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PHYS 512
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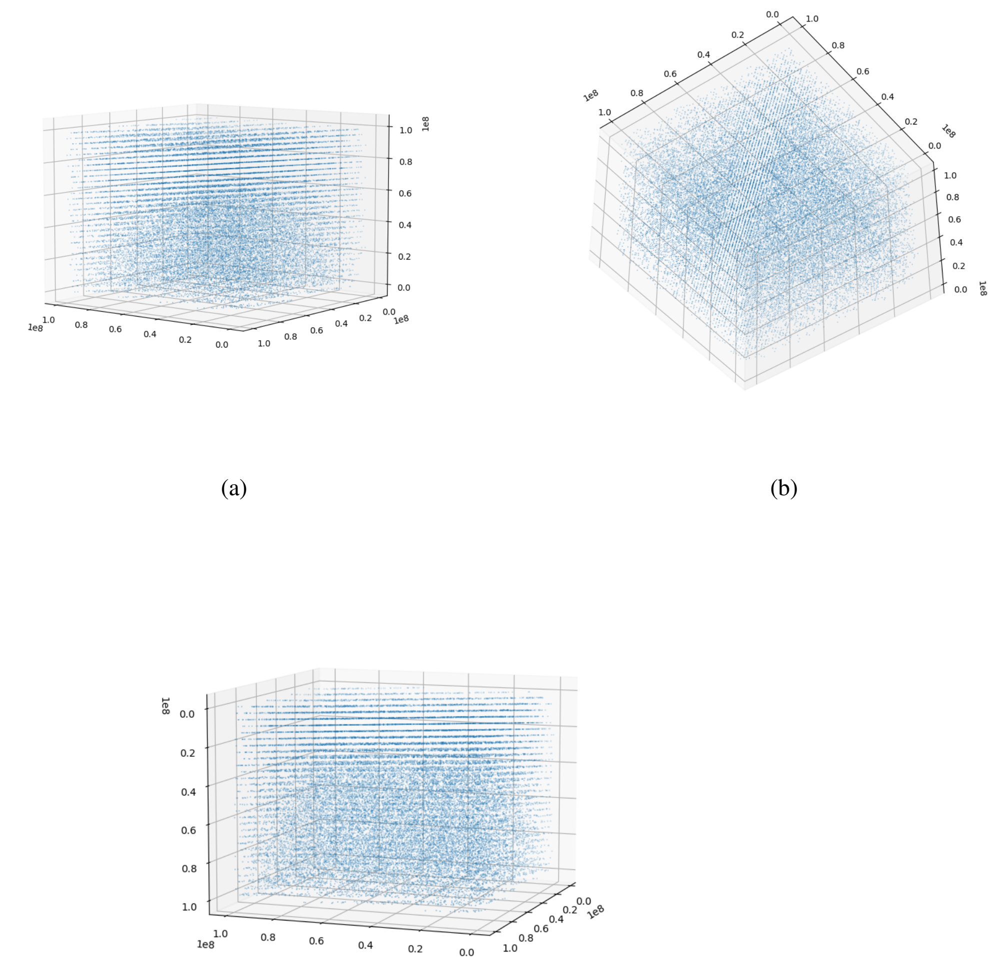
Problem Set 7

1 PRNG

We first look at the 3D data set generated by the C standard library in Figure 1. It is clear than when we are rotating it at certain angles, those points lies within the same plane. Which is bad.

We perform the same check on a python RNG, which we write up a similar code in prng_py.py. We show the results in figure 2. I've tried rotating at different angles, but all the points are scattered randomly without lying on the same planes. This is an indicator that this PRNG is less flawed.

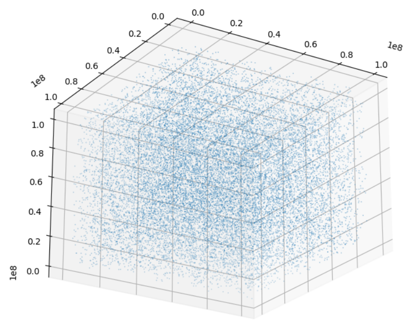
I didn't have time to run it on my local machine. :)



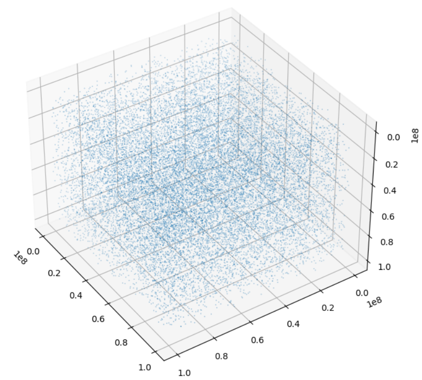
(a) (b)

(c)

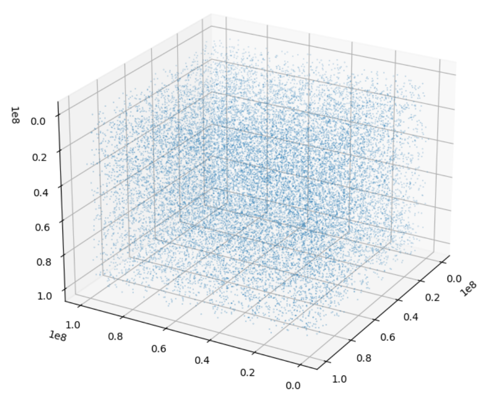
Figure 1: 3D display of the pseudo-random number generator by the C standard library.



(a)



(b)



(c)

Figure 2: 3D display of the pseudo-random number generator by the python library.

