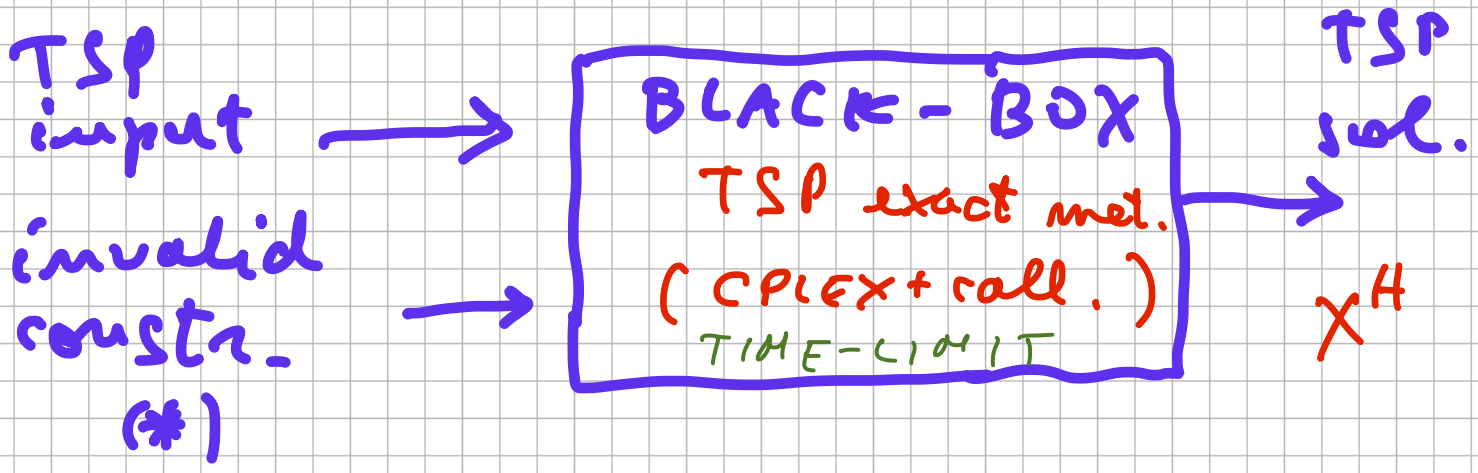
ORZ 20-may-2022

LOCAL BRANCHING



LOCAL BRANCHING CONSTR:

Given x^H current solution to improve

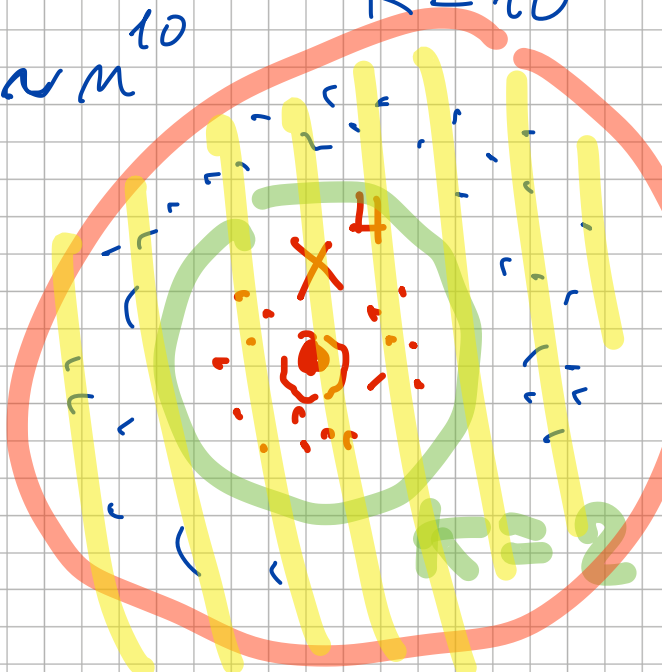
(+) $$\sum_{(i,j):\, x^H_{ij}=1} x_{ij} \geq n - K$$

