Abstracts from the 1974-1975 Rand Information Sciences Conference

G. F. Groner, Editor

July, 1975

P-5233/1

The Rand Paper Series

Papers are issued by The Rand Corporation as a service to its professional staff. Their purpose is to facilitate the exchange of ideas among those who share the author's research interests; Papers are not reports prepared in fulfillment of Rand's contracts or grants. Views expressed in a Paper are the author's own, and are not necessarily shared by Rand or its research sponsors.

The Rand Corporation
Santa Monica, California 90406

PREFACE

The Rand Information Sciences Conference (RISC) was initiated in Fall, 1973 to promote interaction among Information Sciences Department (ISD) and Rand Computation Center (RCC) staff members about their work in mathematics, computer science research, programming and analysis. In the concurrent ISD Seminar series, visitors give technical presentations. RISC operates on a continuing basis with a Call for Papers and Schedule for each three-month period. There are usually two sessions each month during the Fall, Winter and Spring Quarters. Papers or sets of related papers are presented in hour-long sessions.

The purposes of this Paper are to document the second series of Fall, Winter and Spring sessions and to illustrate Rand's research and applied work in the information sciences. It comprises the abstracts of all the papers presented.

CONTENTS

FALL SESSION ABSTRACTS

IFIP 74 AND ICC CONFERENCE REVIEW

Fred Blackwell, Bob Gammill, Bill Josephs, Rein Turn, Eric Harslem

The first four speakers attended the International Federation for Information Processing Congress 74 (IFIP 74) in Stockholm August 5-10, and will informally present highlights and impressions of the Conference. Eric Harslem will do the same for the Second International Conference on Computer Communication, which was held immediately following and at the same place as IFIP 74.

References:

Information Processing 74 (Proceedings of IFIP Congress), Jack L. Rosenfeld (Editor), North-Holland Publishing Company, Amsterdam; also American Elsevier Publishing Company, New York, 1974.

Proceedings for the Second International Conference on Computer Communication, Stockholm, August 1974.

STATLIB - A STATISTICAL COMPUTING LIBRARY

Dan Relles

STATLIB is a collection of FORTRAN-callable subroutines and systems of subroutines which perform a variety of functions useful to the statistician. The library is presently available on the OS 370 system at Rand. This talk will describe its contents, which include packages for general data analysis, regression analysis, time series analysis, and many more. Its interactive computing capabilitities will also be discussed.

Reference:

W. M. Brelsford, D. A. Relles, "Interactive Statistical Computing, with Applications to Forecasting and Data Analysis," Proceedings of Computer Science and Statistics: 8th Annual Symposium in the Interface, Health Sciences Computing Facility, University of California at Los Angeles, February 1975.

PEER REVIEW, CITATIONS, AND BIOMEDICAL RESEARCH POLICY: NIH GRANTS TO MEDICAL SCHOOL FACULTY

Grace Carter

Data has been gathered describing citations of all articles published under a sample of grants awarded in FY 1967 by the National Institutes of Health to medical school faculty. A model was developed that predicts the number of citations that will appear in the future as a function of earlier citations.

The relationship between frequency counts of citations and the evaluation of a grant by the study sections of NIH will be described. A preliminary evaluation of the effect of the decreased level of NIH funding on biomedical research output is presented.

This work was performed as part of the project to evaluate the effects of federal programs on biomedical research output.

Reference:

G. M. Carter, "Peer Review, Citations, and Biomedical Research Policy: NIH Grants to Medical School Faculty", R-1583-HEW, The Rand Corporation, December 1974.

THE IBM DATA SECURITY STUDY

Dennis Hollingworth, Session Chairman

In 1972, IBM announced a program designed to strengthen research and technology in the field of data security. This program took the form of a widely publicized $40 million investment, with work proceeding along several fronts. One of these was a study of the major issues related to the protection of stored data. Four study sites were chosen: MIT, TRW, The State of Illinois, and IBM's Federal Systems Center. Each of these was charged with the investigation of specific topics, and the results were recently published by IBM as a series of six documents.

