

Assignment 2

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Download all python codes from

<https://github.com/spdanda/AI1103/blob/main/Assignment2/Assignment2.py>

and latex - tikz codes from

<https://github.com/spdanda/AI1103/blob/main/Assignment2/Assignment2.tex>

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 denote the no. of kings in a draw of 2 cards.

$$\Rightarrow \Pr(X=0) = \frac{48C_2}{52C_2} = \frac{188}{221} \quad (1)$$

$$\Pr(X=1) = \frac{4C_1 \times 48C_1}{52C_2} = \frac{32}{221} \quad (2)$$

$$\Pr(X=2) = \frac{4C_2}{52C_2} = \frac{1}{221} \quad (3)$$

X	0	1	2
Pr(X)	$\frac{188}{221}$	$\frac{32}{221}$	$\frac{1}{221}$

Above is the probability distribution table of the no. of kings obtained when two cards are drawn simultaneously from a deck of 52

cards.

Now, Mean of $X = E(X)$

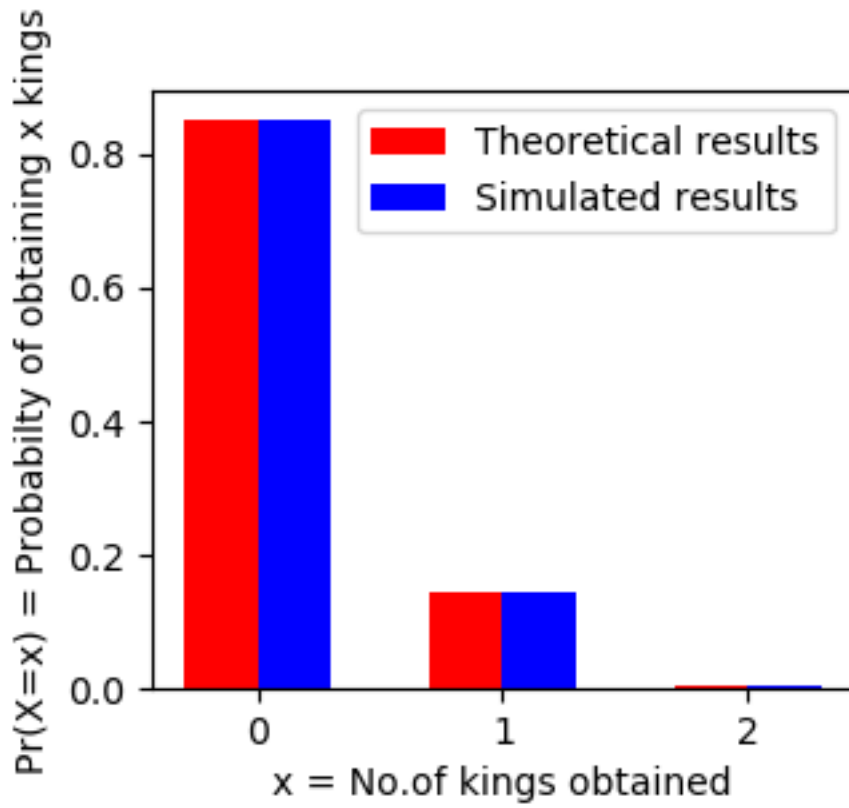
$$\begin{aligned} &= \sum_{k=0}^2 k \Pr(X=k) \\ &= 0 \times \frac{188}{221} + 1 \times \frac{32}{221} + 2 \times \frac{1}{221} \\ &= \frac{34}{221} = 0.154 \quad (4) \end{aligned}$$

Variance = $E(X^2) - [E X]^2$

$$\begin{aligned} &= \sum_{k=0}^2 k^2 \Pr(X=k) - \frac{34^2}{221^2} \\ &= 1^2 \times \frac{32}{221} + 2^2 \times \frac{1}{221} - \frac{34^2}{221^2} \\ &= \frac{6800}{48841} = 0.139 \quad (5) \end{aligned}$$

Standard Deviation $\sigma = \sqrt{\text{Var}(X)}$

$$\begin{aligned} &= \sqrt{0.139} \\ &= 0.373 \quad (6) \end{aligned}$$



Above is the bar graph showing both the simulated and the theoretical results. Both represent almost the same values.