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EE 381

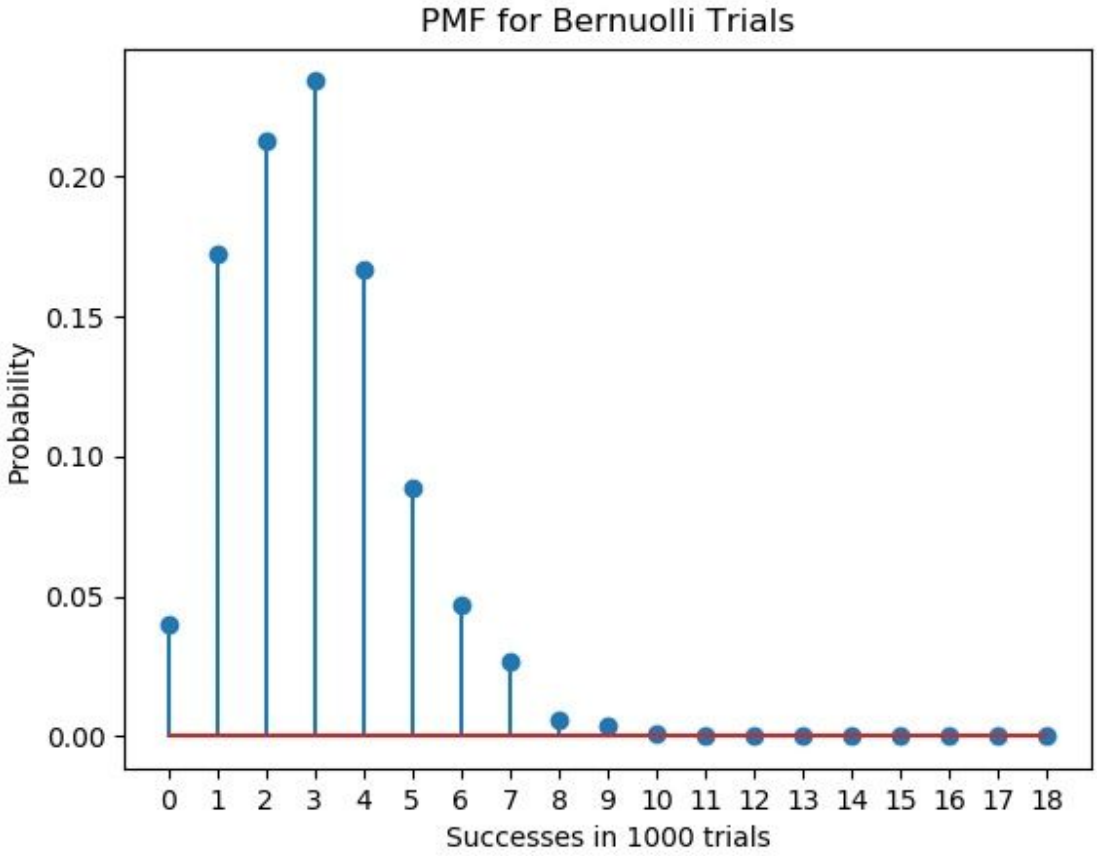
Lab 3

10-14-20

1. Experimental Bernoulli Trials

Consider the following experiment: You have three identical multi-sided unfair dice. The probability vector (p) for the dice has been provided to you.
One roll is considered "*success*" if you get: "one" for the first die; "two" for the second die; "three" for the third die.
You roll the three dice n=1000 times, and the number of successes in n rolls, will be your random variable "X". This is considered one experiment. The goal is to create the PMF plot of "X".

