

General Inclusion Exclusion formula

$$\begin{aligned} P\left(\bigcup_{j=1}^n A_j\right) &= \sum_{j=1}^n P(A_j) - \sum_{i < j} P(A_i \cap A_j) + \sum_{i < j < k} P(A_i \cap A_j \cap A_k) \\ &\quad - \sum_{i < j < k < l} P(A_i \cap A_j \cap A_k \cap A_l) \\ &\quad \dots + (-1)^{n+1} P(A_1 \cap A_2 \cap \dots \cap A_n) \end{aligned}$$

Saw $n=2$ and $n=3$ cases immediately prior