



$$\Omega = B_1 \cup B_2 \cup B_3$$

$$B_i \cap B_j = \emptyset, \quad i \neq j$$

$$A = (A \cap B_1) \cup (A \cap B_2) \cup (A \cap B_3)$$

$$P(A) = P(A \cap B_1) + P(A \cap B_2) + P(A \cap B_3)$$

$$= P(B_1 \cap A) + P(B_2 \cap A) + P(B_3 \cap A)$$

$$= P(B_1) \cdot P(A|B_1) + P(B_2) \cdot P(A|B_2) + P(B_3) \cdot P(A|B_3)$$

$$P(A) = P(A|B_1) \cdot P(B_1) + P(A|B_2) \cdot P(B_2) + P(A|B_3) \cdot P(B_3)$$

LAW OF TOTAL PROBABILITY

$$P(B_i | A) = \frac{P(B_i \cap A)}{P(A)} = \frac{P(B_i) \cdot P(A|B_i)}{P(A)}$$

$$= \frac{P(A|B_i) \cdot P(B_i)}{P(A)}$$

$$P(A|B_1) \cdot P(B_1) + P(A|B_2) \cdot P(B_2) + P(A|B_3) \cdot P(B_3)$$

Bayes' Rule