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COMPE510 - Fall 2025  
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## Programming Assignment 1 - Probability Theory

### A) Results

#### - Toss A Coin

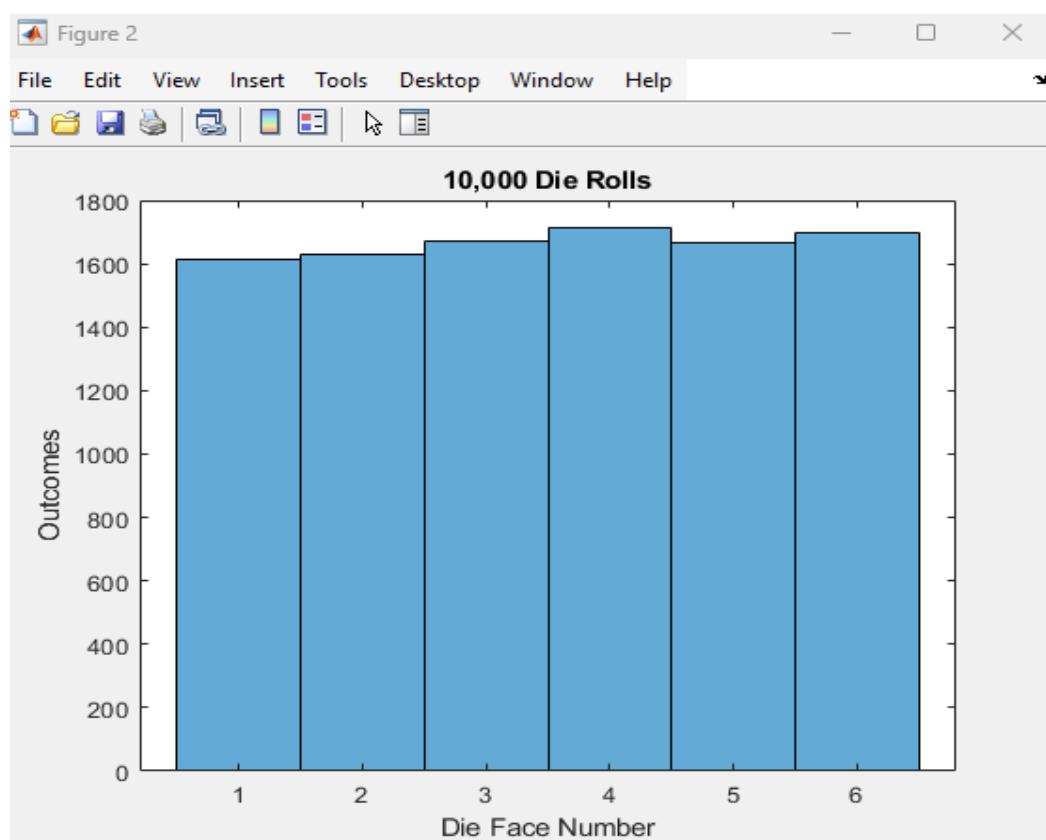
