Stream Cipher
Pseudorandom Number Generator

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The PRNG was designed based on the Linear Congruential Generator according to the lecture slides Symmetric Key Encryption I.

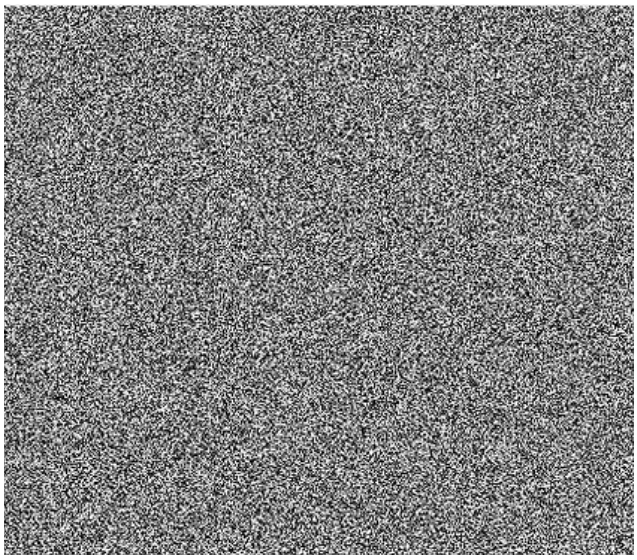
It generates uniform random numbers by using modulo arithmetic and a recursive calculation:

$$xi+1 = axi + b \bmod m$$

The following conditions were considered in design of this generator:
- Very long period
- multiplier a ε [1, m – 1] , constant b ε [0, m – 1]

When choosing a number for m in a linear congruential generator (LCG), there are different strategies, however, in order to safely encrypt as many bytes as feasible, we needed to choose a high value modulus and a primitive root that would result in a high period.
The most common is for m to be a prime (according to Euler's function, prime numbers give long period). As a result, I chose the largest prime that can be represented by int.[1,2] The variable modulus that I've chosen is
$2^{31} - 1 = 2,147,483,647$.
The suggested primitive root modulo M31 which is tried and true is
a = 48, 271, now known as MINSTD. Languages like C++11 make use of these values.[3] The offset b does not change the statistical properties, so I have just set the constant to 0.

Java's java.util.Random use 2^{48} for m and 25214903917 ($5DEECE66D_{16}$) for multiplier a.[4] So, $\Phi(m) = 2^{47} = 140737488355328$.



Bitmap generated by Java Random[5]