Promise Tickets: A Call for Comments

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Overview I

Background

About Me and My Previous Work

- PhD[1] and previous postdoc[2] were in the field of Constraint Satisfaction and Combinatorial Optimisation (sometimes just called **CP** for Constraint Programming)
- CP is often useful in scheduling and planning problems, especially when ad-hoc constraints exist

[1] Felix Ulrich-Oltean, Peter Nightingale, and James Alfred Walker. "Learning to Select SAT Encodings for Pseudo-Boolean and Linear Integer Constraints". In: *Constraints* (2023). DOI: 10.1007/s10601-023-09364-1.

[2] Michael Prümm, Peter Nightingale, and Felix Ulrich-Oltean. "Scheduling Telescope Observations for the European Southern Observatory". In: *31st International Conference on Principles and Practice of Constraint Programming (CP 2025)*. 2025. DOI: 10.4230/LIPIcs.CP.2025.43.

Previous Research, Quick Example

- Problems are written in a higher level constraint modelling language.
- They can be encoded to Boolean SAT to be solved by fast SAT solvers.
- There's more than one method of encoding your problem (somewhat analagous to compiling a C++ program).
- The choice of encoding can affect the solving time, sometimes by orders of magnitude.
- Perhaps ML can help.

Quick Example Continued

- We had 6 available encodings (algorithms) for each of two aspects of a problem.
- Each of the 36 combinations came out on top for some problem instances.
- A portfolio of 6 combinations could get within 16% of the absolute optimum.
- Allowed us to run a practical set of experiments to get training data for ML.

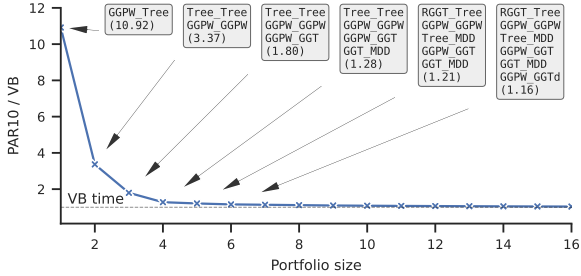

Figure 1: Relative performance of different portfolio sizes

Promise Tickets

The Idea

The Problem

- Imagine going to a show or sports match.
- There are 6 in your party, and you want to sit together.
- One of you has a weak bladder and prefers to be by the aisle.
- The arena is already pretty booked up, so finding 6 seats together is impossible.

An Improvement

- What if the venue could shift people around slightly to accommodate your request?
- Customers could book a "promise", e.g. "6 seats together, by the aisle", but the exact seats were not decided until the day of the show (or when sold out).

Some Applications

- Show seating / airline bookings
  - "We need 4 seats together"
  - "I'd just like a window seat"
- Medical appointments
  - Appointment in 3 weeks - for now, the date (+am/pm) will do.
  - Exact time can be given the day before.
  - Clinicians and time slots can be reassigned, for a more robust and efficient workflow.
- School parents' evening
  - We need to see teachers A, B, C, D.
  - I can only get there after 6.30pm.
  - Want to get home as soon as possible.

An Example: Airline Seats

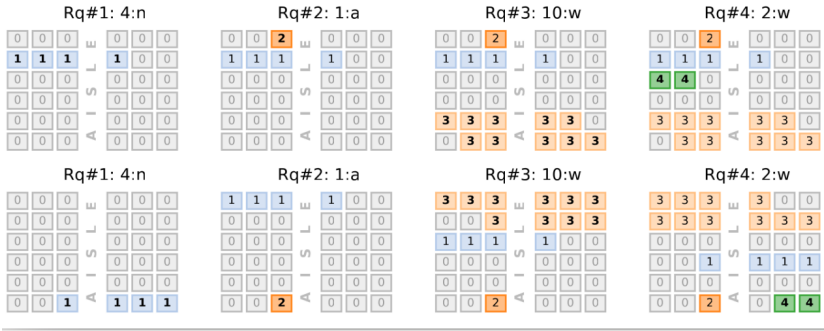

Figure 2: The eager vs lazy solution for the seating requests 4:n 1:a 10:w 2:w 1:w // 6:a 2:n 2:n 1:w 3:a 3:n 1:w // 5:w

Airline Seats Continued

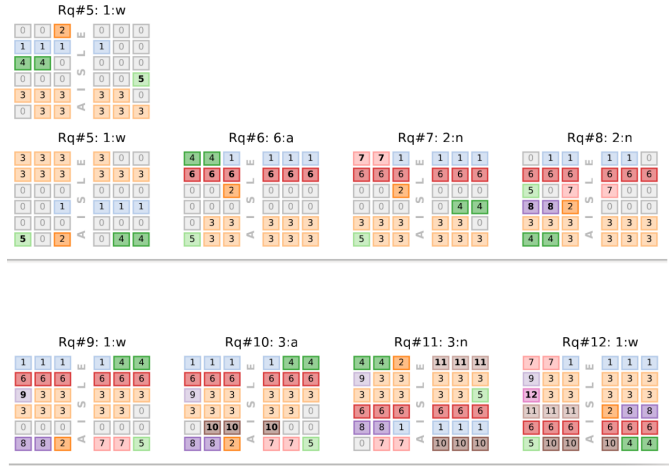

Figure 3: The eager vs lazy solution for the seating requests 4:n 1:a 10:w 2:w 1:w // 6:a 2:n 2:n 1:w 3:a 3:n 1:w // 5:w

The Framework

- A way of modelling the promises and solutions (CP is good fit)
- A guaranteed implementation/solution with each promise
- A way to quickly establish what promises are available

Call for Problems

Application in RTDS

Features

- A service provider which accepts requests to be scheduled, giving certain guarantees.
- The ability to quickly offer a menu of available guarantees.

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