1981 Winter Simulation Conference Proceedings
T.I. Ören, C.M. Delfosse, C.M. Shub (Eds.)

THE PREEMPTION CAPABILITY IN GPSS

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ABSTRACT

One of the important capabilities offered by the General Purpose Simulation Language (GPSS) is the preemption capability. This capability is of use in modeling many real situations in which it is necessary to interrupt an ongoing activity before it comes to completion on a natural basis, e.g., failure of equipment in a manufacturing context; completion of an input or output activity in a multiprogrammed computing system; routing of roving vehicles, such as police cruisers, to a point of crisis; or simply providing immediate service to a high-priority demand which has occurred. Preemption logic is potentially quite complicated, including as it does the need to specify how the interrupted ongoing activity is to be handled, both at the time of preemption and subsequent to that time. This tutorial will explore various aspects of the preemption topic as implemented in GPSS.

1. OVERVIEW OF THE TUTORIAL

The GPSS preemption tutorial will present the two fundamental blocks used in GPSS to support preemption, then illustrate their use in a series of four examples:

(1) A one-line, one-server queuing system in which the one line is characterized by two types of users, Type 1 and Type 2, where Type 1 users have the right to interrupt the server and demand immediate service at the expense of Type 2 users. (This means that Type 2 users receive service only if no Type 1 users are present in the system.) Queue discipline within the class of Type 1 users is first-come, first-served, as it is within the class of Type 2 users. When displaced from the server by a Type 1 user, a Type 2 user simply stands by until the server again becomes available to him, at which time service for the Type 2 user is resumed.

(2) A one-line, multiple-server queuing system, modeled as an extension of the one-line, one-server system in (1). The complication here is that in GPSS, the preemption capability is implemented only with respect to servers who are simulated with the Facility entity. This means the Storage entity cannot be used to model parallel servers if they are to be subject to preemption; instead, the servers must be modeled with multiple Facilities which operate logically in parallel. A further complication is that only one line of users forms ahead of the battery of parallel servers. Use of SELECT blocks is indicated to support the logic of server selection by a user. Furthermore, User Chains come into use as a place to keep waiting users until such time as a server becomes available to them.

(3) and (4) The third and fourth examples illustrate options available to the displaced user other than simply standing idly by, waiting until service can begin again on his behalf. Specifically, the third example illustrates how the displaced user can proceed elsewhere in the model to do other things, with no particular intention of ever interacting with the server again. The fourth example shows how the displaced user can proceed elsewhere in the model to do other things, but with the intention of resuming his relationship with the server at a later time. This option is useful when it is necessary to take into account a time-cost connected with the preemption process. For instance, extra time is often required by a server when he resumes previously-interrupted work, and this extra time should be taken into account in determining when the previously-interrupted work will come to completion.

These examples, and supporting explanatory materials, are contained on pages 426-462 in Schriber 1974. The Winter Simulation Conference GPSS preemption tutorial will be based on transparencies taken from figures and ideas appearing in this source. The materials are too long to reproduce in these conference proceedings, but copies of the material

81CH1709-5/81/0000-0379$00.75

will be distributed to those in attendance at the tutorial. Those not attending the tutorial, and who do not have convenient access to the indicated source, can obtain single copies of the material on request from Thomas J. Schriber at the above address.

Additional preemption discussion and supporting examples can be found in Bobillier et. al. 1976, and in Gordon 1975. The various GPSS user's manuals can also be consulted for discussion of preemption principles.

REFERENCES

Bobillier, P.A., B.C. Kahan, and A.R. Probst (1976), Simulation with GPSS and GPSS V, Prentice-Hall, Englewood Cliffs, New Jersey.

Gordon, G. (1975), The Application of GPSS V to Discrete System Simulation, Prentice-Hall, Englewood Cliffs, New Jersey.

Schriber, T.J. (1974), Simulation Using GPSS, John Wiley & Sons, Inc., New York, New York.