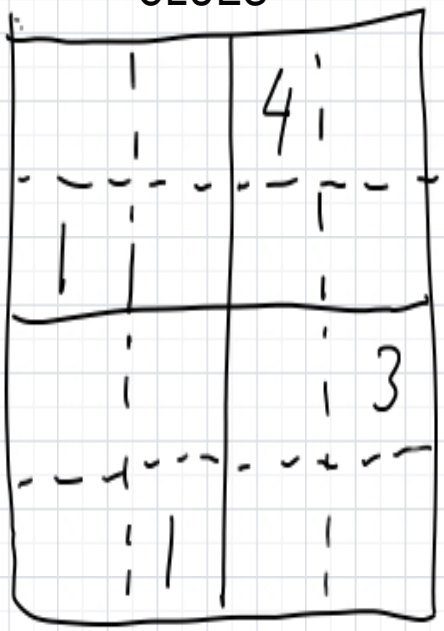
Simple Example (4x4)

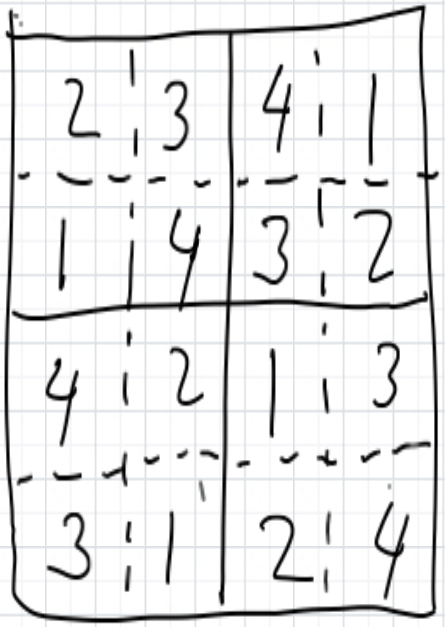
- Each space takes an Integer between 1-4

- Each Integer should only show up once
  - -- 1.) in each 2x2 cell
  - -- 2.) in each row
  - -- 3.) in each column
  - -- 4.) in each space
  - -- 5.) No Clue should be replaced

- Need to find a feasible Integer solution

CLUES





Feasibility Problem

- Integer Programming Problem

$\{1, 2, 3, \ldots 9\}$

-- Binary Programming Problem

$\{0, 1\}$

- How do we define A and b

-- based on the "rules"

-- based on the definition of x

Ex (4x4)

minimize ?

subject to $Ax = b$

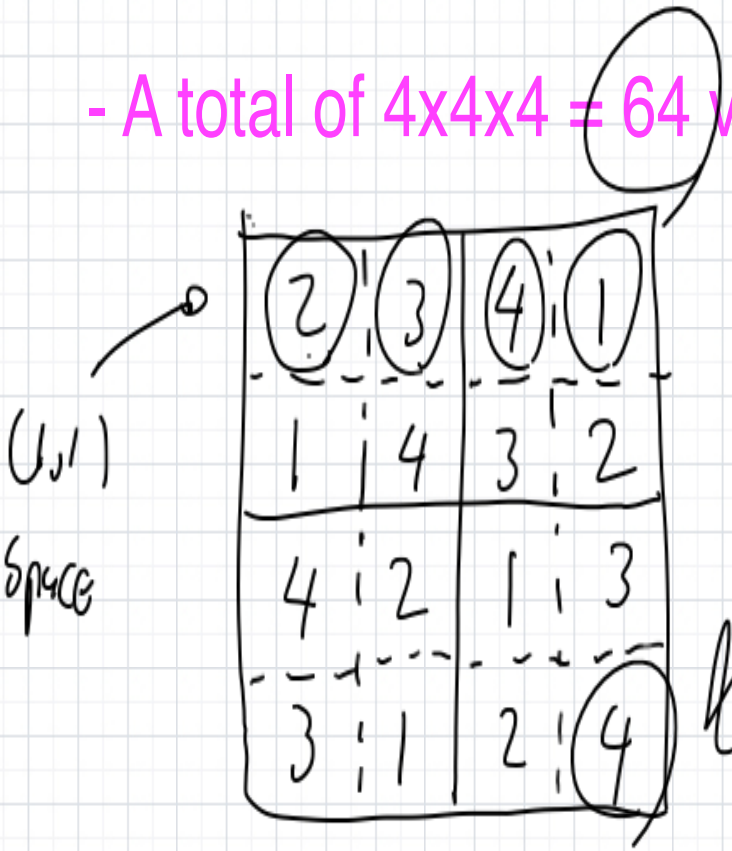
Rules

Define the variables x

- Use the 4x4 example

- each space is defined by 4 binary variables

- A total of 4x4x4 = 64 variables



$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \\ x_{10} \\ x_{11} \\ x_{12} \\ x_{13} \\ x_{14} \\ x_{15} \\ x_{16} \\ \vdots \\ x_{61} \\ x_{62} \\ x_{63} \\ x_{64} \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \\ \vdots \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \begin{matrix} \\ \end{matrix} \begin{matrix} \text{space } (1,1) = 2 \\ \\ \\ \\ \text{space } (1,2) = 3 \\ \\ \\ \\ \text{space } (1,3) = 4 \\ \\ \\ \\ \text{space } (1,4) = 1 \\ \\ \\ \\ \vdots \\ \\ \\ \\ \text{space } (4,4) = 4 \\ \\ \\ \end{matrix}$$