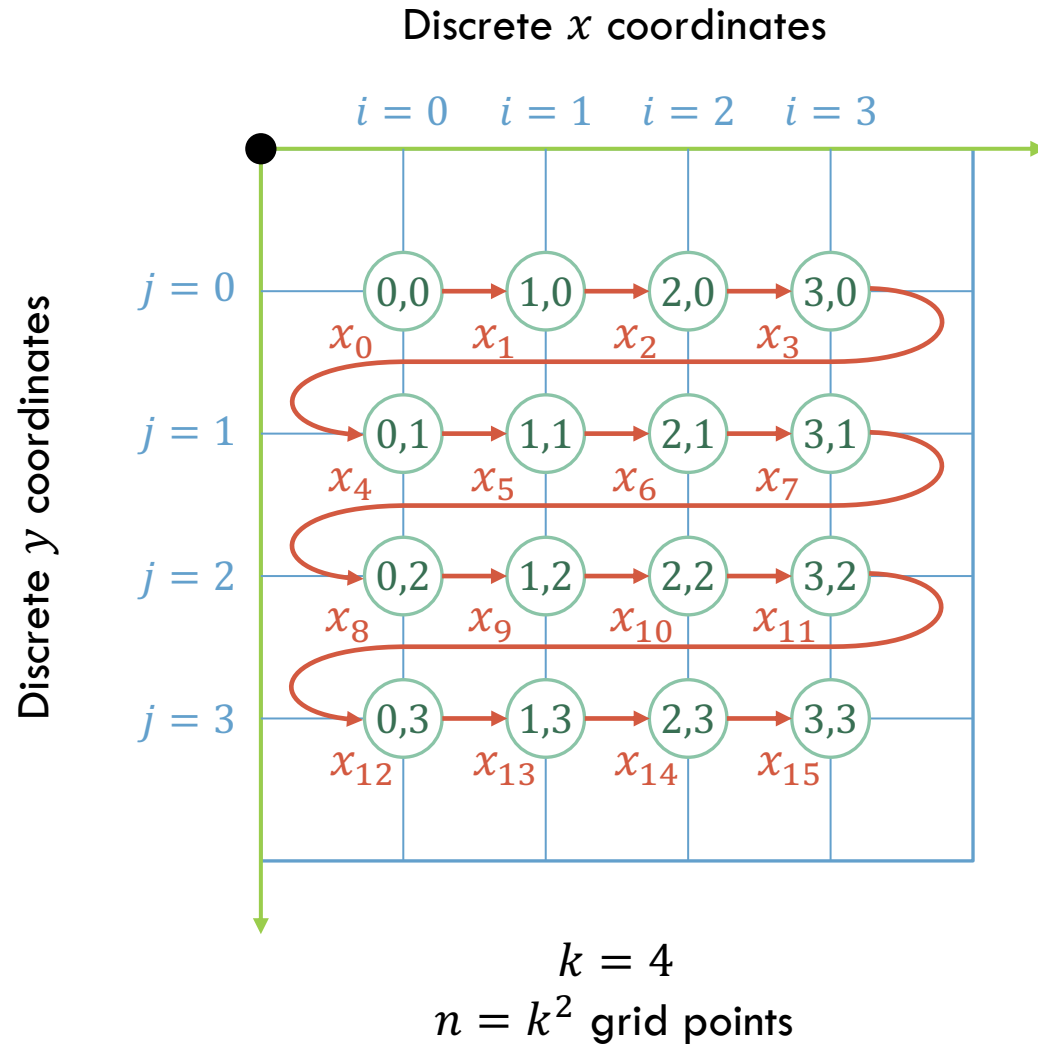


A decorative graphic on the left side of the slide consists of a network of thin, light blue lines. These lines are arranged in a way that resembles a circuit board or a neural network, with several small, empty circles at the end of the lines, suggesting nodes or connection points. The lines and circles are concentrated on the left side of the slide, with some extending towards the center.

# BUILDING THE TEMPERATURE MATRIX

CS111 • SECTION B • SESSION 2

# DISCRETIZING THE DOMAIN



$k$  equations in  $k$  unknowns

$$\mathbf{x} = \begin{bmatrix} x_0 \\ x_1 \\ \vdots \\ x_\ell \\ \vdots \\ x_{n-2} \\ x_{n-1} \end{bmatrix}$$

