Computational details on the search for duplications in the outputs of MersenneTwister Pseudorandom Number Generator MT19937

We present here the number of distinct cases that arise due to the mathematical exceptions described in the paper "Some Patterns of Duplications in the outputs of MersenneTwister Pseudorandom Number Generator MT19937" (preprint available at https://arxiv.org/abs/2512.21678)

After initial indications from the results of our VLST (Very large-scale tests No. 4) showing exceptionally high numbers appear at repetition 623, 1246 and above, we found that these repetitions are caused by duplications occurring at the distances of 227-454-908-1816-3632-7264. The distance of 227 was identified by Makoto Matsumoto after mathematically analysing the structure of the problem.
To systematically search for duplications at these distances, we ran 800 streams of 32-bit random numbers using MT19937, each stream containing 125'000 billion numbers, for a total of 10^17 numbers. The MT19937 was initialised with 624 * 32-bit random numbers. After generating a new random number, we checked for potential duplicates at the six specified distances. For every detected case, we recorded a line in a file indicating the stream-number, the distance, the position within the stream and the value of the random number.

Recap. of the number of identical (pairs) found at the 6 distances:

227	=	23279312
454	=	23288180
908	=	23285021
1816	=	23282936
3632	=	23277828
7264	=	23294061
Total	:	139707338

average per distance: 23284556.333…
expectation: 23283064.365…

These figures seem in line with the probability, no excessive cases.

Recapitulation of the 2-fold found, always same distance between the pairs:

227-454	=	11642253
454-908	=	5820827
908-1816	=	1455374
1816-3632	=	91271
3632-7264	=	356

Recapitulation of the 3-fold found:

```
 227-454-908     =   2909389
 454-908-1816    =    363630
 908-1816-3632   =      5772
1816-3632-7264   =         0
```

Recapitulation of the 4-fold found:

```
 227-454-908-1816    =   181753
 454-908-1816-3632   =     1430
```

Recapitulation of the 5-fold found:

```
227-454-908-1816-3632   =    677
```

This last case of 5 pairs at specific distances is also possible by true probability, but of course not at a frequency of 1 in 147710 billion cases, as we measured.

The other, 2-fold, 3-fold and 4-fold also occur at a higher frequency than expected by true probability. In contrast, this does not influence the total probability for pairs at specific distances.

Example of a detected 5-fold case:

```
2000    227    109396943358327    3452421575
2000    454    109396943358950    1889556475
2000    908    109396943360196    2951015737
2000   1816    109396943362688    3598719214
2000   3632    109396943367672     564280131
```

The analysis was performed on the HPC "Tralles" from SICAP R&D.

Weidingen, 29. December 2025

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