Computing Probabilities

Pure/classical approach -> assumes all simple outcomes are equally likely.

If event A can happen in \( X \) simple ways in an experiment with \( N \) simple outcomes then

\[
P(A) = \frac{X}{N}.
\]

Ex: Roll a fair unbiased die (outcomes: \( 1, 2, 3, 4, 5, 6 \))

then

\( A \) = roll is less than 3
\( B \) = roll is odd
\( C \) = roll is less than 10
\( D \) = roll is negative.

\[
P(A) = \frac{2}{6} = \frac{1}{3} \approx 0.333 = 33.3\%.
\]

\[
P(B) = \frac{3}{6} = 0.500 = 50.0\%.
\]

\[
P(C) = \frac{6}{6} = 100\%.
\]

\[
P(D) = \frac{0}{6} = 0.00\%.
\]

\[
P(A \text{ or } B) = \frac{4}{6} = \frac{2}{3} = 0.667 = 66.7\%.
\]

\[
P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{2}{6} + \frac{3}{6} - \frac{1}{6} = \frac{2}{3}
\]

\[
P(A \cap B) = \frac{1}{6} = P(A) \cdot P(B)
\]

\[
= \frac{2}{6} \cdot \frac{1}{2} = \frac{1}{6}
\]