Beykoz University

Department of “Computer Engineering”

“Graph Theory Applications”

Project Interim Report - Part 2

- Stable Matching Problem -

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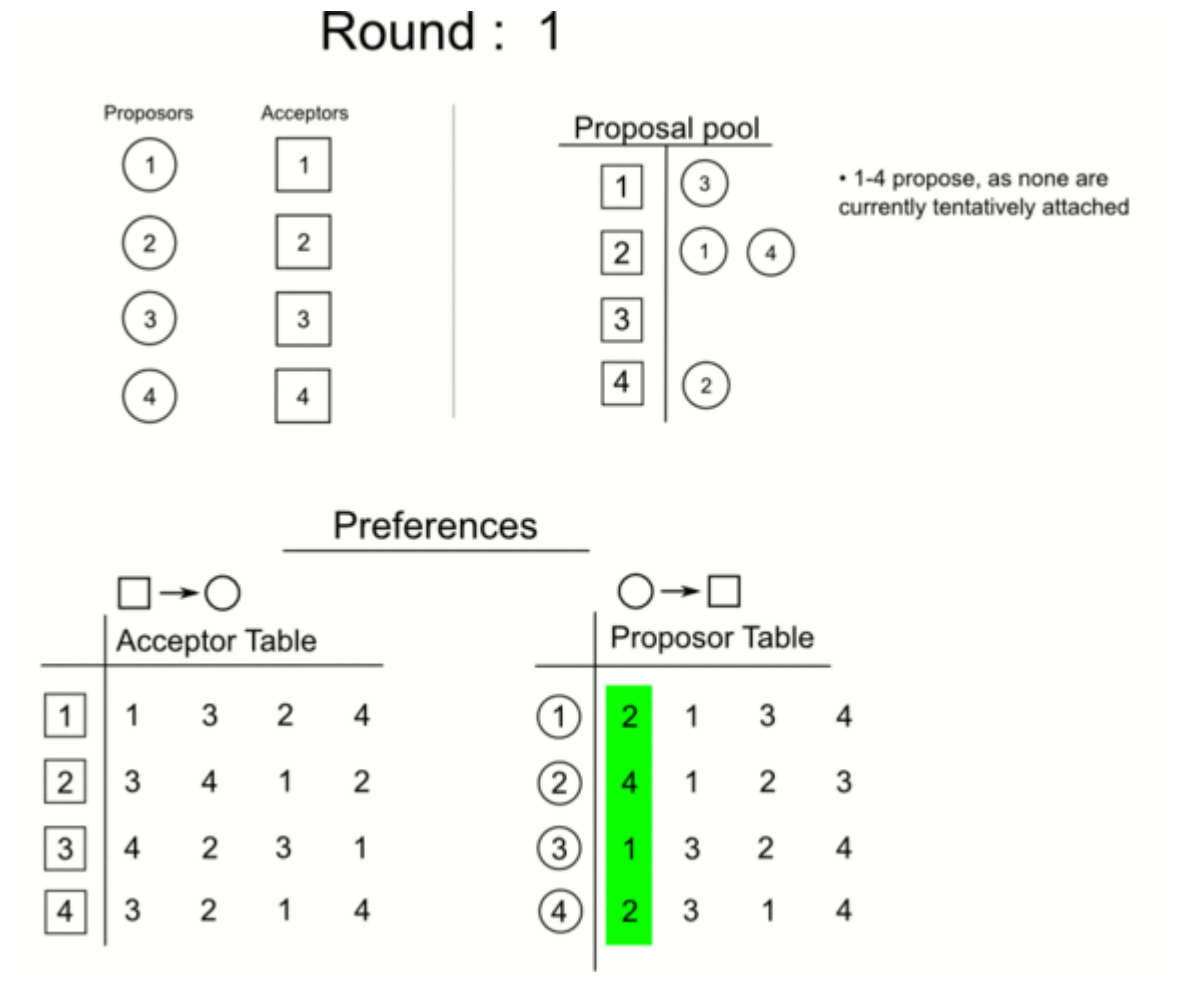
Explanation:

"Stable Matching problem" is also known as the "Stable Marriage Problem".
This problem was found by Gale Shapley and it's called the "Gale Shapley" algorithm. The Stable Matching or the Stable Marriage algorithm is a mathematical algorithm that finds stable matches between two equally sized sets of elements, the proposers and the acceptors. The algorithm works off two independent preference-frames for each set which allows preference based matching to occur.

