Is lottery fair?

Michal Horáček
Matrikelnummer 6373382
`michal.horacek@student.uni-tuebingen.de`

Carson Zhang
Matrikelnummer 6384481
`carson.zhang@student.uni-tuebingen.de`

Abstract

We investigate lottery.

1   Introduction

Lottery/Hazard business is big many. Games such as lottery and dice are (probably?) one of the first application of randomness in human culture. But for the same time organizers have cheated in lotteries, skewing the uniform distribution of drawn numbers expected by common sense for their own monetary gain. We investigate the distribution of answers for the German Lotto lottery drawn from 1955 to the present day.

In the second part of this paper, we explore the "quality" of random numbers generated by lottery draws via the Diehard battery of tests [1]. These tests were developed in the 1990's by George Marsaglia and are still in use today to test random number generators [2].

2   Dataset

Our primary dataset consists of numbers drawn in German lottery Lotto from 1955 onwards. We have focused on these dataset because of geographical locality and historical depth of 70 years. Since its beginning, the rules have undergone slight changes, such as the introduction of "super numbers" in December of 1991. Nonetheless, the core principle of the lottery, six numbers between 1 and 50 has not changed once in almost 70 years and thus provides a consistent basis for our work.

Is there a dataset for a rigged lottery?

However even 70 years of Lotto numbers is not sufficient to produce enough data for the diehard tests. These require 10 to 12 MB of random bits, which is substantially more than 28.4 KB of Lotto numbers.

Merge datasets?

The numbers are drawn individually, but their order within a single lottery draw does not matter - but maybe it does for some of our tests?

Investigate this

3   Methods

In the first part we test whether the drawn numbers come from a uniform distribution $\mathcal{U}(1, 50)$. To investigate this, we use Pearson's χ^2 test and the Kolmogorov-Smirnov test.

For more information about the Diehard battery of tests we refer the reader to the original paper [3].

4 Results

We have applied the tests and found that we are indeed very smart.

5 Discussion

Hard to say when no research has been done at the moment.

References

[1] George Marsaglia. The marsaglia random number cdrom including the diehard battery of tests of randomness. https://web.archive.org/web/20160125103112/http://stat.fsu.edu/pub/diehard/, 1995.

[2] Migran Gevorkyan, Anastasia Demidova, Anna Korolkova, and Dmitry Kulyabov. A practical approach to testing random number generators in computer algebra systems. *Computational Mathematics and Mathematical Physics*, 60:65–73, 03 2020.

[3] George Marsaglia. A current view of random number generators. In Elsevier Science Publishers, editor, *Computer Science and Statistics, Sixteenth Symposium on the Interface*, 1985.