ProbabilityManagement.org Random Number Generation Initiative

A new family of Random Number Generators

We at ProbabilityManagement.org in collaboration with Hubbard Decision Research are hosting an open forum to develop a new family of cross platform random number generators meeting a specified set of conditions.

Why bother?

There are many well tested random number generators available today, but the discipline of probability management has added two new desirable conditions.

Networked Simulation Support

The SIPmath™ Standard from ProbabilityManagement.org allows multiple simulations created by different authors on diverse platforms to be [networked](#) together through SIP Libraries of simulated trials[i]. The proposed Hubbard/Savage Framework for Coherent Random Number Management is being developed to prevent any two independent simulations from inadvertently using the same random number stream, while allowing intentionally dependent simulations to use the same stream. This assures that simulations may be networked without unintended correlations. To accomplish this, a pseudo random number generator is required with multiple seeds. Since these seeds are used to identify specific trials of variables for specific organizational models, we will refer to them as an "ID".

For example,

- A Trial ID to identify a particular trial.
- A Variable ID to identify a variable within a simulation.
- A Time Period ID in case time series are being modeled.
- An Entity ID, for example to identify all simulations from XYZ Corp.

This defines a multi-dimensional array of numbers in which it is desirable to be able to access any particular number directly through its four (or higher) dimensional address. Thus we refer to it as a Random Access Random Number Generator (RARNG). Note that recursive generators to not have this property, as each variate is based on the last variate instead of multiple input parameters. Note that one possible approach is to simply create data bases of random variates created by such means as atmospheric noise. Random.org currently generates such SIP Libraries in SIPmath format.

Excel SIPmath Support

Currently SIPmath in Microsoft Excel enables interactive simulation through the native Data table command, in which a Column Input cell named PM_Trials iterates through the trials with each keystroke. This provide an instant user base of roughly 500 million users who can access simulation dashboards created under the SIPmath standard. Thus the generators must be supportable with native Excel formulas.

NOTE: The HDR generator in the 3.0 SIPmath modeler tools is a first step in this direction. Developed by Doug Hubbard, it supports a Trial ID (PM_Trials) and a Variable ID only, which is automatically updated when a new variable is added to the model. This generator is designated as HDR1, and passes the "Small Crush" random number test. It is ideal for quickly generating spreadsheet simulations, but where higher quality is mandatory, the HDR instances in an Excel SIPmath model may be replaced retro actively with

Index calls into any regenerated set of numbers such as those from the Mersenne Twister or the L'Ecuyer MRG

The RARNG Initiative

This initiative is an open call for a Random Access Random Number Generator (RARNG) which satisfies the conditions below. Email Support@ProbabilityManagement.org if you wish to make a submission.

1) It passes at least 12 of the "dieharder" tests (or equivalent in Crush) and fails none of them (the remainder being "weak" passes).
2) It can handle 6 and 12 digit IDs for the following: Entity, Variable, Trial, and Time.
3) Preferably it can fit in a single Excel cell with less than 1000 characters, but multi-cell formulas will not be disqualified if they offer significant other advantages.
4) It cannot violate precision limits in Excel (no operation can produce a value greater than 15 decimal digits) or other limitations for Excel functions (such as the dividend in a mod() function cannot be more than 2^27 times the divisor).

Also, time performance is a consideration but alternatives will be measured against each other on selected hardware. To be competitive, the proposed method should generate 1 million Trials for a single Variable I in less than 10 seconds in Excel running on an i5 processor.

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[i] Towards a Simulation Network – or – The Medium is the Monte Carlo (with apologies to Marshall McLuhan), Sam Savage & Marc Thibault, Proceedings of the 2015 Winter Simulation Conference http://www.informs-sim.org/wsc15papers/467.pdf