Projet : INFO-F-302 Informatique Fondamentale.

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1 Introduction

Le premier objectif de ce projet est de modeliser divers problemes en problemes de satisfaction de contraintes (CSP). Le second objectif est d'implementer un programme resolvant ces problemes en utilisant ChocoSolver.

link : http ://www-master.ufr-info-p6.jussieu.fr/2005/IMG/pdf/rp3.pdf

2 Question 1

L'ensemble des cases du jeux V où $\#V = n^2$

Variables de décision $X = \{x_{i,j} | \forall i, j (1 \leq i \leq n).(1 \leq j \leq n)\}$, n^2 variables de décision

Domaines : $D = (vide, fous, cavalier, tour)$

Contraintes :

Contrainte Xij si Di=F alors pour nimporte quel i=j -¿ xij Contrainte Xij si Di=T alors pour un i,j -¿ tout les j xij et tout les i de xij Contrainte Xij si Di=c alors pour un i,j -¿ tout les j de xij + tout les i de xin, tout les i de xij + tout les j de xnj

$\{x_{i,j} \wedge tour \rightarrow x_{i,j}(\forall algocrois) \wedge vide\}$

$\forall x_{i,j} \in D_4 : \exists l = n : (\forall x_{l,j} \in D_1, l \neq j) \wedge (\forall x_{i,l} \in D_1, l \neq i)$

$c_1 = (\{x_1, x_2\}, (b_i, b_j) | b_i = T, b_j = vide \vee b_i = vide, b_j = T)$

Contraintes tour

$c_{T_{col},j} = ((x_{1,j}, x_{2,j}, \ldots, x_{n,j}), \{(b_1, b_2, \ldots, b_n) | b_i = T, b_j = V, \forall j \neq i\})$ pour les colonnes

$c_{T_{ligne},j} = ((x_{i,1}, x_{i,2}, \ldots, x_{i,n}), \{(b_1, b_2, \ldots, b_n) | b_i = T, b_j = V, \forall j \neq i\})$ pour les lignes

Contraintes fou

$c_{F,2*n-2} = ((x_{1,n-1}, x_{2,n}), \{(b_1, b_2) | b_1 = F, b_2 = V \vee b_1 = V, b_2 = F\}) \wedge ((x_{1,2}, x_{2,1}), \{(b_1, b_2) | b_1 = F, b_2 = V \vee b_1 = V, b_2 = F\})$

$\vdots$

$c_{F,n+1} = ((x_{1,2}, x_{2,3}, \ldots, x_{n-1,n}), \{(b_1, b_2, \ldots, b_{n-1}) | b_i = F, b_j = V, \forall j \neq i\}) \wedge ((x_{1,n-1}, x_{2,n-2}, \ldots, x_{n-1,1}), \{(b_1, b_2, \ldots, b_{n-}$ $F, b_j = V, \forall j \neq i\})$

$c_{F,n} = ((x_{1,1}, x_{2,2}, \ldots, x_{n,n}), \{(b_1, b_2, \ldots, b_n) | b_i = F, b_j = V, \forall j \neq i\}) \wedge ((x_{1,n}, x_{2,n-1}, \ldots, x_{n,1}), \{(b_1, b_2, \ldots, b_n) | b_i = F, b_j = V, \forall j \neq i\})$

$c_{F,n-1} = ((x_{2,1}, x_{3,2}, \ldots, x_{n,n-1}), \{(b_1, b_2, \ldots, b_{n-1}) | b_i = F, b_j = V, \forall j \neq i\}) \wedge ((x_{2,n}, x_{3,n-1}, \ldots, x_{n,2}), \{(b_1, b_2, \ldots, b_{n-1}) | b_i$ $F, b_j = V, \forall j \neq i\})$

$\vdots$

$c_{F,2} = ((x_{n-1,1}, x_{n,2}), \{(b_1, b_2) | b_1 = F, b_2 = V \vee b_1 = V, b_2 = F\}) \wedge ((x_{n-1,n}, x_{n,n-1}), \{(b_1, b_2) | b_1 = F, b_2 = V \vee b_1 = V, b_2 = F\})$

$$\begin{pmatrix} c_{F,n} & c_{F,n+1} & \cdots & c_{F,2*n-2} & \\ c_{F,n-1} & c_{F,n} & c_{F,n+1} & \vdots & c_{F,2*n-2} \\ \vdots & c_{F,n-1} & c_{F,n} & c_{F,n+1} & \vdots \\ c_{F,2} & \vdots & c_{F,n-1} & c_{F,n} & c_{F,n+1} \\ & c_{F,2} & \cdots & c_{F,n-1} & c_{F,n} \end{pmatrix} \tag{1}$$

