# E.A.5.6 (Cards)

## 1.1 Modellazione

### 1.1.1 Variabili e domini

Dati i parametri $k, n \in \mathbb{N}$ t.c. $k \geq 2, n > 0$

- $X = X_C \cup X_P$ t.c.
  - $X_C = \{C_i \mid i \in \{1, ..., kn\}\}$
  - $X_P = \{P_i \mid i \in \{1, ..., kn\}\}$
- $D = D_C \cup D_P$ t.c.
  - $D_C = \left\{ D_{C_i} \mid \exists C_i \in X_C \wedge D_{C_i} = \{1, ..., n\} \right\}$
  - $D_P = \left\{ D_{P_i} \mid \exists P_i \in X_P \wedge D_{P_i} = \{1, ..., kn\} \right\}$

### 1.1.2 Vincoli

- $C = C_{\text{cards}} \cup C_{\text{pos}} \cup \text{ alldifferent}(P_1, ..., P_n)$ t.c.

$$
\begin{aligned}
C_{\text{cards}} = \{\langle \{C_r\}, R \rangle \mid \\
C_r \in X_C \wedge \\
\exists i, j \\
i \in \{1, ..., n\} \wedge \\
j \in \{1, ..., k\} \wedge \\
r = (i-1) * k + j \wedge \\
R = \{i\} \\
\}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
C_{\text{pos}} = \{\langle \{P_{r-1}, P_r\}, R \rangle \mid \\
P_{r-1} \in X_P \wedge \\
P_r \in X_P \wedge \\
\exists i, j \\
i \in \{1, ..., n\} \wedge \\
j \in \{2, ..., k\} \wedge \\
r = (i-1) * k + j \wedge \\
R = \{(x, y) \mid x, y \in \{1, ..., k * n\} \wedge y = x + C_r + 1\} \\
\}
\end{aligned}
\tag{2}
$$

## 1.2 Istanziazione

### 1.2.1 Variabili e domini

Dati $k = 2, n = 4$
- $X = X_C \cup X_P$ t.c.
  - $X_C = \{C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8\}$
  - $X_P = \{P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8\}$
- $D = D_C \cup D_P$
  - $D_C = \left\{D_{C_1}, D_{C_2}, D_{C_3}, D_{C_4}, D_{C_5}, D_{C_6}, D_{C_7}, D_{C_8} \mid D_{C_i} = \{1, ..., n\}\right\}$
  - $D_P = \left\{D_{P_1}, D_{P_2}, D_{P_3}, D_{P_4}, D_{P_5}, D_{P_6}, D_{P_7}, D_{P_8} \mid D_{P_i} = \{1, ..., kn\}\right\}$

### 1.2.2 Vincoli

- $C = C_{\mathrm{cards}} \cup C_{\mathrm{pos}} \cup \ \mathrm{alldifferent}(P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8)$

$$C_{\mathrm{cards}} = \{$$
$$\langle \{C_1\}, \{1\}\rangle,$$
$$\langle \{C_2\}, \{1\}\rangle,$$
$$\langle \{C_3\}, \{2\}\rangle,$$
$$\langle \{C_4\}, \{2\}\rangle,$$
$$\langle \{C_5\}, \{3\}\rangle, \qquad (3)$$
$$\langle \{C_6\}, \{3\}\rangle,$$
$$\langle \{C_7\}, \{4\}\rangle,$$
$$\langle \{C_8\}, \{4\}\rangle$$
$$\}$$

$$C_{\mathrm{pos}} = \{$$
$$\langle \{P_1, P_2\}, \{(1,2), (2,3), (3,4), (4,5), (5,6), (6,7), (7,8)\}\rangle,$$
$$\langle \{P_3, P_4\}, \{(1,3), (2,4), (3,5), (4,6), (5,7), (6,8)\}\rangle,$$
$$\langle \{P_5, P_6\}, \{(1,4), (2,5), (3,6), (4,7), (5,8)\}\rangle, \qquad (4)$$
$$\langle \{P_7, P_8\}, \{(1,5), (2,6), (3,7), (7,8))\}\rangle,$$
$$\}$$

## 1.3 Codifica in MiniZinc

```
include "alldifferent.mzn";

int: k = 3;
int: n = 10;

array[1..k * n] of var 1..n: cards;
array[1..k * n] of var 1..k * n: positions;

constraint forall(i in 1..n, j in 1..k)(
    cards[(i - 1) * k + j] == i
);

constraint forall(i in 0..n - 1, j in 2..k)(
    positions[i * k + j] ==
        positions[i * k + j - 1] + cards[i * k + j] + 1
);

constraint alldifferent(positions);
```