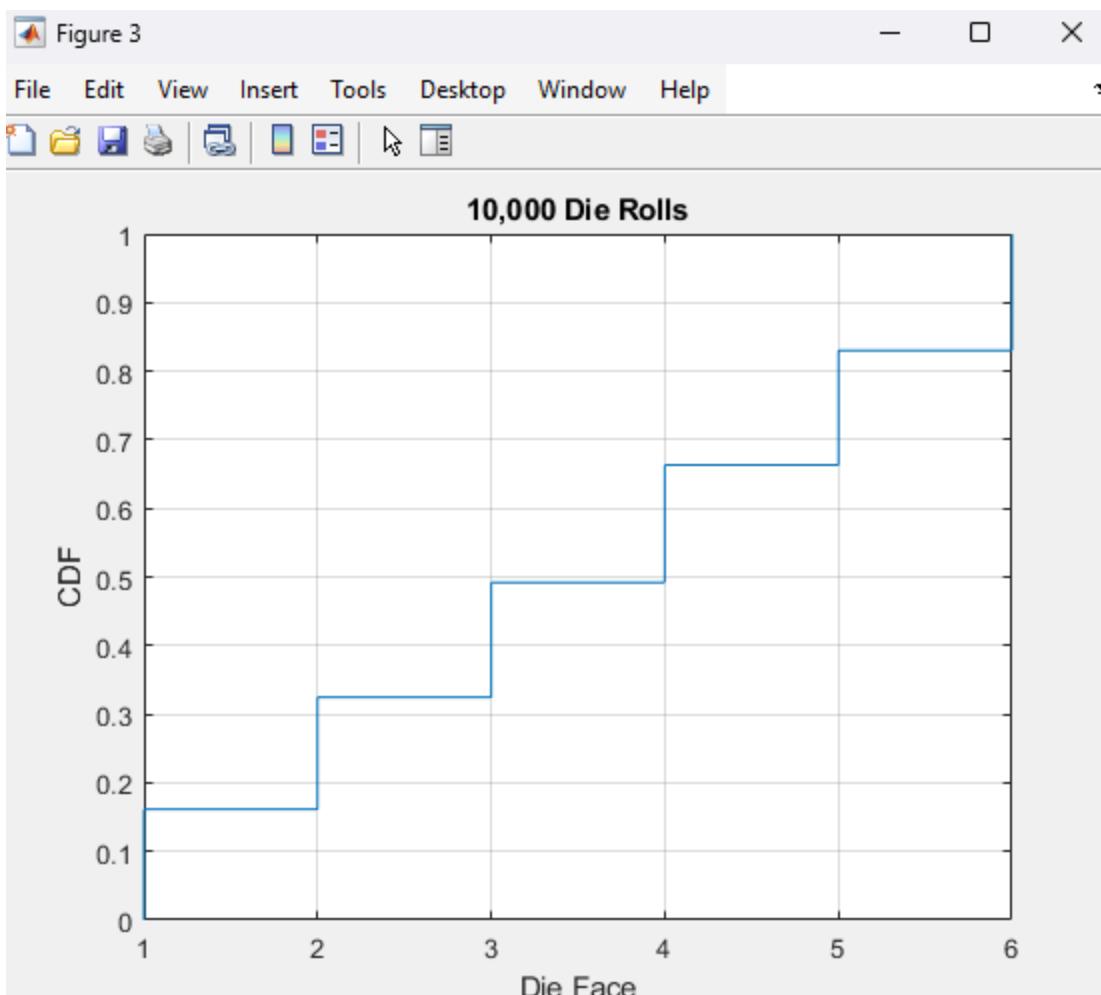
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Current Folder

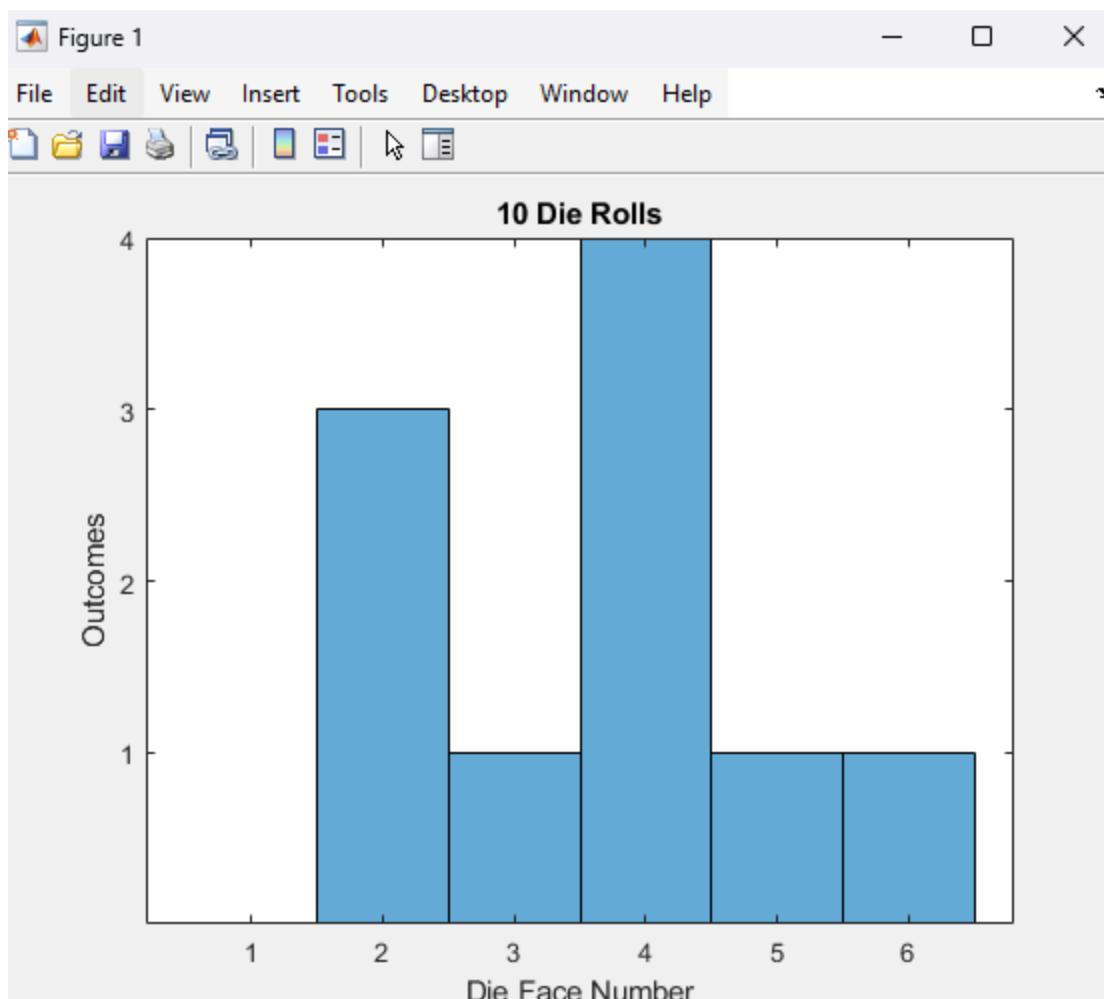
>> Toss_a_Coin
===== Part 1: Toss a coin =====
Toss a coin ...
