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Given integers m and n, this paper finds an acyclic directed graph with m edges and n vertices and two distinguished vertices s and t such that the number of distinct paths from s to t (not necessarily disjoint) is maximized.

R78-70—Thevenod-Fosse, P. and R. David, "A Method to Analyze Random Testing of Sequential Circuits" (27 pp., Laboratoire D'Automatique de Grenoble, France)

This report presents a method for analyzing random testing of sequential circuits. It allows the division of a circuit into several blocks, each of which may be studied almost separately. The method has been applied to several TTL, SSI, and MSI circuits.

R78-71—Lipton, R. J. and F. G. Sayward, "Response Time of Parallel Programs" (31 pp., Yale University, New Haven, Connecticut)

The response time of a parallel program is defined to be the maximum delay between successive activities of an event. This paper investigates response times in relation to two factors: the parallel program's structure and the program's scheduler policies.


This thesis discusses computer system resources and their management in multiprocessing systems. The author examines resource allocation and control, with special attention paid to the problems of deadlock and shared resources.

R78-73—Shaw, B., ed., "Computing System Design: Proceedings of the Joint IBM-University of Newcastle upon Tyne Seminar" (265 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

These proceedings present papers dealing with system development projects, program design, general network theory, and performance evaluation. The various authors also comment on these topics in relation to computer science education.


Author outlines the development and characteristics of early IBM machines, from the firm's first research efforts in the area of electronic computer circuits beginning in 1939, to the delivery of the IBM 608 in 1955.

R78-75—Hamid, A., W. F. McClure, and T. B. Whitaker, "Stepwise Linear Regression for a Large Number of Independent Variables in a Memory-Limited Environment" (84 pp., North Carolina Agricultural Experiment Station, North Carolina State University, Raleigh, North Carolina)

A method is described for fitting a least squares linear model to a data set consisting of a large number of independent variables. The method is especially useful in a minicomputer environment.

R78-76—Gomez, L., R. Gomez, and B. Garcia, "Selective Addressing of Subcubes of a Digital Memory of 2^16 Bytes" (9 pp., Departamento de Electricidad y Electrónica, Universidad de Granada, Spain)

Paper describes a simple synchronous programmable binary counter that permits the selective addressing of subcubes of a digital memory of 2^16 bytes. The authors also present some applications for such a circuit.

R78-77—Gomez, L., R. Gomez, and B. Garcia, "On the Simplification of Boolean Expressions—Some Properties of
R78-78—Gomez, L. R. Gomez, and B. Garcia, "On the Simplification of Boolean Expressions—Theoretical Foundations and General Description of a Method for the Simplification of Boolean Expressions" (20 pp., Departamento de Electricidad y Electrónica, Universidad de Granada, Spain)

Based on the properties of Boolean expressions examined in the previous paper, a method of simplification of these expressions is presented. A simple implementation of a special-purpose machine can carry out such a simplification.

R78-79—Phillip, J., "Digital Image and Spectrum Restoration by Quadratic Programming and Modified Fourier Transformation" (37 pp., Department of Mathematics, Royal Institute of Technology, Stockholm, Sweden)

The author considers the convolution equation \( f * h = c \), where \( f \) is sought, \( h \) is a known "point spread function," \( c \) represents random errors, and \( d \) is the measured data. All these functions are defined on the integers \( \text{mod}(N) \). Numerical tests of the solution methods are presented, especially tests where \( d \) is a blurred image.


The definition of a basic security system as a 5-tuple is set forth and then the concept of a covered security system, where at least one security measure exists for each identified path, is briefly discussed. A formal model is presented which focuses on the interactions of the security measures with the threats they combat and with the objects they protect. The problem of imprecision in measuring security is presented; linguistic (as opposed to numeric) measurement tools are proposed.

R78-81—Anderson, T. and S. K. Shrivasitava, "Reliable Software: A Selective Annotated Bibliography" (26 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

Paper contains 64 references to papers, books, and conference proceedings on software reliability, and includes a paragraph of commentary with each reference.

R78-82—Merlin, P. M. and B. Randell, "Conservative System Recovery in Distributed Systems" (43 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This paper concerns a problem in designing fault-tolerant distributed computing systems. The concepts involved in "backward error recovery" are formalized so as to apply to distributed systems. A protocol is presented which could be used in each distributed system node to provide system recoverability in the face of even multiple faults.

R78-83—Ghani, N. and J. G. Givens, "A Teaching Laboratory for Digital Systems" (67 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This report describes the hardware used in a digital systems laboratory set up to provide a suitable environment for teaching the design of systems. Equipment included a highly flexible breadboard system and a microprocessor system implemented as a set of plug-in cards.

R78-84—Agrawal, R. P. and J. Deshpande, "A New Algorithm for One-Terminal Telpak Problem" (25 pp., Indian Institute of Technology, New Delhi, India)

It is assumed that the maximum requirement of each terminal is specified in terms of voice-grade channels. Voice-grade lines as well as Telpak types 5700 and 5800 are assumed to be available on lease. The algorithm presented is easily implemented and nearly optimal for interactive design.

