mrg32k3a

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CONTENTS

This package provides a Python implementation of the mrg32k3a pseudo-random number generator of L'Ecuyer (1999) and L'Ecuyer et al. (2002). It extends the implementation used in PyMOSO to handle streams, substreams, *and* subsubstreams. The generator's period of 2^{191} is split into 2^{50} streams of length 2^{141}, each containing 2^{47} substreams of length 2^{94}, each containing 2^{47} subsubstreams of length 2^{47}.

CHAPTER

ONE

DETAILS

The mrg32k3a module includes the `MRG32k3a` class and several useful functions for controlling the generators.

- The `MRG32k3a` class is a subclass of Python's `random.Random` class and therefore inherits easy-to-use methods for generating random variates. E.g., if `rng` is an instance of the `MRG32k3a` class, the command `rng.normalvariate(mu=2, sigma=5)` generates a normal random variate with mean 2 and standard deviation 5. Normal random variates are generated via inversion using the Beasley-Springer-Moro algorithm.
- The `MRG32k3a` class expands the suite of functions for random-variate generation available in `random.Random` to include `lognormalvariate`, `mvnormalvariate`, `poissonvariate`, `gumbelvariate`, `binomialvariate`. Additionally, the methods `integer_random_vector_from_simplex` and `continuous_random_vector_from_simplex` generate discrete and continuous vectors from a symmetric non-negative simplex.
- The `advance_stream`, `advance_substream`, and `advance_subsubstream` functions advance the generator to the start of the next stream, substream, or subsubstream, respectively. They make use of techniques for efficiently "jumping ahead," as outlined by L'Ecuyer (1990).
- The `reset_stream`, `reset_substream`, and `reset_subsubstream` functions reset the generator to the start of the current stream, substream, or subsubstream, respectively.

The matmodops module includes basic matrix/modulus operations used by the `mrg32k3a` module.

CHAPTER

TWO

DOCUMENTATION

Full documentation for the mrg32k3a and matmodops modules.

CHAPTER

THREE

REFERENCES

- Cooper, Kyle and Susan R. Hunter (2020). "PyMOSO: Software for multi-objective simulation optimization with R-PERLE and R-MinRLE." *INFORMS Journal on Computing* 32(4): 1101-1108.
- L'Ecuyer, Pierre (1990). "Random numbers for simulation." *Communications of the ACM* 33(10):85-97.
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- L'Ecuyer, Pierre, Richard Simard, E Jack Chen, and W. David Kelton (2002). "An object-oriented random number package with many long streams and substreams." *Operations Research* 50(6):1073-1075.