

AI-1110 Assignment-1

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12.13.1.11 Question: A fair die is rolled. Consider events $E = \{1,3,5\}$, $F = \{2,3\}$ and $G = \{2,3,4,5\}$. Find

- 1) $\Pr(E|F)$ and $\Pr(F|E)$
- 2) $\Pr(E|G)$ and $\Pr(G|E)$
- 3) $\Pr(E + F|G)$ and $\Pr(EF|G)$

Solution: Sample space when a die is rolled = $\{1,2,3,4,5,6\}$.

$E = \{1,3,5\}$	$\Pr(E) = \frac{1}{2}$
$F = \{2,3\}$	$\Pr(F) = \frac{1}{3}$
$G = \{2,3,4,5\}$	$\Pr(G) = \frac{2}{3}$
$EF = \{3\}$	$\Pr(EF) = \frac{1}{6}$
$FG = \{2,3\}$	$\Pr(FG) = \frac{1}{3}$
$EG = \{3,5\}$	$\Pr(EG) = \frac{1}{3}$
$EFG = \{3\}$	$\Pr(EFG) = \frac{1}{6}$

TABLE 3: From given data

1)

$$\Pr(E|F) = \frac{\Pr(EF)}{\Pr(F)} \quad (1)$$

table 3,

$$\Pr(E|F) = \frac{\frac{1}{6}}{\frac{1}{3}} \quad (2)$$

$$\Pr(F|E) = \frac{1}{2} \quad (3)$$

2)

$$\Pr(F|E) = \frac{\Pr(EF)}{\Pr(E)} \quad (4)$$

table 3,

$$\Pr(F|E) = \frac{\frac{1}{6}}{\frac{1}{2}} \quad (5)$$

$$\Pr(F|E) = \frac{1}{3} \quad (6)$$

3)

$$\Pr(E|G) = \frac{\Pr(EG)}{\Pr(G)} \quad (7)$$

table 3,

$$\Pr(E|G) = \frac{\frac{1}{3}}{\frac{2}{3}} \quad (8)$$

$$\Pr(E|G) = \frac{1}{2} \quad (9)$$

4)

$$\Pr(G|E) = \frac{\Pr(EG)}{\Pr(E)} \quad (10)$$

table 3,

$$\Pr(G|E) = \frac{\frac{1}{3}}{\frac{1}{2}} \quad (11)$$

$$\Pr(G|E) = \frac{2}{3} \quad (12)$$

5)

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

$$\Pr((E + F)G) = \Pr((EG) + (FG)) \quad (14)$$

$$\Pr((E + F)G) = \Pr(EG) + \Pr(FG) - \Pr((EF)G) \quad (15)$$

table 3,

$$\Pr((E + F)G) = \frac{1}{3} + \frac{1}{3} - \frac{1}{6} \quad (16)$$

$$\Pr((E + F)G) = \frac{1}{2} \quad (17)$$

$$\Pr(E + F|G) = \frac{\frac{1}{2}}{\frac{2}{3}} \quad (18)$$

$$\Pr(E + F|G) = \frac{3}{4} \quad (19)$$

6)

$$\Pr(EF|G) = \frac{\Pr(EFG)}{\Pr(G)} \quad (20)$$

table 3,

$$\Pr(EF|G) = \frac{\frac{1}{6}}{\frac{2}{3}} \quad (21)$$

$$\Pr(EF|G) = \frac{1}{4} \quad (22)$$

Answer:

$$\Pr(E|F) = \frac{1}{2}, \quad (23)$$

$$\Pr(F|E) = \frac{1}{3}, \quad (24)$$

$$\Pr(E|G) = \frac{1}{2}, \quad (25)$$

$$\Pr(G|E) = \frac{2}{3}, \quad (26)$$

$$\Pr(E + F|G) = \frac{3}{4}, \quad (27)$$

$$\Pr(EF|G) = \frac{1}{4} \quad (28)$$