Research Summaries

Mathematical Model for a Documentation System

Center for Documentation and Communication Research, Western Reserve University, Ohio

Reported by: Allen Kent (August 1960)

Descriptors: **documentation system, mapping**

The Center is currently engaged in a number of theoretical and basic research investigations which are expected to lead to the formulation of a theory of documentation and of searching strategy. A basic program is leading to the development of a mathematical model for a documentation system. Work is proceeding (1) on a comprehensive investigation of the properties of aggregates and systems of messages in order to arrive at a general theory of "measure" for documentation systems, (2) on an analysis of the algebra that is imposed on the message complex, and (3) on a detailed study of the concept of mapping in documentation.

REFERENCES—Technical Notes on Contract No. AF 49 (638)-357:

REES, J., and KENT, A., May 15, 1958 (ASTIA No. 158250, AF OSRTN 58-445).

PERRY, J. W., Subject matter analysis and coding—some fundamental considerations. May 29, 1958 (ASTIA No. AD 158 311, AFOSRTN 58-501).

KENT, A., Nonconventional retrieval systems in documentation—preliminary comparative analysis. June 24, 1958 (ASTIA No. AD 158 396, AFOSRTN 58-575).

WADSWORTH, H. M., and BOOTH, R. E., Some statistical sampling concepts applied to the information retrieval process of documentation systems. August 19, 1958 (ASTIA No. 201 864, AFOSRTN 58-765).

KENT, A., and PERRY, J. W., The storage and retrieval of numerical data in large and complex documentation systems. February 24, 1959 (ASTIA No. AD 210 142, AFOSRTN 59-82).

ADAM (Attrition Damage Assessment Model)

Computer Sciences Department, The RAND Corporation, Santa Monica, California

Reported by: B. A. Batchelder (October 1960)

Descriptors: **computer simulation, Monte Carlo method, programming, computer application, weapons effectiveness**

ADAM is a computer routine designed to do a Monte Carlo simulation of a one-sided air battle. ADAM requires as input plans for bombing missions (including targets) the initial condition of defense installations (missile sites, radar sites, and fighter bases) and bomber bases, and parameters determining aircraft characteristics and weapon effectiveness. Time is broken into short intervals (15 minutes as presently coded), and during each time interval ADAM carries out the action called for by the plans and computes the consequences, thus setting up a new set of conditions for the next time period. During this cycle the functions performed include: (1) flight following—the movement of aircraft is directed in accordance with the route specifications; fuel consumption, altitude, and distance traveled are computed; airborne operations such as refueling, air release of deception devices, the dropping of bombs, and communication of mission results are carried out; (2) attrition—radar detection of bombers and attacks by fighters and missiles are simulated; (3) targeting—designated ground zeros for bombs dropped over target are selected and the amount of information obtained by reconnaissance missions is determined; (4) damage—blast damage to bomber bases and defense installations is computed, as well as their restricted operation as a result of radioactive fallout from ground bursts. The output from ADAM consists of the final status of bomber bases and defense installations, a time history of all bombing missions, counters (these include such quantities as the number of aircraft killed by missiles or fighters, the number of bases and defense installations destroyed or rendered inoperable because of radiation), the actual ground zeros (from bomb drops at target points or attrited bombers), and the fighter engagements. A strike of 312 bombers against 71 bomber bases and 1158 defense installations takes about 15 minutes of 704 time.

REFERENCE:

DALKEY, N. C., and WEGNER, L. H. The strategic operations model. RAND Report 2250 (Confidential).

Symbolic Analysis Methods for Information Systems

Stanford Research Institute, Menlo Park, California

Reported by: Ned Chapin (November 1960)

Descriptors: **system analysis, system design, information systems, data processing, symbolic analysis methods, formalized analysis techniques, application mechanization, systems automation**

The purpose of this research in the area of information systems is basically twofold: (1) to produce new techniques of systems analysis and systems design that will be free of many of the defects of present techniques, and (2) to program a general purpose computer to enable it to apply at least major parts of these new techniques, in a way that will enable a linkage with automatic coding techniques. The major defects of the present techniques are high cost, low validity, low reliability, heavy reliance upon intuition and experience, and slow speed of effective application.

The research work thus far has concentrated on aspects of the nature and role of information systems in formal human organizations, as this appears to be one of the most difficult and comprehensive cases. From the preliminary findings, some suggestions for new analysis and design techniques have been developed and given limited tests, thus far with apparently successful results. Very little programming work has been done as yet, although parts of the use of some of the new analysis techniques have been mechanized by using punched card machines. Since the research work has thus far received no direct sponsorship, no reports are available for public distribution.

The important place of adequate systems analysis and systems design is widely recognized. Systems analysis and design can be likened to the preparation of blueprints. Blueprints are not the thing to be built nor are they the directions for doing it. Yet from the blueprints, competent directions can be produced. Programming and coding, as through automatic coding techniques, prepare the directions needed for the implementation of an information system. Yet, as a logical necessity, systems analysis and design must precede programming and coding. One must first have a grasp of the situation before one can give adequate directions on how to handle it. In short, what is needed is techniques in systems analysis and systems design that are at least as powerful in their areas as automatic coding techniques are in programming and coding. And to be of most value, the new techniques must, at the end of their effective range, be able to mesh cleanly with automatic coding techniques at the start of their effective range.

REFERENCES:

CHAPIN, NED. On the design of business systems for computers. Presented at the Eleventh National Meeting of the Association for Computing Machinery (1956).

——, A new method of symbolic statement for data processing operations. Presented at the Thirteenth National Meeting of the Association for Computing Machinery (1958).

