Probability Assignment

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***Abstract*—This document contains the solution to Question 15 of Exercise 1 in Chapter 13 of the class 12 NCERT textbook.**

1) Consider the experiment of throwing a die, if a multiple of 3 comes up, throw the die again and if any other number comes, toss a coin. Find the conditional probability of the event 'the coin shows a tail', given that 'at least one die shows a 3'.
Solution: Let X denote the die roll for the first trial. The pmf of X is

$$\Pr\left(X=k\right)=\begin{cases}\frac{1}{6} & 1\le k\le 6\\ 0 & \text{otherwise}\end{cases} \tag{1}$$

Let Y be the random variable denoting the outcome of the coin toss in the second trial. The pmf of Y is

$$\Pr\left(Y=k\right)=\begin{cases}\frac{1}{2} & 0\le k\le 1\\ 0 & \text{otherwise}\end{cases} \tag{2}$$

We are required to find $\Pr\left(Y=1|X=3\right)$. However, from the given data,

$$\Pr\left(Y=1,\ X=k\right)=\begin{cases}\frac{1}{12} & k\in\{1,2,4,5\}\\ 0 & \text{otherwise}\end{cases} \tag{3}$$

Therefore, from (3),

$$\Pr\left(Y=1|X=3\right)=\frac{\Pr\left(X=3,\ Y=1\right)}{\Pr\left(X=3\right)}=0 \tag{4}$$