Constraint Programming: Duality of CP

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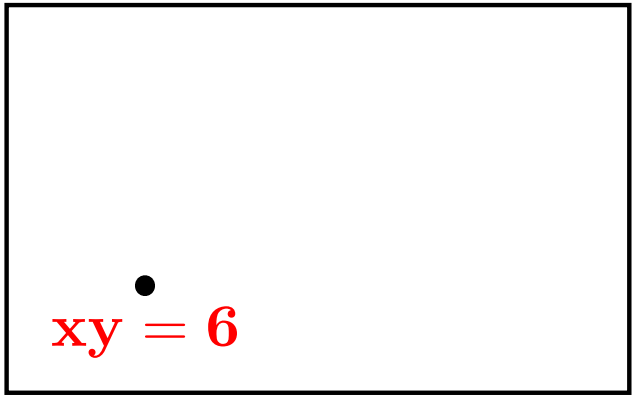
Objectives

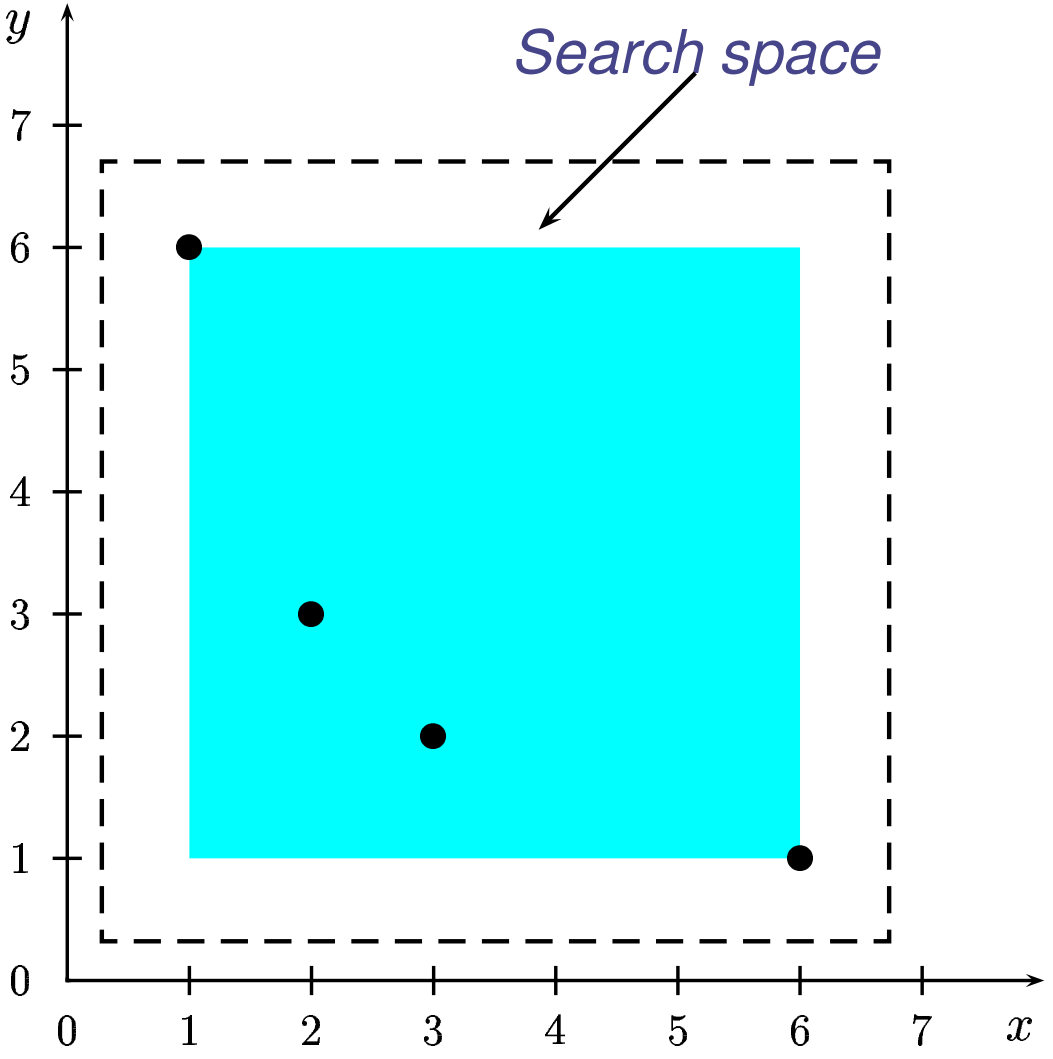
- to show duality between terms and relations
- to illustrate duality of constraints and reducing domains
- notion of search space and solution space

