## Obtaining consistent results between simulations

When working in teams, a model is often passed around for development, review and verification. It is quite common to observe small variations in the output statistics. For instance, the mean, standard deviation or percentile values of a forecast may be slightly different when the simulation is run on different computers, or even at different times. This newsletter is intended to provide an understanding of how random numbers are generated in Crystal Ball and how this can be controlled to obtain more consistent results.

### Random number seed

Crystal Ball uses a particular formula to generate a series of random numbers for the input probability distributions. The formula uses an initial 'seed' value to generate these numbers and the seed can be specified in Run Preferences > Sampling. Left unchecked, Crystal Ball uses the *number of milliseconds elapsed since Windows started* as the seed. Because of variations in the random number seed, you may see differences in the output statistics.
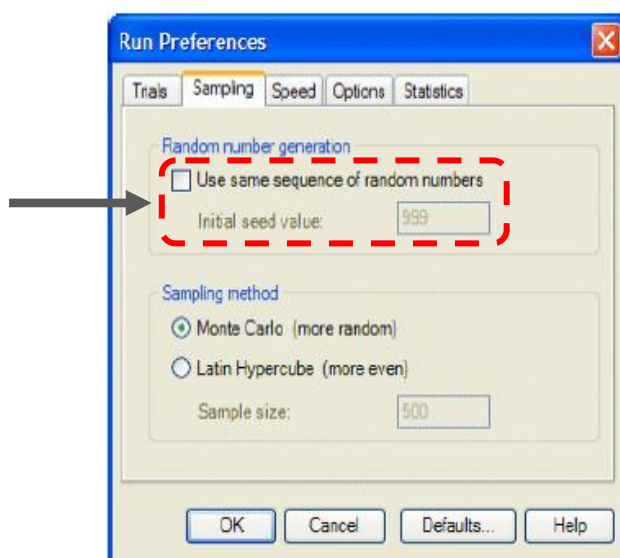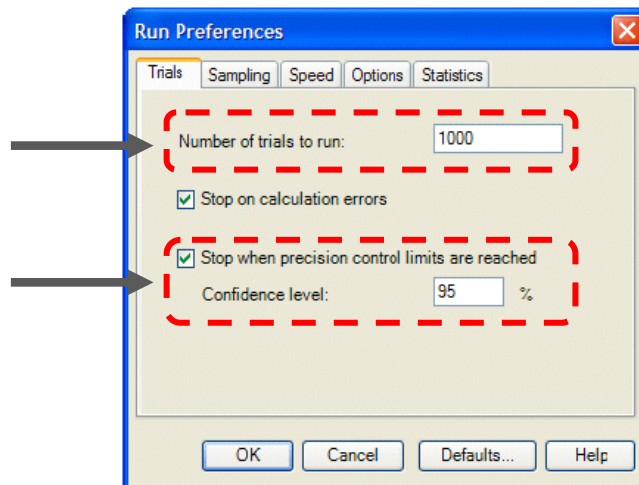


Sampling options in Crystal Ball Run Preferences

If the seed is specified, the same sequence of random numbers will be generated every time you run a simulation. In order to obtain consistent output statistics, the initial seed should always be set.

### Number of trials

The number of trials determines the maximum number of simulations that Crystal Ball runs before it stops and can be specified in Run Preferences > Trials. More trials lead to better statistical accuracy but requires longer simulation time. To ensure that outputs are consistent you should always use the same number of trials.

Trials options in Crystal Ball Run Preferences

## Takeaway

In summary, to obtain consistent results you should:

1) Set a specific *seed* value and *number of trials* to be used by everyone in the organisation. The easiest value to use for the seed is '1'.
2) If you are using precision control, ensure that everyone is using the same settings*.

*Precision control requires further explanation which will be addressed in the next newsletter. If you require immediate help, please contact Dan Tengku at crystalball@hearne.com.au.

**Note:** If you are using Excel 2007 with multi-threading, there is no guaranteed order of execution for user-defined functions included in Crystal Ball models. For this reason, they will not always return consistent results, even if a seed is set.