

# Sudoku Report

## Explanation of the problem

Give the representation of a solution, as explained during the course.

$$X = \left\{ \begin{array}{l} x_{1,1} \dots x_{1,j} \dots x_{1,m} \\ x_{i,1} \dots x_{i,j} \dots x_{i,m} \\ x_{m,1} \dots x_{m,j} \dots x_{m,m} \end{array} \right\}$$

$X$  represents each tile,  $i$  represents each column,  $j$  represents each row and  $m$  is 9. Therefore,  $m$  is only placed on the edges and the bottom because the sudoku board is  $9 \times 9$ , so there will be 9 columns and 9 rows.

Give the equation of the restriction(s) of the problem.

$$X_i = X_i \cup \{1,2,3,4,5,6,7,8,9\}, \text{ (one number can only occur once in a column)}$$

$$X_j = X_j \cup \{1,2,3,4,5,6,7,8,9\}, \text{ (one number can only occur once in a row)}$$

$$X_{i,j} = (X_{m,m} / 3) * 9 \cup \{1,2,3,4,5,6,7,8,9\} \text{ (one number can only occur once in each small mini grid on } 3 \times 3)$$

What is considered as a state? In addition, explain why.

A state is any way the board is at the moment with tiles form 1-9, or blanks.

Which is the initial state? In addition, explain why.

The initial board is a board with only a few tiles that contains numbers the rest of the tiles are empty.

Which is/are possible action(s)? Explain why.

The action is to fill all the empty tiles with number from 1-9 and make sure that the mini group of board do not have the same number twice and that each row and column don't have the same number more than once.

What is the maximum branching factor of the tree (b)? Explain why.

The branching factor is 9 because it is depended on what actions we can take. If the row and the column at my position in the board only contains empty tiles and the mini grid on  $3 \times 3$  also contains empty tiles, then I will be able to fill with 1-9. It is always depending on possible actions; therefore, the maximum branching factor is 9. Because if we are in that position I mentioned, I will have 9 possible actions.

What is the maximum depth of the tree (m)? Explain why.

The depth factor is depending on how many tiles that is going to be filled. In the worst scenario, I would have a totally empty board. In that case I would have to fill 81 tiles, since the board is 9x9. The maximum depth is 81. It depends on how many empty tiles the board has.