AVLSI Project

A solution to routing problem using ILP

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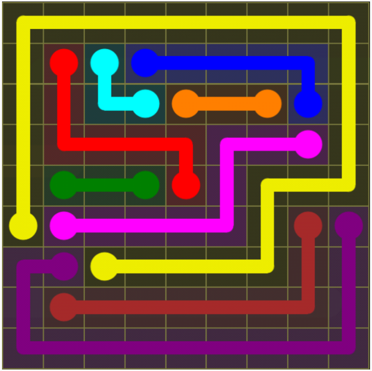
Introduction

The Problem



- Dimensions of the grid and pairs of pins as input.
- Create a route from each pin to its pair.
- Don't allow short circuits.
- Minimize the length of routes.

The Project

Decision variables

- *Boards*. Array of boolean matrix such that each of them is associated with a pin pair.
- *Main Board*. Boolean matrix where the solution will be represented.

Constraints

- Each pair of pins belongs to a single board.
- The pins positions have to be different among all the panels (avoid collisions).
- All marked positions in individual boards have to appear in the general board.
- Neighbourhood of pins and no pin values.

Constraints

Being s_x, s_y, t_x and t_y, the coordinates of a pair p of pins (from set P) s and t:

$$\forall p \in P \quad boards_{p,s_x,s_y} = 1 \quad \&\& \quad boards_{p,t_x,t_y} = 1 \tag{1}$$

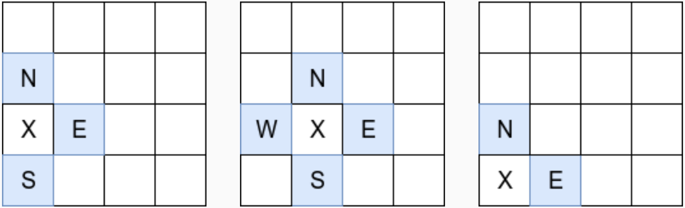
Being D the board dimensions, and being p and p_2 two pairs of pins:

$$\forall d, d_2 \in D, \forall p, p_2 \in P \quad boards_{p,d,d_2} = 1 \rightarrow boards_{p_2,d,d_2} = 0 \tag{2}$$

$$\forall d, d_2 \in D, \forall p \in P \quad boards_{p,d,d_2} = 1 \rightarrow main\_board_{d,d_2} = 1 \tag{3}$$

Many conditions

- Pin position: Must have exactly one neighbor (trivial)
- No pin position: There are two cases:
    - If there are wires at position: must have two neighbors (trivial)
    - If not wires: depends on the cell location (conflicting).



Modeling conflicting constraint

Being N_p the set of neighbors for cell p:

$$\forall d, d_2 \in D, \forall p \in P \quad board_{p,d,d_2} = 1 \rightarrow \sum_{n \in N_p} = 2 \tag{4}$$

$$\begin{cases} if(\#neighbors = 4) \\ \quad N + S + E' + W' \quad or \\ \quad N + S' + E' + W \quad or \\ \quad N' + S' + E + W \quad or \\ \quad .... \\ elif(\#neighbors = 3) \\ \quad .... \end{cases}$$

Being N_p the set of neighbors for cell p:

$$\forall d, d_2 \in D, \forall p \in P \quad board_{p,d,d_2} = 1 \rightarrow \sum_{n \in N_p} = 2 \tag{5}$$

$$\begin{cases} if(\#neighbors = 4) \\ \quad N + S + E' + W' \quad or \\ \quad N + S' + E' + W \quad or \\ \quad N' + S' + E + W \quad or \\ \quad \ldots\ldots\ldots \\ elif(\#neighbors = 3) \\ \quad \ldots\ldots\ldots \end{cases}$$

Demo

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