

Aces in bridge

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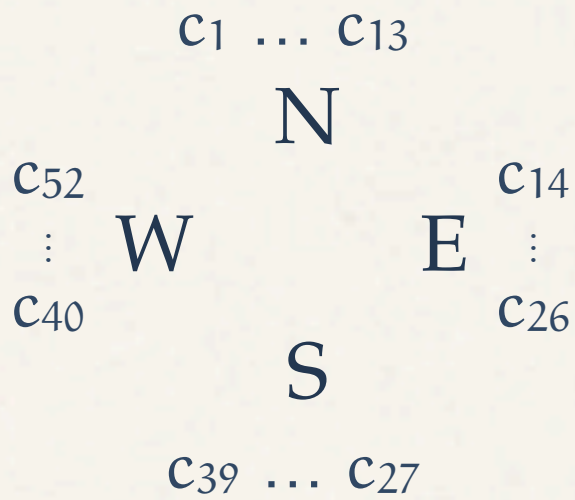
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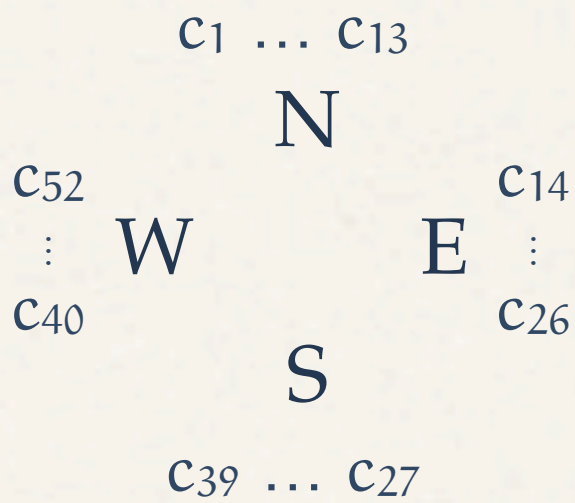


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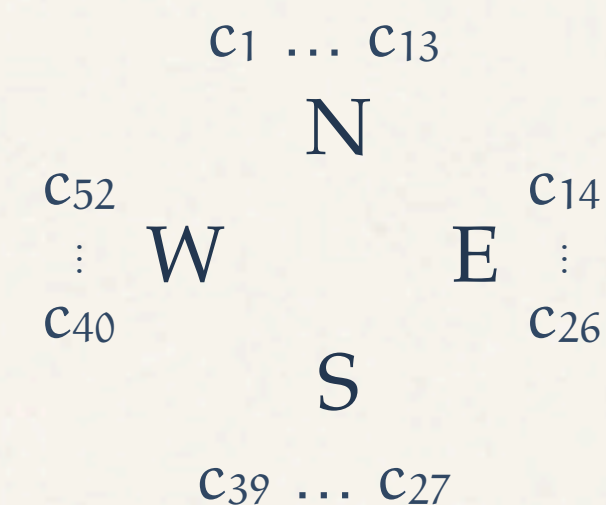


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- ❖ *Probability measure* \mathbf{P} : uniform atomic probabilities placing equal mass $1 / (52)!$ on each permutation. Each distinct bridge hand has probability $(13)!^4 / (52)!$.



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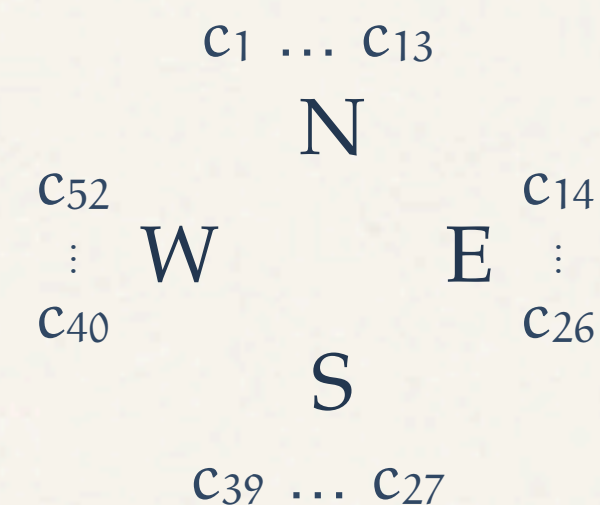
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❖ *Events*:

