

EAV Format Introduction

Sparse Matrices: EAV

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1

Sparse Matrices: EAV

A table represents points
in n-Dimensional Space.

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1

Sparse Matrices: EAV

A table represents points in n-Dimensional Space.

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1

- Can we represent all tables in a single schema?
- Any table or matrix cell can be described by row, column and value.
- Represent each cell of a table in its own row.
- Entity-attribute-value model

Sparse Matrices: EAV

Row ID. Needs to be unique for a given row in the original table. Does not need to be a number or sequential

Column Name

Cell Values

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1

[illegible]

- Can we represent all tables in a single schema?
- Any table or matrix cell can be described by row, column and value.
- Represent each cell of a table in its own row.
- Entity-attribute-value model

Sparse Matrices: EAV

Row ID. Needs to be unique for a given row in the original table. Does not need to be a number or sequential

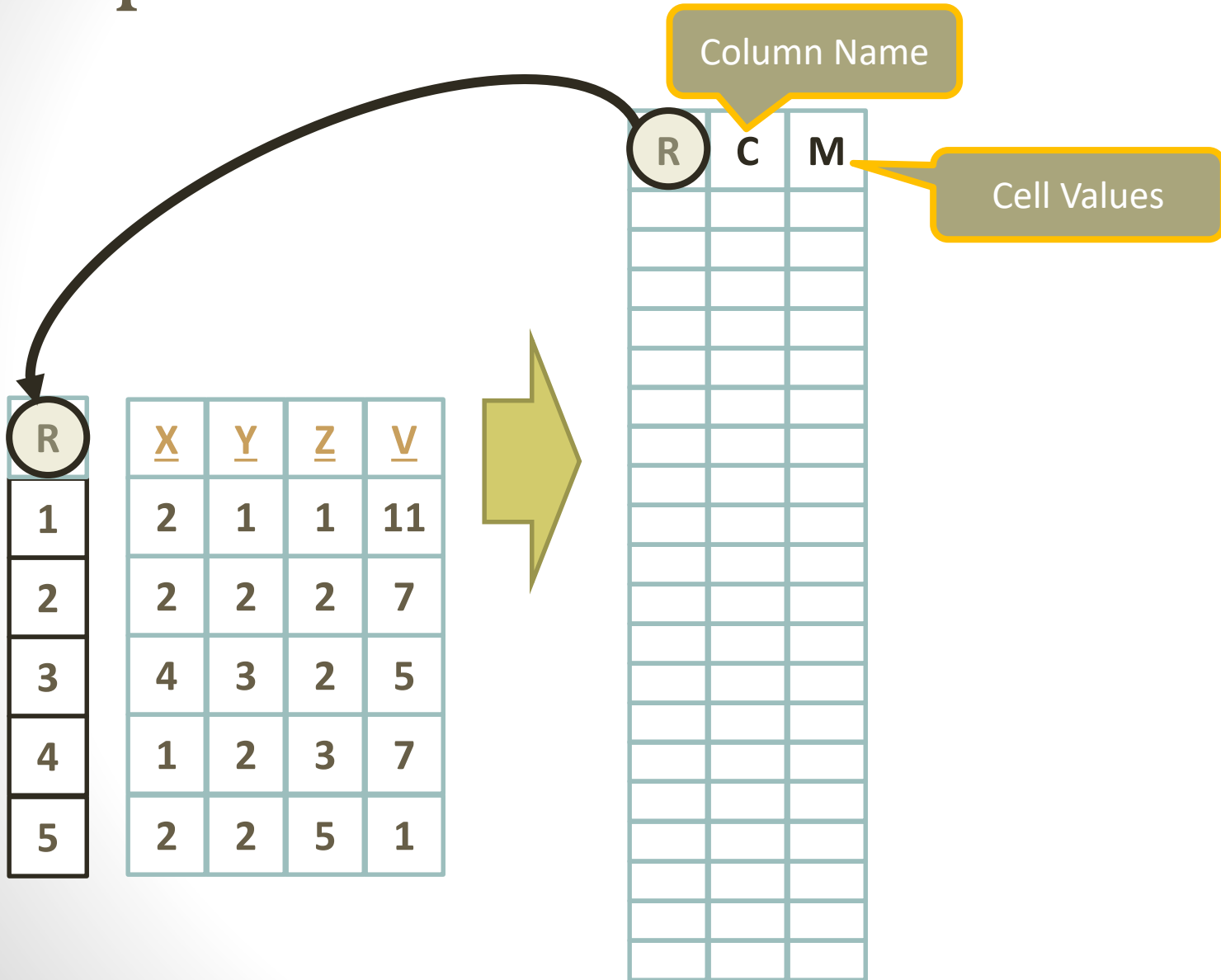
Column Name

Cell Values

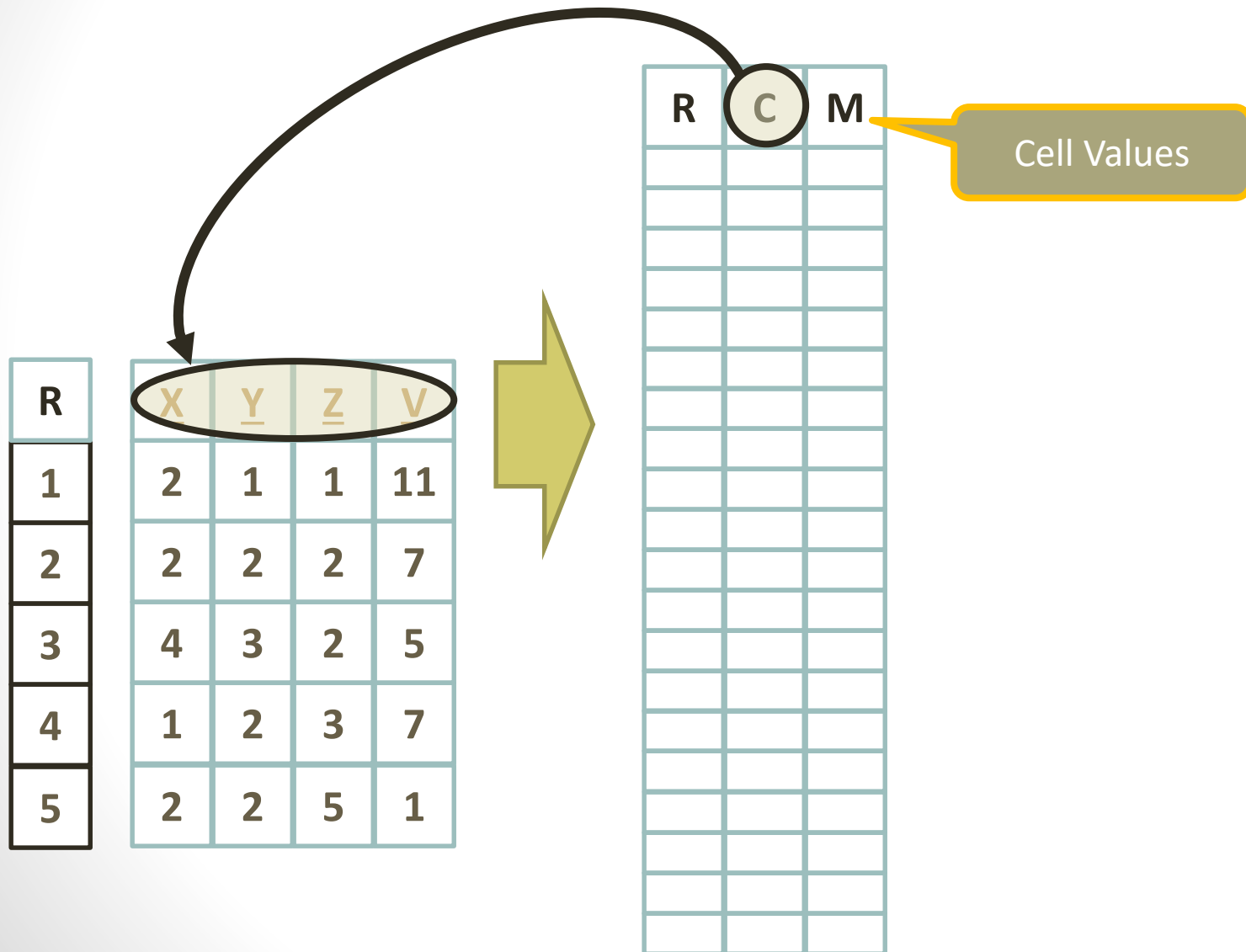
<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1

[illegible]

