

Assignment 2

AI1110: Probability and Random Variables
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12.13.1.7 Question:

- 1) Two coins are tossed once, where
(a) E : tail appears on one coin. F : one coin shows head
(b) E : no tail appears. F : no head appears

Answer:

- (a) 1
(b) 0

Solution: Here two coins are tossed once. So the possible outcomes are {HH, HT, TH, TT}

X_1 :	the number of tails appeared on the coin
X_2 :	the number of heads appeared on the coin

TABLE 1: Random Variables

- 1) (a) For event E : Tail appears on one coin.
Possibilities for E: One coin shows a tail and the other shows a head Using random variables, we can express event E as: E: ($X_1 = 1$ and $X_2 = 1$)
For event F: One coin shows a head.
Possibilities for F: One coin shows a head and the other shows a tail
Using random variables, we can express event F as: F: ($X_1 = 1$ and $X_2 = 1$)
To calculate $\Pr(E|F)$, we need to find $\Pr(E \cap$

	X_1	X_2
E:	1	1
F:	1	1

TABLE 1: Case(a)

$F)$ and $\Pr(F)$. $\Pr(E \cap F)$ is the probability that both E and F occur, which corresponds to the case where one coin shows a tail and the other shows a head:

$$\Pr(E \cap F) = \Pr(X_1 = 1 \text{ and } X_2 = 1) \quad (1)$$

$$= \frac{2}{4} \quad (2)$$

$$= \frac{1}{2} \quad (3)$$

$$\Pr(F) = \Pr(X_2 = 1 \text{ and } X_1 = 1) \quad (4)$$

$$= \frac{2}{4} \quad (5)$$

$$= \frac{1}{2} \quad (6)$$

$$\Pr(E|F) = \frac{\Pr(E \cap F)}{\Pr(F)} \quad (7)$$

$$= \frac{\frac{1}{2}}{\frac{1}{2}} \quad (8)$$

$$\Pr(E|F) = 1 \quad (9)$$

- (b) For event E : No tail appears.
Possibilities for E: Both coins show head
Using random variables, we can express event E as: E: ($X_2 = 2$)
For event F: No head appears..
Possibilities for F: Both coins show tail
Using random variables, we can express event F as: F: ($X_1 = 2$)
To calculate $\Pr(E|F)$, we need to find $\Pr(E \cap F)$

	X_1	X_2
E:	0	2
F:	2	0

TABLE 1: Case(b)

and $\Pr(F)$. $\Pr(E \cap F)$ is the probability that both E and F occur, which here doesn't correspond to any case as both the coins either show head or tail:

$$\Pr(E \cap F) = 0 \quad (10)$$

$$\Pr(F) = \Pr(X_1 = 2) \quad (11)$$

$$= \frac{1}{4} \quad (12)$$

$$\Pr(E|F) = \frac{\Pr(E \cap F)}{\Pr(F)} \quad (13)$$

$$\Pr(E|F) = 0 \quad (14)$$