Time tabling

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Part I

General Time Tabling

Chapter 1

Introduction

The aim is to create a flexible system for managing timetables that can be easily customized for different needs. We will accomplish this by first creating a general framework for timetabling and then showing how it can solve a specific problem, the *University Course Timetabling Problem* (**UCTP**). In this introductory chapter, we will address three key questions: Why is it important, What needs to be done, and How to approach it.

1.1 Motivation

1.2 Precise formulation of problem

A time table specification revolves around three main actors:

1. **Parties**(P): The parties involved in the activities taking place in the time table.
2. **Meetings**(M): A meeting is an interaction that occurs between parties.
3. **Places**(L): Meetings occur in places.

Each one of these actors may have requirements which are compulsory:

1. **Party requirements**: A party may have a set of requirements. Ex. Not working for more than x hours in a day.

2. **Meeting requirements**: A meeting may have requiremets. Ex. Requires the prescence of certain parties to take place.
3. **Place requirements**: A place may have requirements. Ex. A place may only be able to accomodate a perticular number of people.

For a complete list of considered requirements refer to *Appendix-A*. Apart from these 3 actors there is a fourth, time(T). Available timings where meetings can take place must also be specified. Time is a little special compared to the other factors, as the requirements imposed by time are mostly common to all domains.

Each one of these actors may have preferences:

1. **Party preferences**: Likes it if all meetings are clumped together
2. **Meeting preferences**: Would like it if there are less than x meetings in a cycle.
3. **Place preferences**: Would like it if there are less than y number of people at any instance of time.

Time is unique in that it does not have preferences. Preferences **must be concrete**, i.e there exists a preference function which provides a rating of how good or bad a time table solution is. In literature, preferences are called *soft-constraints* whereas requirements are called *hard-constraints*.

From here on out, P refers to some subset of the power set of P.

1.2.1 Solution

A subset $A \subset P \times M \times L \times T$ is said to be a solution to the time table specification given that *all meetings take place in* A, *meetings must be singular*, and *no conflicts should be present*.

Meetings taking place

A meeting $m \in M$ is said to take place in $A \subset P \times M \times L \times T$ iff

$$\exists a \in A \text{ s.t } a = (p', m, l', t')$$

where $p' \in P, l' \in L, t' \in T$.

Singularity

A actor instance x is said to be singular if

$$\exists a \in A \text{ s.t } a = (\cdots, x, \cdots) \rightarrow \nexists a' \in A \text{ s.t } a' \neq a \text{and} a = (\cdots, x, \cdots)$$

Conflicts

A conflict is a situation where for a $t \in T \exists a_i$ such that, COMPLETE this.

1.2.2 Feasibility

A solution which satisfies all requirements is feasible.

1.2.3 Optimality

A solution is said to optimal if it satisfies the *global preference function* better than any other solution.

Global preference function

1.3 Solution methodology in brief

Part II

Specific Time Tabling Problems

Chapter 2

University Course Time Tabling Problem (UCTP)

2.1 Terminology

2.2 Requirements

1.

2.3 Preferences

2.4 References

1. First three sections have been paraphrased from *"Problem Description of General UCTP.pdf"*