The value of the coin:
1
Toss a coin for 10 times ...
The number of heads:
5
fx >>
```

#### - Roll A Dice

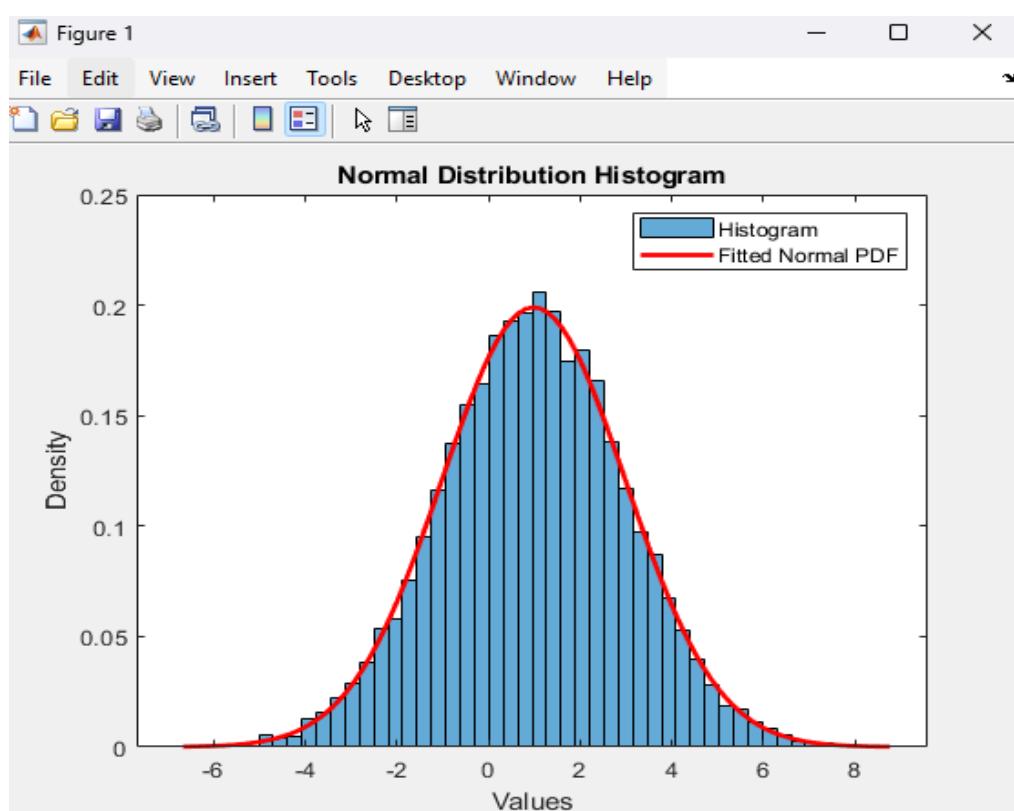
```
Command Window

>> Roll_a_Die
===== Part 2: Roll a die =====
Roll a die ...
