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INTRODUCTION

Planning for, and installation of, a Data Processing System is a complex process. At a certain stage, decisions are required concerning the type and number of components which will form the Computer System. A certain variety of components is offered for choice, such as terminals for data entry and display, long distance communication lines, data storage units, data processing units and their interconnections. Also, operating procedures have to be chosen.

Let this set of decisions be called Systems Design. Its major criteria are

- whether the system can adequately handle the expected workload,
- whether it can be expected to have adequate reliability and availability,
- whether its cost is optimal and in an appropriate relation to the service produced.

An essential part of the design process is the Systems Analysis, - the subject of this course. It can be understood as the set of considerations and computations which establish whether a supposed system satisfies the design criteria. The results of Systems Analysis serve within the design process either by immediate backward computation, or in some form of trial-and-error procedure until the criteria are satisfied.

The methods of Systems Analysis are largely determined by the random nature of many design data : Volume and transmission times of 'long-distance data', record lengths, and locations in direct access storage, execution times of programs depending on conditions determined by the data, - all these are variable and can at best be predicted statistically. Hence, probability theory plays a key role in Systems Analysis.

Asynchronous operation, with the consequences of possible interference and queuing, is an essential technique in modern computer systems, - either enforced by the fact that data are presented to the system at unpredictable times, or as a result of hardware and program structures. Hence the considerable share which queuing theory takes within this course.

The methods discussed in this course are briefly presented and referenced in the text. More space, however, is devoted to exercises and their solutions, - stressing the application of the methods. A Case Study has been chosen as a starting point. It provides numerical values for the exercises ; it gives a motivation for the particular selection of methods for this course ; and, by the order in which the analysis could proceed for this case study, it also determined the order in which the methods are presented.

The course can be studied with two different aims : The reader who is mainly interested in the applications of Systems Analysis will concentrate his attention on the exercises related to the Case Study (which are quoted by topic and number in the table of contents) and will find some convenience in the numerical tables collected as appendix C . Also, for programmed computations, he will find formulae and procedures in appendices B and E.

A reader with this aim should be familiar with the basic notions of calculus, probabilities and statistics. Also, some familiarity with the available components and programming concepts is assumed.

The other view would be at the theoretical reasoning that leads to the formulae and tables. Here, the reader may gain a deeper understanding of their applicability and a basis for further analysis of problems not discussed in this course.

The mathematical notions referenced in this context are surveyed in appendix D .

The notes are based on lectures given by the author at the IBM European Systems Research Institute in Geneva, Switzerland. My sincerest thanks go to the Institute, its direction, faculty and students, for their encouragement and critical discussions.

Geneva

December 1971 Wolfgang Everling

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