OMA Assignment 2017-2018

Examination Time Tabling : Group 03

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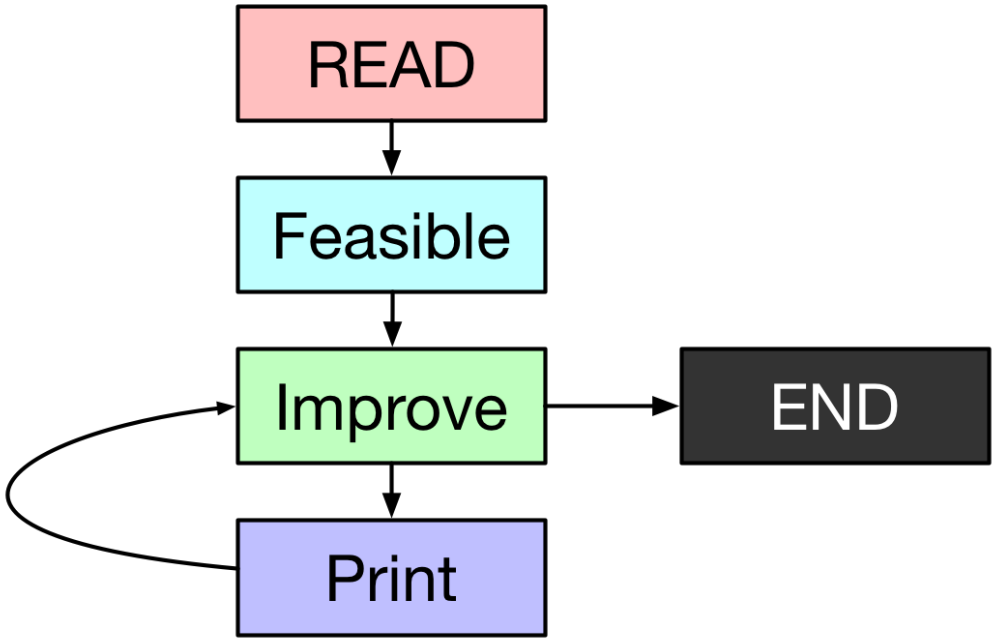
The Problem

- Solving a time scheduling problem trying to minimize the penalties of exam proximities.
- Step:
  1. Read & Store data input
  2. Finding a feasible solution
  3. Improving founded feasible



Data Structure

- The software is written in **C** due to its high performance.
- The main structure is a **GRAPH** built on a adjacency matrix.
- When two exams CAN'T be sustained in the same time slot adjM[e1][e2] = 1, otherwise -1.
- The TABU is of 1000 moves with 7 iterations.

Feasible

Finding Feasible

- The initial idea was to implement a **TABU** SEARCH over the data. Starting with this strategy resulted a little bit slow with those instances that have an high grade of complexity and conflicts.
- The final version use a **GREEDY** algorithm to reduce the complexity and then it pass this partial solution to the **TABU** implementation.
- From ~3 minutes to ~10 seconds.

Greedy

- Trying to **reduce** ”the complexity” of the problem.
- Initial data is sorted from the exam with more collision to the the fewer ones.
- **Workflow**:
  - Use the FIRST available (no collision) time slot for each exam.
  - If there aren’t enough timeslots with this configuration it adds more timeslots.
- The added timeslots will be removed with the next step.

Tabu Search

- It reduces the number of added (by the greedy) time slot till the correct number.
- TO DO…

Improve

Used techniques

Local Search

Local Swap

- Implements a STEEPEST DESCENT STRATEGY.
- Evaluates Neighborhood N(x) of the current optimal solution x.
- **Workflow**:
  - Switches exams scheduled in a timeslot with those contained in any another to find a new feasible solution x'.
  - If x' has a better benchmark than that of x, then x=x'.
  - Loop until there is no improvement anymore
- Slower than FIRST IMPROVEMENT strategy but more efficient.