The value of the die:
6
Roll a die 10 times ...
Showing the histogram of the die...
Roll a die 10000 times ...
Showing the empirical cdf of the die...
fx >>
```





- Plot A Normal Distribution



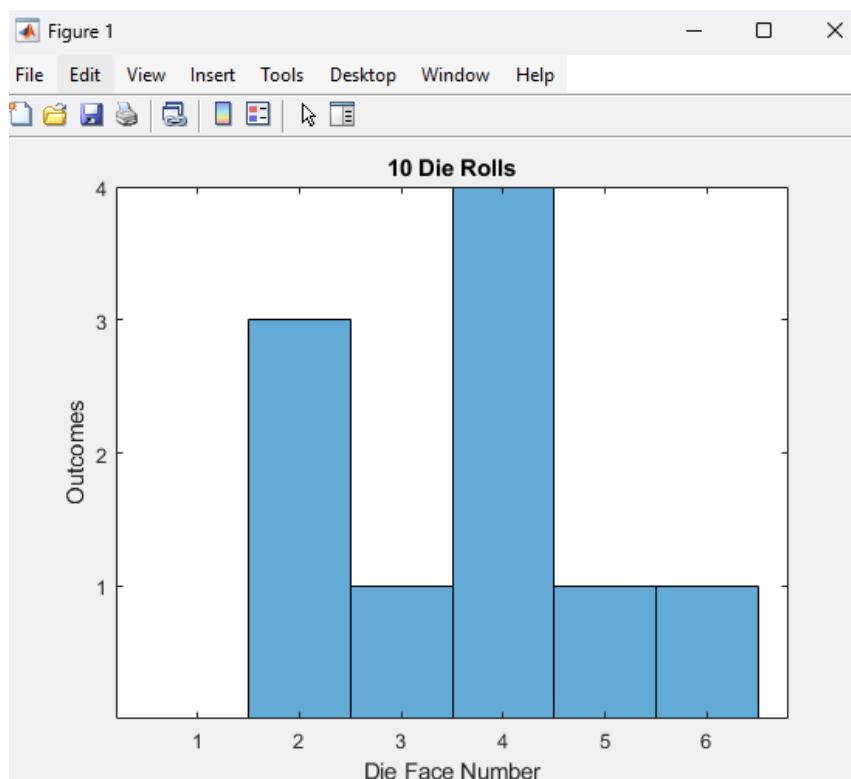
## B) Questions

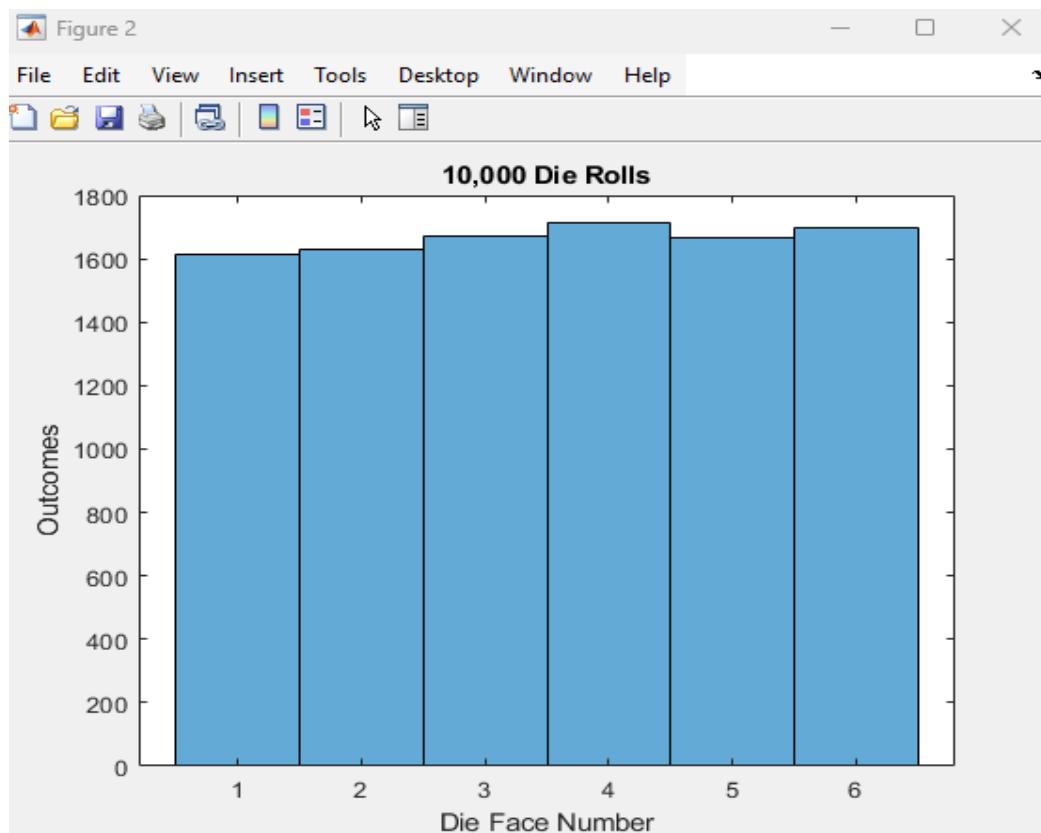
- In the tossing a coin experiment (part 1), when you simulated 10 coin tosses, were your results what you expected? Why or why not? If repeated multiple times, how would you expect the results to change?

In the tossing a coin experiment, when I simulated the 10 coin tosses, the results were what I expected because the output produced an integer value that tells me how many heads there were after the 10 coin tosses. The code simulates 10 random coin tosses and documents the total amount of heads (1), so if the code were to be repeated multiple times, I would expect the results to produce random integers equal to or less than 10 since that it the max amount of coin tosses being done, in order to represent how many of the coin tosses resulted in landing heads (1).

- In the rolling a die experiment (part 2), after simulating 10 rolls and then 10,000 rolls, how did the shape of the histogram change? What does this reveal about randomness and sample size? Include visual or numerical evidence to support your answer.

In the rolling a die experiment, when comparing the histograms of the 10 rolls and 10,000 rolls, the general consensus of change is that the graph for 10,000 rolls is way more filled up than the graph for 10 rolls and all faces of the die are more likely to have results because of the difference in the amount of rolls. In regards to randomness and sample size, these two factors affect the results of the data and the appearance of the histogram. Provided below will be the histogram of both 10 dice rolls and 10,000 dice rolls in order to demonstrate these ideas.





- How would you explain the concept of "variance" to someone by only showing them your histogram plots? What visual patterns would you point to?

In order to explain variance to someone by only showing them a histogram plot, I would say that the histogram displays the spread of averages of data or information, just like the definition of variance as that is what a histogram does. Additionally, the visual patterns I would point out are that the taller bars would be where most of the data is, resembling more of the average while the smaller bars that are spread out or farther away are less likely the average and is low variance.

### C) Summary

In this first programming assignment, I believe that the implementation of each of the three program files went well. The things that went well regarding this first assignment include producing outputs for the instructions/requirements, and understanding what they mean and how to write statistics and machine learning code in MATLAB. On the other hand, some challenges along the way included debugging my code when it did not produce an output at all, and learning about new functions and how to use them. In summary, this first programming assignment was a good introduction to using the statistics and machine learning toolbox and writing code related to that on MATLAB.