Assignment 6

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Outline

NCERT Class 12 Example 29

1. Question
2. Solution
3. Code

Problem

Q) 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 the random variable $X \in \{0, 1, 2\}$ denote 'The number of kings in a draw of two cards'.
Then,

$$\Pr(X = 0) = \frac{{}^{48}C_2}{{}^{52}C_2} \tag{1}$$

$$= \frac{\frac{48!}{2!(48-2)!}}{\frac{52!}{2!(52-2)!}} \tag{2}$$

$$= \frac{188}{221} \tag{3}$$

Solution

$$\Pr(X = 1) = \frac{{}^{4}C_1 \, {}^{48}C_1}{{}^{52}C_2} \tag{4}$$

$$= \frac{32}{221} \tag{5}$$

$$\Pr(X = 2) = \frac{{}^{4}C_2}{{}^{52}C_2} \tag{6}$$

$$= \frac{1}{221} \tag{7}$$

Solution

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

Table: Probability Distribution of X

Graph

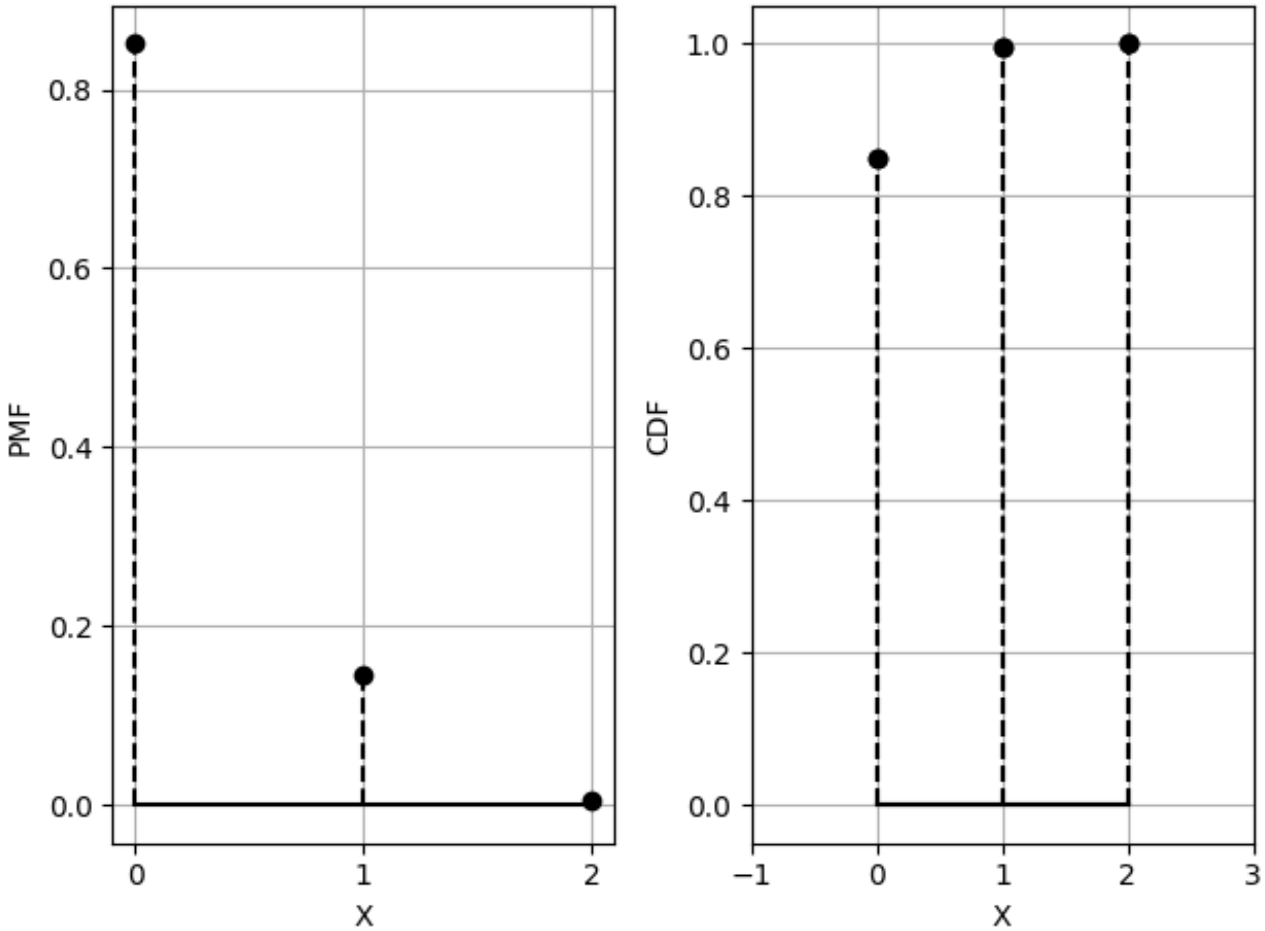

Figure: PMF and CDF of X

Mean of X

$$\text{Mean of } X = \tag{8}$$

$$E(X) = \sum_{i=1}^{n} x_i p(x_i) \tag{9}$$

$$= 0 \times \frac{188}{221} + 1 \times \frac{32}{221} + 2 \times \frac{1}{221} \tag{10}$$

$$= \frac{34}{221} \tag{11}$$

Variance

$$E(X^2) = \sum_{i=1}^{n} x_i^2 p(x_i) \tag{12}$$

$$= 0^2 \times \frac{188}{221} + 1^2 \times \frac{32}{221} + 2^2 \times \frac{1}{221} \tag{13}$$

$$= \frac{36}{221} \tag{14}$$

$$\sigma_x^2 = E(X^2) - E(X)^2 \tag{15}$$

$$= \frac{36}{221} - \left(\frac{34}{221}\right)^2 \tag{16}$$

$$= \frac{6800}{(221)^2} \tag{17}$$

Standard Deviation

$$\sigma_x = \sqrt{Var(X)} \tag{18}$$

$$= \frac{\sqrt{6800}}{221} \tag{19}$$

$$= 0.37 \tag{20}$$

Code

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Python

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