ROBUSTNESS
AND
ANALYTIC COMPUTER SYSTEM MODELS

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The use of simulation studies to investigate the behavior of computer hardware/software systems is well established, although in some sense analytic models are more desirable. Simulation is used in a situation which is completely intractable to analytic machinery, or for which the essence is lost when the prerequisite abstractions and simplifying assumptions necessary to the analytic technique are made. In this paper, the term analytic model is used to refer to that set of computer system models based upon queuing theory.

Many view the operating system as a network of resources each potentially precipitating queues. Such a view allows the units passing through the network to request (employ) the devices in various combinations in a multiprogramming environment. The computing system is thus viewed as sequences of resource seizures and releases (processors, memory and input-output equipment) with appropriate holding time assumptions. In many cases, the models indicate rather clearly how various policies and variables interact to effect system performance, and the predictions of some coincide well with measurable data.

For such network models it is informative to ascertain information concerning the robustness of the model. Stated differently, we are interested in knowing to what extent the operating characteristics of the models are independent of the probability distribution and queuing discipline assumptions necessary to the analytic tractability of the model. Such investigations naturally appeal to simuation. Basically, perturbations, are made to the original distribution assumptions, and simulation experiments are conducted and results compared with those produced by the model equations. It would seem that much of this kind of work is done, although seldom reported.

This report discusses a simulation study designed to investigate robustn s for a particular computer system network model briefly described as a three-stage closed queuing network. The study conducted included experiments which provided for selectable proportions of various distributions, as well as various queuing disciplines. The study extensively employed the use of antithetic variates.

A MODEL FOR SIMULATING AND EVALUATING THE RESPONSE OF A MANAGEMENT INFORMATION SYSTEM

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This paper discusses the development of a model to simulate the information flow of a program management organization. The objective of the study was to evaluate the response of the information system when changes to the system were made.

The model is written in GPSS II for use on the UNIVAC 1100. It contains a different generate block for each type message entering the information system. As each message is created, it is assigned a destination, delivery dur on, type of processing, and a processing duration. Assignments are made from a distribution describing that activity. Outgoing messages are created by the incoming messages and are assigned destinations and durations from corresponding distributions.

In developing the model, an information decision scheme was used. Each message is represented by a transaction and each decision maker is represented as a facility. The flow of messages through the system activate the nodes and create the output statistics.