

AI5002 - Assignment 5

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Download code and LaTeX from below hyperlinks

1. [Codes/MiscellaneousDistributions_5_31.py](#)
2. [LaTeX](#)

Problem 5.31

Two cards are drawn simultaneously (or successively without replacement) from a well shuffled pack of 52 cards. Find the mean, variance and standard deviation of the number of kings.

Solution

Let X be a random variable.

X = Number of kings present in the two cards drawn from a well shuffled pack of 52 cards.

The values that X can have are $= \{ 0, 1, 2 \}$.
The probability of X taking each of the above values are -

$$P(X = 0) = \frac{\binom{48}{2}}{\binom{52}{2}} = \frac{188}{221} \approx 0.8507 \quad (0.0.1)$$

$$P(X = 1) = \frac{\binom{4}{1} * \binom{48}{1}}{\binom{52}{2}} = \frac{32}{221} \approx 0.1448 \quad (0.0.2)$$

$$P(X = 2) = \frac{\binom{4}{2}}{\binom{52}{2}} = \frac{1}{221} \approx 0.0045 \quad (0.0.3)$$

The Mean calculated as $E(X)$ is given by,

$$\begin{aligned} E(X) &= \sum X.P(X) \quad (0.0.4) \\ &= 0 * \frac{188}{221} + 1 * \frac{32}{221} + 2 * \frac{1}{221} \end{aligned}$$

$$= \frac{34}{221} \approx 0.154$$

$$E(X^2) = \sum X^2 .P(X)$$

$$= 0^2 * \frac{188}{221} + 1^2 * \frac{32}{221} + 2^2 * \frac{1}{221} = \frac{36}{221}$$

The Variance calculated as $\text{Var}(X)$ is given by,

$$\text{Var}(X) = E(X^2) - [E(X)]^2 \quad (0.0.5)$$

$$= \frac{36}{221} - \left[\frac{34}{221} \right]^2 = \frac{6800}{48841} \approx 0.139$$

The Standard-Deviation calculated as $\text{SD}(X)$ is given by,

$$\text{SD}(X) = \sqrt{\text{Var}(X)} = \sqrt{0.139} \approx 0.373 \quad (0.0.6)$$

