

$$\begin{aligned}
P(2|H) &= \frac{1}{6} \\
P(2|H^C) &= \frac{1}{8} \\
P(H) &= \frac{1}{2} \\
P(H|2) &= \frac{\frac{1}{12}}{\frac{4}{48} + \frac{3}{48}} \\
P(H|2) &= \frac{4}{7}
\end{aligned}$$

$$\begin{aligned}
P(6) &= \frac{1}{6} \\
P(6 \cup 6 \cup 6) &= 1 - P(6^C)P(6^C)P(6^C) \\
&= 1 - \frac{5^3}{6^3} \\
&= 1 - \frac{125}{216} \\
&= \frac{91}{216}
\end{aligned}$$

$$\begin{aligned}
1 - P(F^C)^2 &= 0.64 \\
P(F^C)^2 &= 0.36 \\
P(F^C) &= 0.6 \\
P(F) &= 0.4
\end{aligned}$$