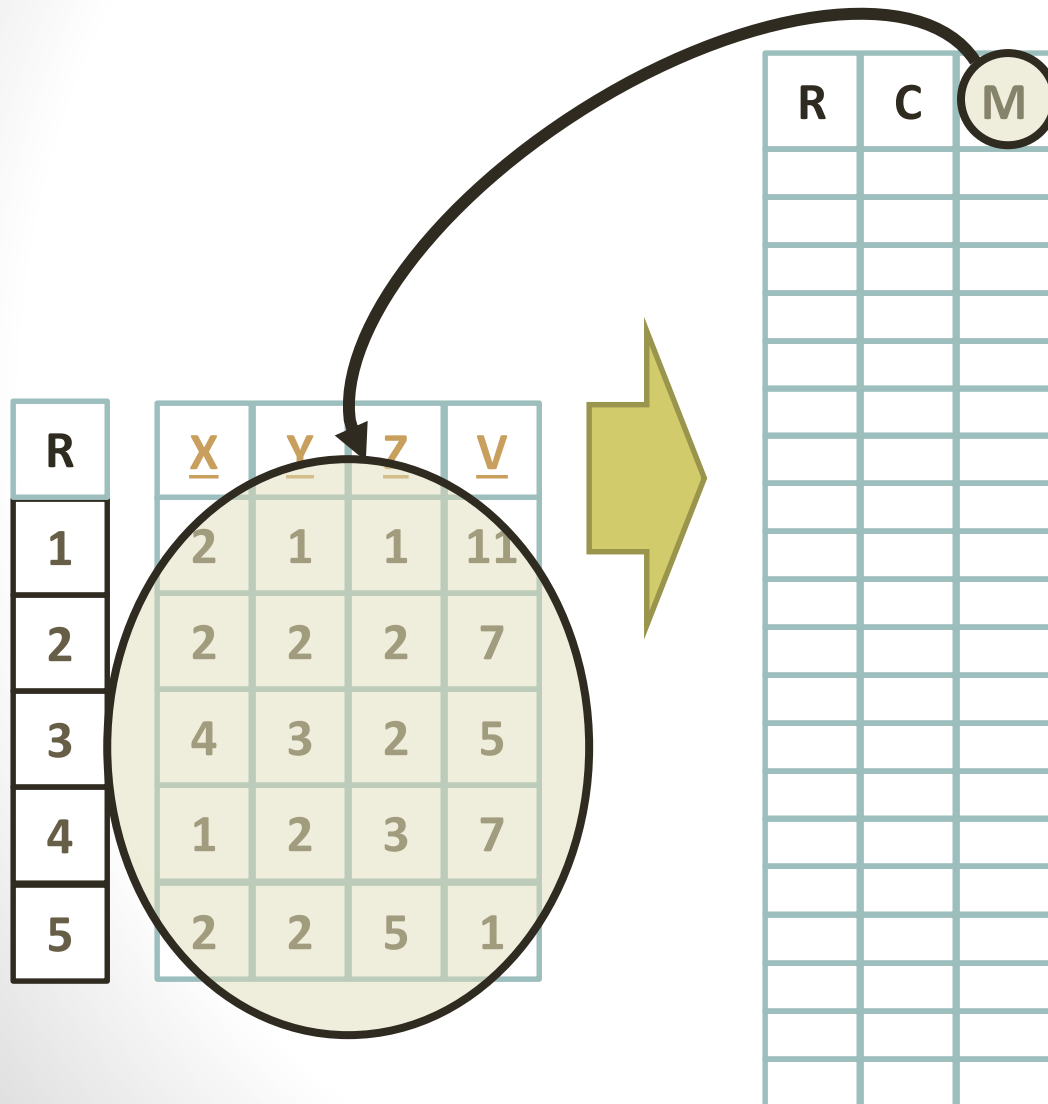
Sparse Matrices: EAV



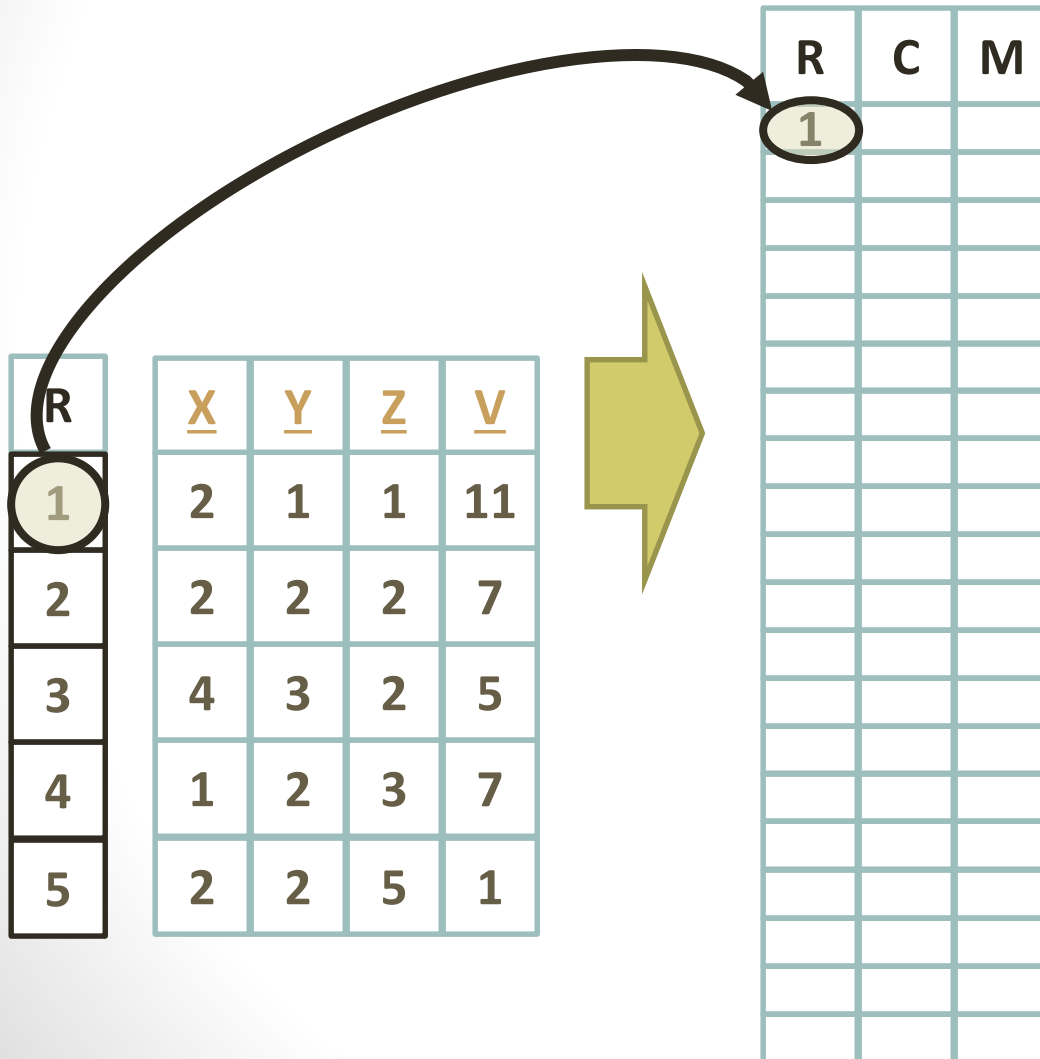
Sparse Matrices: EAV



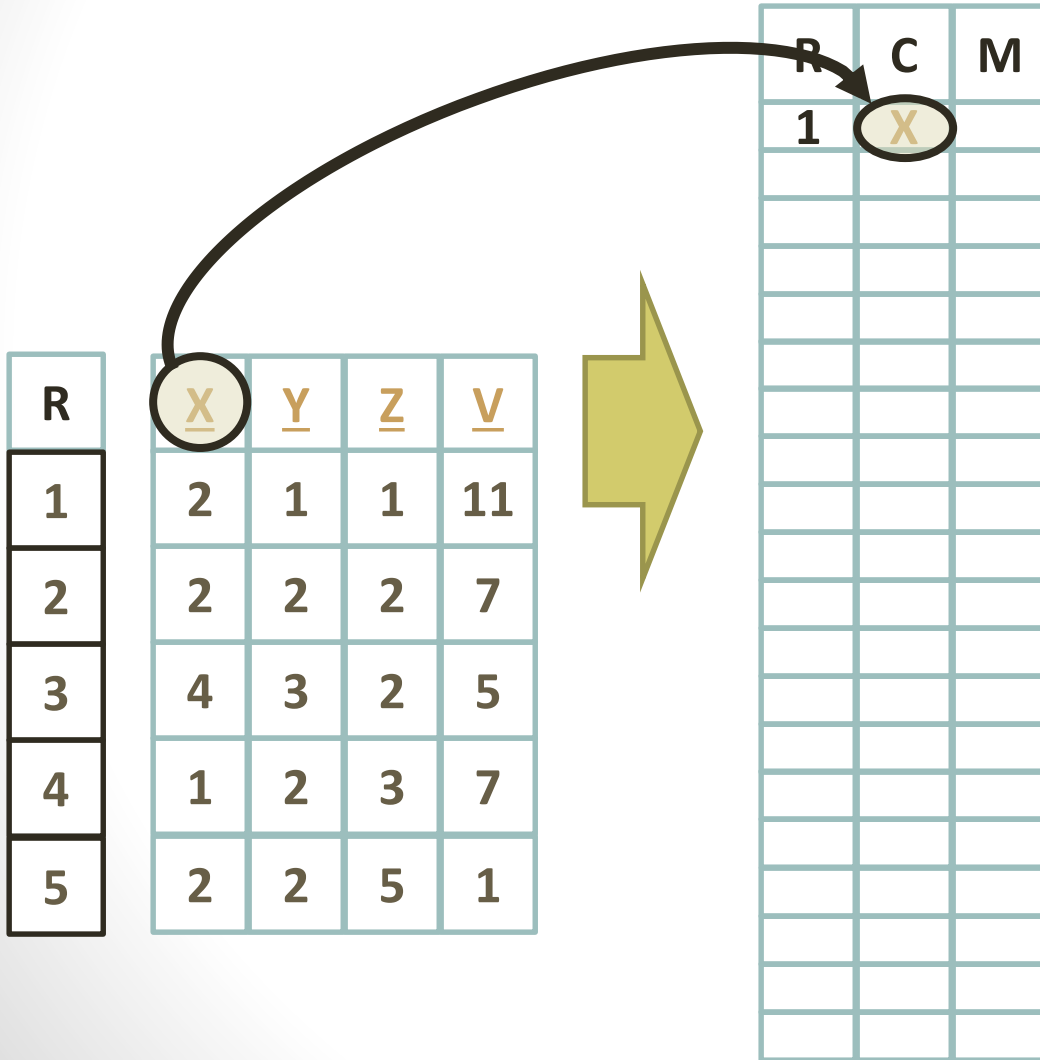
Sparse Matrices: EAV



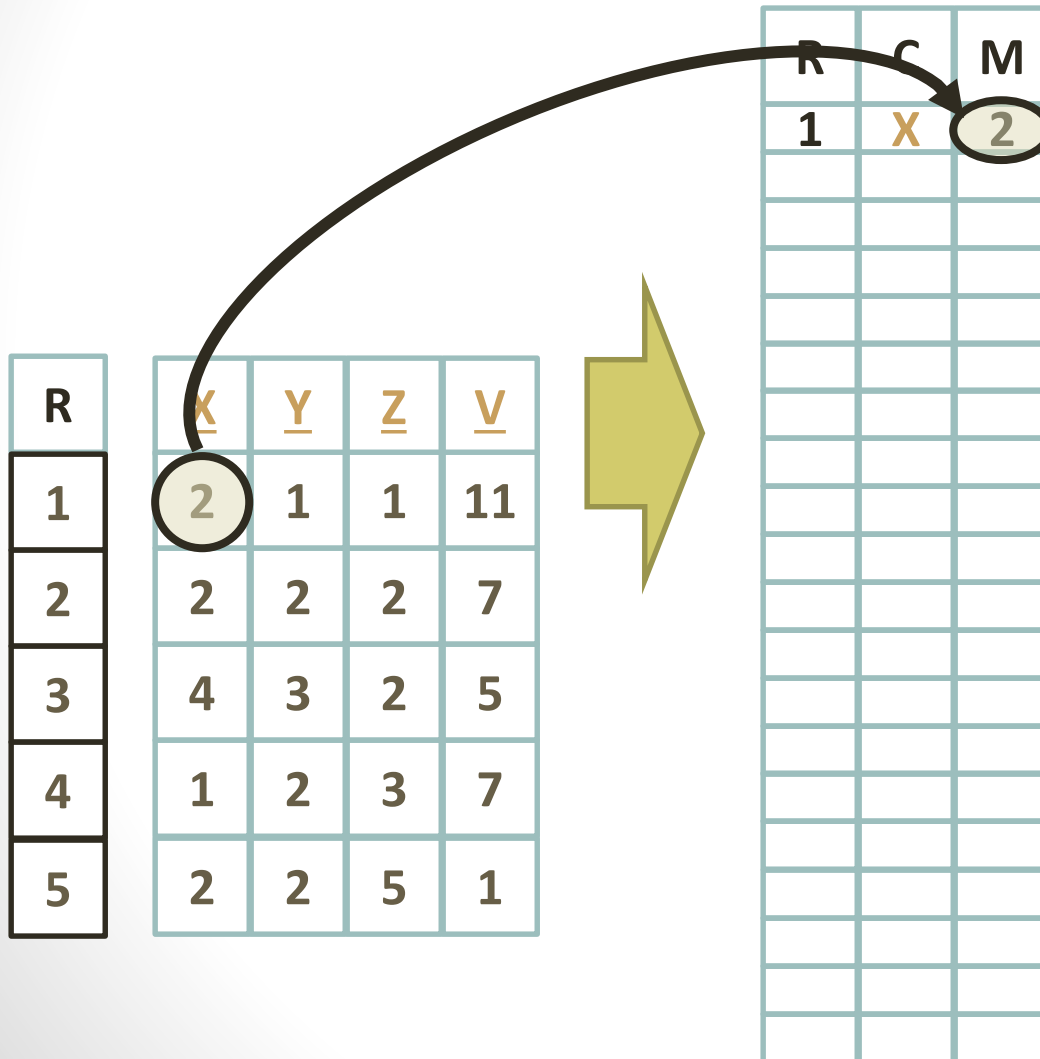
Sparse Matrices: EAV



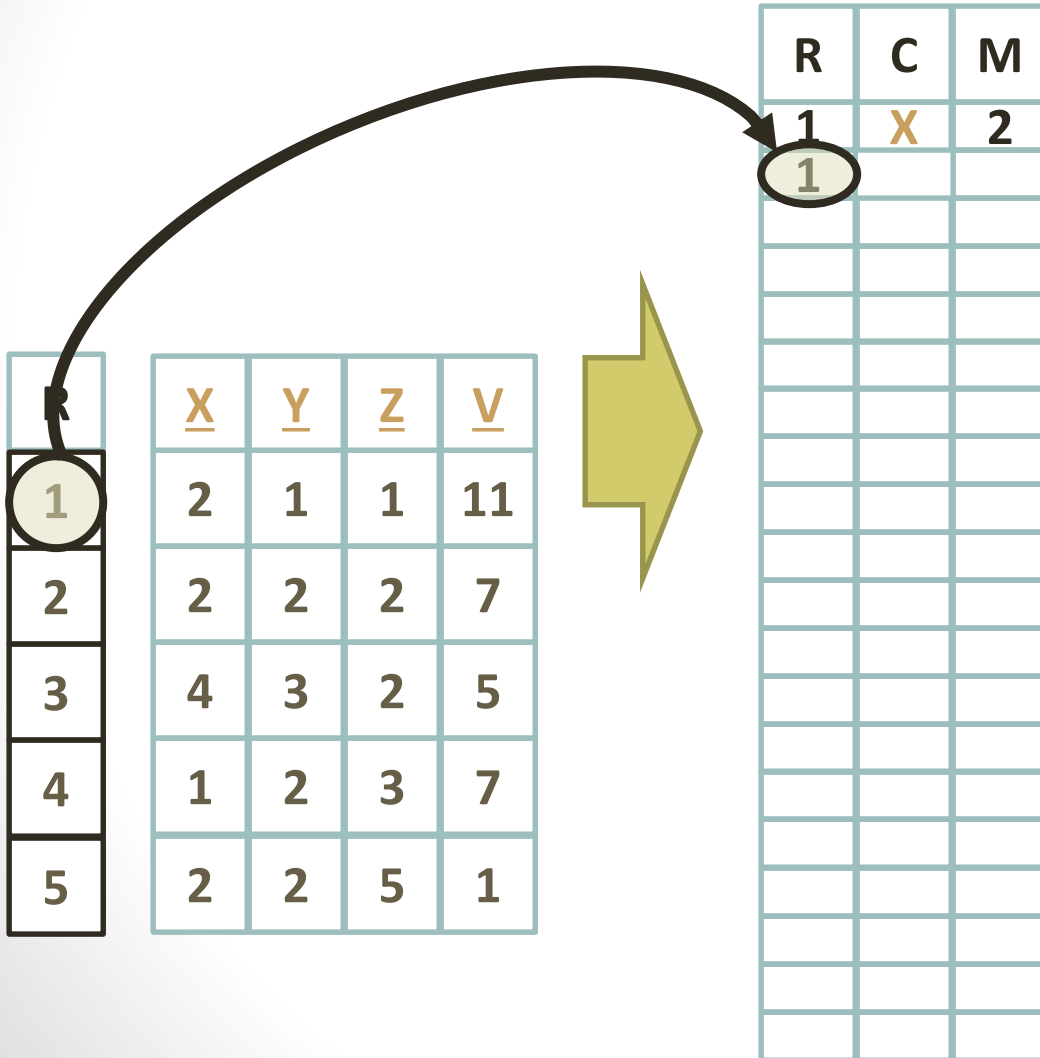
Sparse Matrices: EAV