- ❖ $A_{\spadesuit} :=$ the ace of spades goes to a player.
- ❖ $A_{\spadesuit\heartsuit} :=$ the aces of spades and hearts go to two different players.
- ❖ $A_{\spadesuit\heartsuit\diamondsuit} :=$ the aces of spades, hearts, and diamonds go to three different players.
- ❖ $A_{\spadesuit\heartsuit\diamondsuit\clubsuit} :=$ the aces of spades, hearts, diamonds, and clubs go to four different players.

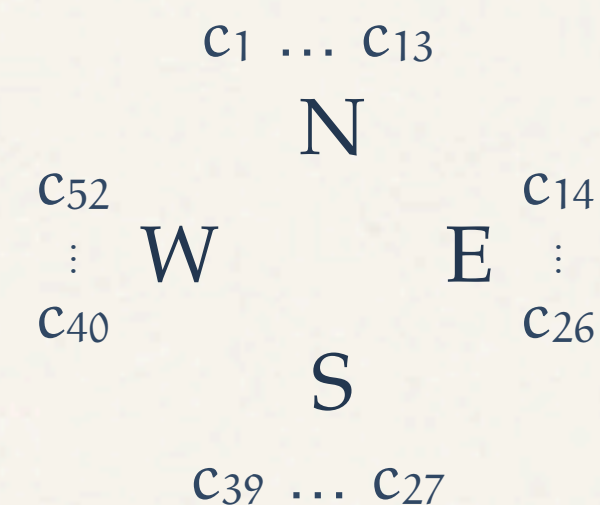


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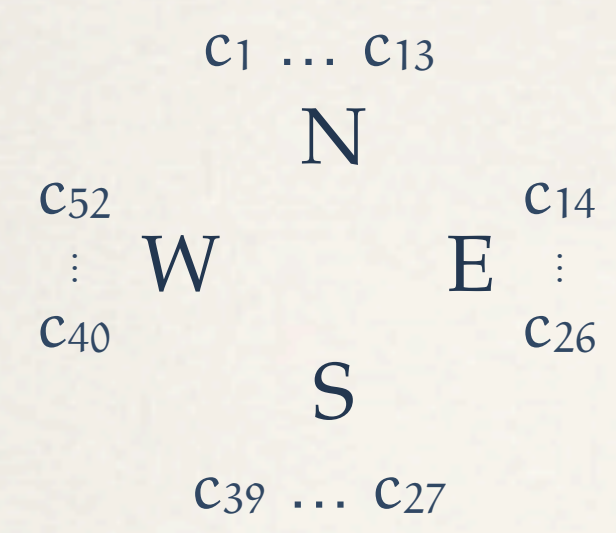
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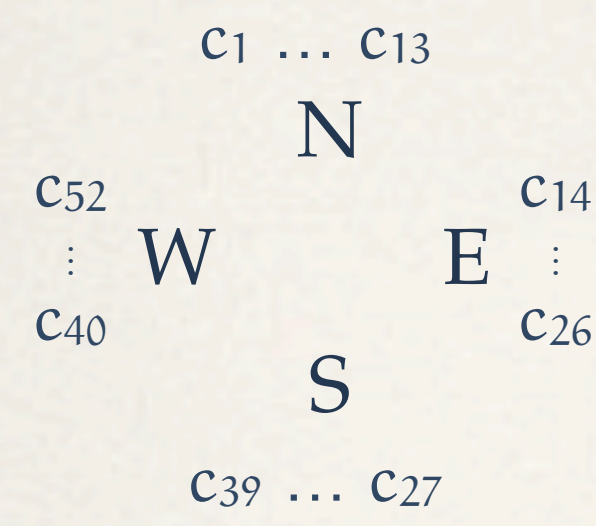
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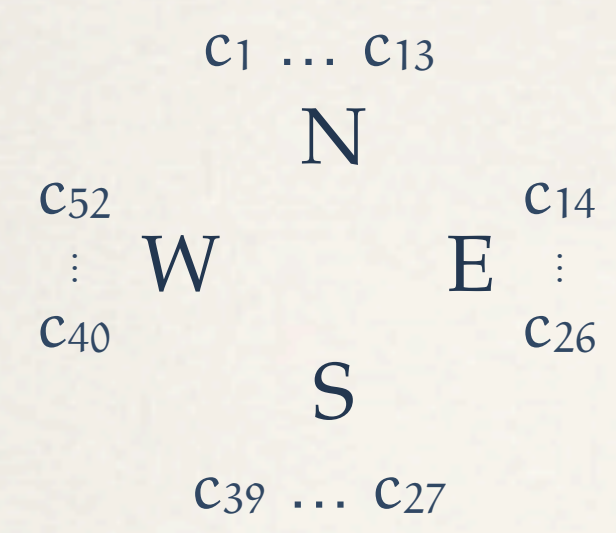
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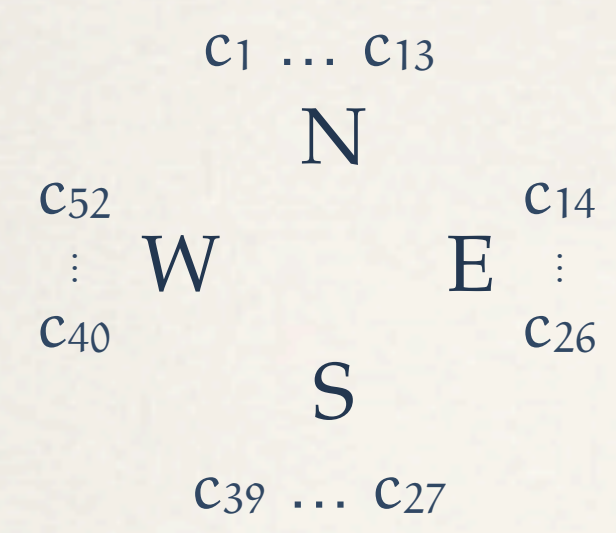
