**3.** Report the number of 1's and 0's in this sequence. How do these numbers compare?

The results show:

* Number of 1's: `510`
* Number of 0's: `490`

These numbers compare quite closely. In a sequence of `1000 bits`, we have `510 1's (51%)` and `490 0's (49%)`. This is very close to the ideal `50/50` split we would expect in a truly random binary sequence.

The difference between the number of `1's` and `0's` is only `20`, which is a relatively small deviation for a sequence of this length. In a perfectly random sequence, we would expect some variation from exactly `500/500`, and this level of variation is well within normal expectations.

This close balance suggests that the generator produces output that appears random in terms of the `1's` and `0's` distribution.

**4.** Consider the sequence "01". How many times does this substring occur in your output sequence? How many times would you expect it to occur in a truly random output sequence?

The results show:

* Observed count of "01" substrings: `248`
* Expected count in a truly random sequence: `249.75`

In the output sequence, the "01" substring occurs `248` times.

In a truly random output sequence of `1000 bits`, we expect the "01" substring to occur about `249.75` times. This is calculated as follows:

* In a `1000-bit` sequence, there are `999` overlapping `2-bit` subsequences.
* In a truly random sequence, each `2-bit` pattern `00, 01, 10, 11` should occur with an equal probability of `1/4`.
* So, the expected count for any `2-bit` pattern is: `999 \* (1/4) ≈ 249.75`

The observed count `248` is remarkably close to the expected count `249.75`. The difference is less than `1%`, which is an excellent match to what we would expect from a truly random sequence.

This close alignment between the observed and expected counts suggests that the generator produces output that closely resembles a truly random sequence, at least in terms of the frequency of this particular substring.

In conclusion, the distribution of `1's` and `0's` and the frequency of the "01" substring in the output sequence closely match what we expect from a truly random binary sequence. This provides good evidence that the implementation of the *linear congruential generator* produces an output with properties of randomness.