Problem 1: Alice and Bob's card game

(2/2 points)

Alice plays the following game with Bob. First, Alice randomly chooses a set of 4 cards out of a 52-card deck, memorizes them, and places them back into the deck. (Any set of 4 cards is equally likely.) Then, Bob randomly chooses 8 cards out of the same deck. (Any set of 8 cards is equally likely.) Assume that the choice of 4 cards by Alice and the choice of 8 cards by Bob are independent.

What is the probability that all 4 cards Alice chose were also among the 8 cards chosen by Bob?

- $\frac{\binom{48}{4}}{\binom{52}{8}}$ ✔
- $\frac{\binom{48}{4}}{\binom{52}{4}}$

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$\frac{\binom{48}{8}}{\binom{52}{8}}$

$\frac{\binom{48}{8}}{\binom{52}{4}}$

Answer:
Let us fix the 4 cards that Alice gets. Since 4 cards are fixed, Bob must choose 4 more cards out of 48 remaining cards, so the total number of possible hands for Bob that include all of Alice's cards is $\binom{48}{4}$. The total number of possible choices of 8 cards for Bob is $\binom{52}{8}$. Thus, the probability is $\binom{48}{4}/\binom{52}{8}$.

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