P1 : Timetable Management System for an Academic Institution

Project Review - 1

Problem statement and solution proposal

Team 7

Design
B4
Coding

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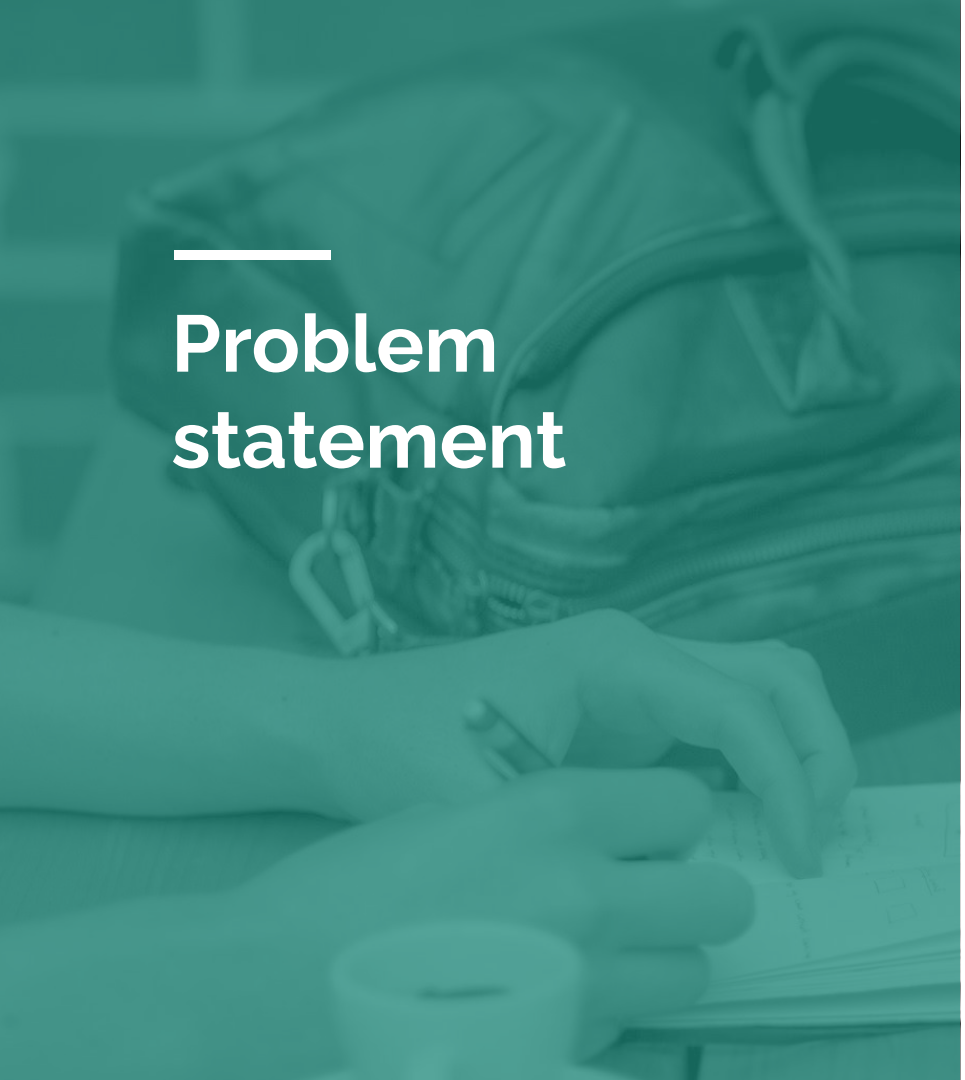


Problem statement

Generate a University Timetable scheduling periods for the given subjects keeping in mind the various soft and hard constraints specified.

The manual approach of establishing a timetable is a grueling task for educationalists in institutions with high numbers of students, and it frequently results in numerous courses clashing or several lectures allocated to the same professor.

For this reason, an automated system capable of generating a timetable following the requirements specified by an end-user is preferred.[1]

Algorithm Inputs and Outputs

Inputs:

