model capable of predicting converter performance under a wide variety of operating conditions," thereby making it unnecessary to conduct expensive and time-consuming road tests with real vehicles.

How does a child learn basic rules of grammar? Attempts to simulate the process are described by Henry Kucera of Brown University in "The learning of grammar." As the author points out, "First-language learning appears to occur almost spontaneously, without any explicit instructions." This hypothesis is demonstrated by a language-learning algorithm that invokes a "parent machine" and a "child machine." The "parent" presents well-formed sentences to the "child," which responds with strings of words which may or may not be accepted by the "parent." Through this binary reinforcement of acceptance or rejection, the "child" eventually acquires the ability to "speak" grammatically.

Much effort today is going toward trying to understand and manage the world's energy problems. In "A worldwide energy model," Leo Rapoport and David Hirshfeld of Virginia Polytechnic Institute and State University (VPI) describe a comprehensive computer-based system that simulates the development and processing of energy supplies—including oil and gas, coal, uranium, synthetic fuels, and hydroelectric power—to aid in analyzing alternative technologies and formulating national policies. The model is employed in conducting studies for the United States government and for large industrial firms, and it is used at VPI as a research tool to investigate the effects of national policies related to energy and the environment.

The Special Report in this issue, entitled "Problem solving—an adaptable art," briefly presents two examples of how the problem-solving approach incorporated into a computer program can be adapted for solving problems in two entirely different disciplines. In one instance, the essential elements of a program designed to aid in medical diagnosis have been adapted for diagnosing faults in computer systems. Conversely, in the second instance, a program designed for analyzing electronic circuits in computer systems is used in medical research to simulate the nervous system. The examples are cited not to describe specific solutions to particular problems but to illustrate interdisciplinary approaches to problem solving. In large measure, that is what *Perspectives in Computing* is all about.

Donald T. Sanders
Editor

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The matrix at right is provided as a scanning aid for readers who want to know at a glance whether their fields of interest are touched upon in this issue of *Perspectives in Computing*. Full color indicates an article's main emphasis; lighter tint indicates secondary emphasis.