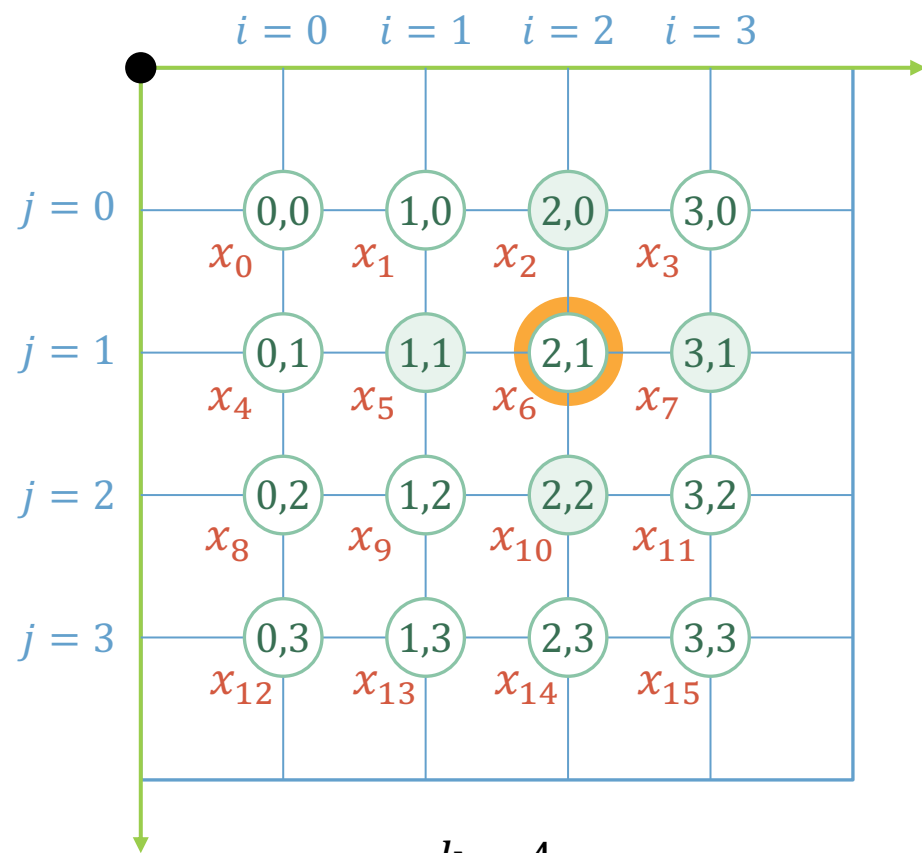
Further,

$$-x_{\ell-k} - x_{\ell-1} + 4x_\ell - x_{\ell+1} - x_{\ell+k} = 0$$

We want to solve the system

$$A\mathbf{x} = \mathbf{b}$$

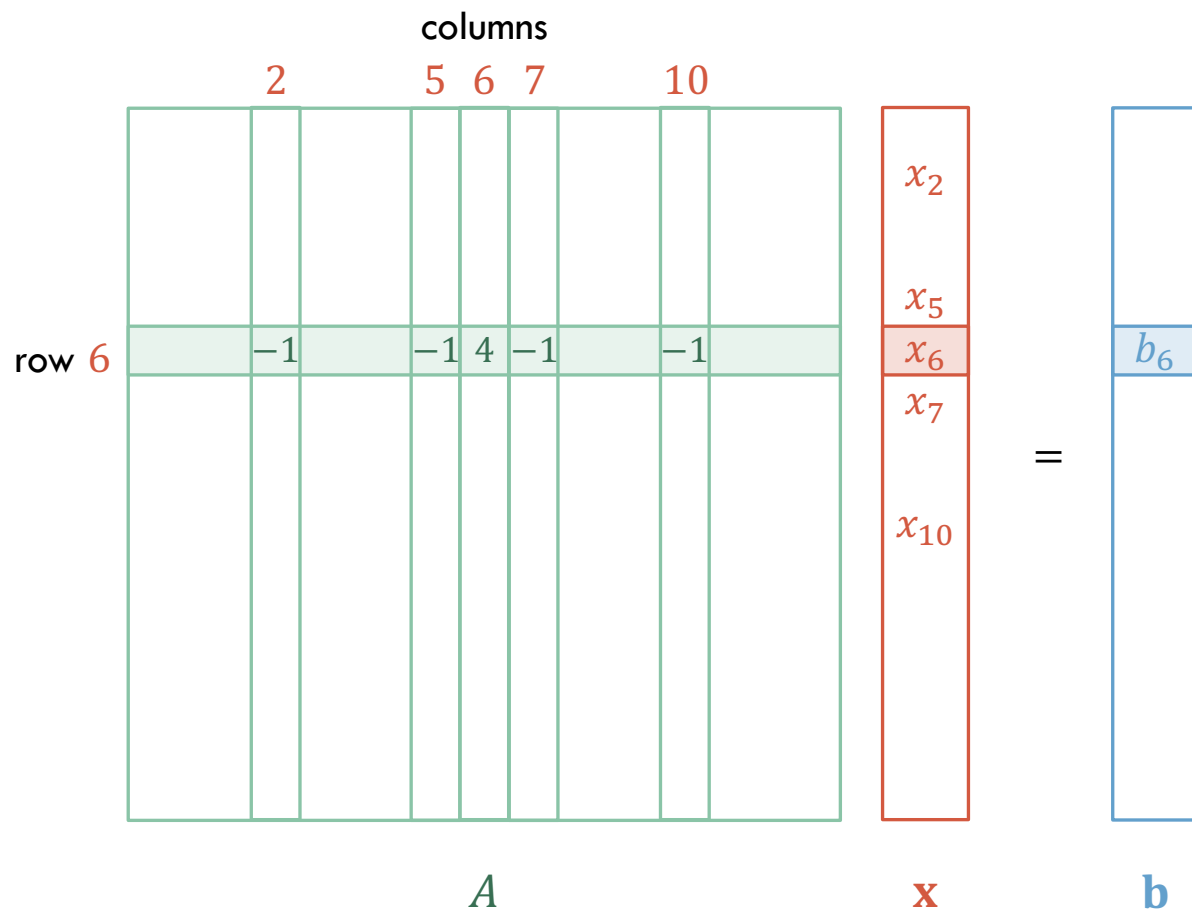
# HOW TO CONSTRUCT $A$ ?