——, SYLATINS: A way out of the systems maze? *Automatic Control 12* (April 1960), 37-38, 41, 43.

High School Students Learn Computer Programming

An experiment course in High Speed Digital Computing designed to attract high school students to the computing field—and especially to the computer programming profession—has been sponsored by the Washington, D.C. Chapter of the Association for Computing Machinery and the Board of Education of Montgomery County, Maryland. The course was presented on Saturday mornings to 26 juniors and seniors from Bethesda-Chevy Chase High School.

Topics covered included the history of computers, the use of binary and octal number systems, analysis of typical problems, fundamentals of programming and applications of computers. Also included were lectures by several leading authorities on war gaming, automatic language translation, satellite tracking and business applications.

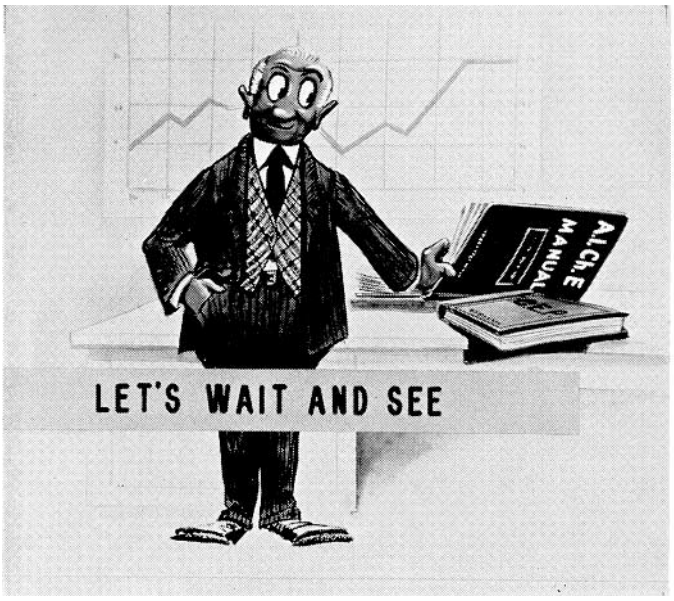
The students first learned to program for a simple, theoretical computer, and then progressed to programs for the high-speed 709 computer. Actual IBM manuals for the 709 were used as training aids, as well as motion pictures designed to teach computer programming and computer technology. IBM's Federal Systems Division provided free program check-out time on the 709 computer at the Space Computer Center. First-hand information about the programming profession was also obtained from IBM personnel during a student field trip to the company's Systems Center in Bethesda, Maryland. A climax of the course was the testing on the 709 of the programs that the students themselves wrote to solve a rocket problem. The students watched as the machine calculated second-by-second altitudes of five simultaneous rocket shots. In addition to writing the 709 program for the rocket problem, the students also programmed such complex problems as the linear programming determination of minimum cost and maximum profit in making ice cream sodas.

Students who volunteered for the extra-curricular course took on three class hours per week, with an average of four to five additional hours of homework a week. Requirements for the course included: grades of A or B in all regular classwork; two years of algebra, one year of geometry, and one year of physics (or enrollment in one of the latter two courses); and a high degree of interest in mathematics and science.

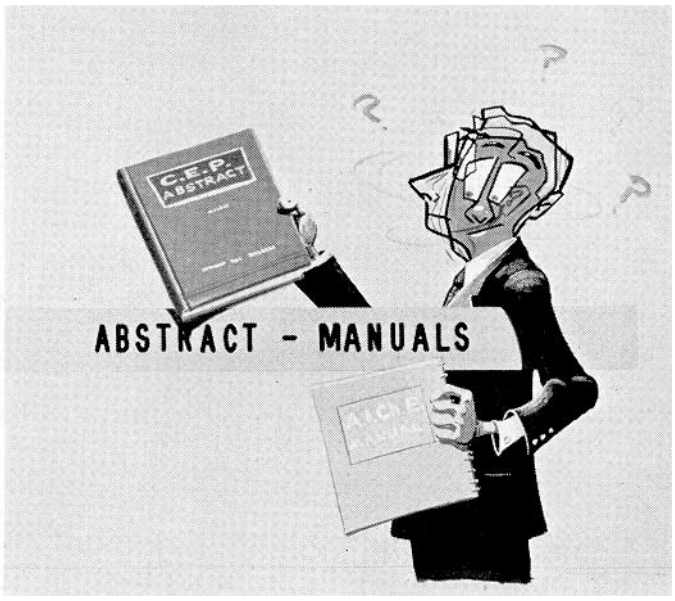
The Washington, D.C. Chapter plans to present similar courses in several other local high schools during the spring of 1961.

The program was organized by George C. Heller, Chairman of the Education Committee of the Washington, D.C. Chapter of ACM and a member of the staff of IBM's Systems Center, engaged in applied programming research. Assisting Mr. Heller with lecturing and administrative work were James S. Nist and Thomas J. McAllister, also programmers with IBM's Federal Systems Division. The instructors all donated their time and effort during weekends and evenings to the course.

There is strong evidence that the course is fulfilling its function of stimulating interest in computers. Several students are competing for awards in the nationwide Westinghouse scientific talent search—by undertaking original research in the computer field. One, for example, is working on an improved chess-playing computer program, while another is preparing a paper on the topic, "Can Machines Learn or Think?" But perhaps the best indication of all that the course is a success is the request of the students for an advanced programming course next term.



Reprinted by permission from Armour Research Institute



Reprinted by permission from Armour Research Institute