Computational Finance Problem Set 1

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QUESTION 1

The Mean of LGM is **0.499444**

The Standard Deviation of LGM is **0.288513**

The Mean of Inbuilt is **0.497515**

The Standard Deviation of Inbuilt is **0.289374**

The mean and standard deviation between the two methods are very similar.

The small difference might be due to the choice of the seed and the default random generator might not be using the same parameters as the LGM method

Histogram

-1 ||****************************

0 ||************************************

1 ||********************

2 ||****************

QUESTION 2

The Mean of Bernoulli is **0.2014**

The Standard Deviation of Bernoulli is **1.02997**

Histogram

```
16  ||*
19  ||*
20  ||*
21  ||*
22  ||***
23  ||****
24  ||******
25  ||********
26  ||**********
27  ||*************
28  ||************
29  ||************
30  ||************
31  ||********
32  ||******
33  ||****
34  ||****
35  ||**
36  ||*
37  ||*
38  ||*
```

QUESTION 3

Probability that binomial value is at least 40 is 0

The mathematical formula which needs to be used is $P(X>=40, p) = P(X=40) + P(X=41) + P(X=42) + P(X=43) + P(X=44)$,

where $P(X=k,p) = 44Ck \, (p^k) \, ((1-p)^{(1-k)})$

Probability using math formula that binomial value is at least 40 is 4.82366e-05

The probability from mathematical formula is very small and is almost equal to 0, which is the value from the statistical method.

This is because to get 40 true values out of 44 independent observations is very low, i.e. $(0.64)^{40} \sim 0$

QUESTION 4

Probability that exponential distribution is greater than 1 0.5081

Probability that exponential distribution is greater than 4 0.0706

Histogram

```
<=0  ||**************************************************
<=1  ||***********************
<=2  ||*************
<=3  ||*******
<=4  ||****
<=5  ||**
<=6  ||**
<=7  ||*
<=8  ||*
<=9  ||*
<=10 ||*
<=11 ||*
<=12 ||*
<=13 ||*
<=14 ||
<=15 ||
<=16 ||*
<=17 ||
```

Mean of exponential distribution is **1.50164**

Standard Deviation of exponential distribution is **1.51054**

QUESTION 5

The mean of box muller normal distribution is **-0.00133455**

The standard deviation of box muller normal distribution is **1.00771**

The mean of polar marsaglia normal distribution is **0.0036287**

The standard deviation of polar marsaglia normal distribution is **0.979747**

Timing difference between Polar Marsaglia and Box Muller in seconds for 5000 normal random numbers is **0.069**

Timing difference between Polar Marsaglia and Box Muller in seconds for 10000 normal random numbers is **0.129**

It can be clearly seen that the Box muller method is more efficient as the number of random numbers to be generated increases