This seminar will review the major findings of each of the study sites, and attempt to place these findings in perspective with respect to Rand's data security research.

INTRODUCTION & BACKGROUND

Dennis Hollingworth

STUDY RESULTS: STATE OF ILLINOIS

Steve Glaseman

STUDY RESULTS: MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dennis Hollingworth

STUDY RESULTS: TRW SYSTEMS, INC.

Rein Turn

STUDY RESULTS: RSS IMPLEMENTATION

Steve Glaseman

References:

"Introduction and Overview", Data Security and Data Processing, Vol. 1, G320-1370-0, International Business Machines Corporation, White Plains, N. Y., June 1974.

"Study Summary", Data Security and Data Processing, Vol. 2, G320-1371-0, International Business Machines Corporation, White Plains, N. Y., June 1974.

References (cont'd):

"State of Ilinois: Executive Overview", Data Security and Data Processing, Vol. 3, Part 1, G320-1372-0, International Business Machines Corporation, While Plains, N.Y., June 1974.

"Evaluations and Installations Experiences: Resource Security Systems", Data Security and Data Processing, Vol. 6, G320-1376-0, International Business Machines Corporation, White Plains, N.Y., June 1974.

"Study Results: TRW Systems, Inc.", Data Security and Data Processing, Vol. 5, G320-1375-0, International Business Machines Corporation, White Plains, N. Y., June 1974.

"Study Results: Massachusetts Institute of Technology", Data Security and Data Processing, Vol. 4, G320-1374-0, International Business Machines Corporation, White Plains, N.Y., June 1974.

"Study Results: State of Illinois", Data Security and Data Processing, Vol. 3, Part 2, G320-1373-0, International Business Machines Corporation, White Plains, N. Y., June 1974.

THE RAND TEXT EDITOR

Peter Weiner

The Rand Text Editor is a computer program that allows textual information to be examined or modified with a minimum of effort. The program, recently implemented at Rand under the UNIX operating system on the PDP 11/45, was designed with the following considerations in mind:

1) It should take full advantage of the two-dimensional capabilities of high speed (9600 baud) CRT terminals.
2) It should do the important editing operations with a minimum of effort.
3) It should be very easy to learn and remember.

The purpose of the RISC presentation is to demonstrate the operation of the editor and to discuss design philosophies.

INTELLIGENT TERMINAL RESEARCH AT RAND

R. H. Anderson, J. J. Gillogly

We are currently developing a minicomputer-based system which will act as an intelligent terminal, with aids to a user for interfacing to external systems such as the ARPANET. We are exploring the use of production systems -- sets of condition-action rules -- for encoding both user preferences and heuristics for interacting with external systems. A production system called "RITA" (Rand Intelligent Terminal Agent) will be described which is capable of executing a set of production rules, either using sequential "left-hand side" condition testing, or else forming a goal-subgoal search tree by backward chaining through the rules starting with the designated goal rule; this latter form of operation allows deductions to be made using a production system.

An example will be given of a set of heuristics, encoded in production rule form, for dealing with the behavior of such external systems as the File Transfer Protocol or Remote Job System on the ARPANET.

The system under development is a prototype "user agent" of the type expected to be locally resident in a user terminal within several years.

References:

Robert H. Anderson, James J. Gillogly, "Rand Intelligent Terminal Agent (RITA): Design Philosophy", R-1809-ARPA, The Rand Corporation, (forthcoming).

Robert H. Anderson, James J. Gillogly, "Rand Intelligent Terminal Agent (RITA): Reference Manual", R-1808-ARPA, The Rand Corporation, (forthcoming).

