Notational Probability

1. $P(A) + P(A') = 1$ or $P(A') = 1 - P(A)$ or $P(A) = 1 - P(A')$

2. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

3. A and B are mutually exclusive events means $A \cap B$ = empty which implies $P(A \cap B) = 0$

4. $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$ $P(B|A) = \dfrac{P(A \cap B)}{P(A)}$

5. A and B are independent events $\equiv$ $P(A \cap B) = P(A) \times P(B)$

Q1) If $P(A') = 0.60$, $P(B) = 0.30$ and $P(A \cap B) = 0.15$, find

a. $P(A) = \dfrac{5}{7}$; $P(A) = 1 - \dfrac{5}{7} = \dfrac{2}{7}$

b. $P(A \cup B)$ $0.4 + 0.3 - 0.15 = 0.55$

c. $P(A|B)$ $\dfrac{0.15}{0.3} = 0.5$

d. $P(B|A)$ $\dfrac{0.15}{0.4} = 0.375$

e. Are A and B mutually exclusive? Explain your reason.

No, $P(A \cap B) \neq 0$ $P(A \cap B) = 0.15$

f. Are A and B independent? Explain your reason.

No $P(A) \times P(B) = 0.4 \times 0.3$

$= 0.12$

$P(A \cup B)$

Q2) If P(A) = 0.40, P(B) = 0.70 and A and B are independent events. Find P(A U B).

$$= P(A) + P(B) - P(A \cap B)$$

$$= 0.40 + 0.70 - (0.40) \times (0.70) = 0.40 + 0.70 - 0.28 = 0.82$$

Q3) If P(A') = 0.35, P(B) = 0.20 and A and B are mutually exclusive events. Find P(A U B).

$$P(A \cup B) = \qquad\qquad P(A \cup B) = 0.65 + 0.2 - (0)$$

$$P(A) = 1 - 0.35 \qquad\qquad = 0.85$$

$$= 0.65$$

Q4) If P(A) = 0.45, P(B) = 0.60 and P(A U B) = 0.85

    i)   Find P(A ∩ B)

$$0.85 = 0.45 + 0.6 - (P(A \cap B))$$

$$0.45 + 0.6 - 0.85 = P(A \cap B) \qquad P(A \cap B) = 0.2$$

    ii)   Are A and B independent? Explain your reason

$$= 0.45 \times 0.6$$
$$= 0.27$$
$$P(A \cap B) \neq 0.27$$

No, not independent

Q5) If P(A|B) = 0.25, P(B) = 0.60 and P(A U B) = 0.75

    i)   Find P(A ∩ B)

$$0.6 \times 0.75 = \frac{P(A \cap B)}{0.6} = 0.6$$

$$0.45 = P(A \cap B)$$

    ii)   Find P(A)

$$0.75 = P(A) + 0.6 - 0.45 \qquad 0.75 - 0.6 + 0.45 = P(A)$$

$$P(A) = 0.6$$

    iii)   Are A and B independent? Explain your reason

$$P(A \cap B) = 0.6 \times 0.6 = 0.36 \qquad 0.45 \neq 0.36$$

not independent

Q6) If P(B|A) = 0.65, P(A) = 0.80, P(B') = 0.45

    i)   Find P(A ∩ B)

$$0.65 = \frac{P(A \cap B)}{0.8} \qquad P(A \cap B) = 0.52$$

    ii)   Find P(A U B)

$$= 0.8 + 0.65 - (0.52)$$

$$= 0.93$$