Men's preferences	Women's preferences
m_1 : w_2 w_4 w_1 w_3	w_1 : m_2 m_1 m_4 m_3
m_2 : w_3 w_1 w_4 w_2	w_2 : m_4 m_3 m_1 m_2
m_3 : w_2 w_3 w_1 w_4	w_3 : m_1 m_4 m_3 m_2
m_4 : w_4 w_1 w_3 w_2	w_4 : m_2 m_1 m_4 m_3

$M_1=\{(m_1, w_1), (m_2, w_2), (m_3, w_3), (m_4, w_4)\}$, $M_2=\{(m_1, w_4), (m_2, w_3), (m_3, w_2), (m_4, w_1)\}$

After the initialization a proposal is made by the proposers to the acceptors and the matching algorithm begins.



Pseudocode:

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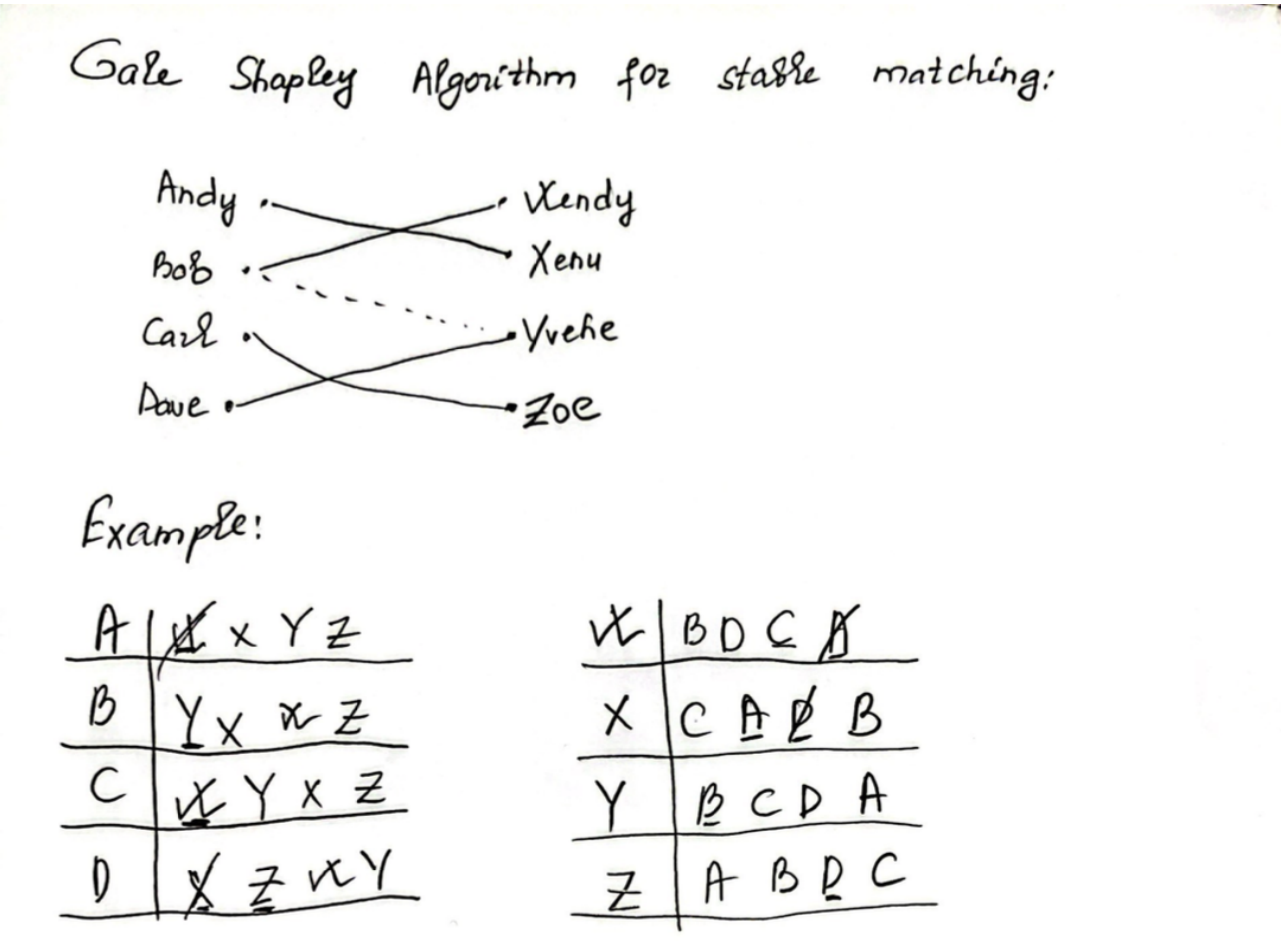
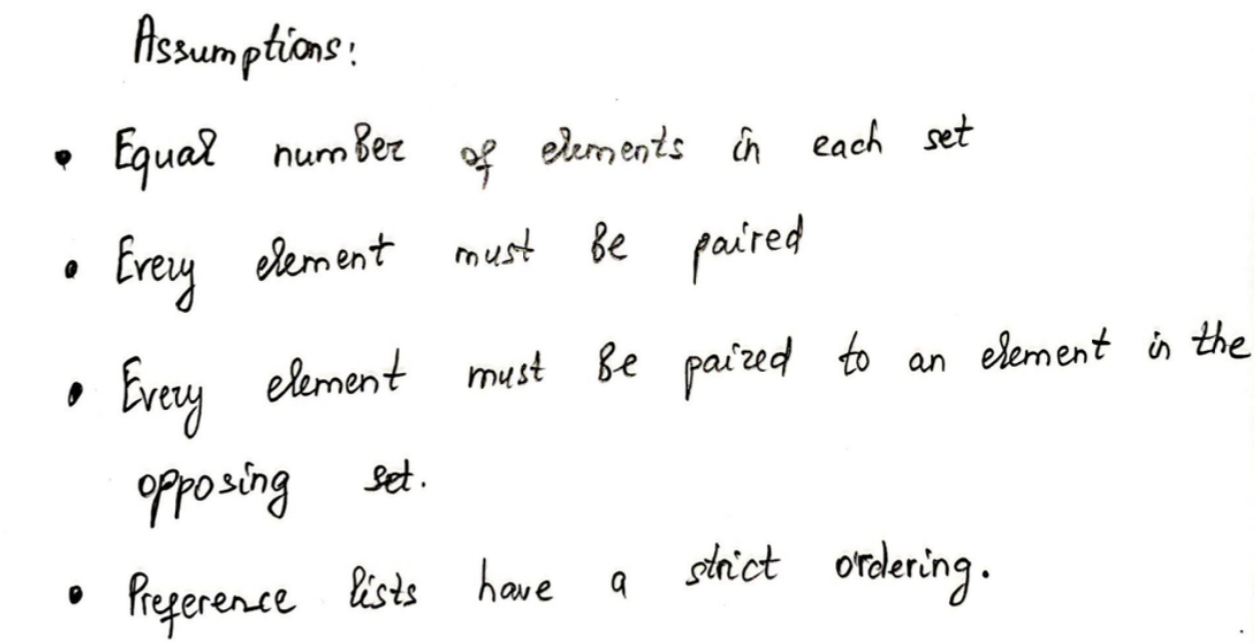
algorithm stable_matching is
    Initialize m ∈ M and w ∈ W to free
    while ∃ free man m who has a woman w to propose to do
        w := first woman on m's list to whom m has not yet proposed
        if ∃ some pair (m', w) then
            if w prefers m to m' then
                m' becomes free
                (m, w) become engaged
            end if
        else
            (m, w) become engaged
        end if
    repeat
```

Problem:

Find a stable matching for 2 sets of elements of the same size of given a list of Preferences for each element.





Source code for my project - Github Link:

https://github.com/leyviya/stable-matching-problem

References:

https://en.wikipedia.org/wiki/Gale%E2%80%93Shapley_algorithm

https://www.geeksforgeeks.org/stable-marriage-problem/

https://www.inc.com/burt-helm/gale-shapley-algorithm-innovation-nobel-prize.html#:~:text=The%20winners%20of%20the%202012,urban%20students%20with%20magnet%20schools.

https://towardsdatascience.com/gale-shapley-algorithm-simply-explained-caa344e643c2