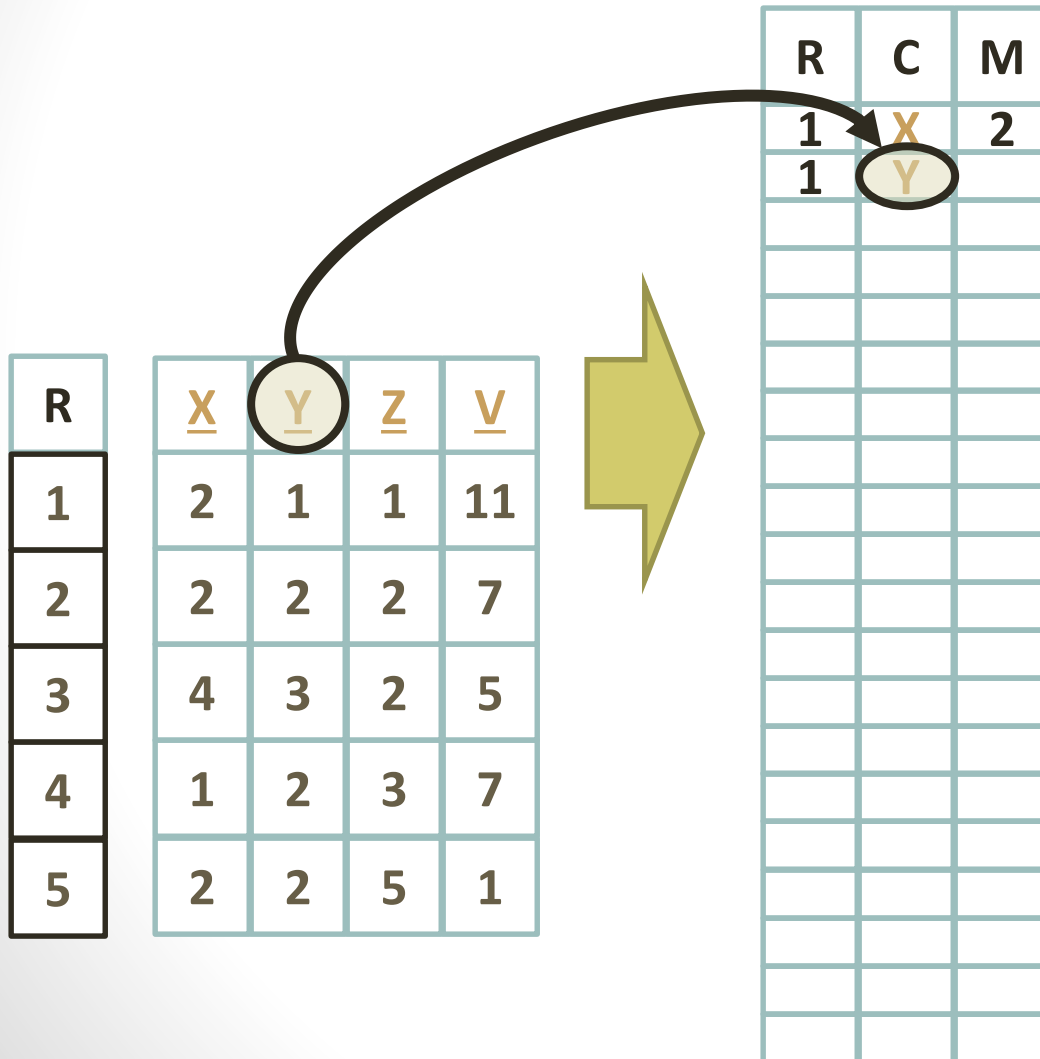
Sparse Matrices: EAV



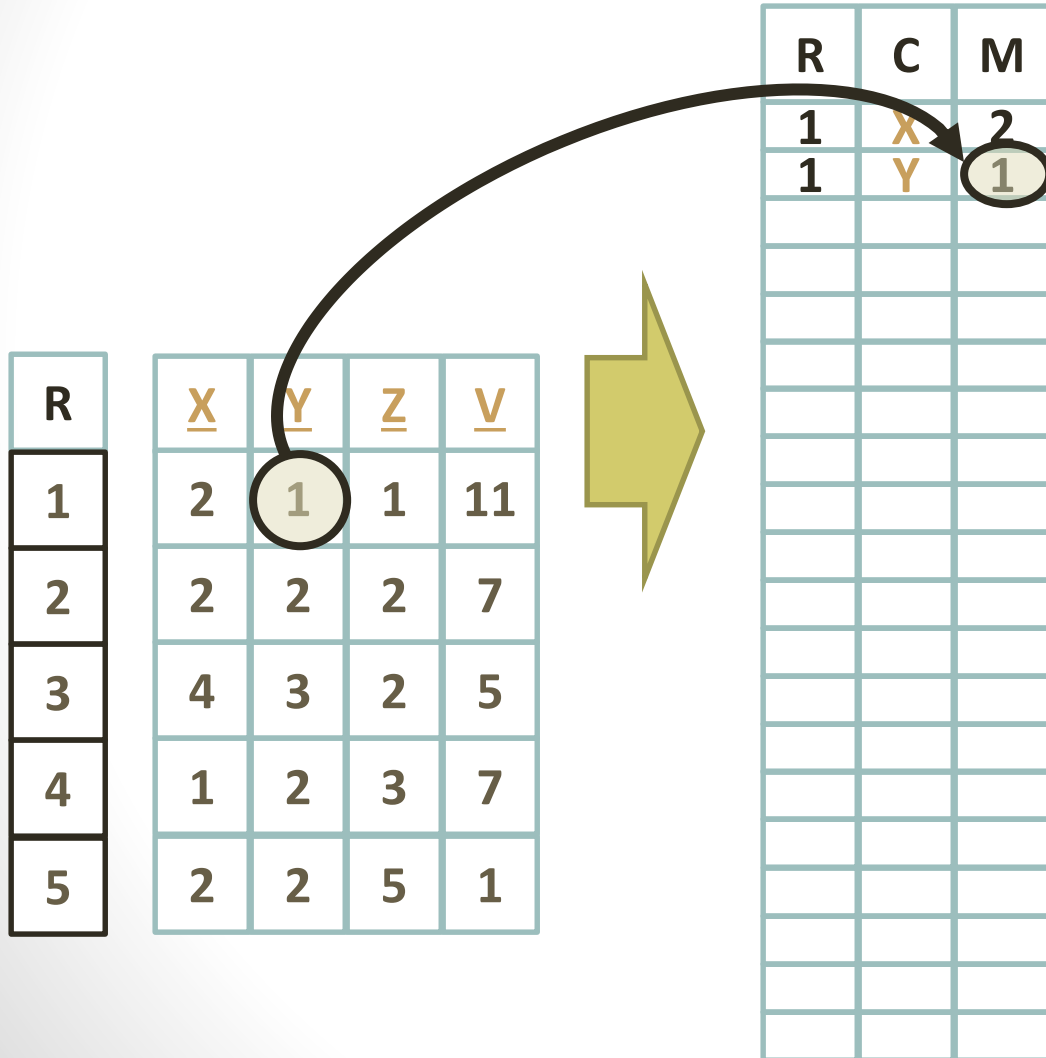
Sparse Matrices: EAV



Sparse Matrices: EAV



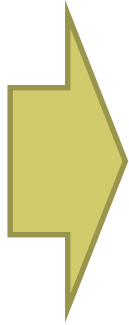
Sparse Matrices: EAV



Sparse Matrices: EAV

R
1
2
3
4
5

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1

[illegible]

