Assignment 3
AI1110 : Probability and Random Variables

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Question:12.3.1.15: 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:

TABLE I
RANDOM VARIABLE DECLARATION

Random Variable	Event	Value
X	Not getting multiple of 3 on throwing die and tossing a coin	1
	Getting multiple of 3 on throwing die and throwing die again	0
Y	Number of times die shows 3	0
		1
		2
Z	Getting tail on coin toss	1
	Getting head on coin toss	0

Given, conditional probability of the event 'the coin shows a tail', given that 'at least one die shows a 3'= $\Pr(Z=1|Y=1) + \Pr(Z=1|Y=2)$
$Z=1 \subseteq X=1$
$Y=1 \subseteq X=0$
$Y=2 \subseteq X=0$

$$\Pr(Z=1|Y=1) = \frac{\Pr(Z=1)\Pr(Y=1)}{\Pr(Y=1)} \tag{1}$$
$$= \frac{0}{\Pr(Y=1)} \tag{2}$$
$$= 0 \tag{3}$$

Similarly,

$$\Pr(Z=1|Y=2) = \frac{\Pr(Z=1)\Pr(Y=2)}{\Pr(Y=2)} \tag{4}$$
$$= \frac{0}{\Pr(Y=2)} \tag{5}$$
$$= 0 \tag{6}$$

Therefore, $\Pr(Z=1|Y=1) + \Pr(Z=1|Y=2)$ =0
The conditional probability of the event 'the coin shows a tail', given that 'at least one die shows a 3'= 0