Worksheet 2: SMP Reductions

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6 Promising Approach

A group of residents each needs a residency in some hospital. A group of hospitals each need some number (one or more) of residents, with some hospitals needing more and some fewer. Each group has preferences over which member of the other group they'd like to end up with. The total number of slots in hospitals is exactly equal to the total number of residents. We want to fill the hospitals slots with residents in such a way that no resident and hospital that weren't matched up will collude to get around our suggestion (and give the resident a position at that hospital instead).

1. We can reduce problem B into SMP problem.
2. We can set up preference list for each hospitals and residents. For example we can have n residents and hospitals can have n or $n-1$.
    - Resident's R_n preference list can have up to n or $n-1$ number of hopsitals.
    - Hospital's, H_n prefference list can have up to n residents.
    - R_1: H_1, H_2
    - R_2: H_2, H_1
    - R_3: H_1, H_2

- H_1: R_1, R_2, R_3
- H_2: R_2, R_1, R_3

3. The solution to the RHP instance from our solution B instance, we can make a stable matching set is $M = (R_1, H_1), (R_2, H_2), (R_3, H_1)$

4. To convert from any instance I of RHP into an instance I' of B,

   (a) We convert this problem to an SMP problem.

   (b) For each resident and hospitals, we give them a preference list.

   (c) Then we make an empty stable matching list M.

   (d) We follow GS algorithm.

   (e) We can convert the stable matching list M to a solution to the RHP instance.

5. To convert from any instance I of B into an instance I' of RHP,

   (a) Since our RHP set is still empty, we can implement the GS algorithm.

   (b) Residents has its own preference list as well as hospitals.

   (c) Find the stable match for either residents or hospitals.

   (d) We iterate until we get the most stable match.