# SOME STATISTICAL USES OF LARGE COMPUTERS

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## 1. Introduction

The analysis of many medical research problems requires a great amount of computation including types for which high-speed computing machinery is necessary. Many medical research problems remain in the discussion and planning stages because of the complex nature of the analysis. Progress on some of these problems can proceed only with the use of a large electronic computer. The following are examples of these types of problems (not necessarily representative examples).

### 1.1. *Scientific computations.*

(1) Construction and testing of simulation models. These models as used in genetics, epidemiology, and psychology and models constructed for analysis of physiological and biochemical systems, in order to be realistic, are necessarily complex. Although simple mathematical expressions are sometimes sufficient to describe a system, general solutions require numerical treatment even when these solutions may be obtained in closed mathematical form.

These models often employ systems of differential or difference equations, which may be linear or nonlinear. These equations are conditioned with various types of restrictions or boundary values and always involve many variables. Also, the boundary values may be determined statistically instead of being given constants. Solutions are not possible without large computers.

These simulated systems are evolved from known relations concerning, for example, homeostasis and feedback mechanisms, diffusion and reaction kinetics, rates of growth and decay.

(2) Analysis of experimental data.

(a) Statistical analysis of data from clinical and laboratory research requiring complex and/or extensive computation, for example, multivariate analysis or data screening.

(b) Spectral and correlational analysis for continuously recorded observations, for example, analyses for various EEG leads related to behavioral and physiological phenomena and to each other.