Additional Papers

For some years now *The Computer Journal* has had offered to it more papers of a publishable standard than could be accommodated within the *Journal* pages. Initially this led to a backlog of papers awaiting publication; more recently it has meant that publishable papers which are not in the mainstream of the selected theme issues have been excluded even though they may have been of a high technical standard.

To improve its service to authors the *Journal* is introducing a new series of *Additional* papers. Such papers will have been typeset and given numbered pages in the same way as other papers, but only the title, authorship and abstract will appear in the *Journal*. To obtain copies of the full paper, readers apply to the editor who will mail copies directly to the reader at cost. Libraries will be able to obtain bound volumes at the year end. Reprints will be supplied to authors. For further information including price lists and order forms, readers and libraries should apply directly to the Editor-in-Chief at the address given on the inside front cover of the *Journal*.

The first collection of additional papers is given below.

Top-down Synthesis of Sorting Algorithms

K. K. LAU, *Department of Computer Science, University of Manchester, Oxford Road, Manchester M13 9PL*

Traditionally sorting algorithms are classified according to their main operational characteristic, rather than their underlying logic. More recent work in program synthesis has exposed the logic of and hence the logical relationships between some sorting algorithms. Following the program synthesis approach, and by using a logic programming system for deriving recursive logic procedures from their specifications, we have synthesised a large family of sorting algorithms in a strictly top-down manner. Such an approach not only produces algorithms which are guaranteed to be partially correct, it also provides a family tree showing clearly the relationships between its members. (pp. A001–A007)

Modular Description of Programming Languages

D. A. WATT, *Computing Science Department, University of Glasgow, Glasgow G12 8QQ*

This paper brings together a collection of techniques that allow programming languages to be formally described in a modular fashion. The key techniques are partitioned attribute grammars, which are defined for the first time here; abstract data types and abstract semantic algebras. The language description is factored into modules describing different aspects of the language. Furthermore, the language description is expressed in terms of familiar concepts of computation, rather than in terms of metalanguage encodings of these concepts. Modular language descriptions are claimed to be more readable, modifiable and re-usable than conventional (monolithic) language descriptions. (pp. A009–A028)

Decomposition Merging with Symmetric Exchanges

S. DVORAK[1] AND B. DŮRIAN[2]
[1]*5. kvetna 1351, 75661 Roznov pod Radhostem, Czechoslovakia*
[2]*Research Institute of Computer Technology (VUVT), Zilina, Nerudova 33, 01001 Zilina, Czechoslovakia*

This paper presents a significant improvement on Pratt's merging by successive decompositions of the initial merging problem. We are using symmetric intervals for exchanges instead of searching for the medium. This enables very simple exchanges to be made in the decompositions. Merging operations are terminated by one-side merging, which reduces the overhead of final merging steps. The complexity of the suggested modification has been analysed. The results of check runs are given, too. (pp. A029–A033)

Discourse and Natural-Language Text Analysis: a Functional Grammar Approach

R. MARSHALL, *Department of Computer Science, Florida Institute of Technology, 150 West University Boulevard, Melbourne, FL 32901-6988, USA*

The standard approach to discourse analysis and natural-language text processing has been to subject the piece of text or discourse to a syntactic and a semantic analysis (in either order), and then assign pragmatics to the text under study. Such an approach becomes quite problematic in textual situations involving anaphora, ellipsis and the like. The problem may be traced to the basic linguistic issue of competence versus performance. Functional grammar's perspective of language as being a communicative tool first and grammarian's tool next is shown to be eminently suited to the processing of a set of sentences, be it in a discourse setting or otherwise. The paper discusses the principles and practices underlying functional grammar and shows how a natural-language processor based on functional grammar has been implemented using Prolog. (pp. A035–A060)

A Relational Database Simulator

W. W. L. LEE AND D. S. BOWERS, *Department of Mathematical and Computing Sciences, University of Surrey, Guildford, Surrey GU2 5XH*

It is not necessary to have a full scale disc-based database to demonstrate some properties of a particular type of database system. A program can be designed to simulate a database system by manipulating a data structure maintained entirely in main memory. This paper describes the design and implementation of a memory-based system to simulate the principal features of a relational database system, providing a user interface based on relational algebra. The resulting program comprises a flexible learning tool which is sufficiently efficient for non-trivial but moderately sized databases for use in a teaching or research environment. The system is robust and highly portable, and the user interface combines 'pure' relational algebra with general database management facilities. (pp. A061–A072)

On an Optimal and Faster Construction of Linear Quadtrees from Raster-Scanned Images

V. GOEL AND Y. V. VENKATESH, *Computer Vision and Artificial Intelligence Laboratory, Department of Electrical Engineering, Indian Institute of Science, Bangalore 560012, India*

The paper deals with the conversion of a raster-scanned binary image to a Linear Quad-Tree (LQT). By trading in-core memory for execution time, and thereby minimising tree traversals, in contrast with the approaches found in the recent literature, a new algorithm (ALGORITHM G-V) which runs faster than all the known algorithms, and is believed to be the fastest, is presented. Moreover, the execution time is independent of the distribution of the BLACK and WHITE nodes in the image.