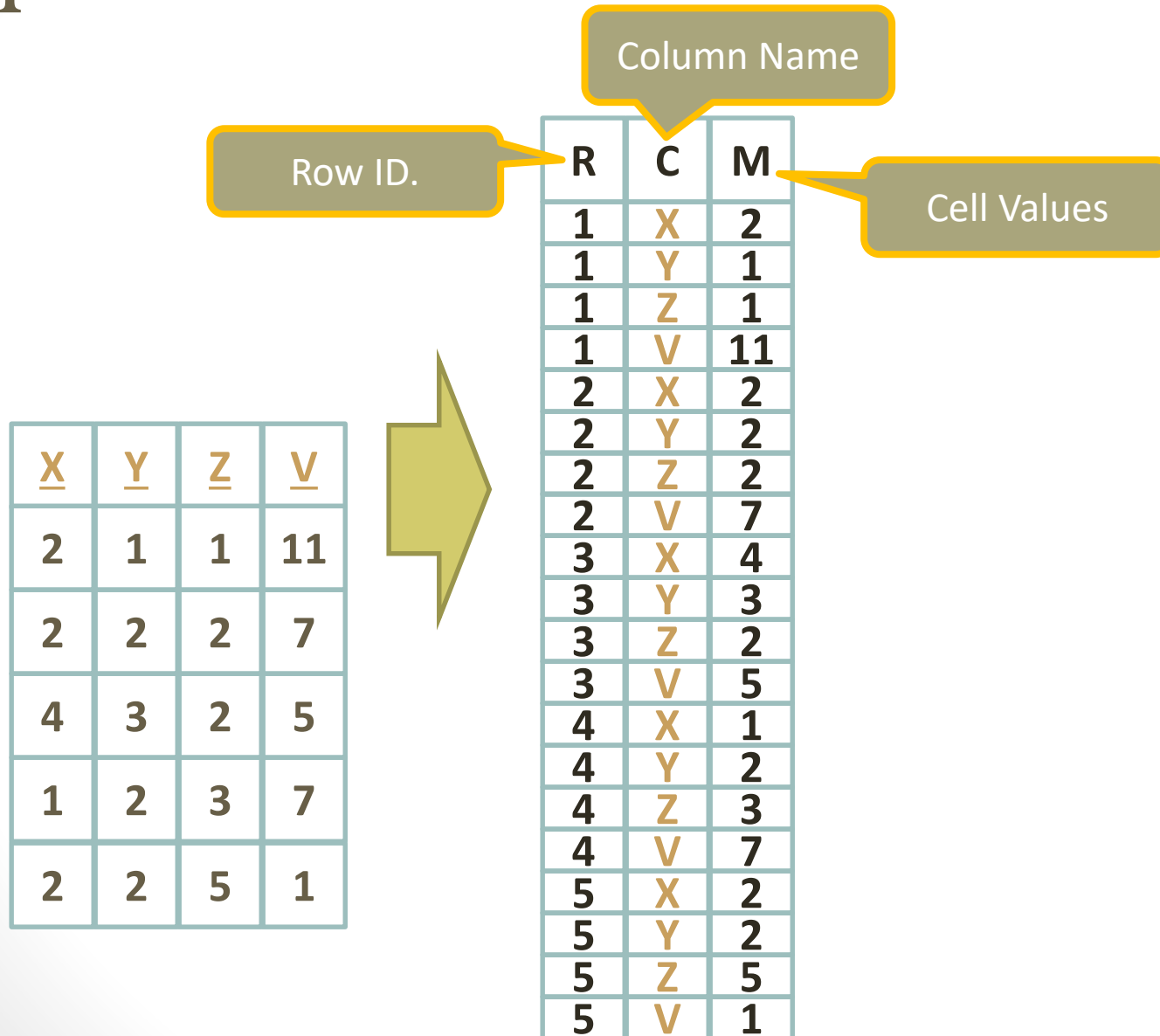
Sparse Matrices: EAV

<u>X</u>	<u>Y</u>	<u>Z</u>	<u>V</u>
2	1	1	11
2	2	2	7
4	3	2	5
1	2	3	7
2	2	5	1



R	C	M
1	X	2
1	Y	1
1	Z	1
1	V	11
2	X	2
2	Y	2
2	Z	2
2	V	7
3	X	4
3	Y	3
3	Z	2
3	V	5
4	X	1
4	Y	2
4	Z	3
4	V	7
5	X	2
5	Y	2
5	Z	5
5	V	1

Sparse Matrices: EAV



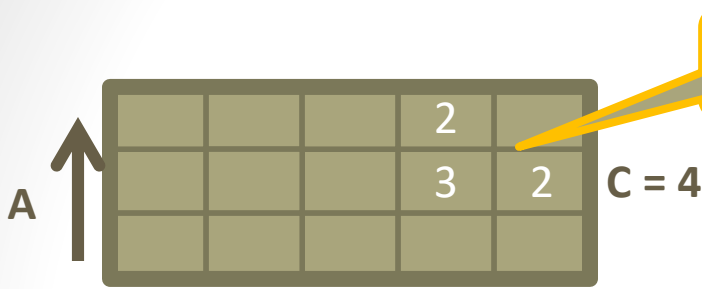
EAV Format Introduction

Quiz on EAV

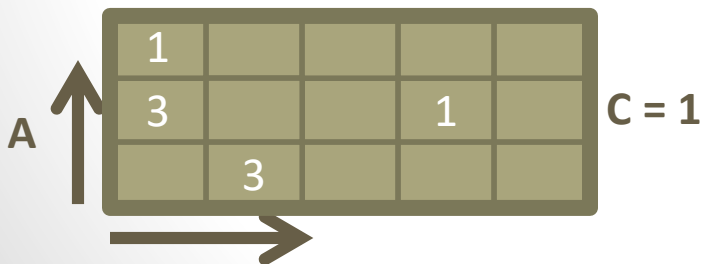
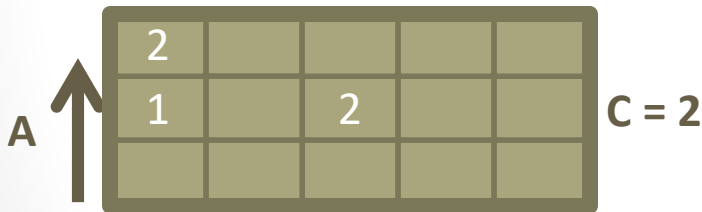
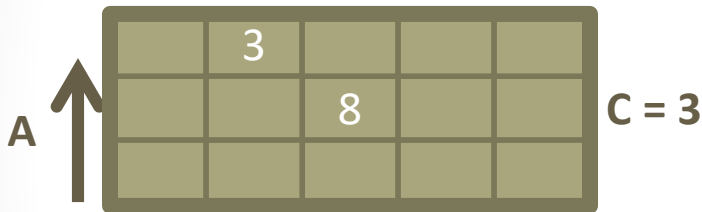
- The questions are presented during the quiz

EAV Format Exercise

Sparse Matrices: Exercise (1)



Number Of
Houses



- Data: Real estate survey of single-family houses in downtown Seattle. Cell values are number (**N**) of houses found for sale.
 - **A**: Area in 1000's of square feet
 - **B**: Number of Bathrooms
 - **C**: Cost in \$100,000.-
- Task: Create sparse matrices of the type in the previous slide.

Sparse Matrices: Exercise (2)

A ↑

			2	
			3	2

C = 4

A ↑

	3			
		8		

C = 3

A ↑

2				
1		2		

C = 2

A ↑

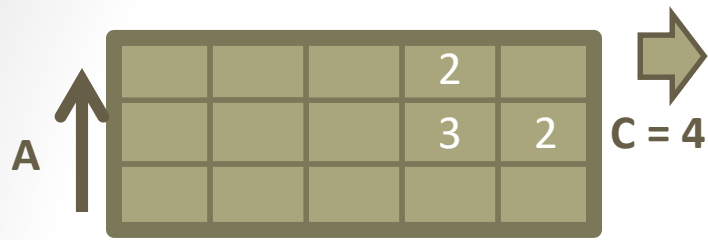
1				
3			1	
	3			

C = 1

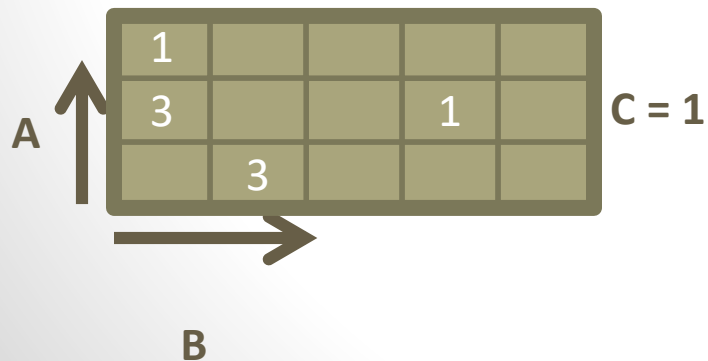
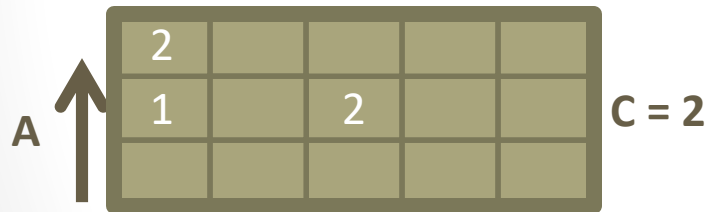
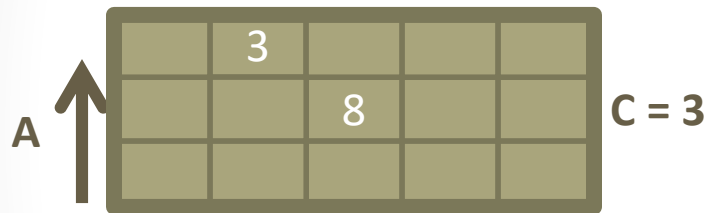
→

B

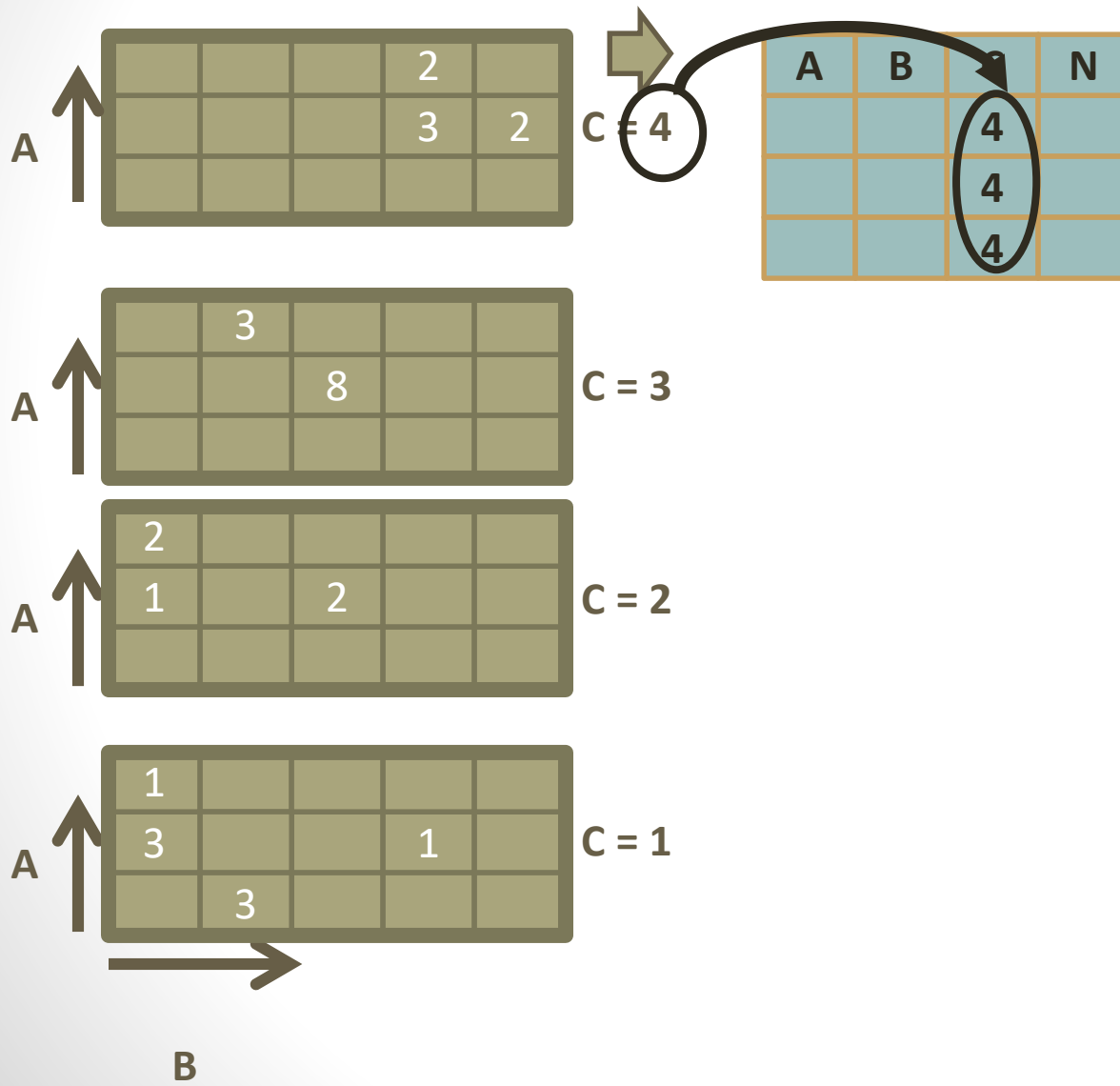
Sparse Matrices: Exercise (3)