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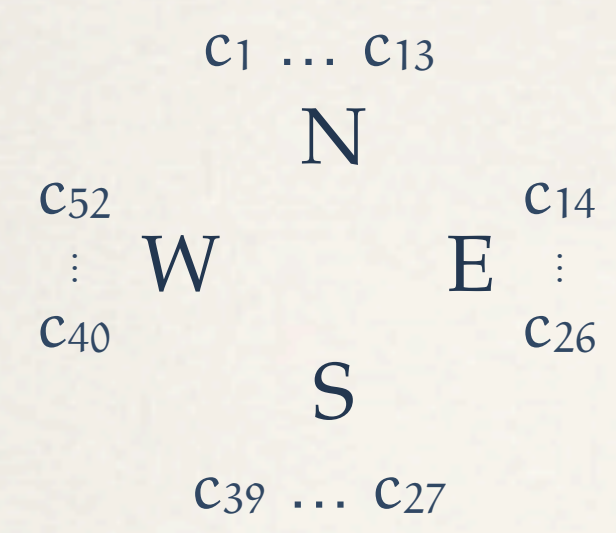
$$\begin{aligned} \mathbf{P}(A_{\spadesuit\heartsuit\diamondsuit\clubsuit}) &= \mathbf{P}(A_{\spadesuit\heartsuit\diamondsuit\clubsuit} \cap A_{\spadesuit\heartsuit\diamondsuit} \cap A_{\spadesuit\heartsuit} \cap A_{\spadesuit}) \\ &= \mathbf{P}(A_{\spadesuit\heartsuit\diamondsuit\clubsuit} \mid A_{\spadesuit\heartsuit\diamondsuit} \cap A_{\spadesuit\heartsuit} \cap A_{\spadesuit}) \times \mathbf{P}(A_{\spadesuit\heartsuit\diamondsuit} \mid A_{\spadesuit\heartsuit} \cap A_{\spadesuit}) \times \mathbf{P}(A_{\spadesuit\heartsuit} \mid A_{\spadesuit}) \times \mathbf{P}(A_{\spadesuit}) \end{aligned}$$



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