A deck of Poker Cards has 52 cards and 13 of these are hearts.

Pick 2 cards from the deck at random.

A = 1st card is a heart
B = 2nd card is a heart.

→ Draw cards without replacement.

\[ P(A \cap B) = \left( \frac{13}{52} \right) \left( \frac{12}{51} \right) = \frac{1}{17} \approx 0.0588 \]

\[ \text{A \cap B are dependent} \]
(Probability of B depended on A)

If A \cap B are dependent \[ P(A \cup B) = P(A) \cdot P(B | A) \]

\[ \text{Probability of B given A} \]

→ Draw cards with replacement.

\[ P(A \cap B) = \frac{13}{52} \cdot \frac{13}{52} = \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16} \approx 0.0625 \]

\[ \text{A \cap B are independent} \]
\[ P(A \cap B) = P(A) \cdot P(B) \]

Rules: (for section 4.2)

\[ P(A \cap B) = P(A) + P(B) - P(A \cup B) \text{ (Addition)} \]
If A \cap B can't both happen, \[ P(A \cap B) = P(A) + P(B) \]

\[ P(A \cup B) = P(A) \cdot P(B) \text{ (A, B independent)} \]
\[ P(A \cup B) = P(A) \cdot P(B | A) \text{ (A, B dependent)} \]