CLAIMS

Claim 1. A computer-implemented method for generating at least one discrete random variable capable of being stored in a hardware data storage, the method comprising:

selecting or receiving a convergent infinite series;

based on the convergent infinite series, providing a Discrete probability distribution with infinite sample space having elements, including:

selecting or receiving a first finite sample space, wherein the infinite space includes the first finite sample space and a second infinite sample space, and

assigning an equal probability to first finite elements corresponding to the first finite sample space, and

assigning probabilities, which are derived from the infinite terms of the convergent infinite series, to second infinite elements corresponding to the second infinite sample space, wherein the elements of the infinite sample space include the first finite elements and the second infinite elements;

ascertaining a cumulative probability distribution of the Discrete probability distribution;

estimating a probability of random variable generation failure due to hardware constraints by ascertaining an integration approximation or improper integral of the convergent infinite series using a start limit based on an upper limit of a hardware data storage capacity per random variable and an end limit based on infinity; and

generating the at least one discrete random variable from the infinite sample space if the cumulative probability distribution is equivalent to one and if the probability of failure is less than a predetermined value.

Claim 2. The computer-implemented method of claim 1, wherein the infinite elements are non-numerical.

Claim 3. The computer-implemented method of claim 1 or claim 2, further comprising:

providing the at least one discrete random variable in producing a

random number, constructing a symmetric key, or constructing a cipher text.

Claim 4. The computer-implemented method of any one of claim 1 to claim 3, wherein the first finite sample space is arbitrarily selected.

Claim 5. The computer-implemented method of any one of claim 1 to claim 4, further comprising:

ascertaining a variance and an expectation of discrete random variable;

selecting or receiving a different convergent infinite series upon ascertaining any one of the following: the variance is infinite and the mean is infinite, the variance is infinite and the mean is finite, and the variance is finite and the mean is finite;

using the different convergent infinite series, providing a different Discrete probability distribution with the infinite sample space;

ascertaining a cumulative probability distribution of the different Discrete probability distribution; and

generating at least one different discrete random variable from the infinite sample space if the cumulative probability distribution of the different Discrete probability distribution is equivalent to one.

Claim 6. The computer-implemented method of any one of claim 1 to claim 5, further comprising:

providing a modified Discrete probability distribution with the infinite sample space having the elements, including: interchanging the equal probability of at least one of the first finite elements with at least one of the probabilities of at least one of the second infinite elements;

ascertaining a cumulative probability distribution of the modified Discrete probability distribution; and

generating at least one discrete random variable by utilising the modified Discrete probability distribution if the cumulative probability distribution is equivalent to

one.

Claim 7. A random number generation apparatus comprising:

at least one memory unit for storing computer-executable instructions; and

at least one computer processor communicably coupled to the at least memory unit and configured to: execute the computer-executable instructions to perform the method according to any one of claim 1 to claim 6.

Claim 8. A non-transitory, computer readable medium comprising computer-executable instructions configured to direct at least one computer processor to perform the method according to any one of claim 1 to claim 6.