n. of pursued edges

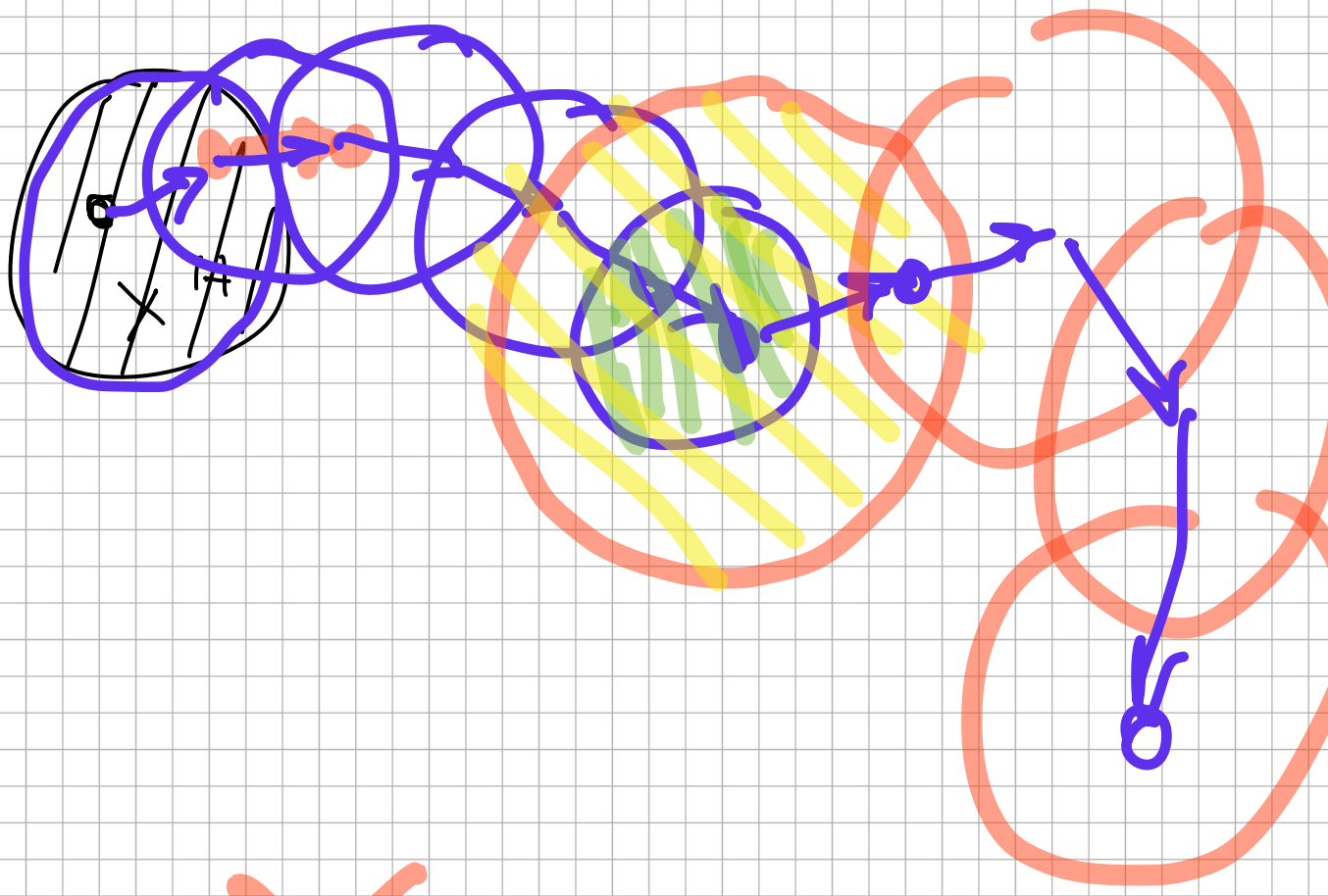
K = radius

$\sim n^{10}$

K = 10



— $k = 10$ — $k = 70$



$K = 2$ ⇝ 2-OPT TOO SMALL!