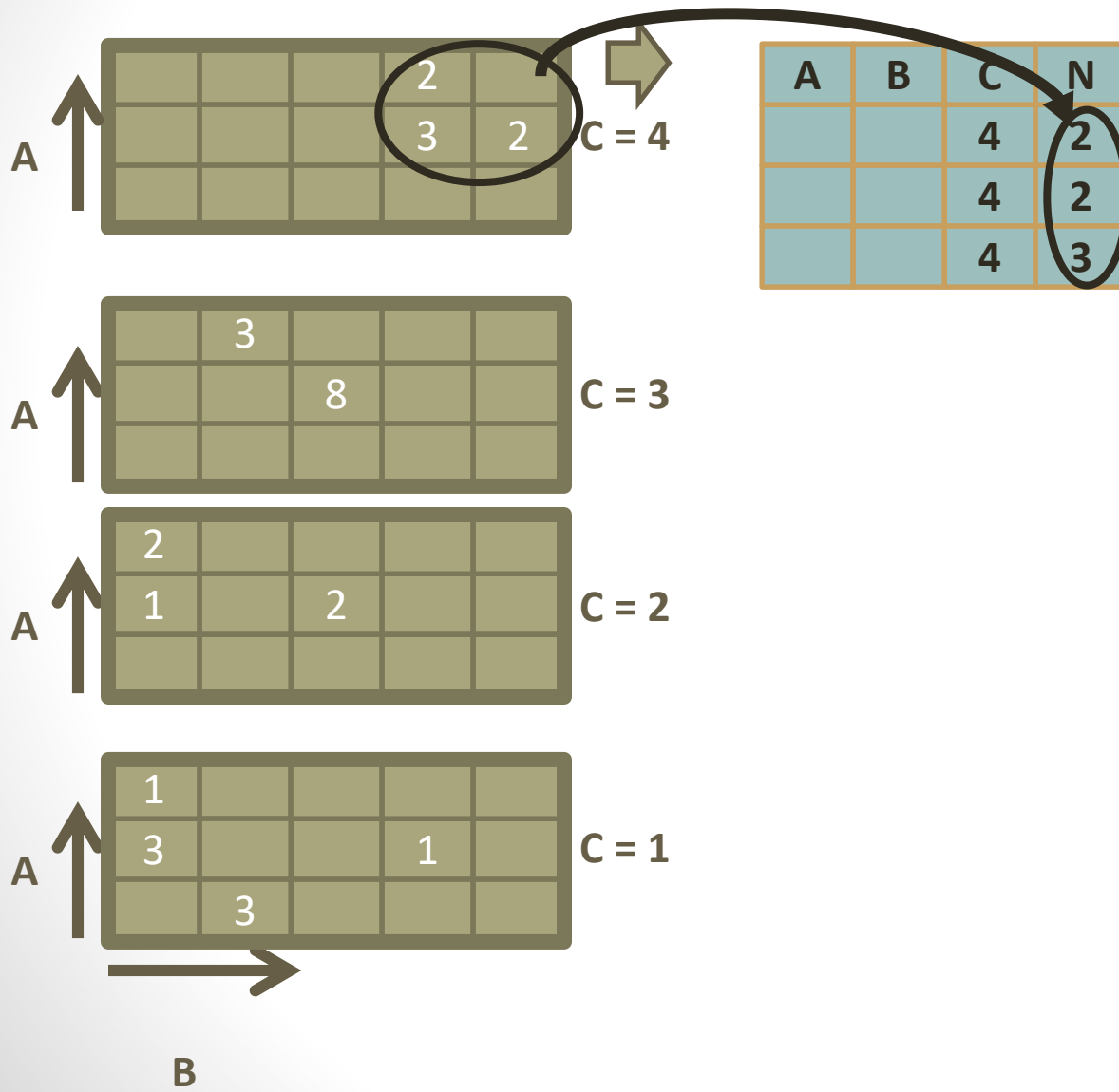
A	B	C	N



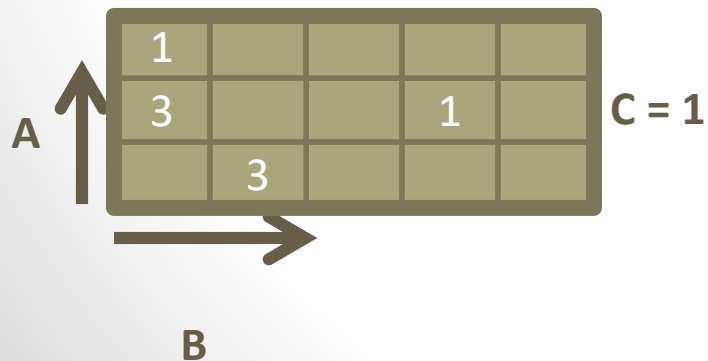
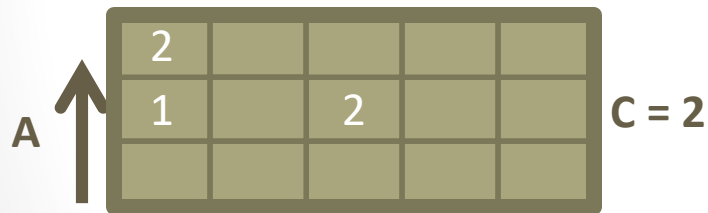
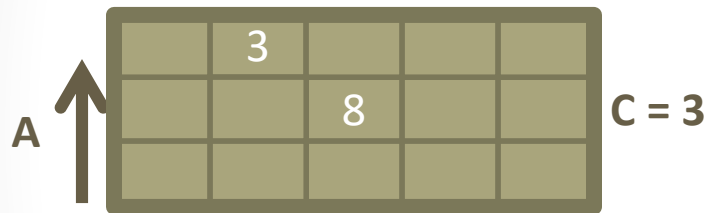
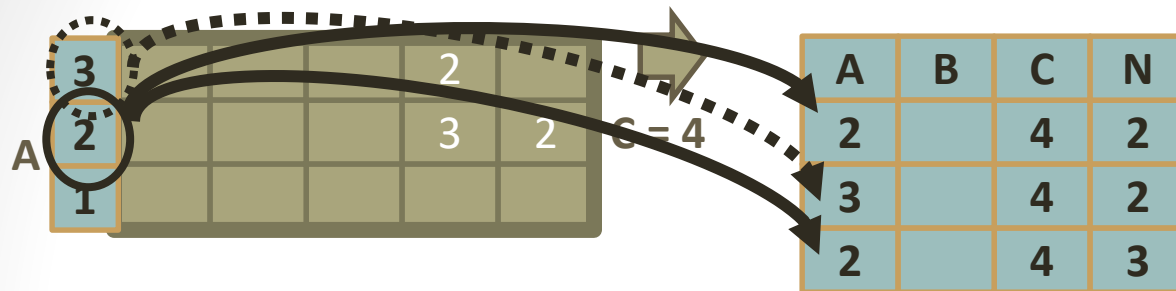
Sparse Matrices: Exercise (4)



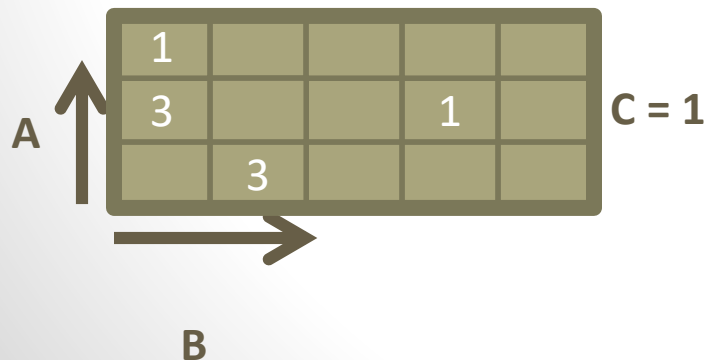
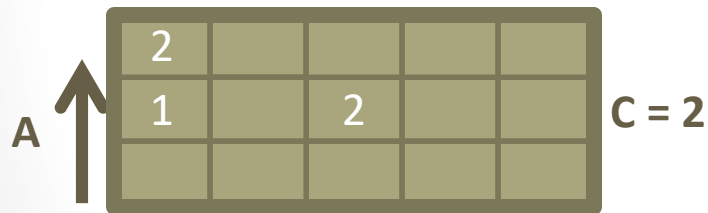
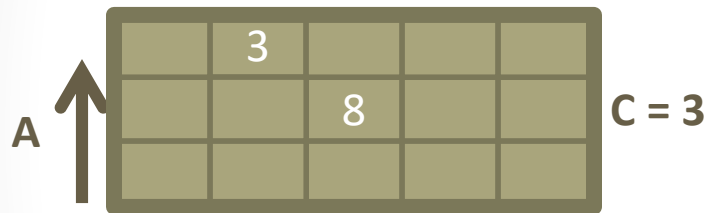
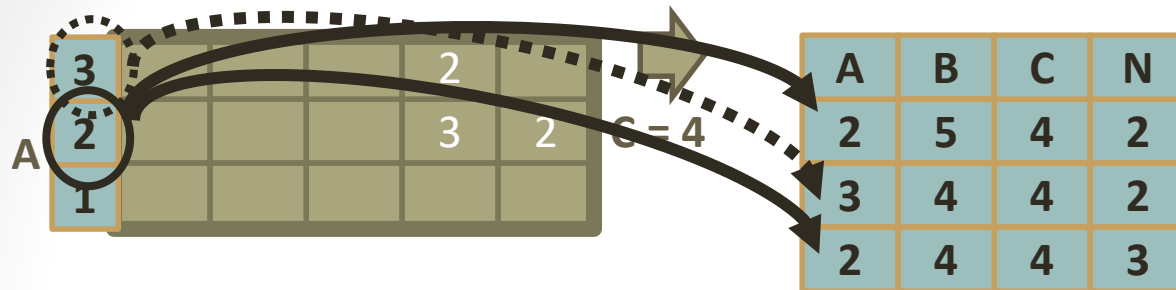
Sparse Matrices: Exercise (5)



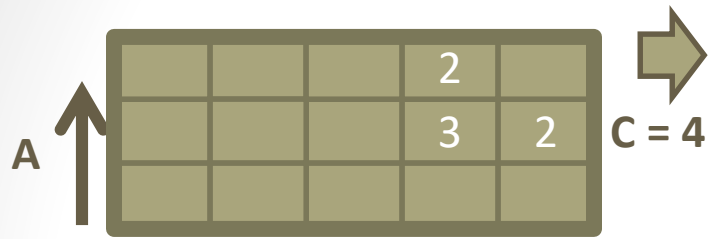
Sparse Matrices: Exercise (6)



