reverse conditional probability (RCB)
The *probability* $P(A|B)$ given the *conditional probabilities* $P(B|A)$, $P(B|\bar{A})$, and the probability of $P(A)$ in general (or their *complements*). Because $P(A|B)$ implies that B already has occurred, it is the proportion of $A \cap B$ occurring and B occurring (with or without A also occurring). So the formula for calculating the RCB is

$$P(A|B) \;=\; \frac{P(A \cap B)}{P(B)} \;=\; \frac{P(A) \cdot P(B|A)}{P(A) \cdot P(B|A) + P(\bar{A}) \cdot P(B|\bar{A})}$$

This formula is widely known as "Bayes rule" or "Bayes theorem".

Example: There are two boxes. Box A contains 12 black and 8 white marbles, box B contains 4 black and 16 white marbles. When randomly drawing a marble, the probability of drawing a marble from box A is $P(A) = 0.5$. The probability of drawing a black marble from box A is $P(Black|A) = \frac{12}{20} = 0.6$. Analogously, $P(Black|\bar{A}) = \frac{4}{20} = 0.2$. (Each box contains 20 marbles.) Given these probabilities, the RCB of a randomly drawn black marble coming from box A would be:

$$\begin{aligned} P(A|Black) \;&=\; \frac{P(A) \cdot P(Black|A)}{P(A) \cdot P(Black|A) \;+\; P(\bar{A}) \cdot P(Black|\bar{A})} \\ &=\; \frac{0.5 \cdot 0.6}{0.5 \cdot 0.6 \;+\; 0.5 \cdot 0.2} \;=\; \frac{0.3}{0.4} \;=\; 0.75 \end{aligned}$$