$= 10$

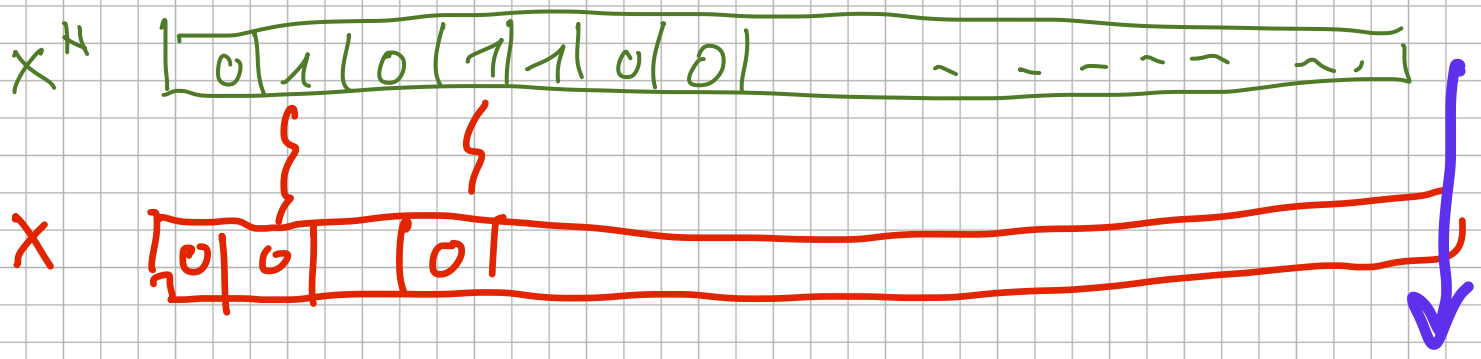
$= 20$

$= 30$

$= n/2$ TOO MUCH!

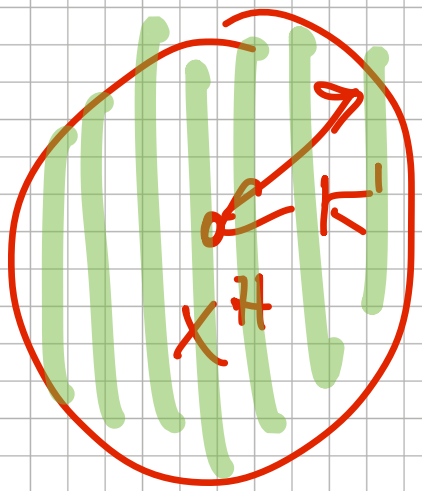
"k by DEEP LEARNING"

Given $x^H \in \{0,1\}^{|E|}$



HAMMING distance

$$\Delta(x, x^H) \leq K'$$



$$\Delta(x^H, x) =$$

$$\sum_{(i,j):\, x^H_{ij}=1} (1 - x_{ij}) + \sum_{(i,j):\, x^H_{ij}=0} x_{ij} \leq K'$$

n. flips $1 \to 0$

n. flips $0 \to 1$

Note: $|\{ij : x^H_{ij} = 1\}|$ constant

$(= n$ for TSP $\Rightarrow$

$$\sum_{ij : x^H_{ij}=1} (1 - x_{ij}) = \sum_{ij : x^H_{ij}=0} x_{ij}$$

$\Rightarrow$

$$2 * \sum_{ij : x^H_{ij}=1} (1 - x_{ij}) \leq k'$$

$$\frac{2n - k'}{2} \leq 2 \sum_{ij : x^H_{ij}=1} x_{ij}$$

$\Rightarrow$ $\boxed{\sum_{ij : x^H_{ij}=1} 1 \cdot x_{ij} \geq n - k'/2 \qquad 2 = K}$

↳ sparser (i.e. better) ASYMMETRIC form of the LB constr.