(pp. A073–A083)

Simulating Multiple Memory Accesses in Logarithmic Time and Linear Space

W. WAH AND S. G. AKL, *Department of Computing and Information Science, Queen's University, Kingston, Ontario, Canada K7L 3N6*

Let A be an algorithm designed to run in time t and space s on a p-processor, shared-memory parallel computer which allows concurrent-read operations from the same memory location. It is well-known that A can be simulated on a p-processor computer that prohibits concurrent-read operations in time $O(t \times \log p)$ and space $O(s \times p)4$. In this paper we show how this simulation can actually be performed in time $O(t \times \log p)$ and space $O(s+p)$. (pp. A085–A088)

A Study of the Generalized Multiple Bus-Connected Parallel Computer

C. J. WANG[1], C. H. WU[2] AND V. P. NELSON[2]
[1]*Department of Electrical and Computer Engineering, University of Colorado, Colorado Springs, CO 80933-7150, USA*
[2]*Department of Electrical Engineering, Auburn University, Auburn, AL 36849, USA*

In this paper we study an architecture called the generalized multiple bus-connected parallel computer (GMBPA). The GMBPC operates as a message passing MIMD machine in this investigation. The performance of the GMBPC is modelled by generalized stochastic Petri nets (GSPN). To lessen the exponential distribution assumption used in the GSPN model, Monte Carlo simulation techniques have been used to predict the performance probabilistically. For applications, two-dimensional fast Fourier transform algorithms for the GMBPC are derived. The performance of solving the multidimensional Poisson equation by relaxation and fast Fourier transform methods on the GMBPC has also been analysed. (pp. A089–A094)

Dynamic Concurrency Control Algorithms for Large Distributed Database Systems

A. GHAFOOR AND F. Y. FARHAT, *School of Electrical Engineering, Purdue University, 1285 Electrical Engineering Building, West Lafayette, IN 47907-1285, USA*

In this paper we propose two concurrency control algorithms for distributed database systems. Both algorithms employ a token passing mechanism, in which the path of the token is determined dynamically in order to maximize the system's throughput. The two algorithms differ in terms of selecting the next holder of the token in case the system becomes empty. One scheme, the Dynamic-Ring Algorithm (DRA) switches to virtual ring algorithm. The other one, the Dynamic-Status Algorithm (DSA) employs a query based mechanism. Simulation study reveals that both the proposed algorithms perform considerably better than the conventional ring algorithm, under low to medium loading conditions in the network. The difference in performance becomes more prominent as the number of database sites increases. (pp. A095–A104)

Stochastic Automata Solutions to the Object Partitioning Problem

B. J. OOMMEN AND D. C. Y. MA, *School of Computer Science, Carleton University, Ottawa, K1S 5B6, Canada*

Let $\Omega = \{A_1, \ldots, A_W\}$ be a set of W objects that are accessed according to a partitioning Θ. The objects are accessed in groups of unknown size and the sizes of these groups need not be equal. Additionally, the joint access probabilities of the objects are unknown. The intention is to partition the objects into R classes $\{P_1, \ldots, P_R\}$ such that the objects accessed more frequently together are located in the same class. This problem has been shown to be NP-hard. In this paper, we propose two stochastic learning automata solutions to the problem. Although the first one is relatively fast, its accuracy is not so remarkable in some environments. The second solution, which uses a new variable-structure stochastic automaton, demonstrates an excellent partitioning capability. Experimentally, this solution converges an order of magnitude faster than the best known algorithm in the literature. (pp. A105–A120)

Integrated Magic Set Method: a Rule Rewrite Scheme for Optimising Linear Datalog Programs

V. S. ALAGAR, P. GOYAL, P. S. NAIR AND F. SADRI, *Department of Computer Science, Concordia University, 1455 de Maisonneuve Blvd, West Montreal, Quebec H3G 1M8, Canada*

A new optimisation method, called Integrated Magic Set (IMS) method, for efficient processing of logic queries is presented. This method is a harmonious integration of the Magic Set (MS) and Agrawal-Devanbu (AD) methods of 'moving selections into linear least fixpoint queries'. Depending on the structure of the recursive rule and query form, this rule-rewriting strategy may degenerate to either the AD or the MS method. A brief complexity analysis shows that the IMS method is superior to the MS method.

(pp. A121–A129)