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:

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