Question : Ten playing cards numbered 1, 2, 3, .., 10 are placed face down on a table. One card is drawn at random, its number recorded, and then replaced face down. A card is drawn again at random. The probability that the number on the second draw is greater than the number on the first draw (rounded off to two decimal places) is

Solution:

Let, X be the random variable representing number on the first draw.
Y be the random variable representing the number on the second card drawn.
The probability that the second card's number is greater than the first card's number is given by:

$$\Pr(Y > X) = \sum_{x=1}^{10} \Pr(Y > X \mid X = x) \cdot \Pr(X = x) \tag{1}$$

For a given $X = x$, the possible values for Y are $x + 1, x + 2, \ldots, 10$.

$$\implies \Pr(Y > X \mid X = x) = \frac{11 - x}{10} \tag{2}$$

$$\therefore \Pr(Y > X) = \sum_{x=1}^{10} \frac{11 - x}{10} \cdot \frac{1}{10} \tag{3}$$

$$\Pr(Y > X) = 0.55 \tag{4}$$

Therefore, the probability that the number on the second draw is greater than the number on the first draw is approximately 0.55 or 55%.