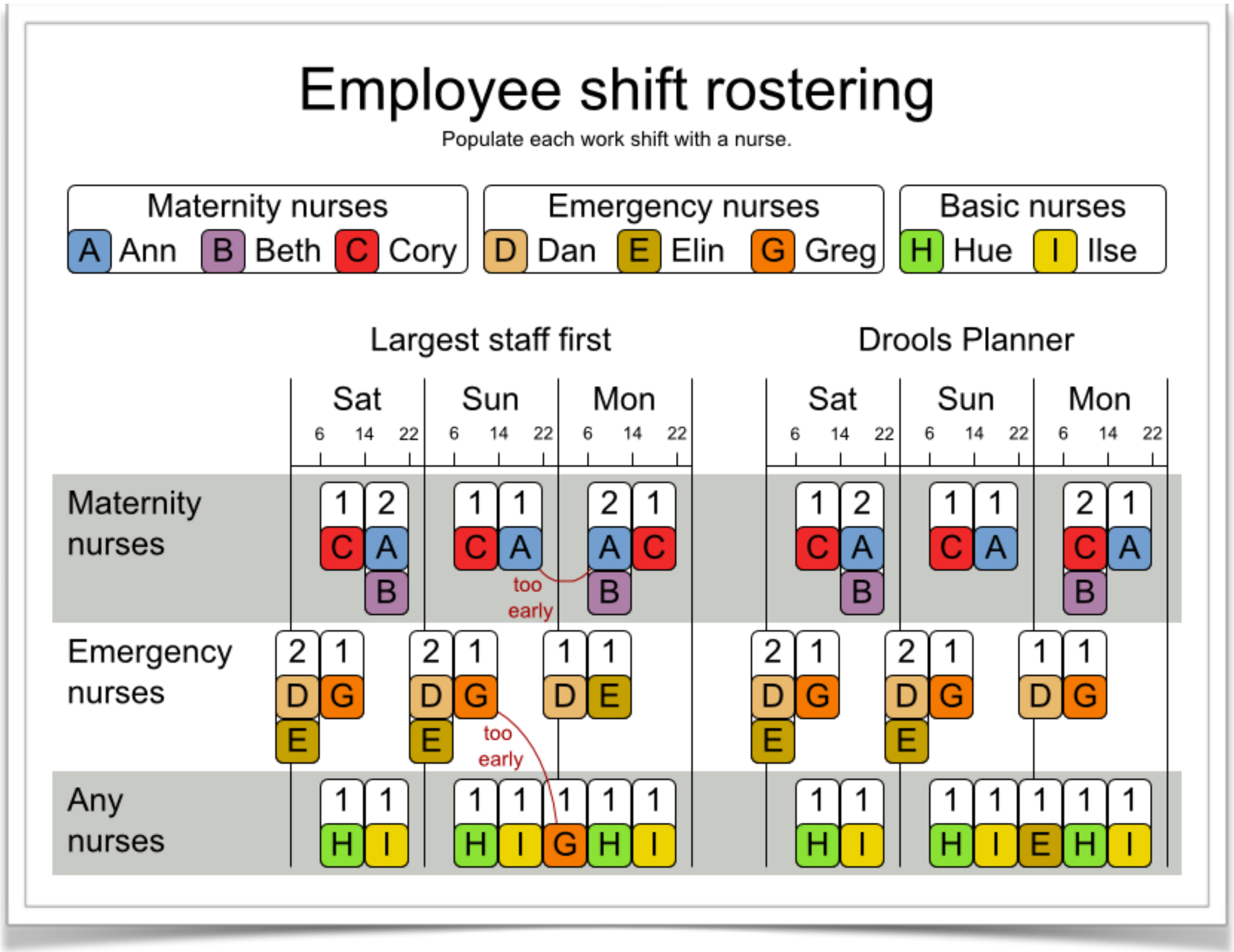
Nurse Rostering Problem

Best Linear Program: more than 10 000 lines



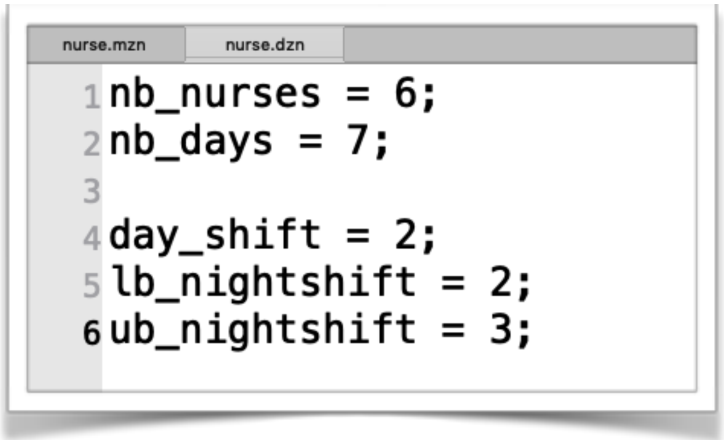
Nurse Rostering Problem

Input:

- Number of nurses
- number of days
- Day shift size
- Min and Max night shift size

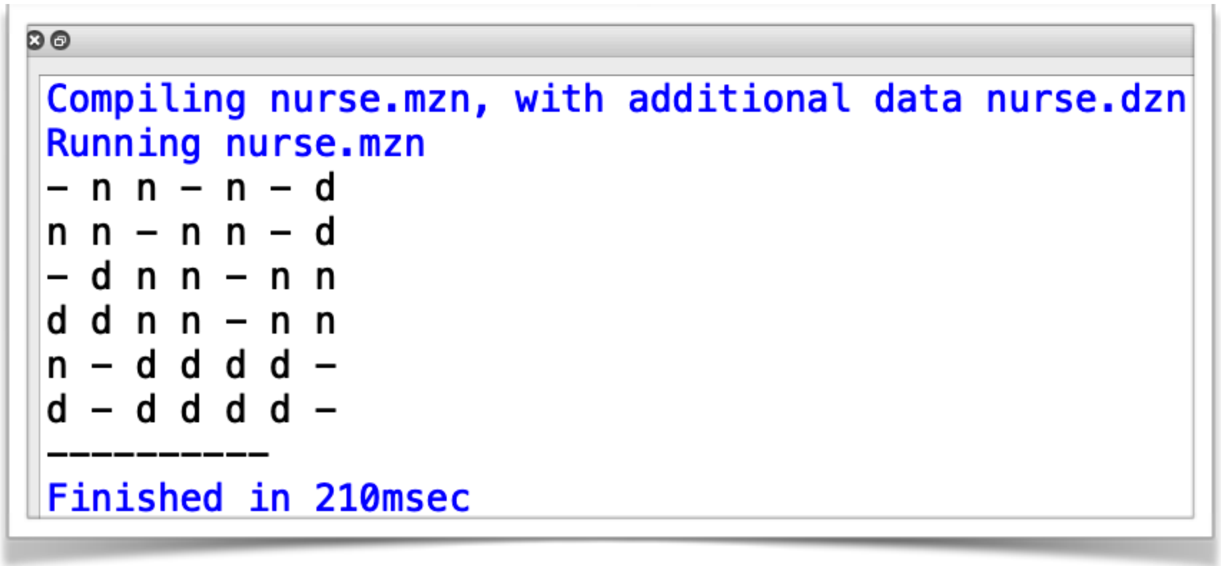
Output:

- Nurse scheduling



```
nb_nurses = 6;
nb_days = 7;

day_shift = 2;
lb_nightshift = 2;
ub_nightshift = 3;
```



```
Compiling nurse.mzn, with additional data nurse.dzn
Running nurse.mzn
- n n - n - d
n n - n n - d
- d n n - n n
d d n n - n n
n - d d d d -
d - d d d d -
----------
Finished in 210msec
```

Nurse Rostering Problem

Variables: `X[i,j], i in nurses, j in days`

Domain: `X[i,j] in {d,n,o}(d: day, n: night, - : dayoff)`

Hospital and services constraints

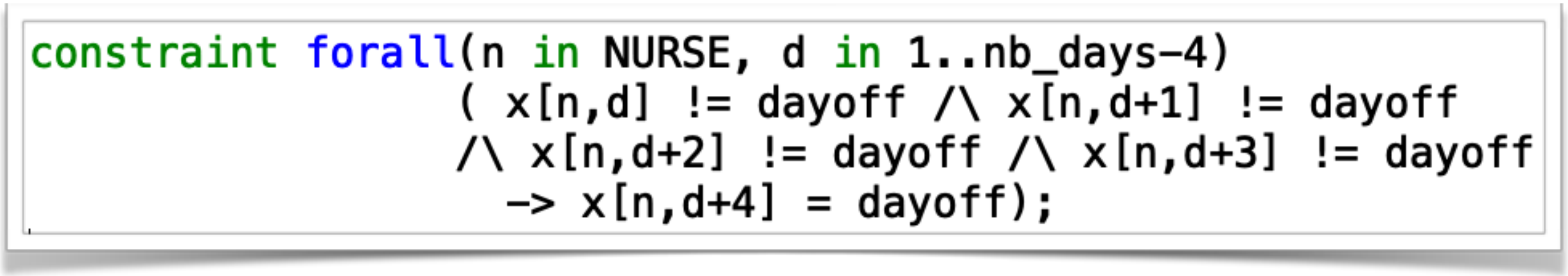
Nurse Constraints and working rules

X	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Nurse 1	d/n/-	d/n/-	d/n/-	d/n/-	d/n/o	d/n/o	d/n/o
Nurse 2	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-
Nurse 3	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-
Nurse 4	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-
Nurse 5	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-
Nurse 6	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-	d/n/-

Nurse Rostering Problem

Nurse constraints and working rules:

