AMM Project - Committee

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Formal Problem Statement

Objective: Form a faculty committee satisfying specific requirements while maximizing compatibility.

$$maximize \frac{1}{\sum_{i=1}^{N} \sum_{j=i+1}^{N} x_{ij}} \sum_{i=1}^{N} \sum_{j=i+1}^{N} m_{ij} x_{ij}$$

Key Elements:

- **Inputs:** Number of faculty members, departments, and compatibility matrix.
- **Outputs:** A selected set of faculty members forming the committee.
- **Goal:** Maximize the average compatibility among committee members.

Goal of the project : Comparing Heuristics / CPLEX

Comparative Performance

- Evaluate the effectiveness of algorithms in various scenarios.
- Identify trade-offs between precision and computational efficiency.
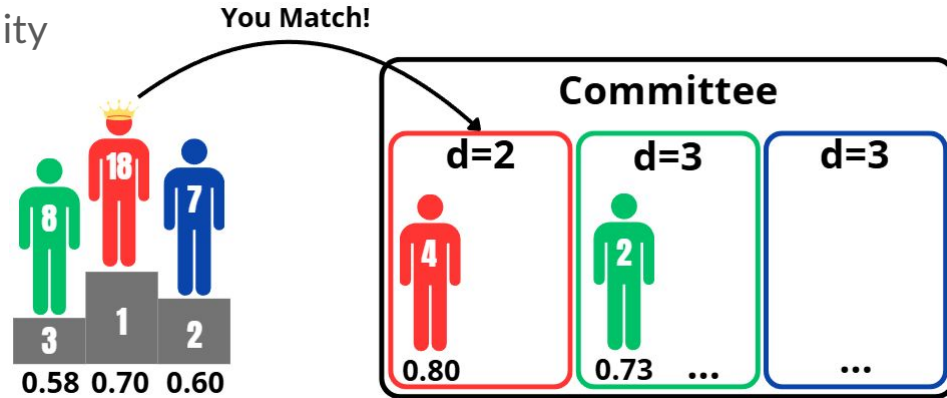
Optimization Opportunities

- Understand where heuristics outperform traditional models.
- Tailor solutions to the specific needs of the problem.

The Greedy Implementation

Step 1 : Sort the members by total compatibility

Step 2 : Take the best feasible at each step
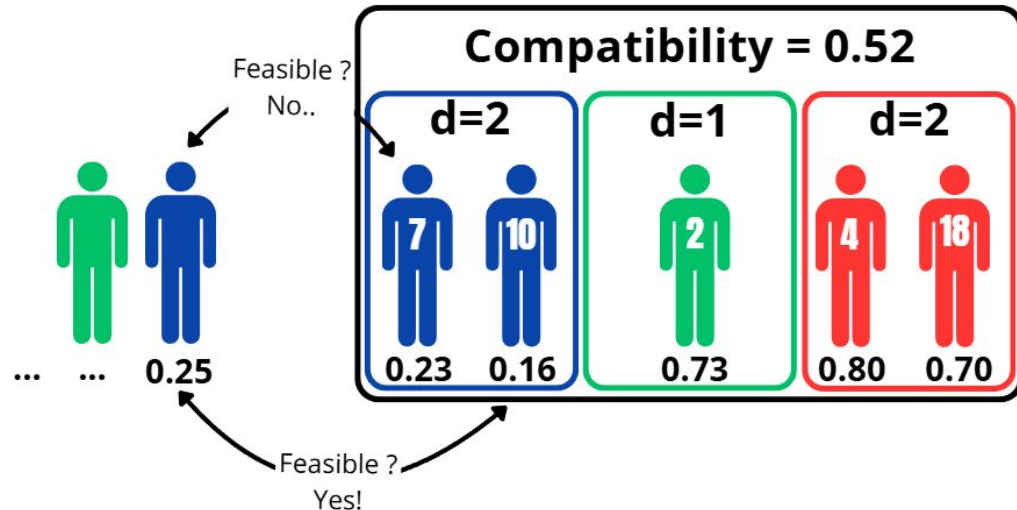
Step 3 : Check if the committee is full

Local Search : Exchange method

Step 1 : Compare the remaining teachers

with the committees

Step 2 : IF the teacher can be assigned

AND the compatibility increase

EXCHANGE the teachers

Step 3 : Repeat until compatibility
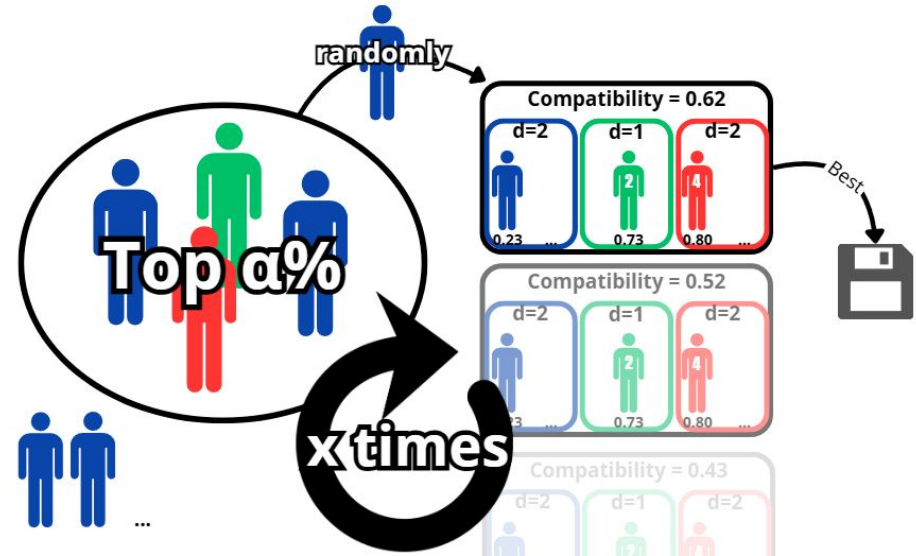
convergence or timeout

