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ELEC 3800 – project 2

Due: 09/21/21

2. 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)
```

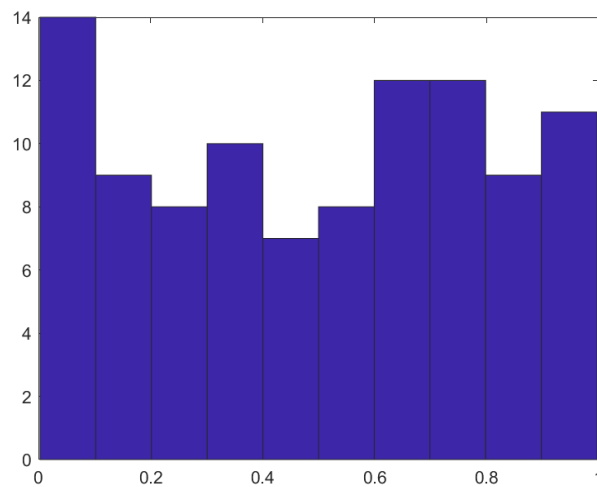


Figure 1: Rand Function Histogram Trial #1

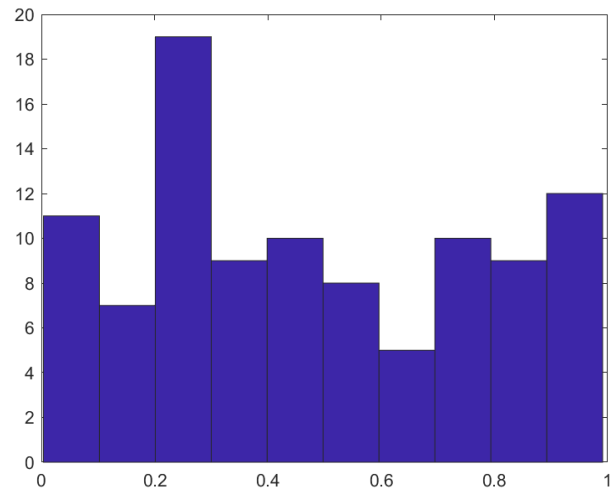


Figure 2: Rand Function Histogram Trial #2

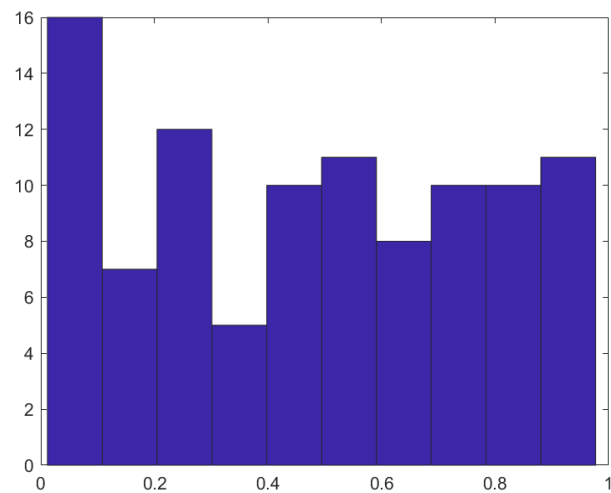


Figure 3: Rand Function Histogram Trial #3

3. 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)
```