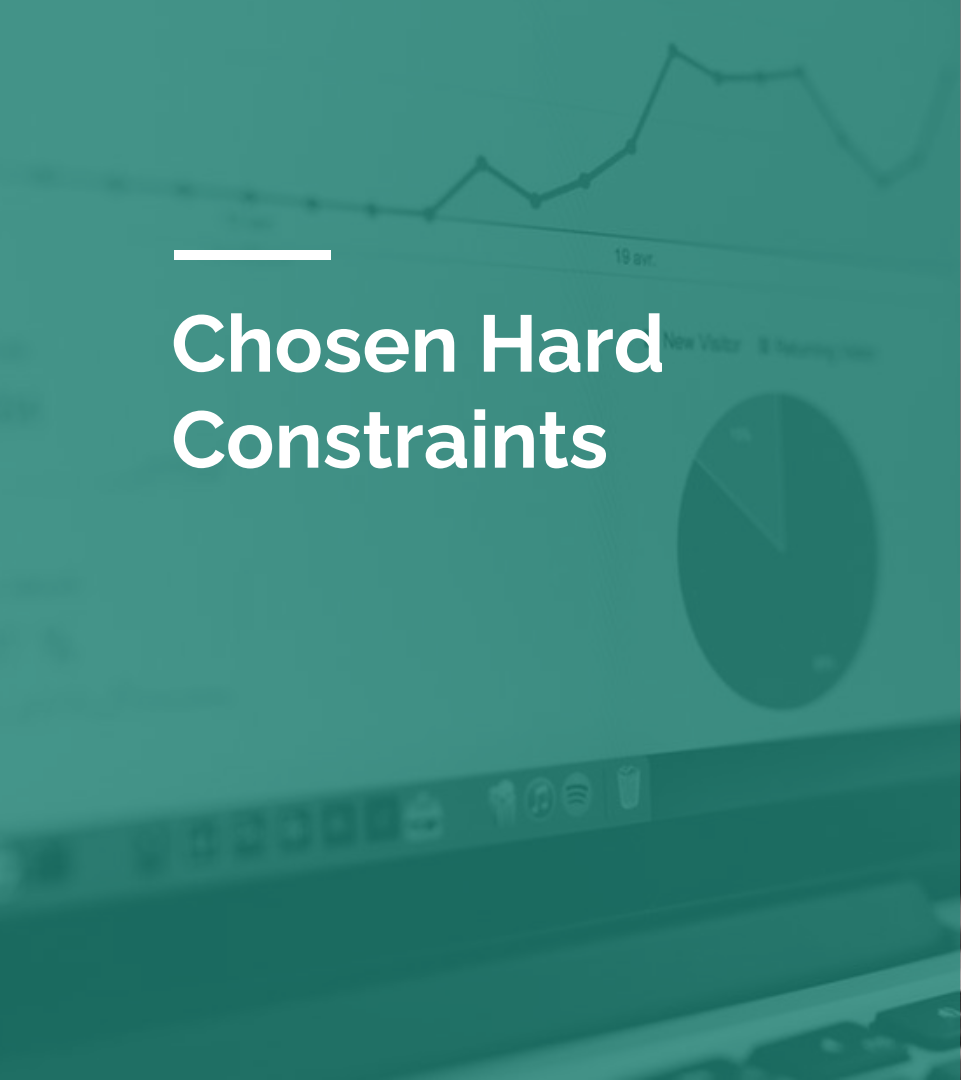
- General Information
  - Degree (UG/PG)
  - Semester

- Resources
  - Classrooms
  - Physical lab and slots
  - Courses available
  - Number of hours per course.
  - Faculty available
  - Students undertaking a course grouped into sections.

- Parameters
  - Day timings [8:00 AM - 3:40 PM etc.]
  - Number of hours in forenoon and afternoon [4 hours-FN/ 2 hours-AN]
  - Break duration between FN and AN sessions.

Outputs:

- Class Timetable for each section.
- Faculty Timetable for each faculty member.
- Lab timetable



Chosen Hard Constraints

1. A classroom is assigned to just one lecture at a time.
2. Staff/Student clash checks - Faculty and Students are not allotted different classes at the same time.
3. The first hour must be allotted to an accredited course.
4. A break between forenoon and afternoon session must exist.
5. A faculty member may have a maximum of two theory hours and a maximum of one lab session per day.
6. Electives are scheduled for the same session across departments.
7. Faculty are not allotted Consecutive teaching hours.

Chosen Soft Constraints

1. Allotting Core subjects in the last time slot should be avoided.
2. Co-curricular subjects are allotted to the afternoon sessions.
3. Sessions alternate between Core and non-Core subjects.
4. First hour session is allotted to department faculty.

Technique Chosen

Constraint Logic Programming

Constraint Programming is a programming paradigm in which variables' relationships with each other can be expressed as constraints. To obtain a solution that satisfies all of the mentioned restrictions, different algorithms are used.

Our timetabling problem is fundamentally a scheduling problem, where three resources must be allocated - the student sections, the professor and the classroom.

Out of these, the sections and professor are already assigned at the start, and the system must assign the classroom to the other two.

Our section, professor and classroom data is first obtained and stored in a manner easily parse-able by the program.

Each course is transformed into a job for the constraint solver, with each job obtaining the required parameters as mentioned above.

Depending on the nature of the hard constraint, it is enforced via pre-existing schemes that are provided by the implementation language, or through intelligent initialisation of output variables.

Soft constraints may be enforced using techniques such as value ordering heuristics.

The solver finally assigns the start-time, day and classroom for a particular course and moves on to the next course to find a slot for it.

Implementation Timeline

Activities (in weeks)	1 R.1	2	3	4 R.2	5	6 R.3	7	8	9	10	11 R.4
Formulating problem statement											
Designing system architecture											
Implementing basic input parsing and unconstrained timetable generation											
Implementing hard constraint recognition											
Implementing soft constraint recognition											
Review of soft and hard constraint recognition feasibility											
Finishing implementation details											

References

1. D. de Werra, An introduction to timetabling, European Journal of Operational Research, Volume 19, Issue 2, 1985, Pages 151-162, ISSN 0377-2217, https://doi.org/10.1016/0377-2217(85)90167-5.
2. https://www.researchgate.net/publication/2309710_Timetabling_in_Constraint_Logic_Programming - Kambi, Maria & Gilbert, David. (1996). Timetabling in Constraint Logic Programming.