

EXAMINATION SCHEDULING

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Problem

Modeling The Problem

Next Steps

PROBLEM

Find a good examination schedule for the exam period of the TUM.

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- No student has to write two exams at the same time
- Rooms for an exam are minimized
- Time between exams is maximized

MODELING THE PROBLEM

$$x_{i,k,l} := \begin{cases} 1, & \text{if exam } i \text{ is written in period } l \text{ in room } k \\ 0, & \text{otherwise} \end{cases}$$

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$$y_{i,l} := \begin{cases} 1, & \text{if exam } i \text{ is written in period } l \\ 0, & \text{otherwise} \end{cases}$$

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$$(1) \sum_{\text{rooms } k} x_{i,k,l} \leq y_{i,l} \cdot M \quad \forall \text{ exams } i, \forall \text{ periods } l$$

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$$(1) \sum_{\text{rooms } k} x_{i,k,l} \leq y_{i,l} \cdot M \quad \forall \text{ exams } i, \forall \text{ periods } l$$

$$(2) \sum_{\text{rooms } k} x_{i,k,l} \geq y_{i,l} \quad \forall \text{ exams } i, \forall \text{ periods } l$$

CONSTRAINTS

- Each exam is planned in exactly one period:

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$$(3) \quad \sum_{\text{periods } l} y_{i,l} = 1 \quad \forall \text{ exams } i$$

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$$\text{c.f. } (2) \quad \sum_{\text{rooms } k} x_{i,k,l} \geq y_{i,l} \quad \forall \text{ exams } i, \forall \text{ periods } l$$

- There are enough seats for the students in the exam rooms:

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$$(4) \quad \sum_{\substack{\text{periods } l, \\ \text{rooms } k}} c_k \cdot x_{i,k,l} \geq s_i \quad \forall \text{ exams } i$$

$s_i :=$ # students taking exam i

$c_k :=$ # seats in room k

- In every room there is only one exam at a given time:

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$$(5) \sum_{\text{exams } i} x_{i,k,l} \leq 1 \quad \forall \text{ rooms } k, \forall \text{ periods } l$$

- There are no conflicts for students taking multiple exams:

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$$(6) \quad \sum_{\substack{\text{exams } j, \\ j \text{ conflicts with } i}} y_{j,l} \leq (1 - y_{i,l}) \cdot M \quad \forall \text{ exams } i, \forall \text{ periods } l$$

- Minimize the total number of rooms:

$$\min \sum_{\substack{\text{exams } i, \\ \text{rooms } k, \\ \text{periods } l}} x_{i,k,l}$$

- Maximize the time between two exams:

$$\max \sum_{\substack{\text{exams } i, j \\ i \text{ conflicts with } j}} d_{i,j}$$

$d_{i,j} :=$ distance between exams i and j

OBJECTIVE FUNCTION

- Combine the previous two objective functions using a weighting factor $\gamma > 0$:

$$\min \sum_{\substack{\text{exams } i, \\ \text{rooms } k, \\ \text{periods } l}} x_{i,k,l} - \gamma \cdot \sum_{\substack{\text{exams } i,j \\ i \text{ conflicts with } j}} d_{i,j}$$

NEXT STEPS

FINDING A FEASIBLE STARTING SOLUTION

Compute planning
order of exams

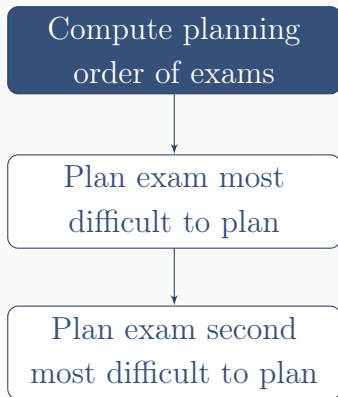
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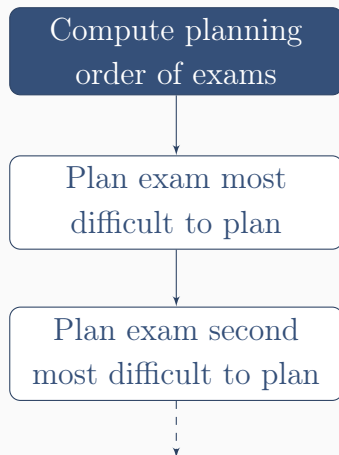