2 Rejection Method

We look at the distribution of the four curves: The exponential, the Lorentzian, the Gaussians and the power laws, as shown in Figure 3.

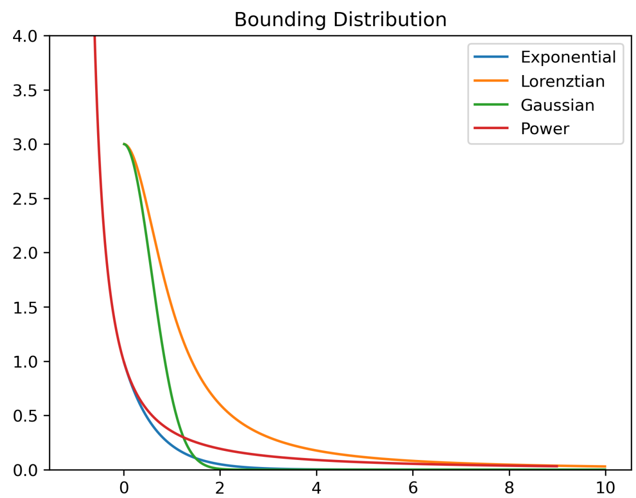


Figure 3: Plot of Distribution of Three different bounding functions and the exponential.

In order for us to use the bounding curve, we would need it to lie completely above the one that we wish to generate (The blue). We see that both power law and lorenztian satisfy this condition. However, Gaussian intersects the exponential halfway and goes below it, making it unsuitable for the rejection method.

Figure 4 shows the histogram of the deviates when using a Lorenztian curve. Here, the efficiency is 0.501, which indicated that 50% of the points are being used.

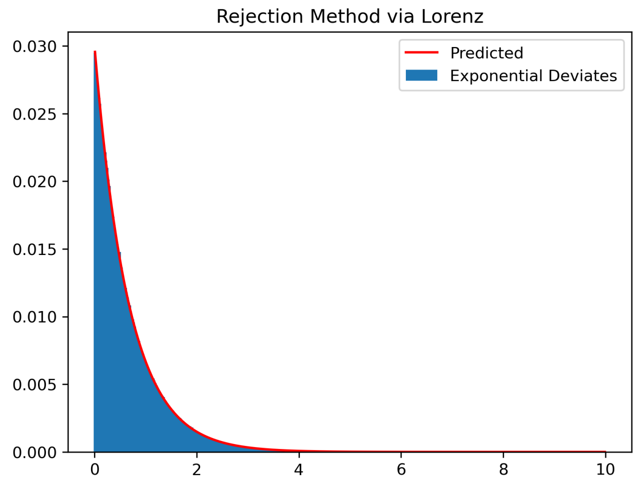


Figure 4: The exponential deviates using rejection method with Lorenztian bounding curve.

Figure 5 shows he histogram of exponential deviates using a power law. Here efficiency is 0.074. Hence, the lorenztian method is more efficient in generating our desired outcome.

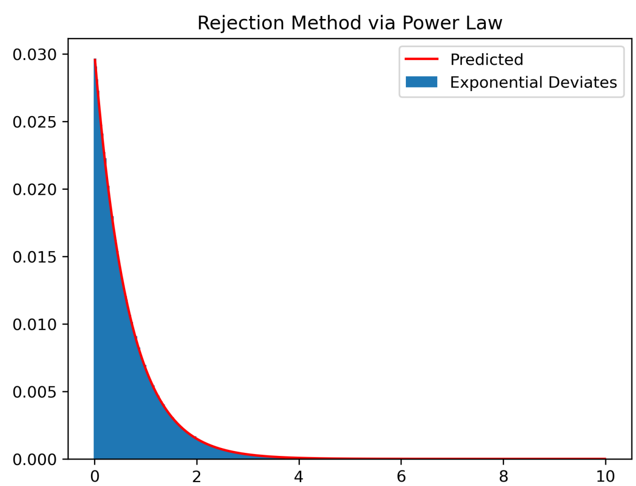


Figure 5: The exponential deviates using rejection method with Power Law bounding curve.

3 Rejection via Ratio-of-uniforms generator

Here, we have $0 < u < 1$, which gives the limit on v to be $-0.8 < v < 0.8$. Any values smaller than 0.5 would not exclude the exponential deviates within its boundary.

Figure 6 shows the histogram of exponential curve using Ratio-of-uniforms method. The efficiency of Ratio-of-Uniform Generator is 0.71. The smaller v we take, the higher the efficiency. But we do have to make sure than it is the correct boundary.

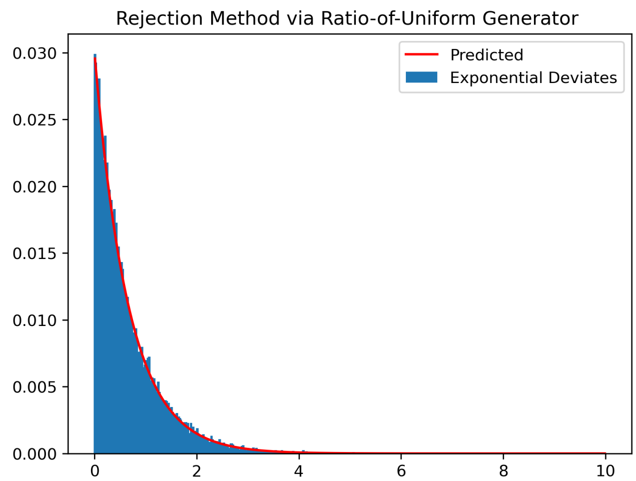


Figure 6: The exponential deviates using rejection method with Ratio-of-uniform method.