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ELEC 3800 – project 2

Due: 09/21/21

1. What is the expected shape of the histogram based on the shape of the density function of the random number generator? Why does the plot vary from its expected shape?

* The expected histogram should look like a Gaussian. The mean value should be in the middle of the curve while the starting and ending ends lower toward the x-axis. The plot varies because the number of bins is not high enough to adequately represent the data as a Gaussian. As the experiment is rerun with different numbers, the magnitude of the bins fluctuates and the overall plot changes into a new shape.
* **Code:**

array = rand(100,1);

hist(array,10)

A close up of a logo

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Figure 1: Rand Function Histogram Trial #1

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Figure 2: Rand Function Histogram Trial #2

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Figure 3: Rand Function Histogram Trial #3

1. How does the bar plot change from the exercise above with 2,000,000 random variables?

* The bar plot flattens out with an almost equal distribution across all the bins.
* **Code**:

array = rand(2000000,1);

hist(array,10)

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Figure 4: Rand Function with 1,000,000 Random Variables

1. What is the shape of the histogram using the randn function and 30 bins?

* The plot takes on the general shape of a Gaussian.
* **Code**:

array = randn(2000000,1);

hist(array,30)

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Figure 5: Randn Function with 30 Bins

1. How much does the variance change as a result of multiplying by 3? What differences do you see between this plot and that of 4?

* The variance increases by a factor of 4. The overall shape of the two plots is very similar. However, the plot from 5 has a slightly sharper curve at the peak of the curve. This is most likely a coincidence, as the curve varies when the code is run again.
* **Code:**

array = randn(2000000,1);

var(array)

array = array .\* 3;

var(array)

array = array + 4;

hist(array,30)

* **Output**:

ans = 0.999

ans = 3.9959

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Figure 6:

1. Do the plots look the same or similar in shape?

* No. The rand function plot looks like a uniform distribution plot, whereas the randn function looks like a Gaussian.
* **Code**:

array = rand(2000000,1);

xform = sqrt(-2\*log(1 - array));

figure(1)

hist(array,100)

figure(2)

hist(xform,100)

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Figure 7: Rand Function

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Figure 8: Transformed Rand Function