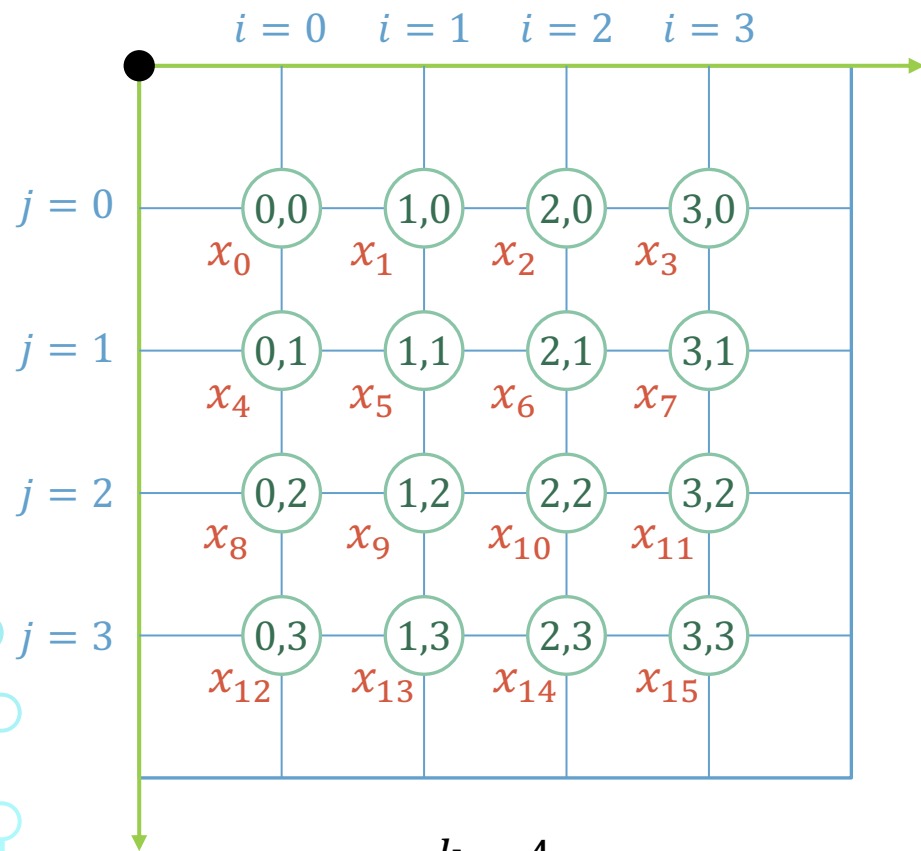
$k = 4$   
 $n = k^2$  grid points

For example, for  $x_6$ , we have

$$-x_2 - x_5 + 4x_6 - x_7 - x_{10} = 0$$



# HOW TO CONSTRUCT $A$ ?



$k = 4$   
 $n = k^2$  grid points

$A$

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	4	-1			-1											
1	-1	4	-1			-1										
2		-1	4	-1			-1									
3			-1	4	0			-1								
4	-1			0	4	-1			-1							
5		-1			-1	4	-1			-1						
6			-1			-1	4	-1			-1					
7				-1			-1	4	0			-1				
8					-1			0	4	-1			-1			
9						-1			-1	4	-1			-1		
10							-1			-1	4	-1			-1	
11								-1			-1	4	0			-1
12									-1			0	4	-1		
13										-1			-1	4	-1	
14											-1			-1	4	-1
15												-1			-1	4

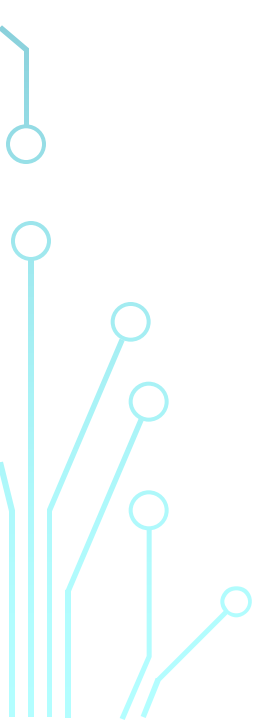

No unknown top neighbors

No unknown bottom neighbors



# QUESTIONS...

Suppose  $k = 3$ :

- How many unknowns (or grid points) are there?
  - How big is  $A$ ?
  - How many rows in  $A$  have all the values  $(-1, -1, +4, -1, -1)$ ?
- 
- 
- 