

- express, based on the results of steps (1) and (2) above, as well as on a study of the capabilities of some current advanced programming languages;
- (4) to suggest a suitable notation;
 - (5) to examine the problems of constructing translators.

It is by no means clear at this point that a satisfactory UNCOL as outlined in this paper is possible. There appears to be no way to decide whether this UNCOL is

possible except to try to construct it. If an UNCOL can be developed along the lines presented here, it offers the distinct possibility of being a high-level programming language which has more capability and convenience than any of the current "advanced programming languages" such as ALGOL.

The author does not pretend to offer in this paper any solutions to problems concerned with UNCOL, but he hopes that he has made clearer the natures of some of the problems involved.

References

- HOLT, A. W., and TURANSKI, W. J. (1960). "Man-to-Machine Communication and Automatic Code Translation," *Proc. of the 1960 Western Joint Computer Conf.*, p. 329.
- IBM (1958). FORTRAN II Reference Manual for the IBM 704 Data Processing System.
- MCCARTHY, J. (1960). "Recursive Functions of Symbolic Expressions and their Computation by Machine, Part I," *Communications of the A.C.M.*, Vol. 3, p. 184.
- NAUR, P., et al. (1960). "Report on the Algorithmic Language ALGOL 60," *Communications of the A.C.M.*, Vol. 3, p. 299.
- SHARE AD-HOC COMMITTEE ON UNIVERSAL LANGUAGES (1958). "The Problems of Programming Communication with Changing Machines," *Communications of the A.C.M.*, Vol. 1, No. 8, p. 12; and Vol. 1, No. 9, p. 9.
- SIBLEY, R. A. (1961). "The Slang System," *Communications of the A.C.M.*, Vol. 4, p. 75.
- STEEL, T. B. (1960). "UNCOL, Universal Computer-Oriented Language Revisited," *Datamation*, Vol. 6, No. 1, p. 18.
- STEEL, T. B. (1961). "A First Version of UNCOL," *Proc. of the 1961 Western Joint Computer Conf.*, p. 371.
- WOODGER, M. (1960). "An Introduction to ALGOL 60," *The Computer Journal*, Vol. 3, p. 67.
- WOODWARD, P. M., and JENKINS, D. P. (1961). "Atoms and Lists," *The Computer Journal*, Vol. 4, p. 47.

Book Review

Microanalysis of Socioeconomic Systems, by ORCUTT, GREENBERGER, KORBEL and RIVLIN, 1961; 425 pp. (Harper Brothers, New York, \$8.)

This work is in five parts. The first part is introductory and outlines the problem of building a satisfactory model of an economic system based on the social unit of a single individual. This is the problem considered in this book. The second part gives the statistical details of the demographic problem proposed, and the third part discusses some extensions to the problem.

The fourth part gives the details of computer programs to solve such problems, and has a very detailed appendix on the generation of random numbers, the generation of which is of great importance in the stochastic processes involved. The fifth part outlines some conclusions reached from experiments making use of the programs, and suggests further possible extensions to this field of research.

Demography is the study of the statistical behaviour of the population of a country. Here, at the micro-economic level, each person is defined by a group of data about such things as age, sex, and marital state, at a given moment. These basic units are then combined with other units representing other people on a semi-random basis, to produce a number of other larger family units. These family units are assumed to be capable of making decisions about the purchase of durable commodities, higher education, travel, and other economic problems. One of the main objects of the research is to simulate the behaviour of these decision-making units in the consumer section of the American economy.

The first step is to simulate the behaviour of these individual and family units by computer programs which imitate, on a stochastic basis, the birth and death of individuals, and marriage and divorce among families. Several chapters in the second section are devoted to the problem of getting

reliable estimates for the probabilities that a given individual will be born, die, marry, or have a child in a given month. These probabilities are then used to set up a large sample for initial data, representing about five thousand families.

The simulation of the economic behaviour of these family units depends not only on these demographic features of a population, but also on their status in the total labour force, their hire purchase debts, their assets, their demand for luxuries, higher education, and travel. Simple models incorporating these factors are introduced in Part III.

Part IV is the section most interesting to professional computers. This section contains a general treatment of the simulation of these large-scale micro-economic models, using a very large high-speed computer. In this case, an I.B.M. 704 with four magnetic-tape decks was used. Full details are given, with flow diagrams of the actual course of the calculation, for this model of the consumer section of the U.S. economy, which was set up in the preceding sectors.

The connection with Markov processes is noted, but to bring the problem within practical bounds, a Monte Carlo process is used to generate the behaviour of any household at any given time. All households in the initial data are processed on magnetic tape, and this produces successive predictions of the future state of the population at monthly intervals.

The last section discusses further the problems of obtaining specific predictions from such micro-analytic models, by this approach based on simulation.

The work is invaluable to anyone concerned in the organization and automatic processing of demographic data, and should be of great interest to those engaged in building economic models of any kind, and to all those who have to build programs for projects with large quantities of data.

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