

# Assignment 0

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## 1

### 1.1 i)

The Stable Marriage Problem states that given  $N$  men and  $N$  women, where each person has ranked all members of the opposite sex in order of preference, marry the men and women together such that there are no two people of opposite sex who would both rather have each other than their current partners. If there are no such people, all the marriages are “stable” Input is  $n$  numbers of men and  $n$  numbers of women. Output is pairs that has been formed according to participant’s wish list.

### 1.2 ii)

Another example might be relationship of Employers and Employees. Assume that there are  $N$  numbers of employer and  $N$  numbers of employee. Employers have an ordered list of employees and Employees have an ordered list of employers. They will be matched correspondingly with the help of SMP algorithm.

## 2

### 2.1 i)

```
Initialize all men and women to free
while there exist a free man m who still has a woman w to propose to
{
    w = m's highest ranked such woman to whom he has not yet proposed
    if w is free
        (m, w) become engaged
    else some pair (m', w) already exists
        if w prefers m to m'
            (m, w) become engaged
            m' becomes free
        else
            (m', w) remain engaged
```

```
}
```

## 2.2 ii)

Assume that one of the women is in the highest order in all of the men's preference list AND the men that women prefer is at the end. Thus, all of the men engages with that women until her favorite person engages to her. If this case also continues with others:

There will be  $N + (N-1) + (N-2) + \dots + 1 = \frac{N(N+1)}{2}$  iteration which is equal to  $O(N^2)$

## 3

### 3.1 i)

```
//0 means free, 1 means engaged
women = [0,0,0,0]
men = [0,0,0,0]
man_pref_list = [[1,2,3,0],[1,2,0,3],[0,3,2,1],[2,1,3,0]]
women_pref_list = [[0,3,1,2],[1,3,0,2],[2,3,1,0],[1,2,0,3]]
men_pref_counter = [0,0,0,0] //shows which preference of each men is the next one.
women_match = [0,0,0,0]
free_men = 4 // n numbers of women and men

def SMP(women,men, man_pref_list,women_pref_list,men_pref_counter,free_men):

    while(len(free_men) != 0):

        for i in range(4):
            if men[i] == 0:
                selected_man = i

        prefer_woman = man_pref_list[selected_man][men_pref_counter[selected_man]]

        if women[prefer_woman] == 0:
            women_match[prefer_woman] = selected_man
            women[prefer_woman] = 1 //engaged
            free-=1
            men[selected_man] = 1 //engaged

        elif women_pref_list[prefer_woman].index(selected_man) < women_pref_list[prefer_woman].index(men[selected_man]):
            left_man = women_match[prefer_woman]
            men[left_man] = 0
```

```
men[selected_man] = 1
women_match[prefer_woman] = selected_man

men_pref_counter[select_man] += 1
```