Duality of CP

Duality of CP (1)

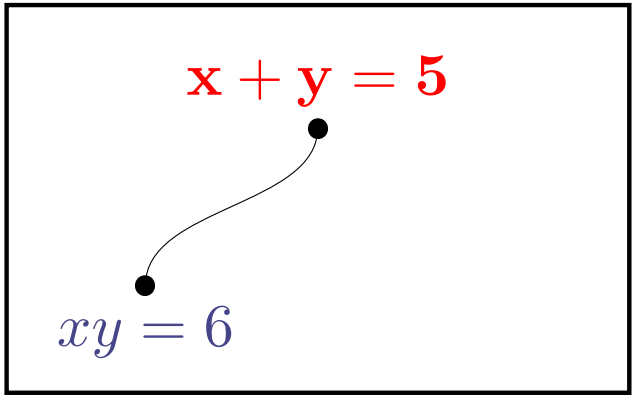
```
1 :- x in 0..7,
2    y in 0..7,
3    x*y = 6,
4    x+y = 5,
5    x   < y.
```



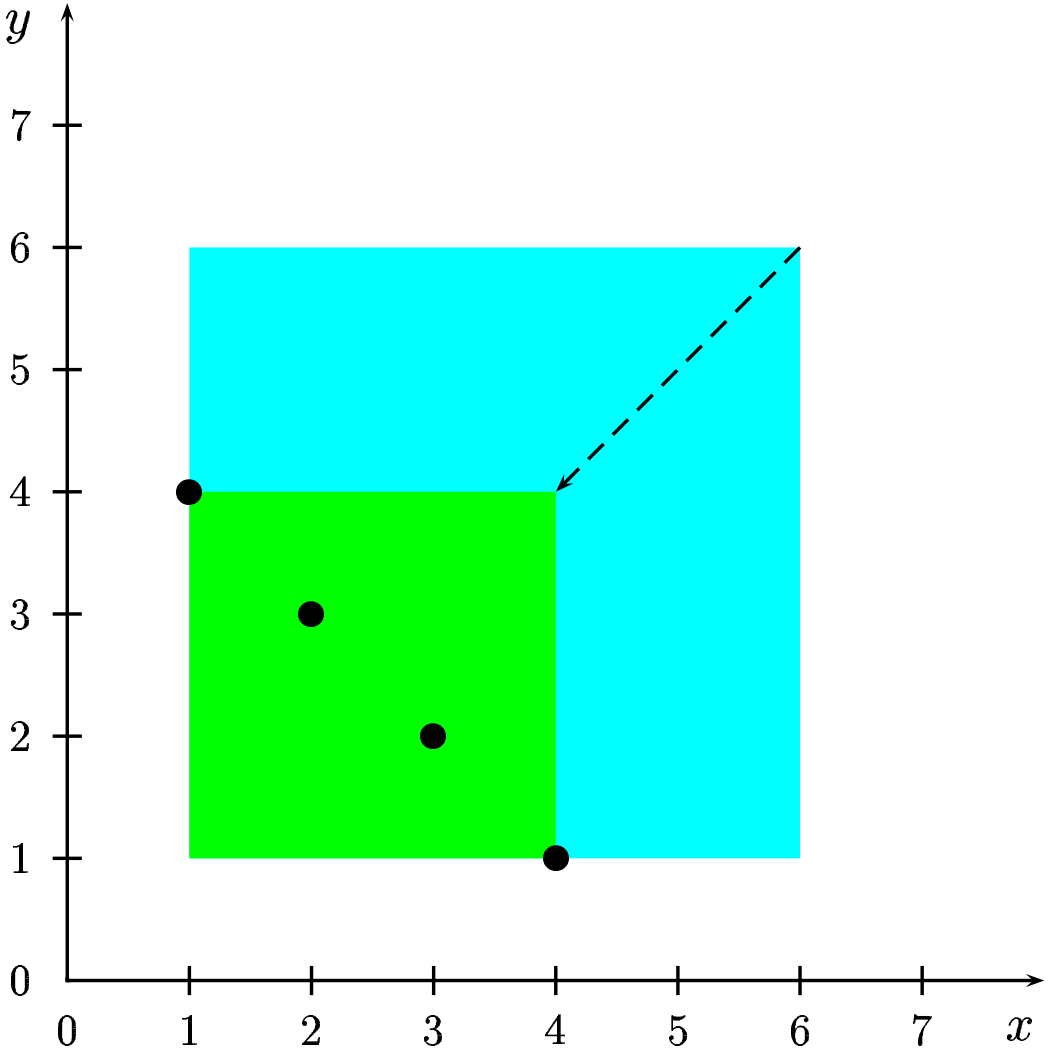


Duality of CP (2)

```
1 :- x in 0..7,
2    y in 0..7,
3    x*y = 6,
4    x+y = 5,
5    x   < y.
```