Contraintes cavalier :

$c_{C,(i,j)} = ((x_{i,j}, x_{i+1,j+2}, x_{i+1,j-2}, x_{i-1,j+2}, x_{i-1,j-2}, x_{i+2,j+1}, x_{i+2,j-1}, x_{i-2,j+1}, x_{i-2,j-1}), \{(b_1, b_2, \ldots, b_9) | b_1 = C, b_2, \ldots b_9 = V\})$

3 Question 2

L'ensemble des cases du jeux V où $\#V = n^2$

Variables de décision $X = \{x_{i,j} | \forall i, j (1 \leq i \leq n).(1 \leq j \leq n)\}$, n^2 variables de décision

Domaines : $D = \{Vide, tour, fous, cavalier\}$ D_i étant le domaine de la variable $x_{i,j}$

Contraintes tours :

$c_T = ((x_{i,j}, \forall i, j (1 \leq i \leq n).(1 \leq j \leq n)), \{b_{i,j}, \forall i, j (1 \leq i \leq n).(1 \leq j \leq n) | b_{i,j} = V, \forall l, (1 \leq l \leq n) \exists b_{l,j} = T \vee b_{i,j} = V, \forall k (1 \leq k \leq n), \exists b_{i,k} = T\})$

$c_{couple,T} = ((x_{i,j}, x_{l,k}), \{(b_{i,j}, b_{l,k}) | b_{i,j} = T, b_{l,k} = V, \rightarrow b_{i,m} \forall m(j < m < k), b_{i,m} = V\} \vee b_{i,j} = T, b_{l,k} = V, \rightarrow b_{m,j} \forall m(i < m < l), b_{m,j} = V)$

Autre possibilité

$c_{couple,T_{colonnes}} = ((x_{i,j}, x_{l,j}), \{(b_{i,j}, b_{l,j}) | b_{i,j} = T, b_{l,j} = V, \rightarrow b_{m,j} \forall m(i < m < l), b_{m,j} = V\}$
$c_{couple,T_{lignes}} = ((x_{i,j}, x_{i,k}), \{(b_{i,j}, b_{i,k}) | b_{i,j} = T, b_{i,k} = V, \rightarrow b_{i,m} \forall m(j < m < k), b_{i,m} = V\}$

Contraintes fous :

$c_F = ((x_{i,j}, \forall i, j(1 \leq i \leq n).(1 \leq j \leq n)), \{b_{i,j}, \forall i, j(1 \leq i \leq n).(1 \leq j \leq n) | b_{i,j} = V, \forall l, k(1 \leq l \leq n).(1 \leq k \leq n) \exists b_{l,k} = F \vee b_{i,j} = V, \forall l, k(1 \leq l \leq n).(n \leq k \leq 1), \exists b_{l,k} = F\})$
$c_{couple,F_{diag1}} = ((x_{i,j}, x_{l,k}), \{(b_{i,j}, b_{l,k}) | b_{i,j} = T, b_{l,k} = V, \rightarrow b_{x,y} \forall x, y(i < x < l).(j < y < k), b_{x,y} = V\}$
$c_{couple,F_{diag2}} = ((x_{i,j}, x_{l,k}), \{(b_{i,j}, b_{l,k}) | b_{i,j} = T, b_{l,k} = V, \rightarrow b_{x,y} \forall x, y(i < x < l).(k < y < j), b_{x,y} = V\}$

Contraintes cavaliers :

$c_{C,(i,j)} = ((x_{i,j}, x_{i+1,j+2}, x_{i+1,j-2}, x_{i-1,j+2}, x_{i-1,j-2}, x_{i+2,j+1}, x_{i+2,j-1}, x_{i-2,j+1}, x_{i-2,j-1}), \{(b_1, b_2, \ldots, b_9) | b_1 = V, \forall i, j \in [+1, +2, -1, -2], \exists b_{i,j} = C\})$

Contrainte finale :

$C = (C_T \wedge c_{couple,T_{colonnes}} \wedge c_{couple,T_{lignes}}) \vee (c_F \wedge c_{couple,F_{diag1}} \wedge c_{couple,F_{diag2}}) \vee c_{C,(i,j)}$

4 Question 3

5 Question Bonus

6 Question 4

7 Question 5