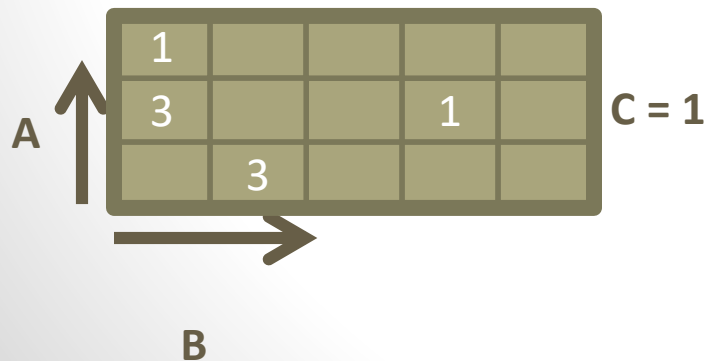
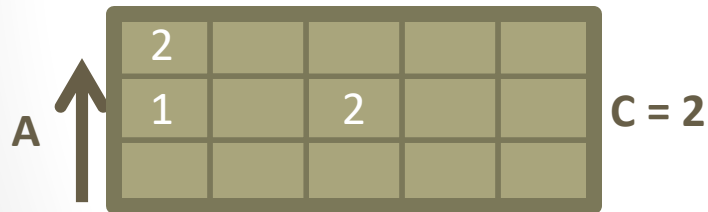
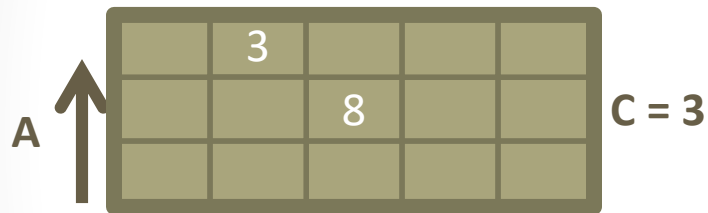
Sparse Matrices: Exercise (7)



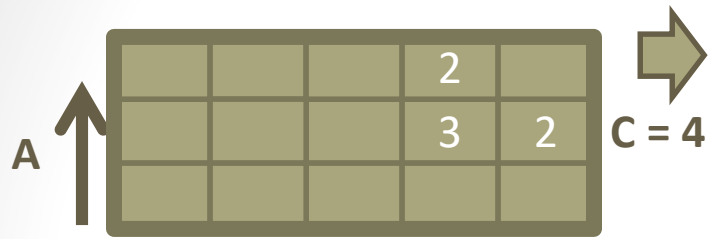
Sparse Matrices: Exercise (8)



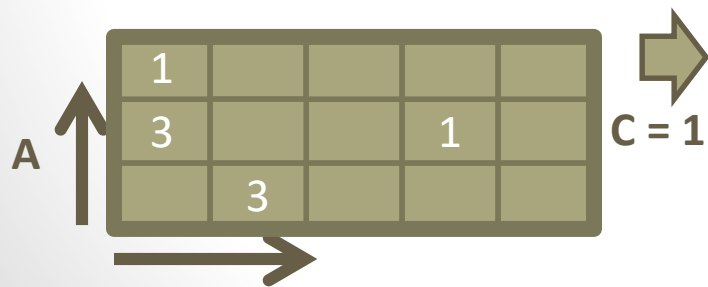
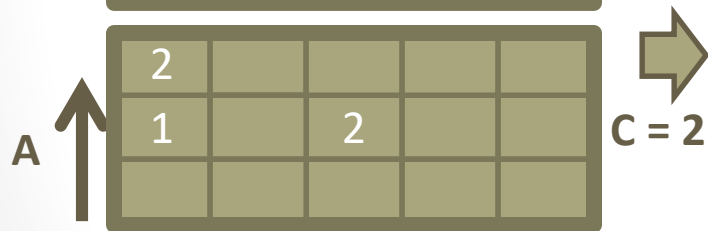
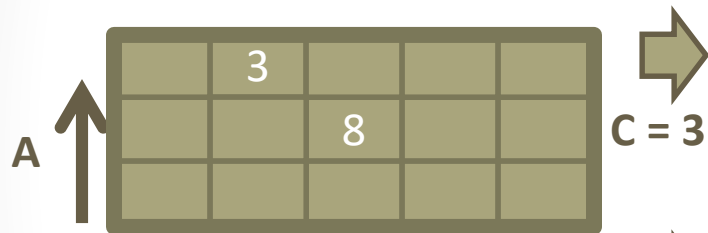
A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3



Sparse Matrices: Exercise (9)

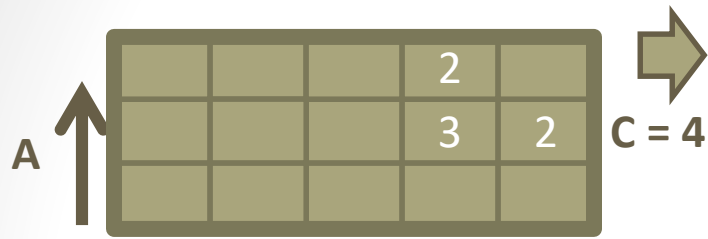


A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3

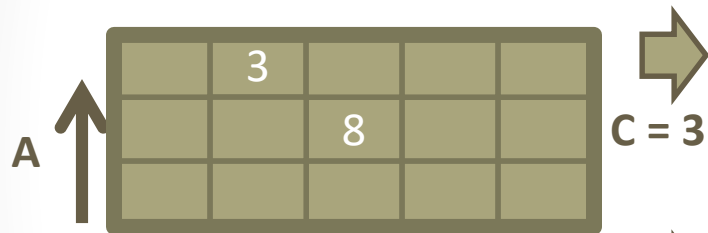


B

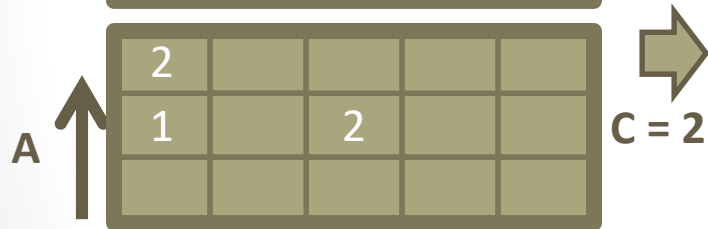
Sparse Matrices: Exercise (10)



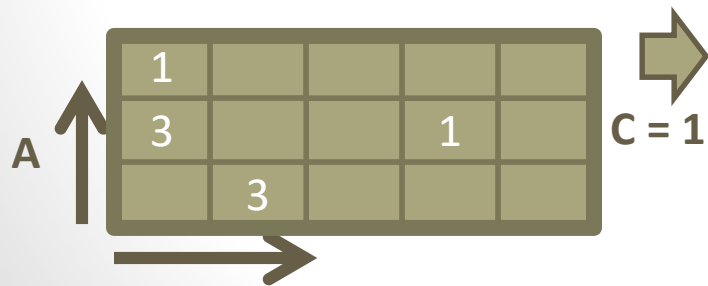
A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3



A	B	C	N
2	3	3	8
3	2	3	3



A	B	C	N
2	3	2	2
3	1	2	2
2	1	2	1



A	B	C	N
2	4	1	1
1	2	1	3
3	1	1	1
2	1	1	3

Sparse Matrices: Exercise (11)

A ↑

			2	
			3	2

C = 4

A ↑

	3			
		8		

C = 3

A ↑

2				
1		2		

C = 2

A ↑

1				
3			1	
	3			

C = 1

→ B

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3

A	B	C	N
2	3	3	8
3	2	3	3

A	B	C	N
2	3	2	2
3	1	2	2
2	1	2	1

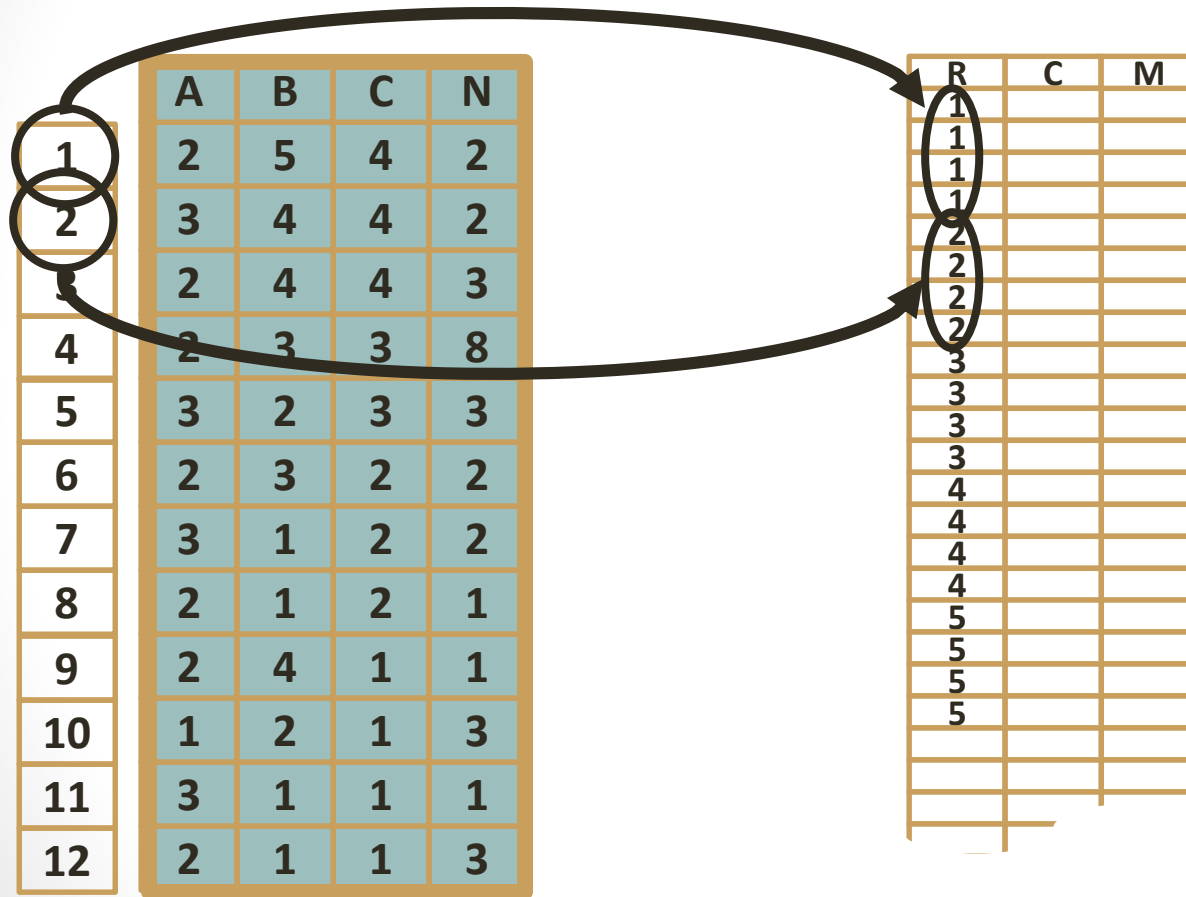
A	B	C	N
2	4	1	1
1	2	1	3
3	1	1	1
2	1	1	3

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2
3	1	2	2
2	1	2	1
2	4	1	1
1	2	1	3
3	1	1	1
2	1	1	3

