December 1969

Brief 69-10608

AEC-NASA TECH BRIEF

Automatic Computation of Data-Set Definitions

A mathematical method is reported (see ref.) for construction of a computer-program data-set description from a computer program containing detailed declarative information. Cartesian products and disjoint-union operators are used to yield a series of recursive group equations.

Most programming systems that attempt to provide flexible and efficient data representations require the user to specify the range of variables, parameters, and functions by extensive and detailed data-structure declarations. It is suggested that much of this declarative information is redundant; that it can be inferred from the nondeclarative portion of the program. Specifically in the context of a restricted but nontrivial programming language, LISP, a method is presented for construction of a data-set description, of the results of a function, from a program for the function and a data-set description of its arguments.

Firstly the concept of a data-set description or definition had to be formalized. The most elegant earlier formalization had considered a data-set definition to be a set of recursive set equations using the operations of cartesian product and disjoint union. This approach has been modified by use of conventional set-theoretical union instead of disjoint union.

Thus a data-set function is considered to be a special case of a recursive set definition, which is a set of equations of the form

$$X_1 \leftarrow \epsilon_1(X_1 \cdots X_n) \cdots X_n \leftarrow \epsilon_n(X_1 \cdots X_n)$$

where the X_i are set variables and the ϵ_i are expressions composed of set constants, set variables, and set functions. In general, recursive set definitions have various applications. The immediate concern was in definition of LISP data sets; i.e., sets of *S*-expressions.

From the definition of a LISP function and a recursive definition of a set of all arguments for the function, a recursive definition of a set was constructed that included all results of the function. The construction method recovers a portion of this information from the function definition itself.

The reference cited provides a more rigorous and general treatment of the material, with proofs of several implicit and explicit assumptions made in the body of the paper; two sections deal with recursive set definitions in general, and with their specific application to the description of LISP data sets.

Reference:

Reynolds, J. C.: Automatic Computation of Data Set Definitions. Argonne National Laboratory, Nov. 1967.

Notes:

1. This innovation may assist in data reduction and evaluation in construction of atomic models for research applications.
2. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B69-10608

Source: J. C. Reynolds
Applied Mathematics Division
(ARG-10475)

(continued overleaf)

Patent status:

Inquiries concerning rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439