

Define $\underline{A_4}$ and $\underline{b_4}$ ^{$\begin{smallmatrix} E_1 \\ 4 \times 4 \end{smallmatrix}$}

- based Rule 4.)
-- Each Integer
should only show
up once 4.) in each
space.

- Notice the pattern!

$\text{Space } (1,1)$

$$\begin{array}{rcl} x_1 + x_2 + x_3 + x_4 & = & 1 \\ x_5 + x_6 + x_7 + x_8 & = & 1 \\ x_9 + x_{10} + x_{11} + x_{12} & = & 1 \\ x_{13} + x_{14} + x_{15} + x_{16} & = & 1 \\ & \vdots & \\ x_{61} + x_{62} + x_{63} + x_{64} & = & 1 \end{array}$$

16
G₄'s

Define A_4 and b_4

- based Rule 4.)
- Each Integer should only show up once 4.) in each space.

- Notice the pattern!

$$\begin{array}{c}
 | | | | \\
 \left[\begin{array}{cccc}
 \mathbf{1}^{1 \times 4} & \mathbf{0}^{1 \times 4} & \dots & \mathbf{0}^{1 \times 4} \\
 \mathbf{0}^{1 \times 4} & \mathbf{1}^{1 \times 4} & \dots & \mathbf{0}^{1 \times 4} \\
 & & \ddots & \\
 \mathbf{0}^{1 \times 4} & \mathbf{0}^{1 \times 4} & \dots & \mathbf{1}^{1 \times 4}
 \end{array} \right]
 \end{array}
 \begin{bmatrix}
 x_1 \\
 x_2 \\
 x_3 \\
 x_4 \\
 \vdots \\
 x_{61} \\
 x_{62} \\
 x_{63} \\
 x_{64}
 \end{bmatrix}
 \begin{array}{l}
 x_1 + x_2 + x_3 + x_4 = / \\
 = \left[\mathbf{1}^{16 \times 1} \right]
 \end{array}$$

LP Relaxation

- The optimal solution will have many more 0's than 1's ($x_i = 0$)

- RELAX: allow x_i to be any real number between 0 and 1 rather than a binary integer

- Maintain the rules while making as many variable zero

- Remember the Histogram!

minimize
subject to

$$\begin{array}{l} \boxed{\|x\|_1} \\ \boxed{Ax = b} \end{array} \quad \text{rules}$$

