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Homework 0

Problem 1

i) SMP is a matching problem. This problem aims to find stable couples between finite number of men (n) and finite number of women (n) according to their preferences order. A couple called stable if there are no two people of opposite sex who would both rather have each other than their current partners.

- Input : A set of women, men and their preferences.
- Output : Stable marriages.

ii) There are 3 men and 3 women. [m1,m2,m3,w1,w2,w3]
m1's list of preferences : [w1,w2,w3]
m2's list of preferences : [w2,w1,w3]
m3's list of preferences : [w1,w2,w3]
w1's list of preferences : [m2,m1,m3]
w2's list of preferences : [m1,m2,m3]
w3's list of preferences : [m1,m2,m3]

stable couples : m1-w1, m2-w2, m3-w3

Problem 2

i)

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Starts as all men and women to free
while (there exist a unmatched men/women and not proposed)
{
   w = m's most preferred w which he has not yet proposed
   if (w is free)
     engage (m, w)
   else if (w is engaged before)
     if (w prefers m to current fellow)
       engage (m, w)
        w's old husband became free
     else
       w and current husband stays engaged
}
```

ii) Gale-Shapley algorithm claims that the algorithm works in O(n^2).
As a proof;
Firstly, there is no man proposes to a woman more than once. Worst case is n women proposes to n men which causes n^2 proposes.
Furthermore, every propose takes O(1) time.
According to these complexities, algorithm works in O(n^2).