

CS486 Assignment 4

Due Mar 6th 10PM ET

1. In class, Thor and Gerry repeatedly used the fact that we can always find an optimal assignment that doesn't have "crossing edges" on the line: Prove this claim. Show that given any assignment that has some edges that are crossing in the opposite direction, we can "swap around" those edges without hurting our solution.
2. Hongcha and Cake are traveling again! This time they're in 'quantum' boxes headed to Antarctica and the North Pole. Hongcha is feeling sleepy on the trip, so much that there is only a 25 % chance that she is awake. Cake is always hyper when Hongcha is sleepy (they're entangled!), so much so that there is a 100% chance that she will be awake when Hongcha is asleep and Cake is always asleep when Hongcha is awake. What are the probabilities that they are awake or asleep in each of their four states. Remember your equation:
 $a_{00}|H_{awake}C_{awake}\rangle + a_{11}|H_{asleep}C_{asleep}\rangle + a_{01}|H_{awake}C_{asleep}\rangle + a_{10}|H_{asleep}C_{awake}\rangle$
3. We'll be exploring Alfie's question: why use a rotation of $\pi/8$? We had mentioned that we thought it was a maximization. Let's look into it.
 - Fill in cases 1-3 methods in the file [MGEB_Handout.ipynb](#) (for help, here is our [presentation](#) and here is a handy [handout](#), see "math behind it" notes in the handout for help for the three cases).
 - Run the test method that we wrote and compare your results. We used 3.14 as our pi, so that could explain little differences.
 - Use methods provided plus matplotlib (or equivalent) and create a plot of the expected probabilities with rotations 0 through $\pi/2$. What does it mean? Ours looks like:
 - As an extension, you can find what the actual rotation value is which maximizes the expected probability!

