Problem Analysis Of Stable Match

YAO ZHAO

```
Initially all m \in M and w \in W are free
While there is a man m who is free and hasn't proposed to
every woman w for which (m, w) \notin F
   Choose such a man m
   Let w be the highest-ranked woman in m's preference list
      to which m has not yet proposed
   If w is free then
      (m, w) become engaged
   Else w is currently engaged to m'
      If w prefers m' to m then
         m remains free
      Else w prefers m to m'
         (m, w) become engaged
         m' becomes free
      Endif
   Endif
Endwhile
Return the set S of engaged pairs
```

Common Problems

What data structures are used for input and output?

How to find the unmatched men efficiently?

How to efficiently query the ranking of a man in a woman's preference list?

Not to test the code sufficiently

What data structures are used for input and output?

Men's Preference Profile

	Oth	1 st	2 nd	3 rd	4 th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preference Profile

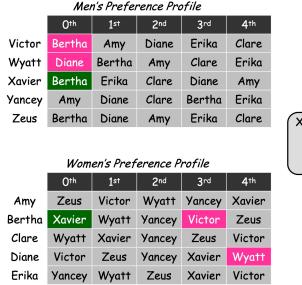
	O th	1 st	2 nd	3 rd	4 th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

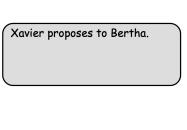
How to find the unmatched Man efficiently?

- Initial, all Men are free and add to a queue
- ► Each iterator get a free man, try to match, If a woman prefers this man over her current provisional partner, the woman will dump her current provisional partner who become free again.

How to find a woman of the highest rank and not be tried match before for a man?

In the following case, Victor is dumped by Bertha, go back to queue. We can record the index of Bertha. When he is popped from queue again, he can propose to Amy(the index of Bertha+1).





Men's Preference Profile						
	Oth	1 st	2 nd	3 rd	4 th	
Victor	Bertha	Amy	Diane	Erika	Clare	
Wyatt	Diane	Bertha	Amy	Clare	Erika	
Xavier	Bertha	Erika	Clare	Diane	Amy	
Yancey	Amy	Diane	Clare	Bertha	Erika	
Zeus	Bertha	Diane	Amy	Erika	Clare	

Wontens Treference Troffie					
	Oth	1st	2 nd	3 rd	4 th
•				Yancey	
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Wamen's Preference Profile

Xavier proposes to Bertha.

- Bertha dumps Victor and accepts Xavier.

How to efficiently query the ranking of a man in a woman's preference list?

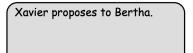
In the following case, Xavier proposes to Bertha. Bertha is matched. Now Bertha should find the rank of Xavier and her current partner Victor, to make a determine whether to accept or reject Xavier

Men's Preference Profile						
	Oth	1st	2 nd	3rd	4 th	
Victor	Bertha	Amy	Diane	Erika	Clare	
Wyatt	Diane	Bertha	Amy	Clare	Erika	
Xavier	Bertha	Erika	Clare	Diane	Amy	
Yancey	Amy	Diane	Clare	Bertha	Erika	
Zeus	Bertha	Diane	Amy	Erika	Clare	
Women's Preference Profile						

Victor Wyatt Yancey Xavier

Wyatt Yancey Victor

Yancev Wyatt Zeus Xavier Victor



- Simple solution: using a loop to find the rank of a man according the man's Appearance No. in the woman's preference list. O(n)
- ► More efficiently solution:
- 1. Maintain a reverse list of a woman's preference list.

Index: man's appearance No. → value: man's rank

Actually, we don't need man's rank → man's appearance No.

2, using map to store man's appearance No. → value: man's rank

Test

- Construct Test Data:
 - ► Generate random names but do not repetitive: Simple and efficient way: w1,w2, w3 ..or m1,m2, m3 ... and so on.
 - ▶ Prefer Lists: generate 1 to n for priority. Random swap 2 elements. You can also construct some special cases, for example, all men's preference lists are the same.
- Check Results:
 - Check the pairs number
 - Check every man has no repetition and exists in men list.
 - Check every man's partner has no repetition and exists in women list
 - Check every pair whether satisfy stable match condition. (no unstable pair)

Unstable pair condition

- woman x and man y are unstable if:
- x prefers y to its assigned man.
- y prefers x to its assigned woman.

Pay Attention

- Object copying
 - deep copy
 - shallow copy