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) P($E|F$) and P($F|E$)
2) P($E|G$) and P($G|E$)
3) P($(E \cup F)|G$) and P($(E \cap F)|G$)

Answer:
$P(E|F) = 1/2$,
$P(F|E) = 1/3$,
$P(E|G) = 1/2$,
$P(G|E) = 2/3$,
$P((E \cup F)|G) = 3/4$,
$P((E \cap F)|G) = 1/4$

Solution: Sample space when a die is rolled = {1,2,3,4,5,6}.We have E = {1,3,5}, F = {2,3} and G = {2,3,4,5}. So, P(E) = 3/6, P(F) = 2/6 and P(G) = 4/6

$$\implies P(E) = 1/2$$
$$\implies P(F) = 1/3$$
$$\implies P(G) = 2/3$$

1) **a)** $P(E|F) = \frac{P(E \cap F)}{P(F)}$

$E \cap F = \{3\}$

$\implies P(E \cap F) = 1/6$

$\therefore P(E|F) = \frac{1/6}{1/3} = 1/2$

b) $P(F|E) = \frac{P(E \cap F)}{P(E)}$

$\therefore P(F|E) = \frac{1/6}{1/2} = 1/3$

2) **a)** $P(E|G) = \frac{P(E \cap G)}{P(G)}$

$E \cap G = \{3, 5\}$

$\implies P(E \cap G) = 2/6 = 1/3$

$\therefore P(E|G) = \frac{1/3}{2/3} = 1/2$

b) $P(G|E) = \frac{P(E \cap G)}{P(E)}$

$\therefore P(G|E) = \frac{1/3}{1/2} = 2/3$

3) **a)** $P((E \cup F)|G) = \frac{P((E \cup F) \cap G)}{P(G)}$

$(E \cup F) \cap G = \{2, 3, 5\}$

$\implies P((E \cup F) \cap G) = 3/6 = 1/2$

$\therefore P((E \cup F)|G) = \frac{1/2}{2/3} = 3/4$

b) $P((E \cap F)|G) = \frac{P((E \cap F) \cap G)}{P(G)}$

$(E \cap F) \cap G = \{3\}$

$\implies P((E \cap F) \cap G) = 1/6$

$\therefore P((E \cap F)|G) = \frac{1/6}{2/3} = 1/4$