1.5 hr

\( A = (1^{st \text{ card club}}) \)

\( B = (2^{nd \text{ card diamond}}) \)

(i) \( P(A) = P(\text{win with } A) \)

(ii) \( P(A \text{ or } B) = P(\text{win with } (i)) \)

\[ \frac{1}{4} \]

\[ \frac{1}{4} \]

\[ = P(A) + P(B) - P(A \text{ and } B) \]

here \( A, B \) are not mutually exclusive
so \( P(A \text{ and } B) = 0 \)

\[ P(A) = P(1^{st \text{ card club}}) \]

\[ = \frac{13}{52} = \frac{1}{4} \]

\( P(B) = P(2^{nd \text{ card diamond}}) \)

\[ = \frac{13}{52} = \frac{1}{4} \]
with IID, marginal probability behavior of 2nd draw is identical to that of 1st draw (with replacement).

Interestingly, the same is true for SRS, even though the second draw depends on 1st (without replacement).

Imagine dealing out all 52 cards (without replacement) from a well-shuffled deck.

\[
P(A \text{ and } B) = P(\text{club and diamond}) = \frac{\binom{13}{1} \binom{13}{1}}{\binom{52}{2}}\]
\[ P(A) \text{ marginal (unconditional) probability} \]

\[ P(A \mid B) \text{ conditional probability} \]

\[ P(C \mid A) \]

\[ P(H) = \begin{cases} x & \text{undefined} \\ \frac{1}{2} & \text{coin-toss} \end{cases} \]

\[ \text{if } P \text{ then } \neg P \]

\[ P(H \mid \neg P) = \text{undefined when } P(P) = 0 \]