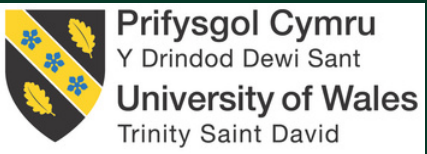




A Configurable Auto-Scheduling Prototype for Social Care Using Constraint Programming

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1.The Problem

Every week, care managers build a rota that must satisfy all of the following at once:

- Working Time Directive rest periods
- Qualification and grade requirements per shift
- Minimum hours for staff on sponsored visas
- Fair distribution of shifts across the team
- Individual staff preferences and leave

None of these is hard alone. The difficulty is tracking all of them together and most UK providers still do it by hand.

2.Research Gap

Commercial rostering tools identify problems after a rota has been built. They flag compliance issues and staffing gaps, but do not optimise for fairness, preferences or sponsorship hours during scheduling itself.

That balancing work stays with the manager.

Three market-leading tools were reviewed. None factors visa compliance into the scheduling process.

3.The Approach: Google OR-Tools CP-SAT

Hard Constraints

- Slot coverage
- Grade
- Qualifications
- Availability
- One shift per day
- 11 hour rest
- Max weekly hours
- Pre-filled roles

Soft Constraints

- Unfilled penalty
- Agency use
- Fairness
- Preferences
- Clustering
- Sponsorship hours
- Contracted hours

All fifteen resolve into a single objective function the solver maximises. Managers reweight priorities with sliders and rerun in seconds

4.Results

Solver vs manual rota

Measure	Solver	Manual
Build Time	<25s	11-16 mins
WTD Compliance	100%	97.8%
Preference Satisfaction	87-96%	41-46%
Fairness	0.14 - 0.23	0.33-0.35
Sponsorship hours met	100%	57-67%
Shift clustering	1.33-1.50	1.56

Two managers · two test weeks · 20 synthetic staff. Managers matched the solver on coverage, grades and qualifications.

5.Key Finding

Manager confidence that their own rota met WTD rest rules: 4 / 5

Neither rota was compliant

Both participants were experienced managers. Both believed they had produced a compliant rota. Both missed the same type of breach. The problem is not carelessness - it is that verifying rest periods across a full week by hand is a difficult task.

The System

Rota KPI Dashboard Staff Overview Manual Entry						
Day Shifts						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Olivia Hartley Senior Support Worker	Olivia Hartley Senior Support Worker	Kwame Asante Senior Support Worker	Kwame Asante Senior Support Worker	James Okafor Senior Support Worker	Amara Patel Senior Support Worker	Amara Patel Senior Support Worker
Marcus Ellis Senior Support Worker	Blessing Eze Support Worker	Yewande Obi Support Worker	Leon Carter Support Worker	Callum Reid Support Worker	Callum Reid Support Worker	Fatima Al-Hassan Support Worker
Aisha Kamara Support Worker	Thomas Brennan Support Worker	Aisha Kamara Support Worker	Priya Nwosu Support Worker	Leon Carter Support Worker	Fatima Al-Hassan Support Worker	Yewande Obi Support Worker
Blessing Eze Support Worker	Aisha Kamara Support Worker	Priya Nwosu Support Worker	James Okafor Senior Support Worker	Priya Nwosu Support Worker		
* Sarah Mitchell Manager	* Sarah Mitchell Manager	* Sarah Mitchell Manager	* Sarah Mitchell Manager	* Sarah Mitchell Manager		
Night Shifts						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
Patrick Nolan Support Worker	Patrick Nolan Support Worker	Thomas Brennan Support Worker	Kieran Walsh Support Worker	Kieran Walsh Support Worker	Sinead Byrne Senior Support Worker	Sinead Byrne Senior Support Worker
Amara Patel Senior Support Worker	Marcus Ellis Senior Support Worker	Blessing Eze Support Worker	Yewande Obi Support Worker	Daniel Hughes Senior Support Worker	Daniel Hughes Senior Support Worker	Kwame Asante Senior Support Worker