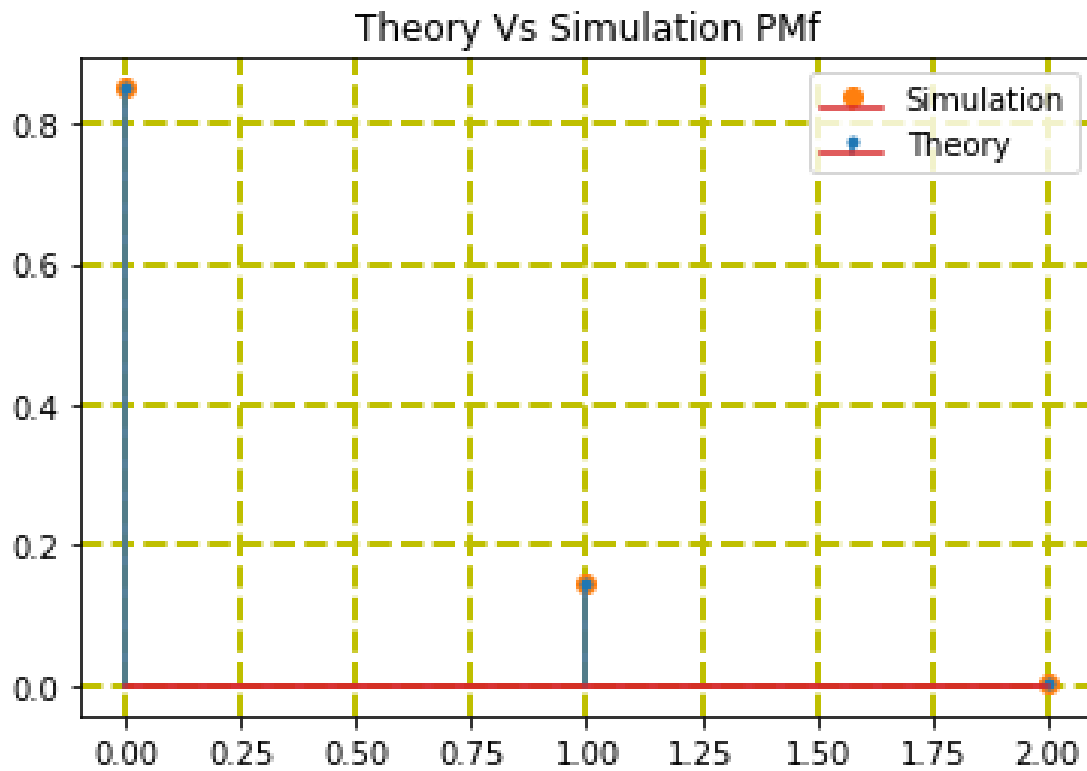


Fig 1.1: Theory Vs Simulation of PMf

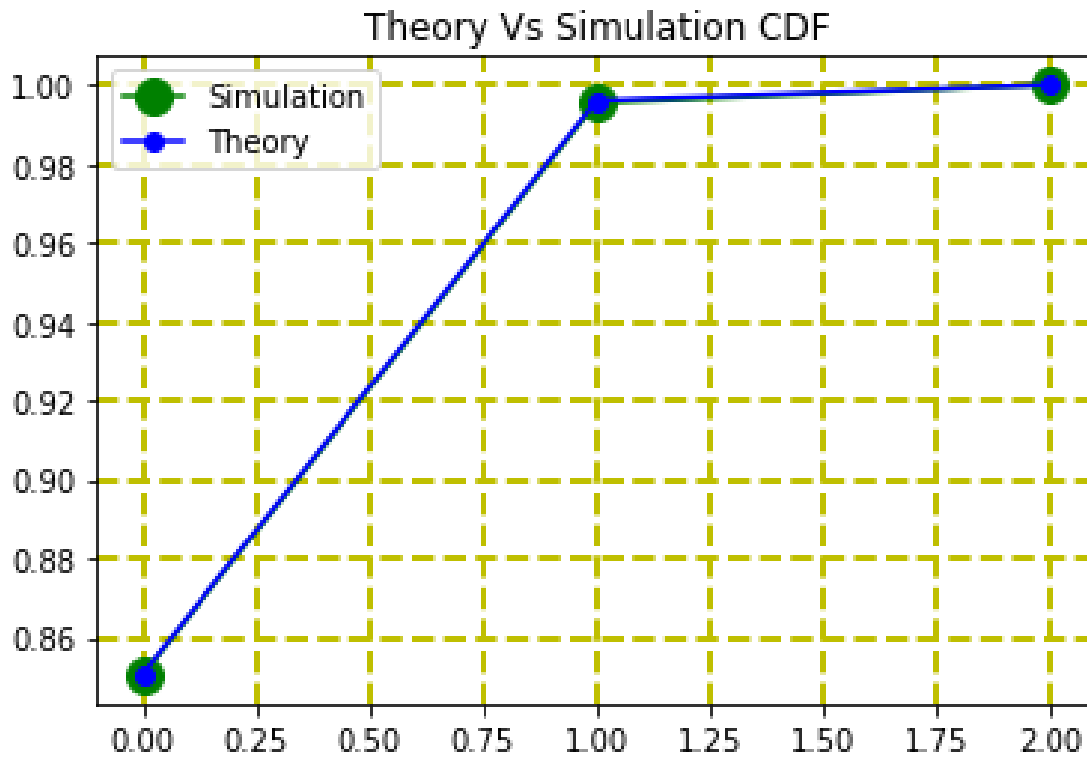


Fig 1.2: Theory Vs Simulation CDF