NCERT Assignment

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Three letters are dictated to three persons and an envelope is addressed to each of them, the letters are inserted into the envelopes at random so that each envelope contains exactly one letter. Find the probability that at least one letter in its proper envelope.

Solution:

Let, event E be such that atleast one letter in its proper envelope.

$\implies$ E' is none of the letters in its proper envelope.

Let,

$$q_i = \textit{wrong letter in envelope } i \tag{1}$$

$$\Pr\left(E_1'\right) = \Pr\left(q_1\right) \tag{2}$$

$$\Pr\left(E_2'\right) = \Pr\left(q_2|E_1'\right) \tag{3}$$

$$\Pr\left(E_3'\right) = \Pr\left(q_3|E_2'\right) \tag{4}$$

$$\Pr\left(E'\right) = \Pr\left(E_1'\right)\Pr\left(E_2'\right)\Pr\left(E_3'\right) \tag{5}$$

$$\implies \Pr\left(E'\right) = \left(\frac{2}{3}\right)\left(\frac{1}{2}\right)(1) \tag{6}$$

$$= \frac{1}{3} \tag{7}$$

$$\implies \Pr\left(E\right) = 1 - \Pr\left(E'\right) \tag{8}$$

$$= 1 - \frac{1}{3} \tag{9}$$

$$\therefore \Pr\left(E\right) = \frac{2}{3} \tag{10}$$