Turning probabilities into other probabilities

\[ P(C, M) = \frac{4}{38} = P(M, C) \]

we can always turn non-negative numbers into probabilities by normalizing, i.e., divide by the sum of the numbers

\[ P(C) = P(M, C) + P(M, \overline{C}) \]

if this is missing, we can recalculate it from the other 3 values: \( 1 - P(C, M) - P(C, \overline{M}) - P(\overline{C}, \overline{M}) \)

\[ P(C \mid M) = \frac{P(C, M)}{P(M)} \]

I left the original all of students in the denominator, so it looked like we could recover the original frequencies. But this has the same \( P(C \mid M) \):

\[ P(M \mid C) P(C) = P(C \mid M) P(M) \]

Bayes' Rule!!!
if B rolls 3 \(rac{1}{4}\) \[10\% \text{ P(B)}\]
if G rolls 3 \(rac{1}{6}\)

\[
\begin{array}{c|c|c}
3 & 73 \\
B & \frac{1}{4} & \frac{3}{4} \\
B & \frac{1}{4} & \frac{3}{4} \\
G & \frac{1}{6} & \frac{5}{6} \\
\end{array}
\]

\[
P(B|3) = \frac{P(3|B) \times P(B)}{P(3)}
\]

\[
= \frac{\frac{1}{4} \times 0.1}{\frac{1}{4} \times \frac{1}{10} + \frac{1}{6} \times \frac{9}{10}}
\]

\[
= \frac{\frac{1}{4} \times \frac{9}{10}}{\frac{1}{4} + \frac{9}{10}}
= 0.1429
\]

Notice that this would be the numerator for P(G|3)!