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CS1538 - Assignment #2, Writeup

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Random Number Generators

Random numbers… because deterministic… goal is to get a long period between repeats… and have no patterns — to be uniformly distributed.

Null hypothesis…

Linear Congruential Generators are …. which…

In this assignment, three (3) total Linear Congruential Generators:

1. Python's Built in Random Function
2. A Linear Congruential Generator (LCG) with Seed value:
3. A Linear Congruential Generator with the RANDU initial settings

In this report, we will run a suite of tests on the output of each generator, attempting to determine just how random each function really is. All random functions except the RANDU are seeded with the value: 123456789. To replicate each test described here, please run and see the source code in: lcgy.py, which is attached.

Python Random

The random library function supplied by the Python programming language is called by invoking random(), which calls Pseudo-Random Number generation algorithm known as the “Mersenne Twister” (PyDocs). The Mersenne Twister makes use of very large prime numbers to is known to have a period of **(2^(19937)−1)**. It is known to pass many statistical randomness tests (Mersenne Twister Wiki), And the results of my testing we as follows:

Test Name	**Sample Size**	**Significance Level**	**Critical Value**	**Test Statistic Found**	**Result**
Chi-Square	10000	0.80	118.5	9.754	FAIL TO REJECT Null Hypothesis
Chi-Square	10000	0.90		9.754	FAIL TO REJECT Null

					Hypothesis
Chi-Square	10000	0.95		9.754	FAIL TO REJECT Null Hypothesis
Kolmogorov-Smirnov	first 100 values				
Runs Test	10000				
Autocorrelation Test with GapSize=2	10000				
Autocorrelation Test with GapSize=3	10000				
Autocorrelation Test with GapSize=5	10000				
Autocorrelation Test with GapSize=50	10000				

##

Once you have done all of your tests, you must look over and analyze your results and present them in a well-written, well-formatted report. Your report should include a discussion of the following:

- What is the random library function that your compiler supplied for you?
- Summarize the outcomes of the statistical tests for each RNG method in a formatted, easy to understand table. What test(s) did the method "pass"? Be specific about the condition (i.e., at what level of significance).
- For each method, prior to generating the numbers and running the statistical tests, do you expect it to work well or poorly? Explain.
- Looking over some of the generated numbers for each method (but before running the statistical tests), do you think they look sufficiently random? Did the outcome of the statistical test surprise you?
- Discuss whether you think the set of experiments you did for this assignment is sufficient. If so, argue why that is the case. If not, explain what additional test(s) or modification(s) to the methodology you'd perform.

Works Cited

Python Random Library Docs:
https://docs.python.org/2/library/random.html

Marsenne Twister:
https://en.wikipedia.org/wiki/Mersenne_Twister#cite_note–32