WINTER SESSION ABSTRACTS

SORTING AND THE HIDDEN SURFACE ALGORITHM

Ivan E. Sutherland

Hidden-surface algorithms compute which surfaces in a complicated collection of objects are visible to a particular observer and which are hidden from him by other objects or surfaces. Once thought quite difficult to write, hidden-surface algorithms are now found in great variety. The common thread among these algorithms appears to be the characteristic types of sorting that they use and the order in which they perform various sorting steps. Examination of the types of sorting used provides a theoretical basis for comparison of algorithm performance. Systematic categorization of the known algorithms by sorting type and sorting order reveals a sorting order category for which no known algorithm exists.

References:

I. E. Sutherland, R. F. Sproull, and R. A. Schumacker, "Sorting and the Hidden-Surface Problem", AFIPS Conference Proceedings, Vol. 42, 1973, pp. 685-693.

I. E. Sutherland and G. W. Hodgman, "Reentrant Polygon Clipping", CACM, Vol. 17, No. 1, January 1974, pp. 32-41.

I. E. Sutherland, R. F. Sproull and R. A. Schumacker, "A Characterization of Ten Hidden-Surface Algorithms", Computing Surveys, Vol. 6, No. 1, March 1974, pp. 1-55.

THE PRIVACY ACT OF 1974

Willis H. Ware

On January 1 of this year, President Ford signed the Privacy Act, P. L. 93-579, which has strong implications for the use of information in government data banks. Willis will discuss the background of this Act, its details, and some of its implications.

References:

W. H. Ware, "Privacy: The Private Sector and Society's Needs", P-5414, The Rand Corporation, March 1975

W. H. Ware, "Computer Privacy and Computer Security", P-5354, The Rand Corporation, October 1974.

W. H. Ware, "Computers, Personal Privacy, and Human Choice", P-5149, The Rand Corporation, November 1973.

W. H. Ware, "Records, Computers, and the Rights of Citizens", A review of the Report of the Secretary's Advisory Committee on Automated Personal Data Systems, chaired by Willis H. Ware, Department of Health, Education and Welfare, P-5077, The Rand Corporation, September 1973.

TERRORISM STUDIES

Bob Reinstedt

Speaker - Brian Jenkins

For some time Rand has been studying international terrorism. Based on interviews and case studies, observations have been made about the organizational structure and behavior of terrorist groups, hostage behavior, negotiations, and trends.

A chronology of terrorist activities has been compiled as well as statistics on incidence rates.

Recent interest has been directed toward terrorist exploitation of nuclear blackmail and capability.

Brian Jenkins will present an overview of findings in the above areas and will discuss the project's future.

RESULTS OF A STATISTICAL PACKAGE COMPARISON

Roy Danchick, Larry Helbers, Ted Fairbrother

Rand supports a number of statistical packages which have many of the same features and perform many of the same functions as one another. The seminar will discuss the strategy, test case, design, results, conclusions and recommendations of a comparative performance evaluation that was conducted by the HASE project.

The statistical packages evaluated were:

- o SPSS
- o DATATEXT
- o RAPFE
- o ECON
- o STATLIB
- o DIOGENES

Performance evaluation criteria were divided into two sets. (1) General data processing which included comprehensiveness, usability, flexibility and maintainability, (2) computational accuracy and efficiency. Also, the speaker will discuss applications of the square root version of the Kalman filter to linear multiple regression problems.

References:

David J. Armour and Arthur S. Couch, Datatext Primer An Introduction to Computerized Social Data Analysis, The Free Press, New York, 1972.

A. P. Dempster, Elements of Continuous Multivariate Analysis, Addison-Wesley, Reading, Mass., 1969.

Daniel A. Relles and William M. Brelsford, STATLIB, Bell Laboratories, December 1969.

William P. Slysz, "An Evaluation of Statistical Software in the Social Sciences", Communications of the ACM, Vol. 17, No. 6, June 1974, pp. 326-332.