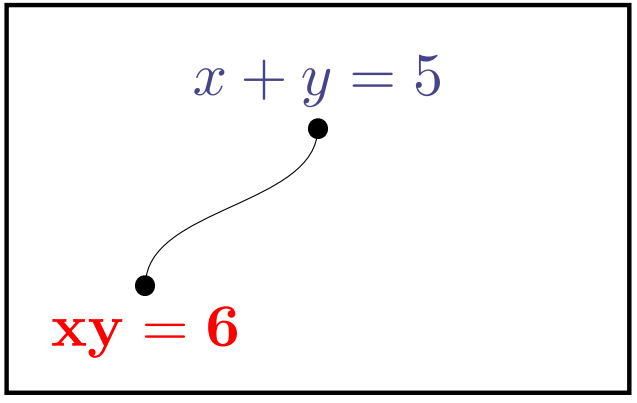


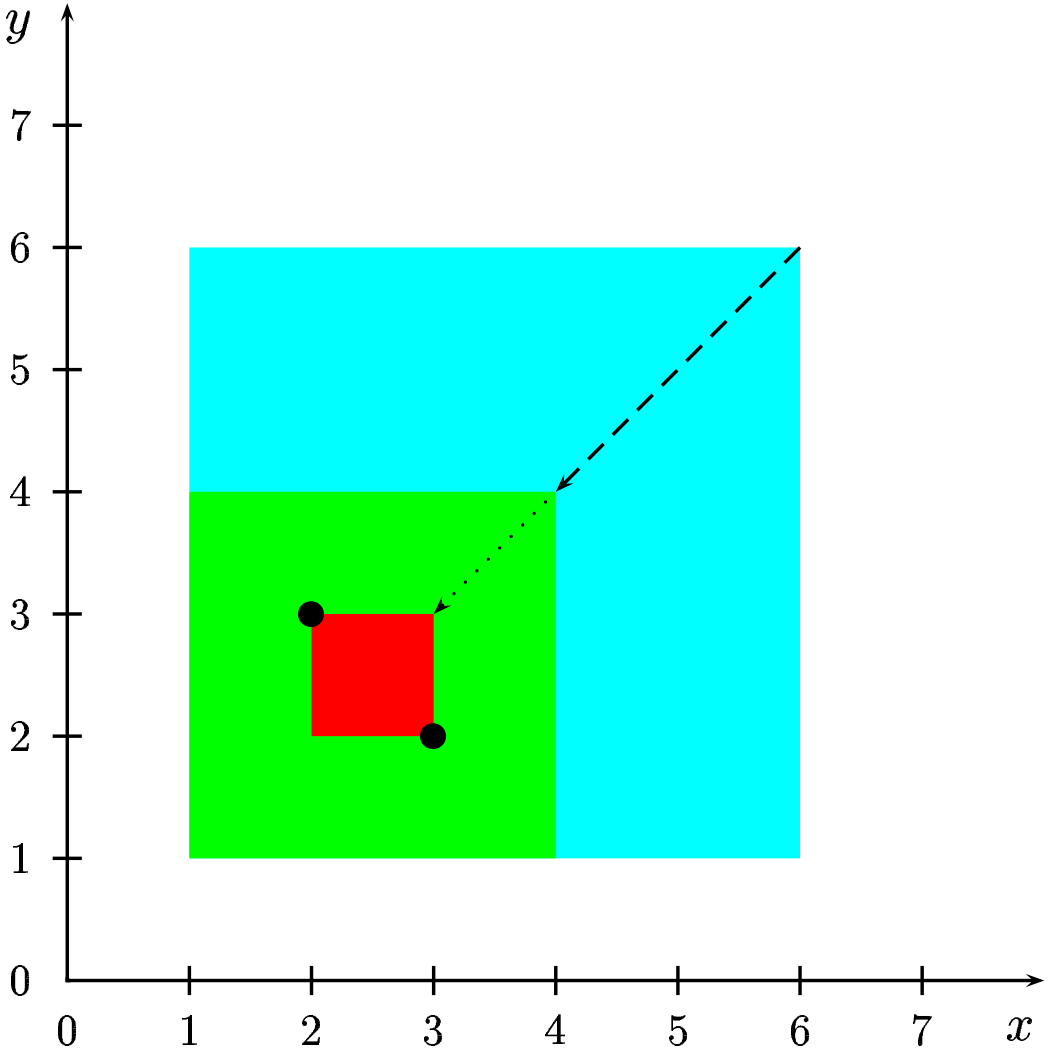
Store



Duality of CP (3)

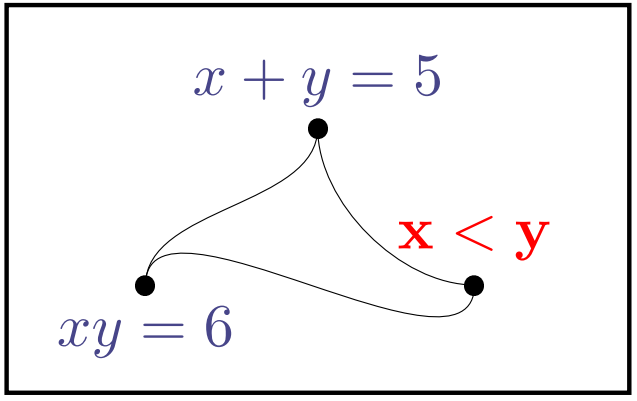
```
1 :- x in 0..7,
2    y in 0..7,
3    x*y = 6,
4    x+y = 5,
5    x   < y.
```



