

Final Project

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1 HOSPITALS AND RESIDENTS STABLE MATCHING

1.1 THE ALGORITHM

In the hospitals and residents stable matching problem, the goal is to assign residents to hospitals given the preferences of both sides so that all assignments are stable. In this context, the term "stability" means that for each resident, there is no hospital that is available that is higher on a resident's list compared to that resident's current assignment. The reason stability is in the terms of the residents is because the residents propose to the hospitals on their preference lists and the hospitals have the ability to either provisionally accept or reject the residents based on their resident preferences and current capacity.

1.2 ASYMPTOTIC ANALYSIS AND COMPARISONS

2 APPENDIX

2.1 LINEAR SEARCH

Algorithm 1 Hospitals and Residents Stable Matching Algorithm

```
1: procedure STABLEMATCHORIGINAL(residents, hospitals)
2:   for r of residents do
3:     r.assignment  $\leftarrow$  null    // Residents start off unassigned
4:   end for
5:   for h of hospitals do
6:     h.assignments  $\leftarrow$  [ ]    // Hospitals initially have no assignments
7:   end for
8:   while !residents.isEmpty() do
9:     r  $\leftarrow$  residents.dequeue()    // Get the next resident in line to be assigned
10:    while r.assignment == null && !r.preferences.isEmpty() do
11:      h  $\leftarrow$  r.preferences.dequeue()    // Try the resident's next top preference
12:      if h.isFull() then
13:        r'  $\leftarrow$  h.getLeastPreferredAssignedResident()
14:        r'.assignment  $\leftarrow$  null    // Set the least preferred assigned resident to be free
15:        residents.enqueue(r)    // Add the resident back to the list to be reassigned
16:      end if
17:      r.assignment  $\leftarrow$  h    // Provisionally assign r to h
18:      if h.isFull() then
19:        s  $\leftarrow$  h.getLeastPreferredAssignedResident()
20:        for i  $\leftarrow$  h.preferences.indexOf(s) + 1, len(h.preferences) - 1 do
21:          s'  $\leftarrow$  h.preferences[i]
22:          s'.preferences.remove(h)    // Remove h from preferences of s'
23:          h.preferences.remove(s')    // Remove s' from preferences of h
24:        end for
25:      end if
26:    end while
27:  end while
28: end procedure
```