R78-85—Lee, P. A., "A Reconsideration of the Recovery Block Scheme" (19 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The recovery block scheme has been introduced as a method for providing fault tolerance at the software level. This paper presents a brief overview of this method and examines issues associated with its implementation and utility.

R78-86—Snow, C. R., "The Software Tools Project" (29 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This paper describes a project in which the software tools of Kernighan and Plauger are implemented on a Burroughs B1700 under a nonstandard operating system. A command language interpreter similar to that of the Unix operating system is implemented to provide an environment in which the tools may be used.


A macro notation incorporating path notation is introduced, permitting the specification of the behavior of a distributed system in terms of resources characterized by associated synchronization statements. This "resource oriented" approach is contrasted with the usual "process oriented" approach. The authors argue that the latter is not suited for specifying a highly parallel system with distributed decision capabilities.

R78-88—Randell, B., P. A. Lee, and P. C. Treleaven, "Reliable Computing Systems" (112 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The paper discusses the various problems involved in achieving very high reliability from complex computer systems, and examines the relationship between system structuring techniques and techniques of fault tolerance. A set of appendices describe a number of computing systems that have been specifically designed for very high reliability.

R78-89—Hine, J. H., I. Mitran, and S. Tsur, "The Control of Response Times in Multiple-Class Systems by Memory Allocation" (25 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The possibility of giving a different quality of service to jobs of different classes by regulating their memory allocation is examined in the context of a paged computer system. Two parameterized algorithms which partition the main memory between two classes of jobs are considered.

R78-90—Treleaven, P. C., "Principal Components of Data Flow Computers" (30 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This paper advocates an alternative concept of a stored program computer based on data flow computation rather than on control flow organization. The paper identifies the principal components, information formats, and operation of a class of data flow computers.

R78-91—Hine, J. H., "Pre-Specified Performance Requirements in Multiprogrammed Computer Systems" (30 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The problem of scheduling a multiprogrammed computer system to meet pre-specified levels of service for different classes of jobs is considered. The levels of service are represented by a perform-
R78-92—Treleaven, P. C., “Exploiting Problem-Parallelism in Computing Systems” (29 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This paper discusses the concepts needed to design a general-purpose parallel computing system. Such a system, by utilizing problem-parallelism, would achieve a significant increase in performance over traditional computers, for a broad class of problems. The paper argues that the current approach, involving enhancements to the conventional (control flow) model of a computer in order to support parallelism, is ineffective.

R78-93—Gimson, R. B., “Data Representation by Program Transformation” (27 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

An approach to data representation is described which is based on transformations applied to the source language form of a program. Such transformations provide a concise machine-manipulable way of writing data representations, which may be checked for correctness and stored in libraries for use during program development.

R78-94—Lauer, H. C. and D. Wyeth, “A Recursive Virtual Machine Architecture” (39 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The design of a computer system with a recursive, virtual machine architecture is presented and the motivations and considerations leading to this design are explained.

R78-95—Verhofstad, J. S. M., “Recovery for Multi-Level Data Structures” (62 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This paper presents techniques for providing recovery in complex global data structures. Several mechanisms are described and their advantages and disadvantages are discussed. A recoverable filing system, which has been implemented, is used to illustrate the problems.

R78-96—Lauer, P. E., E. Best, and M. W. E. Shields, “On the Problem of Achieving Adequacy of Concurrent Programs” (36 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

This paper examines the problem of achieving an adequate behavior of concurrent systems. The authors approach the problem within the framework of a programming language, called path notation, for specifying concurrent systems.

The meaning of the notation is explained in terms of the mathematical theory of transition nets.

R78-97—Eve, J. and R. Kurki-Suonio, “Finding Strongly Connected Components of a Directed Graph” (13 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

Existing treatments of Tarjan’s algorithm for finding the strongly connected components of a directed graph are unsatisfactory in that they are not particularly easy to understand and they leave a strong impression that there is more to be said. This paper examines the algorithm in greater detail.

R78-98—Prince, P. J. and K. Wright, “Runge-Kutta Processes with Exact Principal Error Equations” (22 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The authors discuss and present further modifications to the global error estimation process introduced by Stetter, and extended by Dalle Rive and Pasciutti. It is demonstrated that this process can be unsatisfactory when applied to a problem which suffers from inherent instability.


This report describes system structures which provide for the restoration of the abstract state of user objects. It considers multi-level systems in which the levels provide recovery for different types, and discusses recovery in terms of recovery blocks as developed at Newcastle.

R78-100—Banatre, J. P. and S. K. Shrivastava, “Reliable Resource Allocation Between Unreliable Processes” (31 pp., Computing Lab, University of Newcastle upon Tyne, Great Britain)

The authors first present basic error recovery problems between interacting processes, where the desirability of having separate recovery mechanisms for cooperation and competition is demonstrated. They then concentrate on the recovery mechanisms for processes competing for shared computer system resources.


This questionnaire was developed as part of the authors’ preparatory work for the July 1978 Computer (theme issue on LSI-modular systems). It summarizes the responses of 213 computer scientists and engineers to questions regarding LSI-modular system classification and fabrication.