Simulated Annealing

Greedy Slot Shuffle

Improve

Other techniques tried but not used in the final version…

Benchmark Insertion

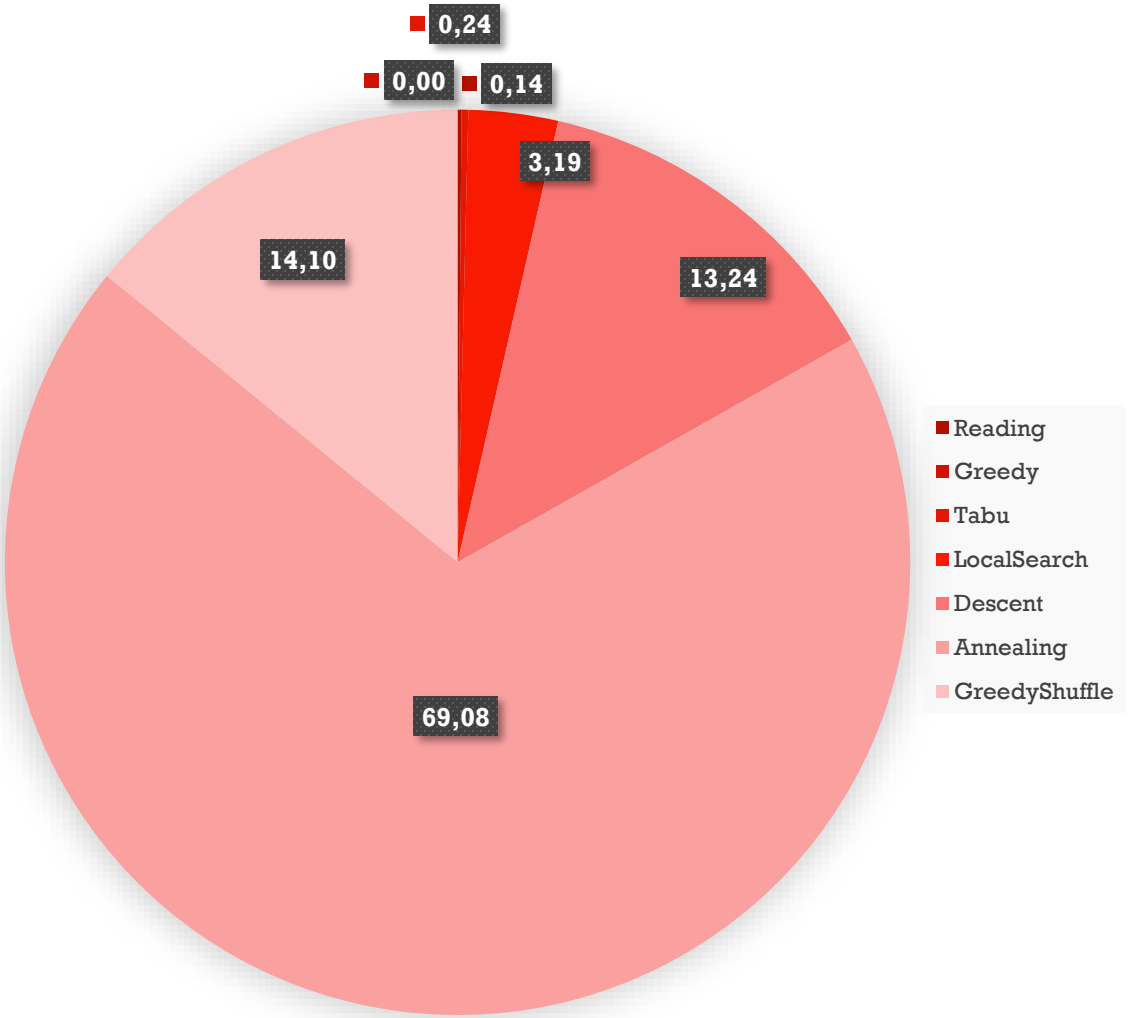
- Starting by selecting a random timeslot and then adding one at the time the best one by checking the benchmark of that temporary solution.
- ADVANTAGES:
  - Avoid ”local minimum” problem
  - Fast and easy to be implemented
- DRAWBACKS:
  - Too random

