

Project Allocation Algorithm

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1 Introduction and Overview

This algorithm is developed for project allotment to students. Here we deal with two sided preference i.e students have a project preference and each project has a student preference given by the faculty which floated the project. Our approach to this is to use the generalised version of Gale Shapley's algorithm.

2 Algorithm Implementation and Development

Set S represents students and set P represents projects.

Let $S = \{S_1, S_2, \dots, S_m\}$ where $S_i = (id_i, preference_i)$ is the i^{th} student and $m \in N$
Let $P = \{P_1, P_2, \dots, P_n\}$ where $P_i = (id_i, preference_i)$ is the i^{th} project and $n \in N$
A necessary condition for this algorithm to work is $n \geq m$.

2.1 Pseudo Code

Algorithm 1: Project Allocation

```
Require:  $n \geq m$ 
 $free \leftarrow S$ 
 $alloted \leftarrow []$ 
 $allocationMap \leftarrow \{\}$ 
while  $|allocationMap| \neq |S|$  do
   $S_i \leftarrow free[0]$ 
   $P_j \leftarrow S_i[1][0]$ 
  if  $\neg allocationMap.containsKey(P_j)$  then
     $allocationMap \leftarrow \{P_j, S_i\}$ 
     $alloted.push(S_i)$ 
     $free - \{S_i\}$ 
  else
     $S_k \leftarrow allocationMap[P_j]$ 
     $S_{k,index} \leftarrow findIndex \text{ of } S_k \text{ in } P_j[1]$ 
     $S_{i,index} \leftarrow findIndex \text{ of } S_i \text{ in } P_j[1]$ 
    if  $S_{k,index} > S_{i,index}$  then
       $allocationMap \leftarrow P_j, S_i$ 
       $alloted - \{S_k\}$ 
       $free - \{S_i\}$ 
       $alloted.push(S_i)$ 
       $free.push(S_k)$ 
    else
       $Pop \text{ the first element of } S_i[1]$ 
    end if
  end if
end while
```

3 Theoretical Background

Since this problem is similar to the admission problem (General case of Gale Shapley's algorithm) we can see that theorems also follow.

4 Computational Results

As we can see from the algorithm the worst case time complexity is $O(n^2)$ as we have some loops inside the outer while loop.

5 Summary and Conclusions

Test run is pending.

References

- [1] D.Gale, L.S.Shapley, *College Admissions and the Stability of Marriage*, Available at <https://www.eecs.harvard.edu/cs286r/courses/fall09/papers/galeshapley.pdf>.