Constraint1: In each four day period a nurse must have at least one day off

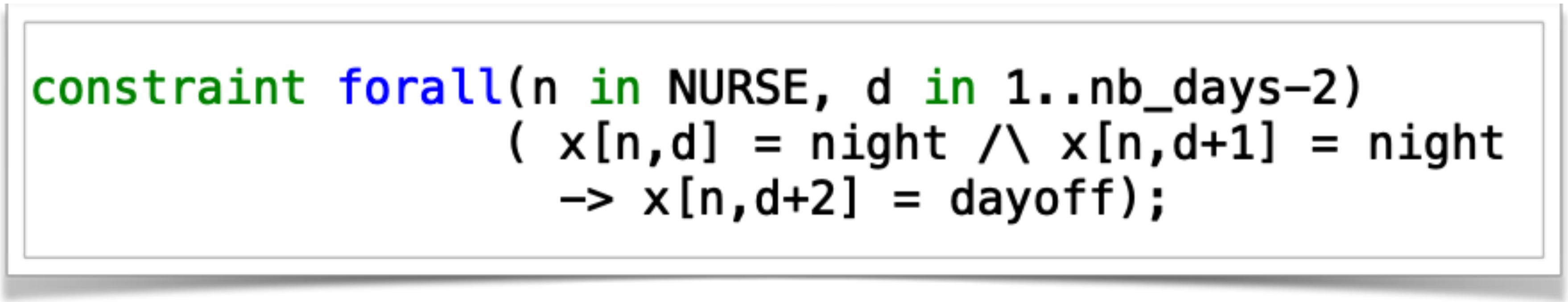


```
constraint forall(n in NURSE, d in 1..nb_days-4)
                 ( x[n,d] != dayoff /\ x[n,d+1] != dayoff
                 /\ x[n,d+2] != dayoff /\ x[n,d+3] != dayoff
                   -> x[n,d+4] = dayoff);
```

Nurse Rostering Problem

Nurse constraints and working rules:

Constraint2: no nurse can be scheduled for 3 night shifts in a row

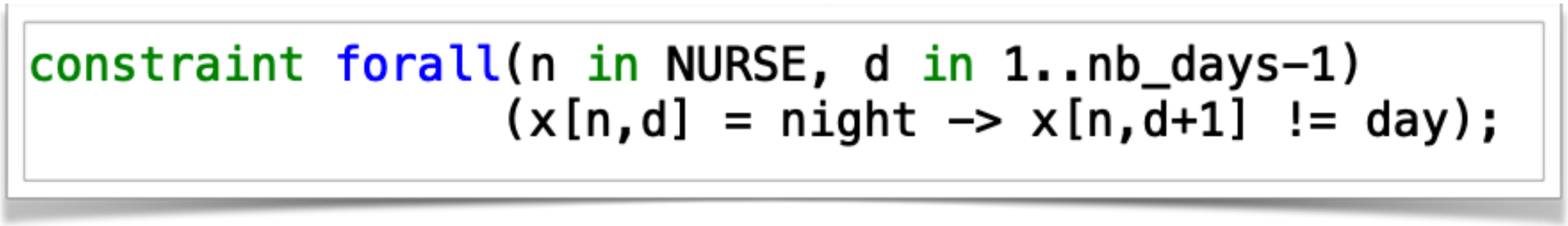


```
constraint forall(n in NURSE, d in 1..nb_days-2)
                  ( x[n,d] = night /\ x[n,d+1] = night
                    -> x[n,d+2] = dayoff);
```

Nurse Rostering Problem

Nurse constraints and working rules:

Constraint3: no nurse can be scheduled for a day shift after a night shift

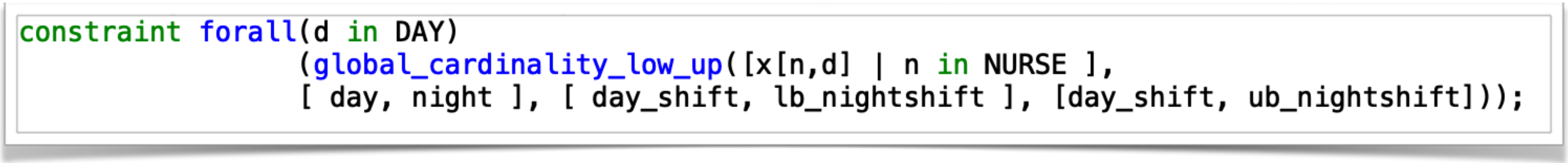


```
constraint forall(n in NURSE, d in 1..nb_days-1)
                 (x[n,d] = night -> x[n,d+1] != day);
```

Nurse Rostering Problem

Nurse constraints and working rules:

Constraint4: Day shift size and min/max night shift size



```
constraint forall(d in DAY)
                 (global_cardinality_low_up([x[n,d] | n in NURSE ],
                 [ day, night ], [ day_shift, lb_nightshift ], [day_shift, ub_nightshift]));
```