SPRING SESSION ABSTRACTS

MULTI-ATTRIBUTE DECISION ANALYSIS AND APPLICATIONS

Peter H. Farquhar

This tutorial seminar reviews some of the theoretical and applied research in decisionmaking with multiple attributed alternatives. After a brief introduction to utility and decision theory, several cases are presented to illustrate the practical implementation of the theory: hospital bloodbanking, airport location, nuclear power plant siting, bundle evaluations, poultry farming, resource allocation, group decision making, and many others. Several areas of future research are also suggested for improving both the theory and its implementation in real decision problems.

References:

Peter H. Farquhar, "A Fractional Hypercube Decomposition Theorem Multiattribute Utility Functions", Operations Research, September, 1975; also P-5433, The Rand Corporation, May 1975.

Peter H. Farquhar, "Nonadditive Utility Functions", Management Science, May 1976.

THE SAD STATE OF DEBUGGING

R. Stockton Gaines

One of the great surprises that users of the first digital computers discovered was the difficulty of getting their program to work right. Among the first utility programs created were some to assist in debugging. More than a quarter of a century later (computer science is not such a young field anymore), people are still having the same difficulties debugging their programs, and for most of the world the tools available are not much advanced (and in some ways a little behind) those provided by the early utility packages. Debugging costs are a substantial part of program development costs, and it is surprising that the situation is still so primitive.

This talk will analyze the programming process from the point of view of debugging, discuss the general nature of the debugging activity, and present some ideas about how the current situation can be improved. A brief exposition of the principal debugging ideas that have been incorporated into various tools and debugging systems will be presented in the context of this analysis of the programming and debugging process. It will be argued that some rather simple debugging aids, properly implemented, would result in substantial assistance in easing the debugging problems of most programmers.

Reference:

R. S. Gaines, "The Debugging of Computer Programs", IDA Working Paper No. 266, August 1969.

EVALUATING THE IMPACT OF FEDERAL FUNDS UPON UNIVERSITIES

David Drew

Quantitative analyses of longitudinal data, supplemented by site visits, were used to evaluate the impact of the NSF Science Development program. Setting as its twin goals a dramatic upgrading in the science capabilities of second-tier universities and a broader geographical distribution of scientific talent throughout the nation, this funding program awarded over $230 million to selected universities during the 1960s.

Several technical decisions were made at the outset to help isolate the unique effects of Science Development. First, wherever possible, the data gathered for this study covered the 15 years from 1958 through 1972. Second, all (nonfunded) doctorate-producing universities in the country were used as controls. Third, the three science fields that received the largest share of Science Development funds - physics, chemistry, and mathematics - were analyzed, as was the nonfunded control field of history. Finally, to define "quality science education" in American graduate schools, multiple indicators (i.e., multiple criteria) were used.

A key measure of quality was the rate of publication by faculty in leading journals; the journals were selected on the basis of an impact factor reflecting their citation rate. Analyses based on this index revealed funding effects and also showed it to be a good predictor of the ACE ratings of departmental excellence.

Reference:

D. E. Drew, Science Development: An Evaluation Study, National Academy of Sciences, Washington, D.C., 1975.

MODIA AND DOSS - SOFTWARE ENGINEERING IN A RESEARCH ENVIRONMENT

Ray Pyles

The software engineering techniques used in the development of the MODIA (Method of Designing Instructional Alternatives) and DOSS (Decision Oriented Scheduling System) software are described and contrasted. In addition, several "danger signals" are identified which should permit the early detection of potential problems in future RAND software projects.

PROJECTED TRENDS IN COMPUTING SERVICES AT RAND

Rod Fredrickson

Private and public thoughts on the future of Computation Center services at Rand. No guarantees, only our ideas on the Center's direction in terms of hardware and systems in anticipation of developing Rand requirements and industry trends.

For example:

- Plans for mass storage
- Thoughts on minis
- Will depreciation factors reduce rates?
- Will efficiencies by MVS reverse the effect of inflation?
- Plans for on-line systems

No exact dates -- just ideas and thoughts on the future.