# 1.00 Problem Set #9: Sample Solution B

"Hall's Perfect Marriage" Algorithm

Compatibility Algorithm

In this solution, we have chosen to implement a "one-way" compatibility score. (That is, the compatibility score from person A to B, is independent of the score from person B to A.) Given person A and person B, for each item in B's profile that matches A's preference, B will get one point, and vice versa. For example, we have the following two people

John Doe 2 4 4 1 3 4 2 1   2 0 4 0 2 0 2 0

Jane Smith 2 2 3 2 2 2 2 1   2 3 4 2 3 4 2 1
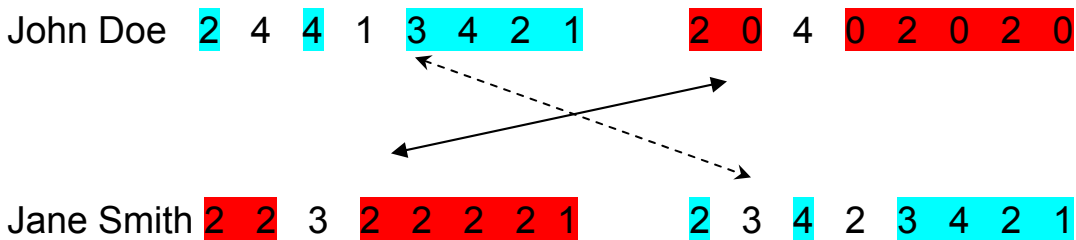
John Doe gets a score of 6 according to Jane Smith's standards and Jane Smith gets 7 points looking at John Doe's preference. Note that when an attribute has a value of 0, it matches any value for that attribute in the mate and thus adds one point.

Matching Algorithm (based on "Hall's Perfect Marriage" Theorem)

For each person, he/she will give all potential candidates a compatibility score, and sort them in decreasing order and store them in a linked list. For example, Jane Smith is trying to rank all possible male candidates, and these are the scores they got:

John Doe   6
Stephen Smith   3
Brian Scott   7
Jason Lee   5
Jose Lopez   7
Robert Carter   5

They will be put into a linked list that looks like this:

Score 7	Score 6	Score 5	Score 3
Brian Scott ↓ Jose Lopez	John Doe	Jason Lee ↓ Robert Carter	Stephen Smith
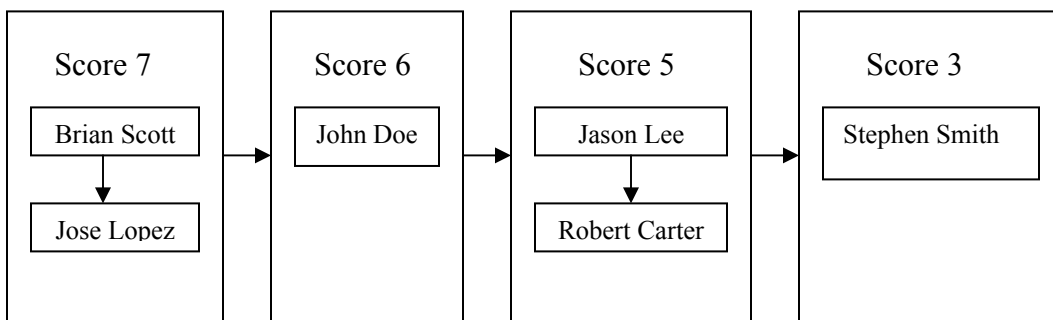
Each box represents an object of **Rank** (please refer to the .java files). It will have two data fields: one keeps the score, and the other stores the list of people with the same score using a linked list.

Using Jane as an example again, we will try to match her with her top choice. Since Brian is the first person in the linked list, we will try to see if we could match Brian with Jane. If Brian hasn't been matched, we will match him with Jane. Otherwise, we will let Brian choose if he wants to keep his current match or if he wants to replace her with Jane. If Brian's current match and Jane are equally good in Brian's eyes, then we will look at with whom does Brian have a higher compatibility score. Only when Jane is a better match for Brian will Brian's current match be replaced, otherwise, we will go down Jane's candidate list and find the next best person to match her with. If Brian's current match is replaced, then we will find her a new match.

Next, we continue with the same process for the next female in the list of females, until one of the following is true:

1. all females have been matched with one male (there may be some unmatched males left over)

2. there are no males left (there may be some unmatched females left over)

3. the best score for all the females left with any male is zero (in which case all males and females that are left over are unmatched)

At the point, the program will output a list of all matched pairs, and a list of all unmatched singles.