Von Kaukeano
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Practicum #1

1. In order to solve for the expected values and standard deviation, I used the equations from chapter 3.

   E[X]: Expected Value
   Var[X]: Variance of X
   σ_x: Standard Deviation
   x: value representing the side
   PX(x): Probability

$$E[X] = \sum_{n}^{n} x * PX(x)$$
$$E[X^2] = \sum_{n}^{} x^2 * PX(x)$$
$$Var[X] = E[X^2] - (E[X])^2$$
$$\sigma_x = \sqrt{Var[X]}$$

   E[X] = (1 * .2) + (2 * .2) + (3 * .2) + (4 * .2) + (5 * .1) + (6 * .1) = 3.1
   $E[X^2] = (1^2 * .2) + (2^2 * .2) + (3^2 * .2) + (4^2 * .2) + (5^2 * .1) + (6^2 * .1) = 12.1$
   $Var[X] = E[X^2] - (E[X])^2 = 12.1 - 9.61 = 2.49$
   σ_x= sqrt(Var[X]) = sqrt(2.49) = 1.57

2. The plot of the simulated probability mass function representing 5000 tosses of the die.

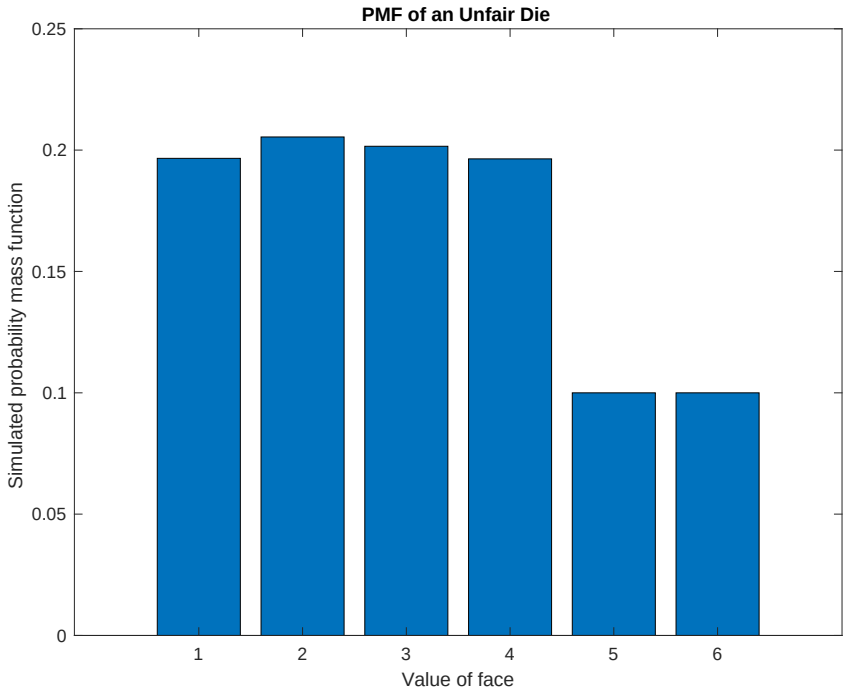

Figure 1: PMF: 5000 Tosses of Unfair Die

3. The simulated expected value and standard deviation printed.

   The mean value is 3.10
   The standard deviation is 1.57

4. Comparing the analytical values of the expected value and standard deviation are identical. This is the case for a single run of the MATLAB code. If ran again, the values would be slightly different because the outcomes would change due to the randomness. In order to improve the simulated results to almost always match the analytical values, I would increase the number of trials which would create a larger distribution of the outcomes.

Appendix

```
%% Practicum 1
% Von Kaukeano
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clc
clear

num_of_experiments = 5000;

die_one = .2;
die_two = .2;
die_three = .2;
die_four = .2;
die_five = .1;
die_six = .1;

n = [1:6];

probability = [die_one die_two die_three die_four die_five die_six];

PMF = randsample(n,num_of_experiments,true,probability);

figure(1)
hist_x = hist(PMF, n);
bar(n,hist_x/num_of_experiments);
title('PMF of an Unfair Die')
xlabel('Value of face')
ylabel('Simulated probability mass function')

mean_PMF = mean(PMF);
std_PMF = std(PMF);

fprintf('The mean value is %4.2f\n',mean_PMF);
fprintf('The standard deviation is %4.2f\n', std_PMF);

Output:
The mean value is 3.10
The standard deviation is 1.57
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Citation

https://stackoverflow.com/questions/2977497/weighted-random-numbers-in-matlab

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