Assignment 4

AI1110: Probability and Random Variables

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Question: Two cards are drawn successively with replacement from a well shuffled deck of 52 cards.Find the probability distribution of the number of aces.

solution: The number of aces is a random variable.Let it be denoted by **X**. Clearly $\mathbf{X} \in \{0, 1, 2\}$
Now since the draws are done with replacement, the two draws form independent events.

$$\begin{aligned} \text{P}\{\mathbf{X=0}\} &= \text{P}\{\text{non ace and non ace}\} \\ &= \frac{48}{52} \times \frac{48}{52} \\ &= \frac{144}{169} \end{aligned}$$

$$\begin{aligned} \text{P}\{\mathbf{X=1}\} &= \text{P}\{\text{ace and non ace or non ace and ace}\} \\ &= \frac{4}{52} \times \frac{48}{52} + \frac{48}{52} \times \frac{4}{52} \\ &= \frac{24}{169} \end{aligned}$$

$$\begin{aligned} \text{P}\{\mathbf{X=2}\} &= \text{P}\{\text{ace and ace}\} \\ &= \frac{4}{52} \times \frac{4}{52} \\ &= \frac{1}{169} \end{aligned}$$

Thus the required probability distribution is:

X	0	1	2
P{X}	$\frac{144}{169}$	$\frac{24}{169}$	$\frac{1}{169}$