

Listed are abstracts from recent papers by IBM authors. Inquiries should be directed to the publications cited.

Abstracts

Combinatory programming and combinatorial analysis, W. H. Burge *IBM Journal of Research and Development* **16**, No. 5, 450-461 (September 1972). The principal purpose of this paper is to illustrate by means of simple examples a technique for deriving programs and generating functions from set descriptions. The paper discusses certain interesting correspondences among types of trees, which follow from the use of the technique, and it demonstrates close connections between programming techniques and some aspects of combinatorial theory.

Compiling optimized code from decision tables, H. J. Myers, *IBM Journal of Research and Development* **16**, No. 5, 489-503 (September 1972). This paper reviews the structure of decision tables and methods for converting them into procedural code. It describes new optimization methods, which are applied before, during, and after code generation. Some results from an experimental decision table processor are provided.

Computation of channel capacity and rate-distortion functions, R. E. Blahut, *IEEE Transactions on Information Theory* **IT-18**, No. 4, 460-473 (July 1972). By defining mutual information as a maximum over an appropriate space, channel capacities can be defined as double maxima and rate-distortion functions as double minima. This approach yields valuable new insights regarding the computation of channel capacities and rate-distortion functions. In particular, it suggests a simple algorithm for computing channel capacity that consists of a mapping from the set of channel input probability vectors into itself such that the sequence of probability vectors generated by successive applications of the mapping converges to the vector that achieves the capacity of the given channel. Analogous algorithms then are provided for computing rate-distortion functions and constrained channel capacities. The algorithms apply both to discrete and to continuous alphabet channels or sources. In addition, a formalization of the theory of channel capacity in the presence of constraints is included. Among the examples is the calculation of close upper and lower bounds to the rate-distortion function of a binary symmetric Markov source.

A fast recursive algorithm to calculate the reliability of a communication network, E. Hänsler, *IEEE Transactions on Communications* **COM-20**, No. 3, 637-640 (June, 1972). This paper describes a recursive algorithm to calculate the probability that all paths between two nodes in a given network are interrupted. It is assumed that all links are undirected and that links and nodes fail with given probabilities. These failures are assumed to be statistically independent. The probability that two nodes are disconnected is expressed in terms of the probability that pairs of nodes are disconnected in subnetworks smaller than the original one. The advantage of the algorithm given in this paper compared to other known procedures results from the fact that, in most cases, these subnetworks can be considerably simplified. These simplifications lead to considerable savings in computing time.

On the analysis and modeling of a class of computer communication systems, W. W. Chu (Univ. of California at Los Angeles) and A. G. Konheim, *IEEE Transactions on Communications COM-20*, No. 3, 645-660 (June 1972). Recent advances in computer communications are discussed including computer-traffic and channel error characteristics, optimal fixed message block size, statistical multiplexing, and loop systems. A unified model is developed and then used to analyze the queuing behavior of the star and loop systems. Numerical results for selected traffic intensities and message lengths, given in graphical form, provide insight into the performance of these systems.

Optimizing the reliability in centralized computer networks, E. Hänsler, G. K. McAuliffe and R. S. Wilkov, *IEEE Transactions on Communications COM-20*, No. 3, 640-644 (June 1972). This paper deals with a heuristic procedure for optimizing the reliability of computer networks consisting of clusters of terminals connected to remote concentrators that are connected to a data-processing center. The expected percentage of terminals connected to the processing center is used as a measure of network reliability. It is shown that configurations other than the frequently used star are often considerably more reliable and less expensive.

Two-way traffic in loop service systems, A. G. Konheim and B. Meister, *Networks* 1, No. 4, 291-301 (April 1972). A model for a communication system, which consists of a computer and a number of buffered terminals connected by means of a loop channel, is analyzed. Data flows in two directions: from the computer to the terminals and from the terminals to the computer. The channel is alternately available to the computer and the terminals to effect these data transfers. The transient behavior of the system is determined and the stationary or limiting expected queue lengths at all terminals are calculated.

ADDENDUM

Since publication of the paper "A general management business simulation in APL" by P. N. Wahi in Volume 11, Number 2 (1972), the game simulation described therein has been released as an IBM Field-Developed Program (No. 5798-AGM) under the title: "IBGS—Interactive Business Game Simulation—A General Business Simulation for APL\360." Details can be obtained from any IBM Branch Office.