Bayes' Theorem (version 4)

Apply this version when we have infinitely many events A_1, A_2, A_3, ... that are non-overlapping and whose union is all of S, i.e., the A_j's are a partition of the sample space S. We want to calculate $P(A_k \mid B)$ for some event B. We write

$$P(A_k \mid B) = \frac{P(A_k \cap B)}{P(B)} = \frac{P(A_k \cap B)}{\sum_j P(A_j \cap B)} = \frac{P(A_k)P(B \mid A_k)}{\sum_j P(A_j)P(B \mid A_j)}$$