

Problem 5.1 Three Rooks on a Small Board

Answer:

The model of the three rooks on a 4×7 chessboard as a constraint satisfaction problem $\langle V, D, C \rangle$ is given below,

1. Set of Variables V :

Let,

x_1, x_2 variables represent the coordinates (row & column) of 1st rook in 4×7 chessboard, similarly,

y_1, y_2 variables represent the coordinates of 2nd rook in 4×7 chessboard, and

z_1, z_2 variables represent the coordinates of 3rd rook in 4×7 chessboard

Therefore, set of variables for this problem, $V = \{x_1, x_2, y_1, y_2, z_1, z_2\}$

2. Domain: Since, the chessboard's dimension is 4×7 ,

for rows: $D_{x_1} = D_{y_1} = D_{z_1} = \{1, 2, 3, 4\}$

for columns: $D_{x_2} = D_{y_2} = D_{z_2} = \{1, 2, 3, 4, 5, 6, 7\}$

3. Constraints: In a 4×7 chessboard rooks can move horizontally and vertically as far as they like, then they will not threaten each other, if and only if, their row and column values can not be the same.

Therefore, constraints C will be as follows,

i. $a_1 \neq b_1$ for all $(a_1, b_1) \in \{(x_1, y_1), (x_1, z_1), (y_1, z_1)\}$

ii. $a_2 \neq b_2$ for all $(a_2, b_2) \in \{(x_2, y_2), (x_2, z_2), (y_2, z_2)\}$

4. Finally, the assignment of (x_1, x_2) , (y_1, y_2) , and (z_1, z_2) will correspond to the coordinates of the squares of rooks in the 4×7 chessboard.