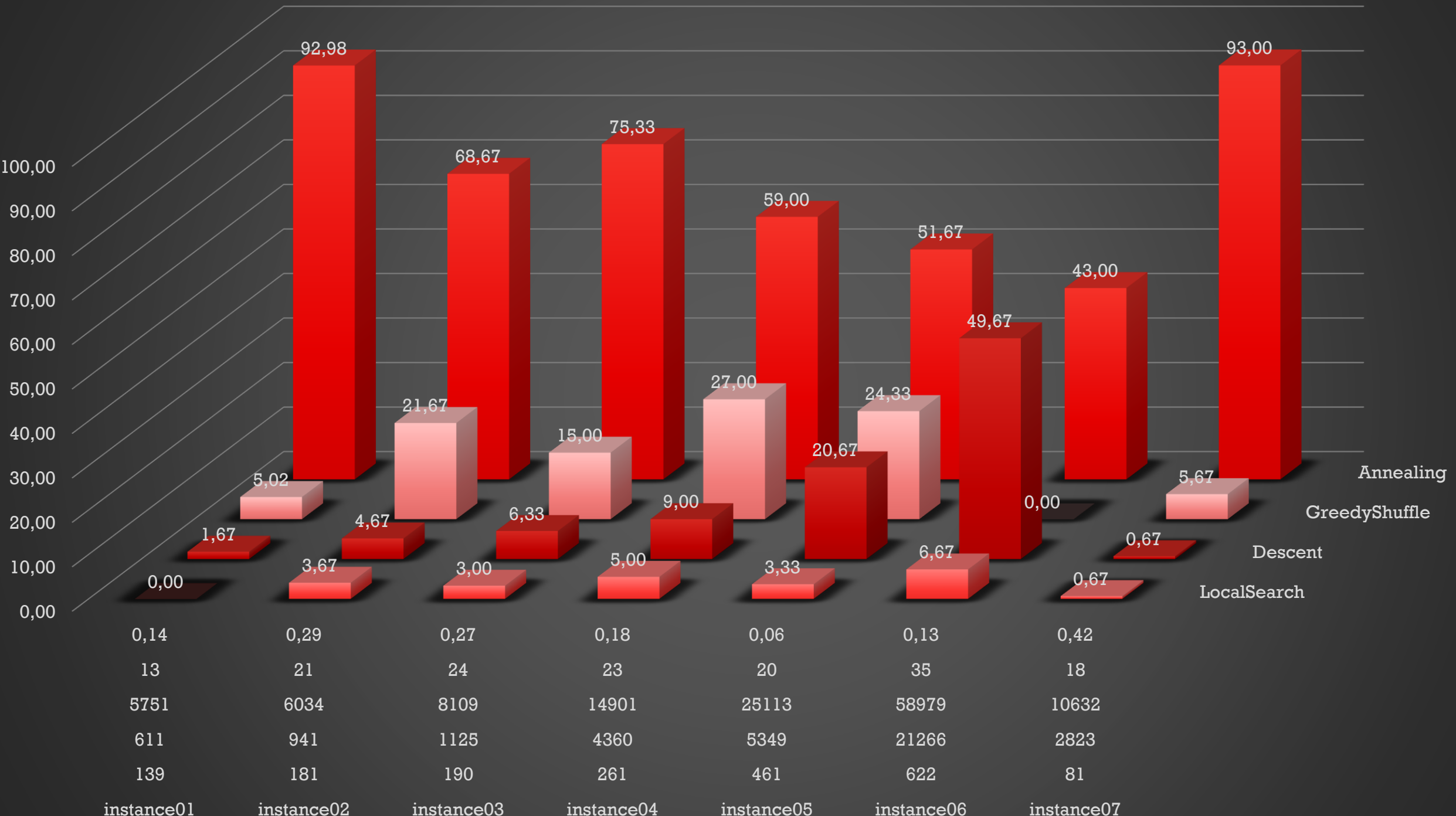
Genetic

- Starting from two or more parents it performs a cross-over between them and occasionally a mutating.
- This algorithm not fit very well this problem because it could generate a lot of unfeasible solution due to its randomness.
- DRAWBACKS:
  - Not too easy
  - Lot of unfeasible solutions

Performance

Average % Algorithm Execution Time




100,00
90,00
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70,00
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10,00
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75,33
59,00
51,67
43,00
93,00
49,67
0,00
5,02
21,67
15,00
27,00
24,33
5,67
1,67
4,67
6,33
9,00
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0,67
Annealing
GreedyShuffle
Descent
LocalSearch
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13
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139
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941
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4360
261
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20
25113
5349
461
0,13
35
58979
21266
622
0,42
18
10632
2823
81
instance01
instance02
instance03
instance04
instance05
instance06
instance07

Repository

- The whole project with code, math model, instances, presentation and benchmark results are available on a **GitHub** public repository:

https://github.com/Jacopx/OMA_ExamTimeTable

Thanks for the attention!