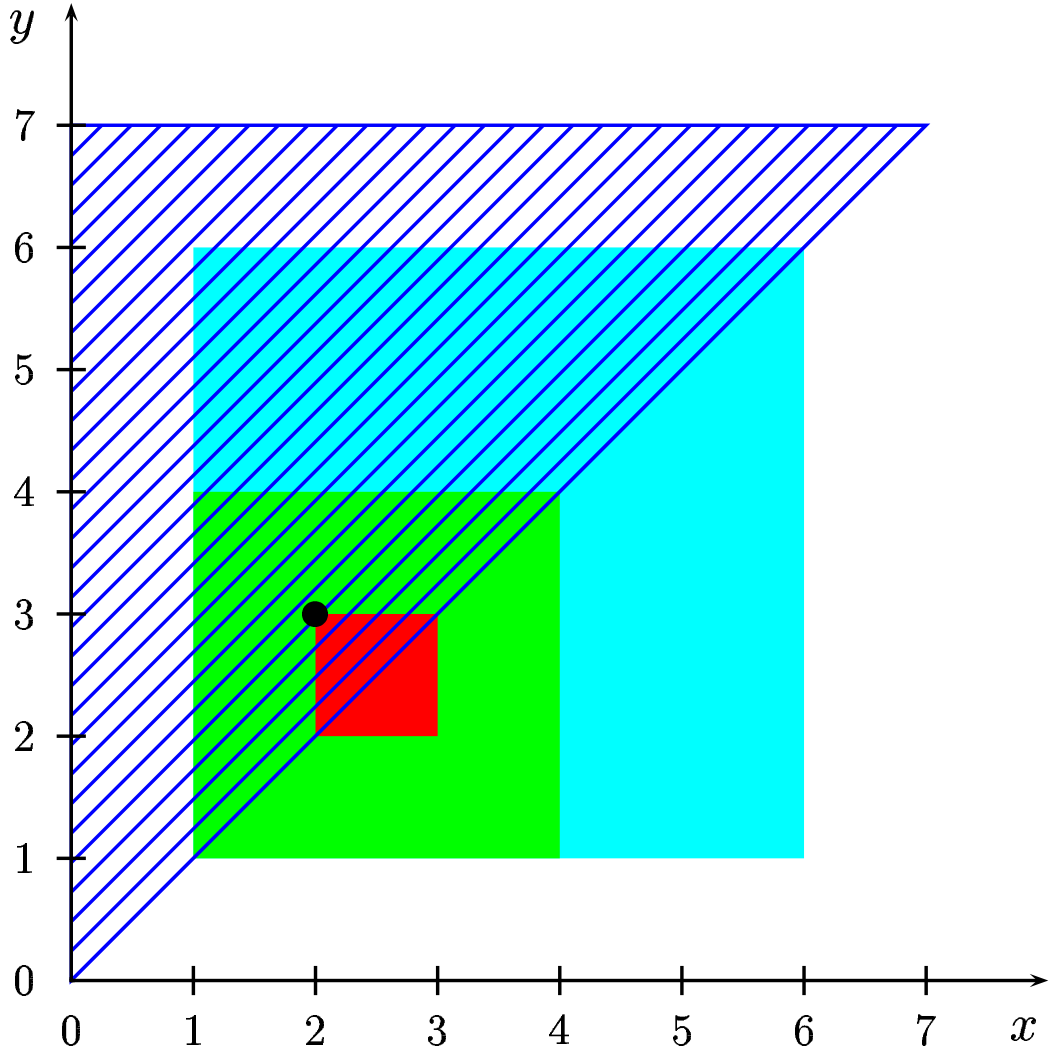


Duality of CP (4)

```
1 :- x in 0..7,
2    y in 0..7,
3    x*y = 6,
4    x+y = 5,
5    x $< y.
```



Store



Search and solution spaces

Given a constraint C on $x_1, \ldots, x_n$ with domains $D_1, \ldots, D_n$, we call :

- *Search space* : the cartesian product $D_1 \times \cdots \times D_n$ of the domains of the variables
- *Solution space* : the set of tuples $(a_1, \ldots, a_n)$ s.t. $a_1 \in D_1, \ldots, a_n \in D_n$ and $C(a_1, \ldots, a_n)$ is true
- *Solution space* : the set of tuples $(a_1, \ldots, a_n) \in D_1 \times \cdots \times D_n$ s.t. $(a_1, \ldots, a_n) \in C$