Probability Assignment-2

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Problem Assigned -: 12.13.3.4

***Question*—In answering a question on a multiple choice test, a student either knows the answer or guesses. Let $\frac{3}{4}$ be the probability that he knows the answer and $\frac{1}{4}$ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability $\frac{1}{4}$.What is the probability that the student knows the answer given that he answered it correctly?**

SOLUTION -:

Given,

Let $X \in \{0, 1\}$ where 0 denotes a guess and 1 denotes that he knows the answer. Let $Y \in \{0, 1\}$ where 0 being the case when the answer is incorrect and 1 being the case that the answer is correct.

From the given information,

Random Variable	Description
$X = 0$	Student guesses the answer
$X = 1$	Student knows the answer
$Y = 0$	Answer is incorrect
$Y = 1$	Answer is correct

TABLE 0
RANDOM VARIABLE AND THEIR DESCRIPTION

Pr(Event)	Value
Pr(Y=1 | X=0)	0.25
Pr(Y=1 | X=1)	1
Pr(X=0)	0.25
Pr(X=1)	0.75

TABLE 0
PROBABILITY OF EVENTS

The probability that the student knows the answer and he answered it correctly is

$$\Pr(X = 1|Y = 1) \tag{1}$$
$$= \frac{\Pr(Y = 1|X = 1)\Pr(X = 1)}{\sum_{i=0}^{i=1} Pr(Y = 1|X = i)Pr(X = i)} \tag{2}$$
$$= \frac{0.75}{0.25 \times 0.25 + 1 \times 0.75} \tag{3}$$
$$= 0.92308 \tag{4}$$