Computing applied to societal problems

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OVERVIEW—Donald L. Thomsen, Jr.

The panel will present problems from three societal fields where computing has made significant contributions. The first field is cultural evolution, which is concerned with how both biological characteristics and new ideas spread throughout a society. Next, from that aspect of the environmental field which is concerned with waste, computer applications to ocean disposal will be discussed. The final presentation will concern programs for allocation of fire companies; this will be followed immediately by a computer demonstration at which time those attending may themselves operate the computer program. Throughout the session the panel will stress the usefulness and applicability of their investigations to the needs of society.

The Interaction Between Biological and Cultural Processes (Abstract of presentation)—Marcus Feldman and Luca L. Cavalli-Sforza

Most studies of evolution concern the genetic system and evolution occurs through changes in gene frequencies in populations. The study of the dynamics of phenotypes which can be specified, for example, at a cultural level has only recently been initiated. In the present work, we present a theory for both genotypes and culturally determined phenotypes. The individuals in the population have a cultural character and a defined genetic type. Both are transmitted by the parents, or members of the group to which the parents belong. The cultural character can be under natural selection. It is shown that selection on the cultural character can cause evolution at the biological level, as in the change of gene frequencies. The studies were based on new applications of classical theories of recursion systems as well as on numerically based computer work.

Computer Applications to Ocean Disposal Research and Engineering (Abstract of presentation)—Robert C. Y. Koh

The role played by computers in three areas related to the technology of disposal of wastes (either waste water or waste heat) to the ocean is discussed. First, the computer is necessary in the development and implementation of mathematical models for the purpose of predicting the effects of discharge on the environment. Unfortunately, this is limited at present primarily by a lack of adequate understanding in the basic processes involved making most models of only limited usefulness. To enhance this understanding, laboratory investigations are being undertaken. Thus the second area where computers are used is in laboratory data analysis sometimes on a real time basis. The third area where computers are used is in the analysis and interpretation of field monitoring data. This is important in assessing the impact, in establishing the background levels and the adequacy of various water quality standards. Examples of applications to actual systems will be discussed.

Programs for Allocation of Fire Companies (Abstract of presentation)—Jan M. Chaiken

Municipal fire departments routinely make long-term planning decisions concerning the location of fire stations. Capital expenses related to these decisions are ordinarily not large compared to the department's budget, but the manning costs can amount to $200,000 per unit per year. Thus the objectives in planning station locations include minimizing the total number of units while providing certain minimum levels of coverage for all parts of the city. In addition, the average response time to fires in the city, and the equity of response time among different areas of the city, are relevant criteria.

The New York City-Rand Institute has designed and tested several computer programs that assist municipal agencies in planning fire station locations. The principles on which they operate, data requirements, and output will be described. The programs will be available for operation by the audience at the conclusion of this session.