MFE405 Project 1

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Problem 1.

1.

LGM:

Empirical mean is 0.4981242345508766

Empirical standard deviation is 0.28946867766385515

2.

BuiltIn:

Mean is 0.49791188132181863

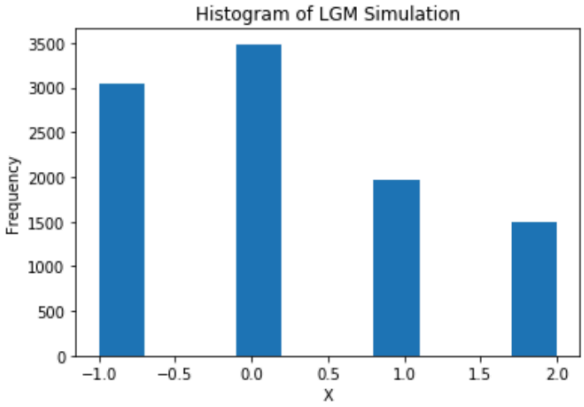
Standard deviation is 0.2870777567699688

3.

The mean and standard deviation of random variables generated by LGM is very close to the BuiltIn method in Python, which suggests that the LGM is a practical way to generate uniform distributed random variables.

Problem 2.

1.



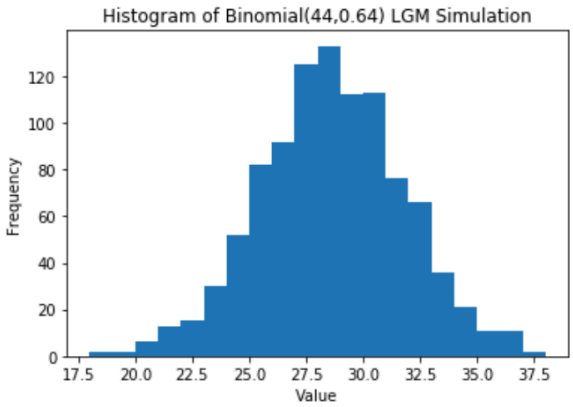
2.

Empirical mean is 0.1926

Empirical standard deviation is 1.0317486321774312

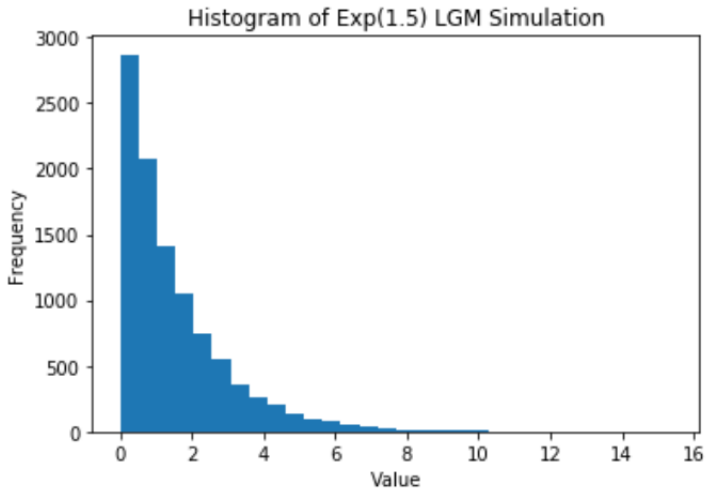
Problem 3.

1.



2.
By simulation, P(X>=40)= 0.0 when X~Binomial(44,0.64)
From statistical solution,
P(X>=40)= P(X=40)+ P(X=41)+ P(X=42)+ P(X=43)+ P(X=44)= 0.0000482366
Since we only generate 10000 random variables, the frequency of X>=40 should be 10000*0.0000482366=0.482366 which is smaller than 1. Hence it is acceptable that we haven't got X>=40 in the simulation. If we increase the number of generating random variables, we will get the expected result.

Problem 4.
2.
P(X>=1)= 0.5132 when X~Exp(1.5)
P(X>=4)= 0.0742 when X~Exp(1.5).
3.
Empirical mean is 1.5153435800740016
Empirical standard deviation is 1.5235044966432918



Problem 5.
1.
Box-Muller Method:
Empirical mean is -0.0004073189565835943
Empirical standard deviation is 0.9982940457952982
2.
Polar-Marsaglia Method:
Empirical mean is -0.0015003443278965775
Empirical standard deviation is 1.0002821777690862
3.
The execution time of Box-Muller method is 0.018122000000001748
The execution time of Polar-Marsaglia method is 0.013545000000000584
The Polar-Marsaglia method is more efficient.