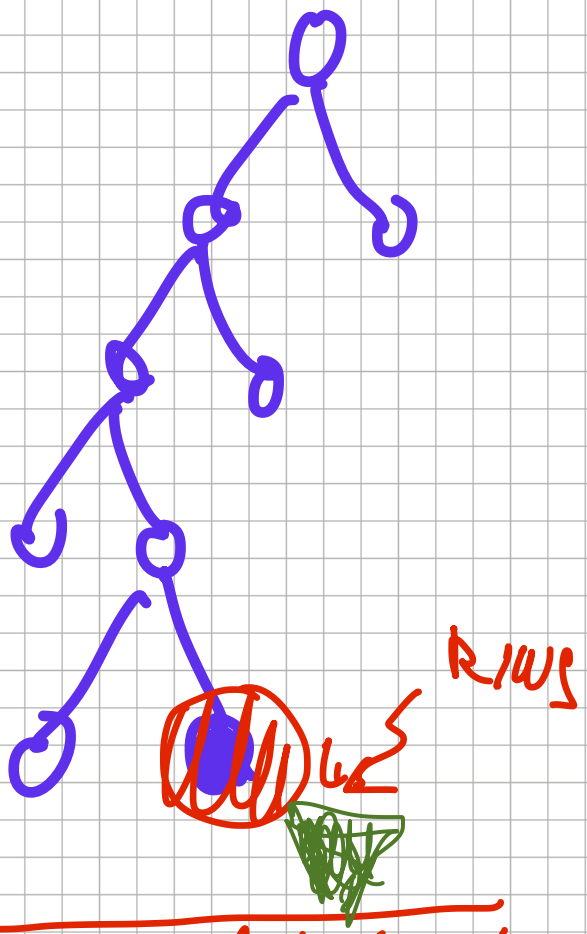
Implementation :

1) CPXaddrows to add the LB constraint
2) use x^H as a MIP start
3) Apply (CPLEX + call.) to get a new (hopefully better) x^H
4) REMOVE the last constraint in your current model *
5) REPEAT

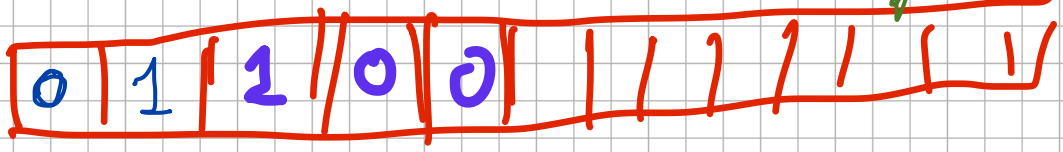
```
int nrows = CPXgetnumrows(env, lp);
CPXdelrows(env, lp, nrows-1, nrows-1)
```

