CP Models using Choco Solver

1 Nurse Rostering Problem

Nurse Rostering problem is a plan for n nurses in hospital on d days. Each nurse is scheduled for each day as either: `(d)` on dayshift, `(n)` on night shift, or `(-)` day off under hospital, services and working constraints:

1. In each four day period a nurse must have at least one day off.
2. No nurse can be scheduled for 3 night shifts in a row.
3. no nurse can be scheduled for a day shift after a night shift.
4. Day shift size and min/max night shift size.

Question 1 • Give an implementation in Choco of the Minizinc CP model discussed in the classroom.

2 Fortenite Battle Royale Problem

Fortnite is an online video game released in 2017. *Fortnite Battle Royale* is a game mode version based on a "battle royale" game in which up to 100 players fight to be the last person standing.

A coordinator of a closed facebook group, coined `THE-FORTNITERS`, has come to you with the following problem: In their group, there are $s \times p$ members, each of whom play a fortnite game once a day within s parallel sessions of p players. They would like you to come up with a schedule of play on d days so that a member play than another in at least min sessions and at most max sessions. If two players are scheduled to play in the same session for a given day, they can not play together the day after.

Question 2 • Propose a CP model for this problem.

Question 3 • Identify some symmetries of the problem by using every similar elements of the problem. Try to improve your model by breaking those symmetries.

Question 4 • Give an implementation of your CP model in Choco.

Example A schedule for `THE-FORTNITERS` of number of sessions $s = 4$, number of players per session $p = 4$, number of days $d = 5$, min sessions $min = 1$ and max sessions $max = 1$ is:

```
     FORTNITERS(4,4,5,1,1)
Day 1
Session 1: 0, 1, 2, 3,
Session 2: 4, 7, 10, 13,
Session 3: 5, 9, 11, 15,
Session 4: 6, 8, 12, 14,

Day 2
Session 1: 0, 4, 5, 6,
Session 2: 1, 7, 11, 14,
Session 3: 2, 8, 10, 15,
Session 4: 3, 9, 12, 13,

Day 3
Session 1: 0, 7, 8, 9,
Session 2: 1, 4, 12, 15,
Session 3: 2, 6, 11, 13,
Session 4: 3, 5, 10, 14,

Day 4
Session 1: 0, 10, 11, 12,
Session 2: 1, 5, 8, 13,
Session 3: 2, 4, 9, 14,
Session 4: 3, 6, 7, 15,

Day 5
Session 1: 0, 13, 14, 15,
Session 2: 1, 6, 9, 10,
Session 3: 2, 5, 7, 12,
Session 4: 3, 4, 8, 11,
```