10.2 \text{ probability w/ tree diagrams}

A cereal box contains a toy in every box, and toys are distributed equally. The toys are a hot wheel or barbie. What is the probability you get both in 2 boxes?

\begin{align*}
\text{path 1: } B, HW &= \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} \Rightarrow P(2 \text{ toys}) = \frac{1}{2} \\
\text{path 2: } HW, B &= \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} \\
\end{align*}

Tree diagram:

Example #2: 2 classes A2. 2nd period has 40% soph and 60% NS. 3rd period has 43% soph and 57% not-soph. What is $P(S \neq NS)$ if I am choosing 1 student from each class.

\begin{align*}
\text{path 1: } (S, NS) &= (.4)(.57) = .228 \\
\text{path 2: } (NS, S) &= (.6)(.43) = .258 \\
\end{align*}

$$P(S \neq NS) = .486$$
Deck of cards: Joe is going to draw 3 cards, one after another in a standard deck. What is the probability he will draw exactly 2 hearts (keeps the cards as he draws).

\[
\begin{align*}
\text{path: } (H, H, N) & = \frac{13}{52} \cdot \frac{12}{51} \cdot \frac{39}{50} = 0.046 \\
\text{path: } (H, N, H, H) & = \frac{13}{52} \cdot \frac{39}{51} \cdot \frac{12}{50} = 0.046 \\
\text{path: } (N, H, H, H) & = \frac{39}{52} \cdot \frac{13}{51} \cdot \frac{12}{50} = 0.046 \\
\end{align*}
\]

\[P(\text{exactly 2 hearts}) = 0.138\]

Probability: \[P(\text{at least 2 hearts}) = P(2H) + P(3H)\]

\[= 0.138 + \left(\frac{13 \cdot 12}{52 \cdot 51} \cdot \frac{11}{50}\right)\]

\[= 0.138 + 0.0129 = 0.151\]

\[P(\text{at most 1 heart}) = 1 - P(\text{at least 2 hearts}) = 0.849\]

Tree diagrams → Drawing 2 cards NHT

Example #3: \[P(NHT | H)\]

*Heart was already drawn* \\

\[P(NHT | H) = \frac{39}{51}\]

\[P(H | H) = \frac{12}{51}\]

Tree diagram: sum of all pathways = 1 \\
Sum of each draw = 1