MATHEURISTICS INSIDE CPLEX

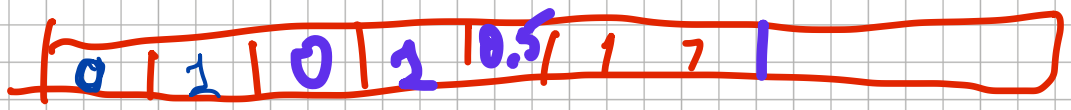
RINS



incumbent x^H



x^*



LP opt. sol. at the current node

HARD FIXING

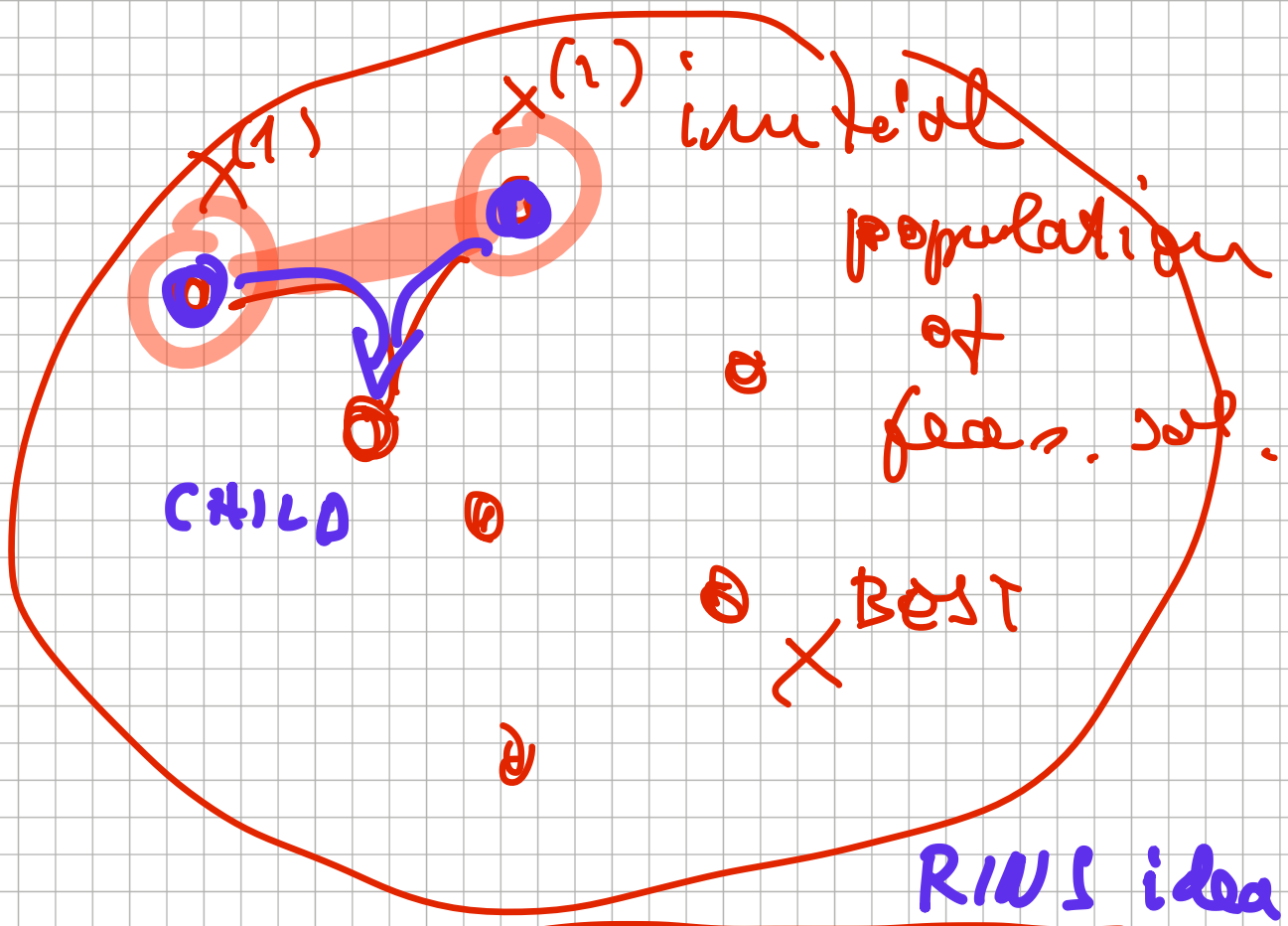
$$x_{ij} = x^H_{ij} \begin{cases} 0 \\ 1 \end{cases}$$

whenever $x^*_{ij} = x^H_{ij}$

→ AUXILIARY "LOCAL" model

POLISHING how.

Genetic alg. at the VERY END of the CPLEX run



RINS idea

$x^{(1)}$ 0 1 0 | | | | | |

= = FREE

$x^{(2)}$ 0 0 1 | | | | | |