Homework 1: Q3

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1 Part (a) Proof Idea

Just proving the lemma as essentially broken down to in recitation notes.
If you match one group with their preferences in a specific column i, then the other group is matched with their preferences in column n−i+1.

m_k is some man, and w_j is some woman, n is the number of men and women. If we can prove the lemma with a generalized form, we can say that it is always true.
Through investigation, given some column i_m, m_k is matched with w_{k+i-1} or if k+i-1 > n, it is matched with $w_{k+i-1-n}$. Also, given some column i_w, w_j is matched with m_{j+i} or if k+i > n, it is matched with m_{k+i-n}.

Given some column i, man m_k gets matched with w_{k+i-1} (lets disregard the intricacy of > n for now as it will pertain to specific input).
To prove the lemma, we have to prove that w_{k+i-1} 's n-i+1 column contains m_k.
For clarity and use of the formula I have given previously, j = k+i-1, i_w = n-i+1.
Again, given some column i_w, w_j is matched with w_{j+i} or if k+i > n, it is matched with w_{k+i-n}.

w_j's i_wth column contains m_{j+I} (i here is i_w), which,

j+i = k+i-1+n-i+1 = k+n, which is clearly greater than n so we actually use the other formula saying to minus n so k+n -n = k

Thus, the woman in m_k's ith column has m_k in her n-i+1 column.

To connect with the rest of the proof idea, given this stable matching family containing specific stable matching instances of this type, there are at least n stable matchings. Each group matches with the other group's n-i+1

2 Part (b) Proof Idea

3 Part (b) Proof Details