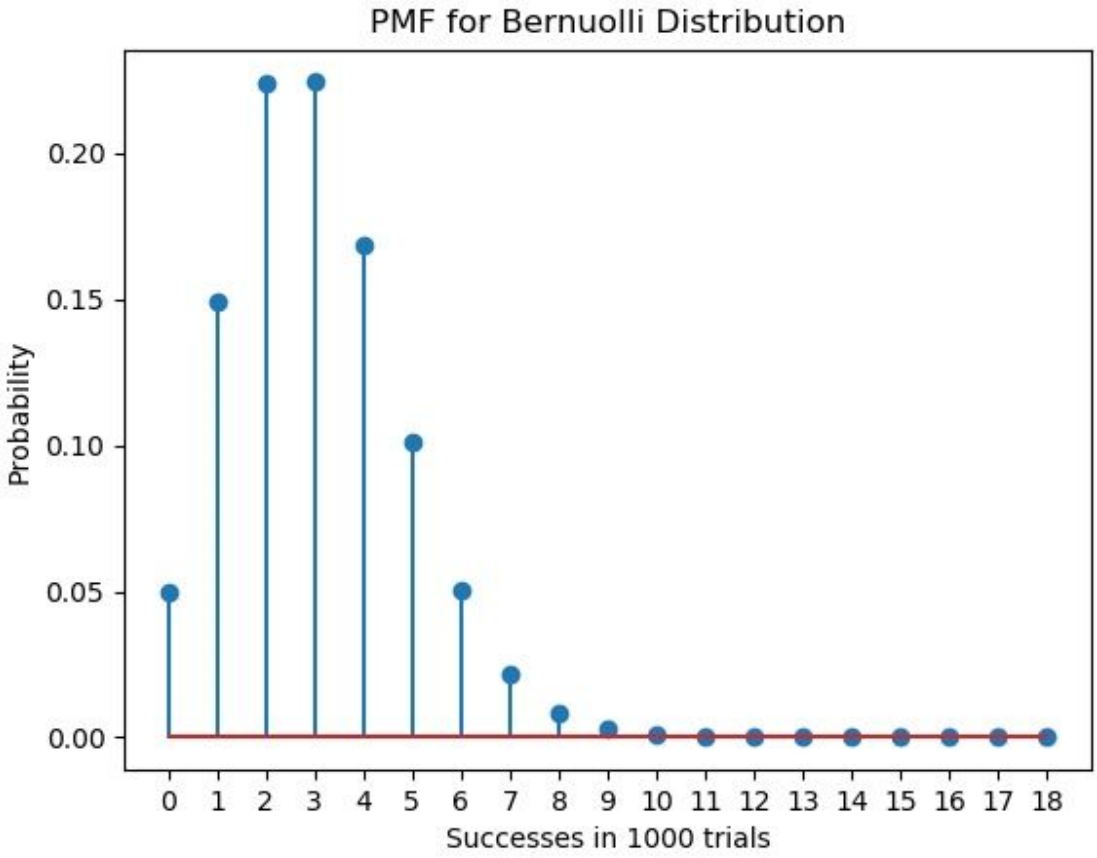
- In order to generate the PMF plot repeat the experiment N=10,000 times, and record the values of "X" each time, i.e. the number of "successes" in n rolls.
- Create the experimental **Probability Mass Function** plot, using the histogram of "X" as you did in previous projects.



2. Calculations using the Binomial Distribution

In this problem you will use the theoretical formula for the Binomial distribution to calculate the probability p of success in a single roll of the three dice.

- Use the Binomial formula to generate the **Probability Mass Function** plot of the random variable $X = \{number\ of\ successes\ in\ n\ Bernoulli\ trials\}$.
- Compare the plot you obtain using the Binomial formula, to the plot you obtained from the experiments in Problem 1.
- "Include the PMF plot in your report, in addition to all other requirements. The graph should be plotted in the same scale as the graph in Problem 1 so that they can be compared. The title should reflect the calculations for problem 2: Bernoulli Trials: PMF – Binomial Formula"



3. Approximation of Binomial by Poisson Distribution

Consider the case when the probability p of success in a Bernoulli trial is small and the number of trials n is large (in practice this means that $n \geq 50$ and $np \leq 5$). In that case you can use the Poisson distribution formula to approximate the probability of success in n trials, as an alternative to the Binomial formula. The parameter λ that is needed for the Poisson distribution is obtained from the equation $\lambda = np$

- Use the parameter λ and the Poisson distribution formula to create a plot of the **probability distribution function** approximating the probability distribution of the random variable $X = \{number\ of\ successes\ in\ n\ Bernoulli\ trials\}$.
- Compare the plot you obtained from the Poisson formula to the plot you obtained from the experiments in Problem 1.
- Include the PMF plot in your report, in addition to all other requirements. The graph should be plotted in the same scale as the graph in Problem 1 so that they can be compared. The title should reflect the calculations for problem 3: "Bernoulli Trials: PMF – Poisson Approximation"