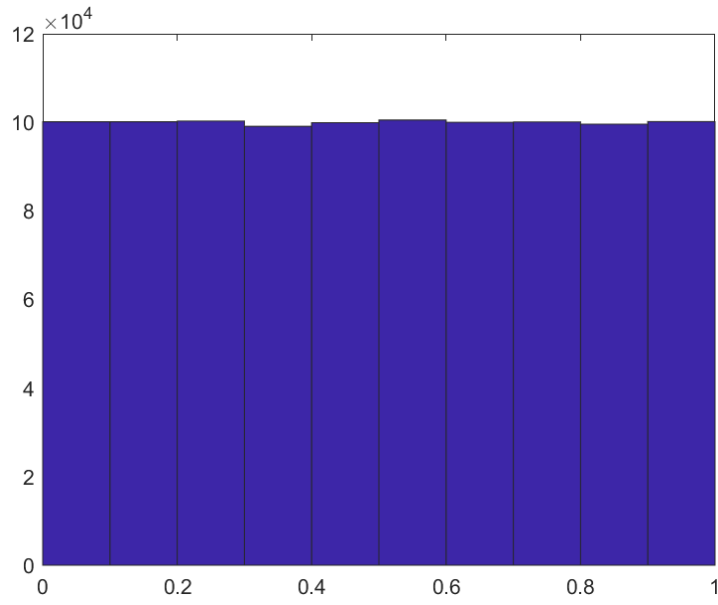


Figure 4: Randn Function with 1,000,000 Random Variables

4. 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)
```

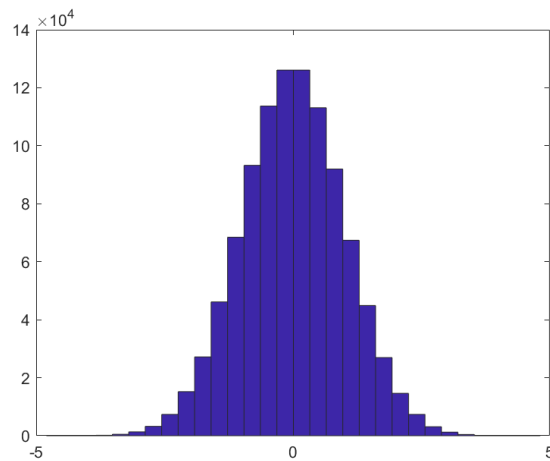


Figure 5: Randn Function with 30 Bins

5. 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

```

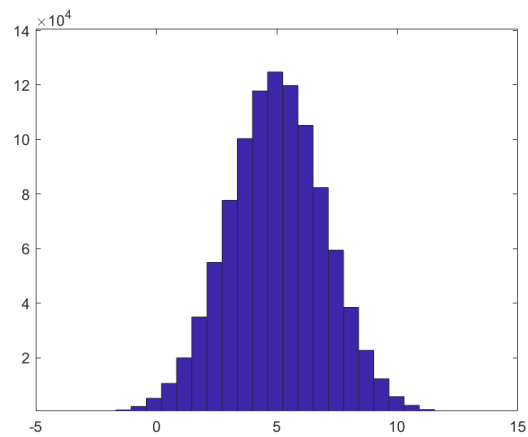


Figure 6:

6. 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)

```

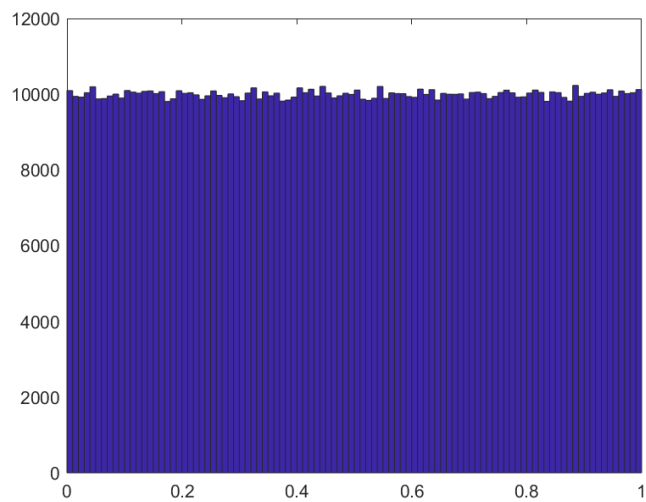


Figure 7: Rand Function

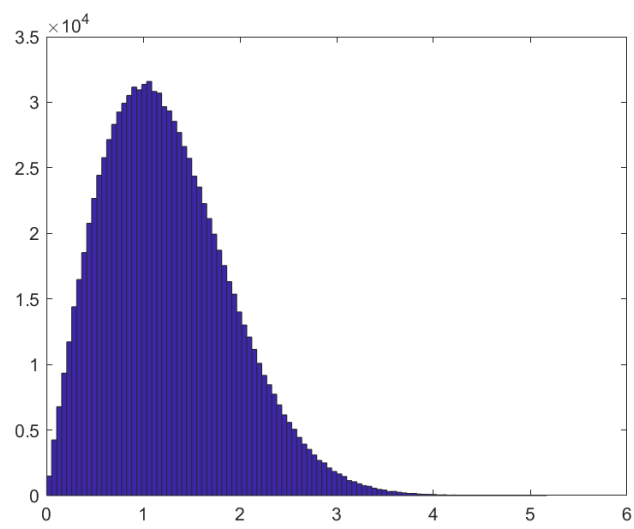


Figure 8: Transformed Rand Function