STATISTICALLY SUITABLE INITIAL MULTIPLIER VALUES FOR IBM'S GPSS V RANDOM NUMBER GENERATORS

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ABSTRACT*

Five collections of statistically acceptable multiplier values suitable for use in initializing the random number generators in IBM's GPSS V are presented. The collections, each consisting of about 50 entries, are respectively appropriate for simulations in which given stochastic elements use sequences of approximately 600, 1200, 2400, 4800, or 9600 random numbers per replication. These sequences are short enough so that localized non-randomness can produce misleading simulation results unless multiplier values are chosen with care, and yet are long enough to span the number of random numbers typically need per stochastic element in many simulations. The multipliers, which take the form of odd, non-negative integers containing five or fewer digits, are statistically acceptable in the sense that they satisfy, at 0.10 and 0.02 significance levels, the one dimensional Chi-square and the Kolmogorov-Smirnov tests for uniformity; and autocorrelation, runs-above-the-mean, modified poker, and two-dimensional Chi-square tests which guard against the presence of unacceptable patterns in the sequences.

A sixth collection, consisting of those initial multipliers which are the most satisfactory on balance for all of the above sequence lengths, is also presented.

No particular pattern is evident in any of the acceptable multipliers, meaning that no guidelines can be given for selecting multipliers which are likely to produce statistically sound random number sequences of one or another length. Furthermore, not many multipliers are common to two or more of the five length-specific collections. This leads to the conclusion that it might be well for simulation languages to provide optional built-in statistical testing of the random number sequences actually produced by their underlying 0-1 uniform random number generators during the course of a simulation. The user could then be told whether each of the one or more random number sequences used in a given simulation was suitably random, or whether localized non-randomness was in effect to such an extent in one or more of the sequences that the simulation run should be discarded, or at least should be interpreted with unusual care.

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