Ten – digit sequence – generating and testing randomness in random numbers

Manav Prabhakar

December 16, 2020

Problem Analysis

A sequence of 10 - digit numbers need to be formed but each of these 10 digits need to be selected randomly. After that, from each of the 10 - digit numbers, 1 digit needs to be selected randomly and a sequence needs to be formed. Then we need to check the randomness of this sequence.

Solution

Forming the sequence:

Hundred 10 – digit numbers were formed. The digits were selected from a discrete uniform distribution. After that, one digit was selected at random from all these 10- digit numbers. In the end we were left with hundred single-digits.

Checking the Randomness:

Interval	O_i	E_i	$(O_i-E_i)^2/E_i$

For our case, the intervals I took were: (0, 1), (2, 3), (4, 5), (6, 7), (8, 9)

Total intervals = 5.

After evaluating the above values for a particular sequence, the X_0^2 was much higher than the value from Chi-square table for alpha = 0.05 and 0.1. Thus, the sequence fails the Chi-square test.

Takeaways

It may be possible that for some sequence, the chi-square test may succeed. For that we can run the algorithm continuously generating random sequences till certain threshold iterations are complete or the sequence passes the test. Also, the higher the number of ten-digit numbers, the lesser the possibility of the sequence to pass the Chi-Square test.

---x---