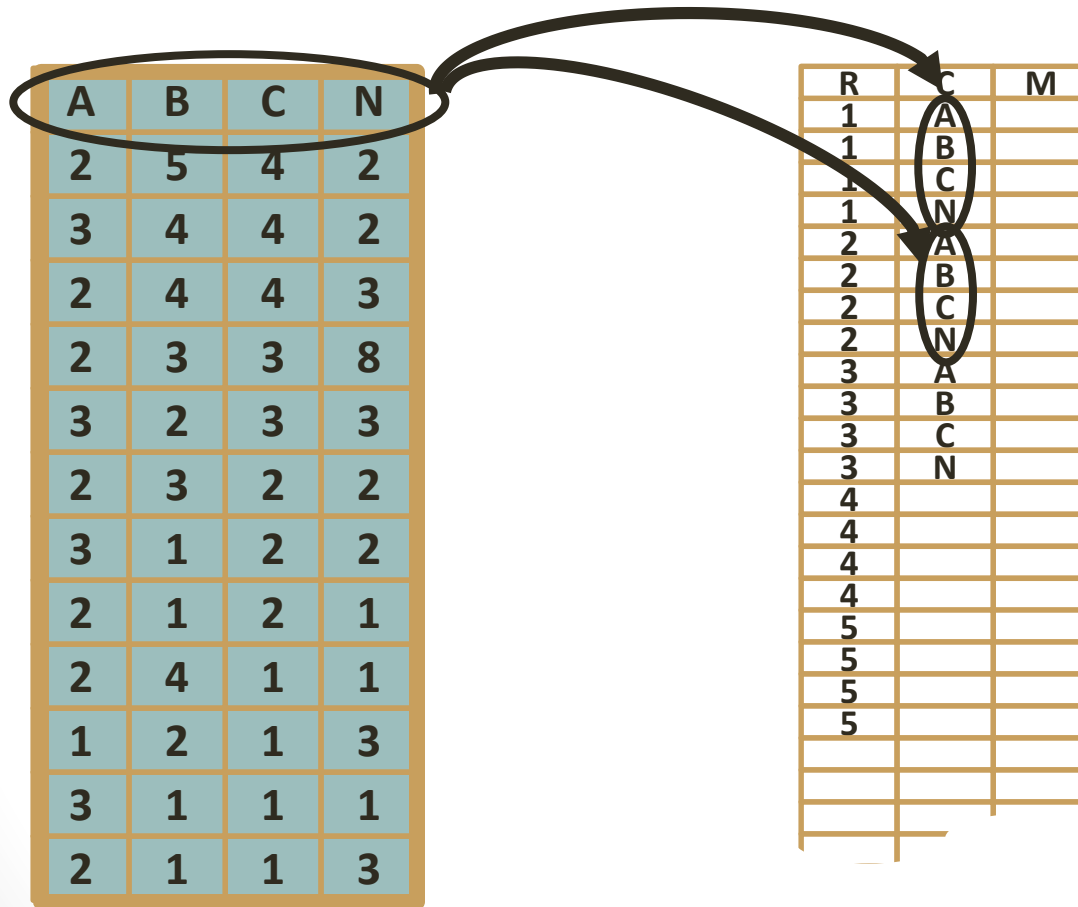
Sparse Matrices: Exercise (12)

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2
3	1	2	2
2	1	2	1
2	4	1	1
1	2	1	3
3	1	1	1
2	1	1	3

Sparse Matrices: Exercise (13)



Sparse Matrices: Exercise (14)



Sparse Matrices: Exercise (15)

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2
3	1	2	2
2	1	2	1
2	4	1	1
1	2	1	3
3	1	1	1
2	1	1	3

R	C	M
1	A	2
1	B	5
1	C	4
1	N	2
2	A	3
2	B	4
2	C	4
2	N	2
3	A	2
3	B	4
3	C	4
3	N	3
4		
4		
4		
4		
5		
5		
5		
5		

Sparse Matrices: Exercise (16)

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2
3	1	2	2
2	1	2	1
2	4	1	1
1	2	1	3
3	1	1	1
2	1	1	3

R	C	M
1	A	2
1	B	5
1	C	4
1	N	2
2	A	3
2	B	4
2	C	4
2	N	2
3	A	2
3	B	4
3	C	4
3	N	3
4		
4		
4		
4		
5		
5		
5		
5		

Sparse Matrices: Exercise (17)

- Main Point:
 - Condensing information from multi-dimensional entity is good but not the main point.
 - The main point is to convince you that a relation and an EAV represent multi-dimensional matrices (Hyper-rectangles, or Cartesian products of their intervals)
- Further Lessons:
 - These tables abide by the rules of relational algebra
 - Rows are unique
 - Columns have headers
 - Row order is irrelevant
 - Relaxed Layout / Schema
 - Extensible: New tables can be added without disrupting the schema

EAV Format Exercise

EAV Format Schema Change

Schema Change: add a column

- Schema change can happen by adding rows (tuples) to a table that indexes another table

Schema Change: add a column

A	B	C
2	5	4
3	4	4
2	4	4
2	3	3
3	2	3
2	3	2

Schema Change: add a column

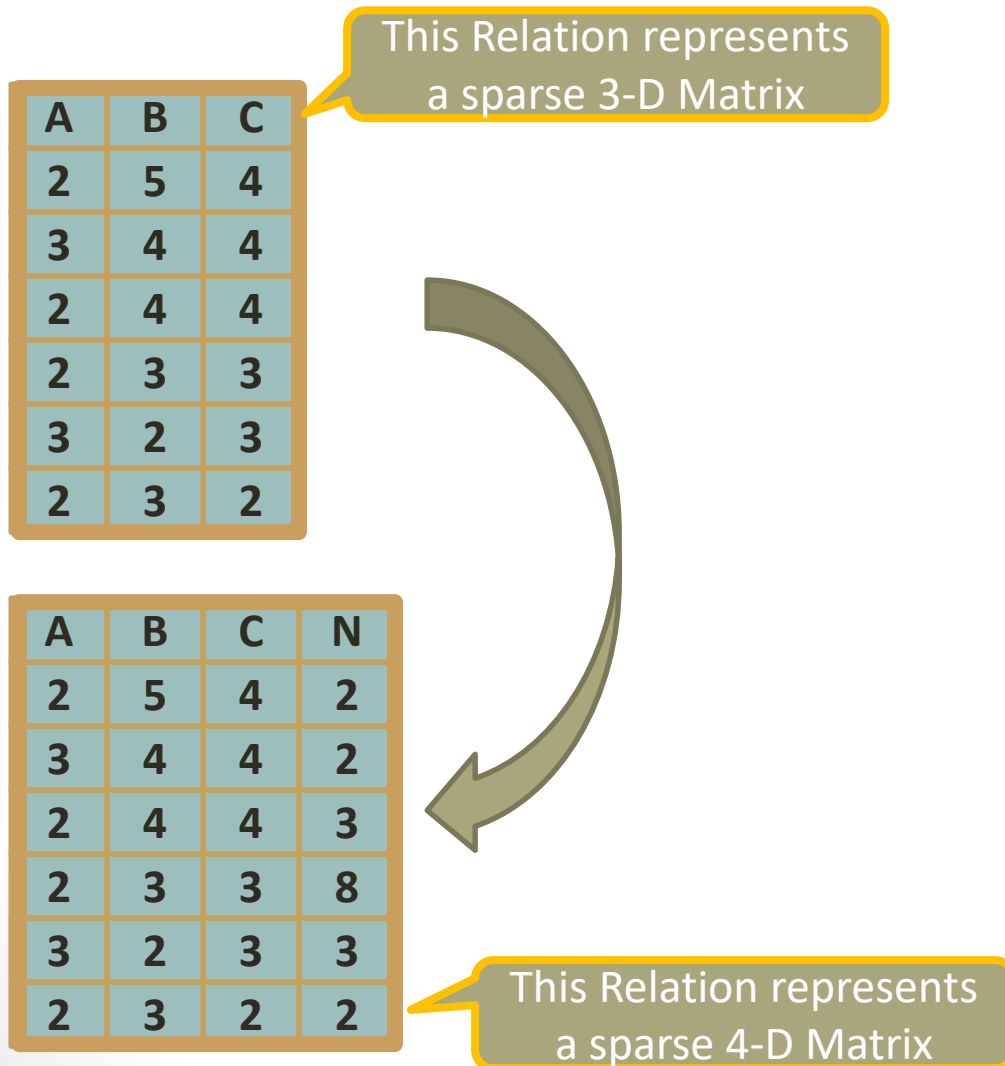
This Relation represents
a sparse 3-D Matrix