Plan exam most
difficult to plan

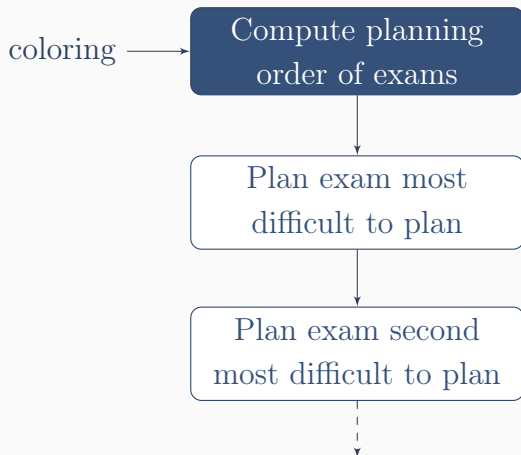
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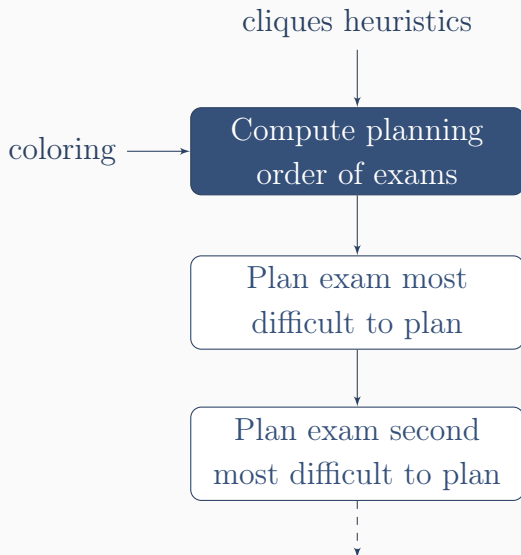
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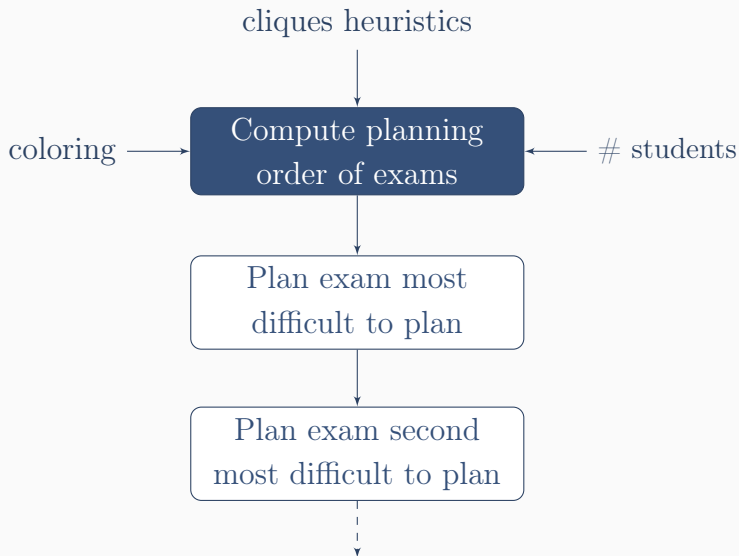
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- Remove absolute value in the objective function.

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- Remove absolute value in the objective function.
- Improve running time using heuristics, pre-solving, etc.
- Using a path based model and column generation



Figure 1: Server, hopefully somewhere in Germany