The GRASP

Step 1 : Build a solution with the Greedy

Step 2 : Create a restricted list to select

randomly amongst the best candidates

Step 3 : Create neighbor solutions until

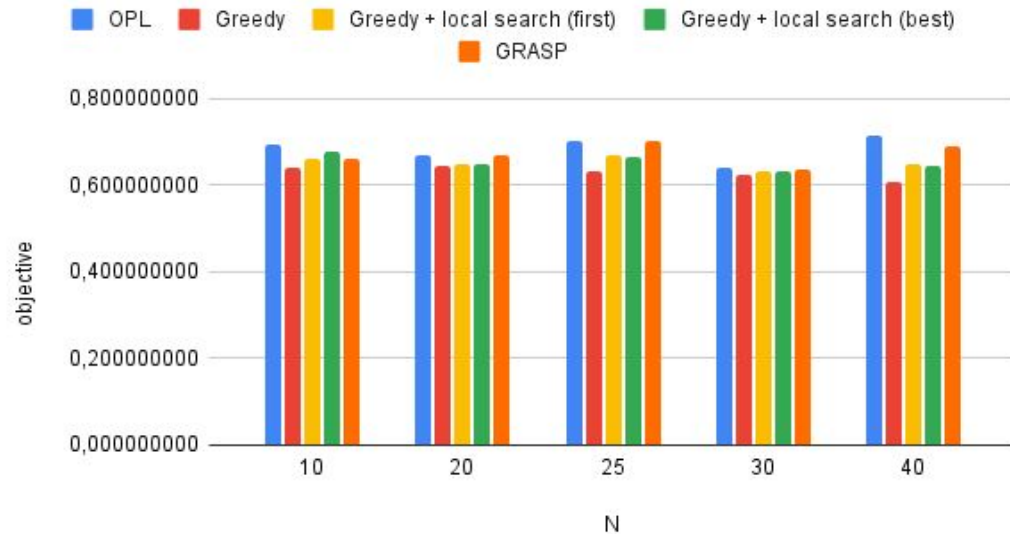a better solution is found and save it

Step 4 : Redo the process to find a solution
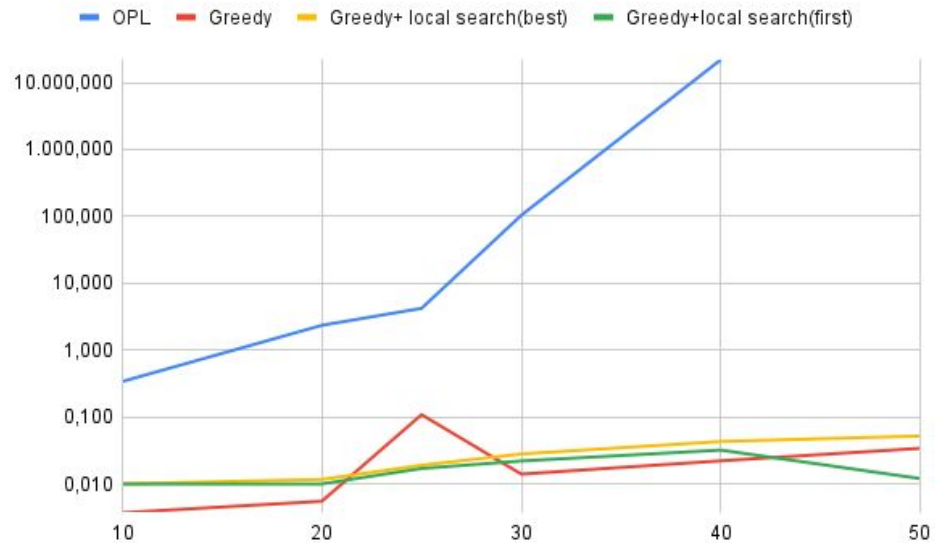
with a better compatibility

Results Comparative :

What heuristic provide the best results ?

OBJECTIVE VALUE

■ OPL   ■ Greedy   ■ Greedy + local search (first)   ■ Greedy + local search (best)
■ GRASP

Time comparison

Conclusion

CPLEX :

- Best results
- Can take a long time
- Deterministic

Greedy :

- Average results
- Very Fast
- Fails a lot

GRASP :

- Good results
- Runtime is selectable
- Not sure if feasible or too long

Greedy and GRASP improved by **local search**