A	B	C
2	5	4
3	4	4
2	4	4
2	3	3
3	2	3
2	3	2

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

This Relation represents
a sparse 4-D Matrix

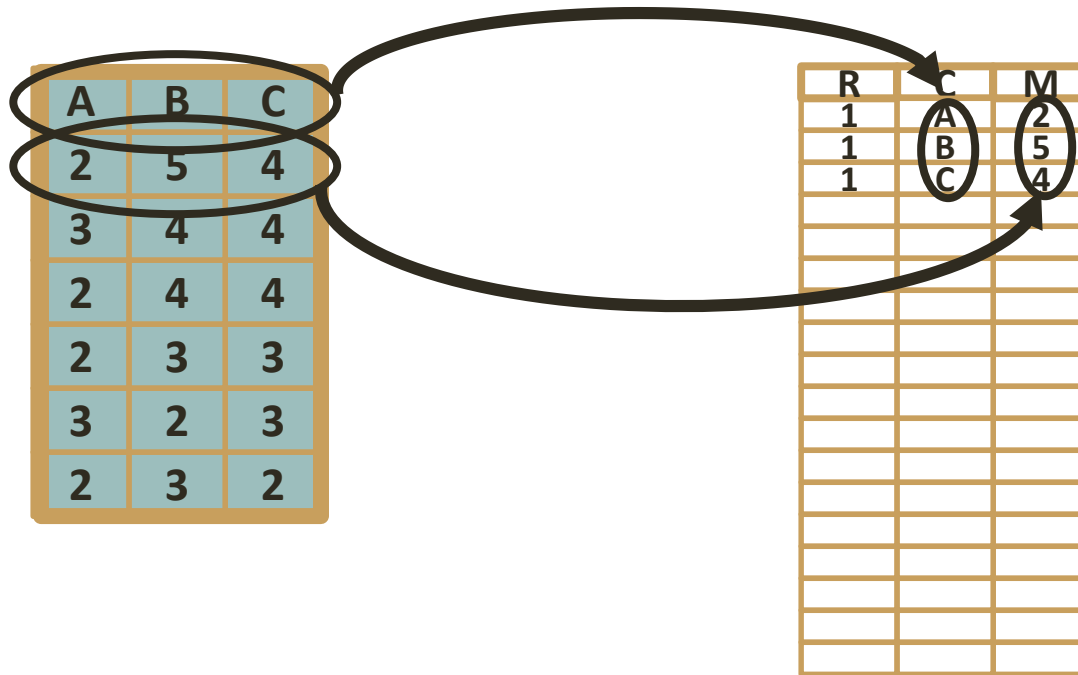
Schema Change: add a column



Schema Change: add a column

A	B	C
2	5	4
3	4	4
2	4	4
2	3	3
3	2	3
2	3	2

Represent Relation by indexing Row, Column, and Value



Represent Relation by indexing Row, Column, and Value

A	B	C
2	5	4
3	4	4
2	4	4
2	3	3
3	2	3
2	3	2

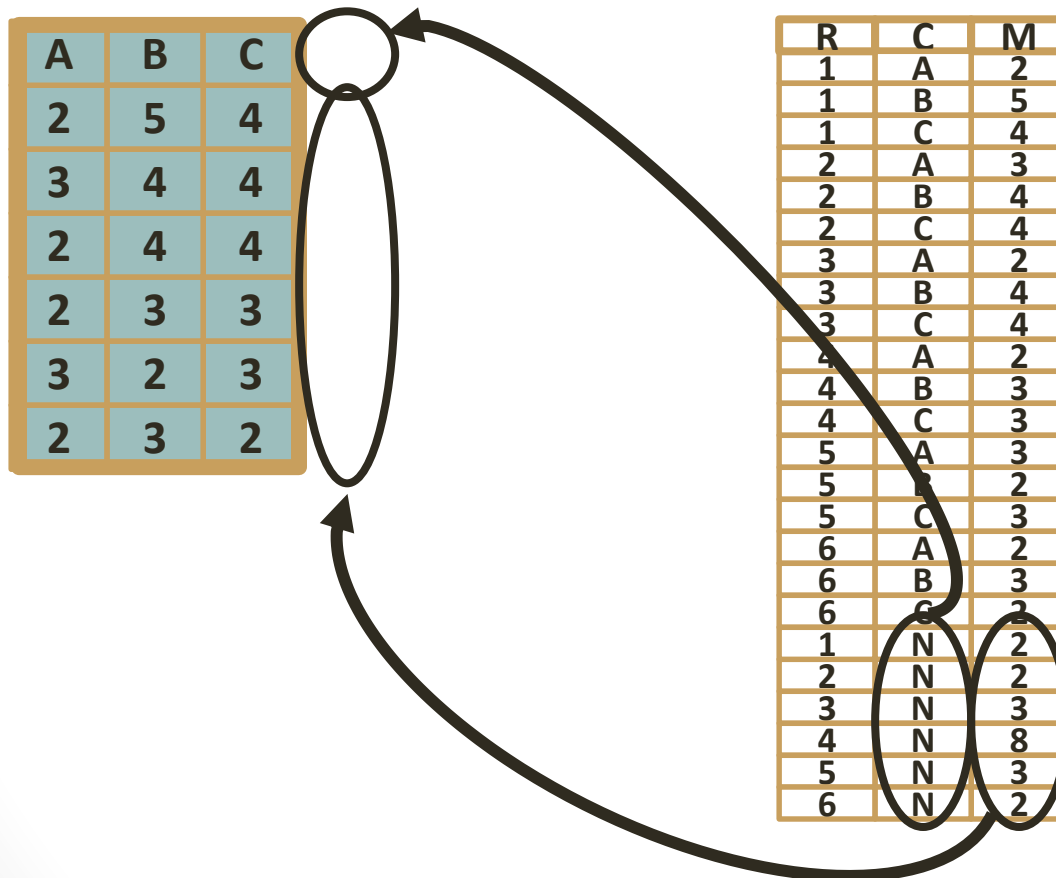
R	C	M
1	A	2
1	B	5
1	C	4
2	A	3
2	B	4
2	C	4
3	A	2
3	B	4
3	C	4
4	A	2
4	B	3
4	C	3
5	A	3
5	B	2
5	C	3
6	A	2
6	B	3
6	C	2

Adding new rows to second table with a new index

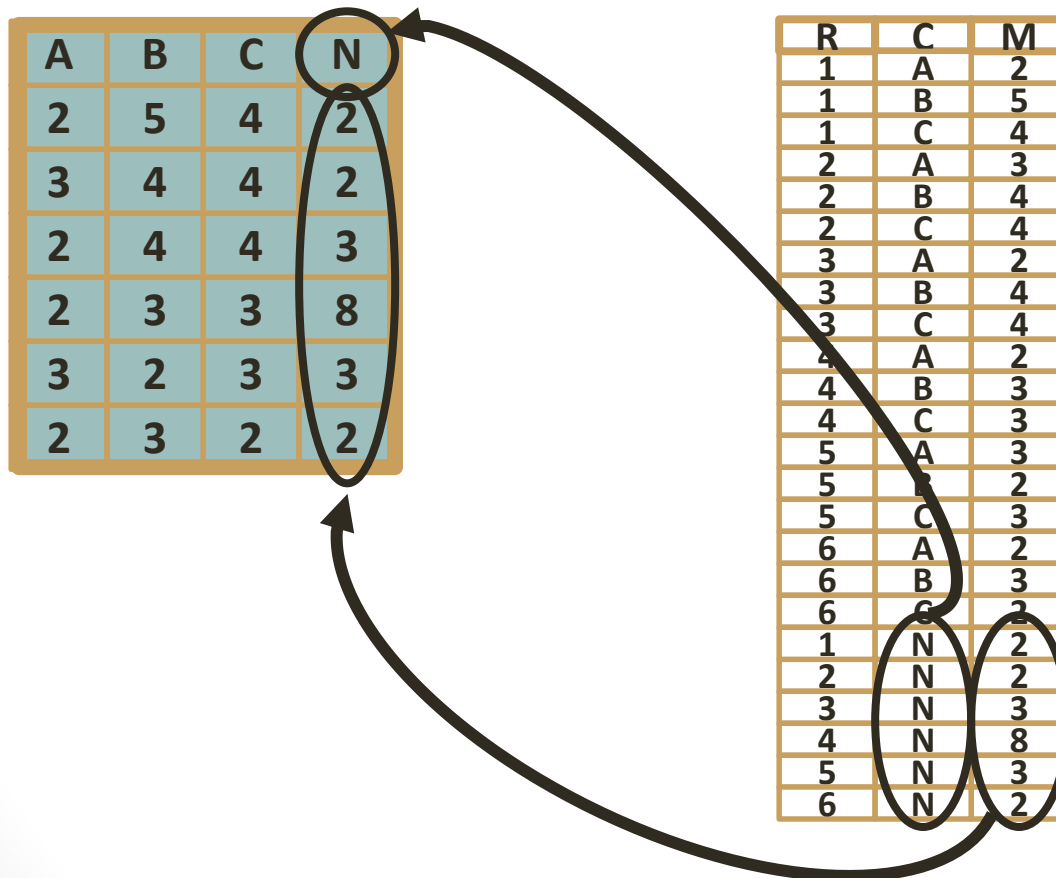
A	B	C
2	5	4
3	4	4
2	4	4
2	3	3
3	2	3
2	3	2

R	C	M
1	A	2
1	B	5
1	C	4
2	A	3
2	B	4
2	C	4
3	A	2
3	B	4
3	C	4
4	A	2
4	B	3
4	C	3
5	A	3
5	B	2
5	C	3
6	A	2
6	B	3
6	C	2
1	N	2
2	N	2
3	N	3
4	N	8
5	N	3
6	N	2

Adding new rows to second table with a new index



Adding new rows to second table with a new index



Adding new rows to second table with a new index

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

R	C	M
1	A	2
1	B	5
1	C	4
2	A	3
2	B	4
2	C	4
3	A	2
3	B	4
3	C	4
4	A	2
4	B	3
4	C	3
5	A	3
5	B	2
5	C	3
6	A	2
6	B	3
6	C	2
1	N	2
2	N	2
3	N	3
4	N	8
5	N	3
6	N	2

Rows may be resorted without changing the relation

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

1	N	2
2	N	2
3	N	3
4	N	8
5	N	3
6	N	2

R	C	M
1	A	2
1	B	5
1	C	4
2	A	3
2	B	4
2	C	4
3	A	2
3	B	4
3	C	4
4	A	2
4	B	3
4	C	3
5	A	3
5	B	2
5	C	3
6	A	2
6	B	3
6	C	2

Rows may be resorted without changing the relation

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

R	C	M
1	A	2
1	B	5
1	C	4

2	A	3
2	B	4
2	C	4

3	A	2
3	B	4
3	C	4

4	A	2
4	B	3
4	C	3

5	A	3
5	B	2
5	C	3

1	N	2
2	N	2
3	N	3
4	N	8
5	N	3
6	N	2

6	A	2
6	B	3
6	C	2

Rows may be resorted without changing the relation

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

R	C	M
1	A	2
1	B	5
1	C	4
2	A	3
2	B	4
2	C	4
3	A	2
3	B	4
3	C	4
4	A	2
4	B	3
4	C	3
5	A	3
5	B	2
5	C	3
6	A	2
6	B	3
6	C	2

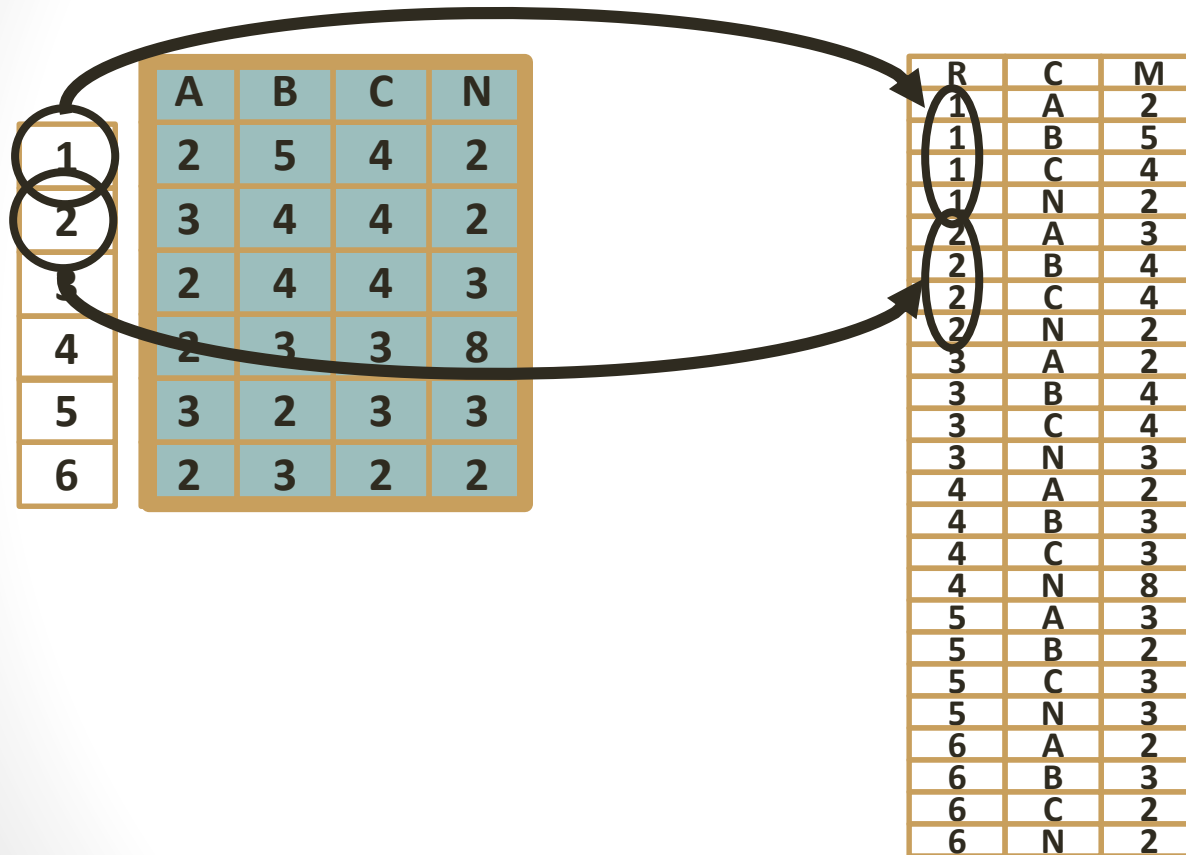
1	N	2
2	N	2
3	N	3
4	N	8
5	N	3
6	N	2

Rows may be resorted without changing the relation

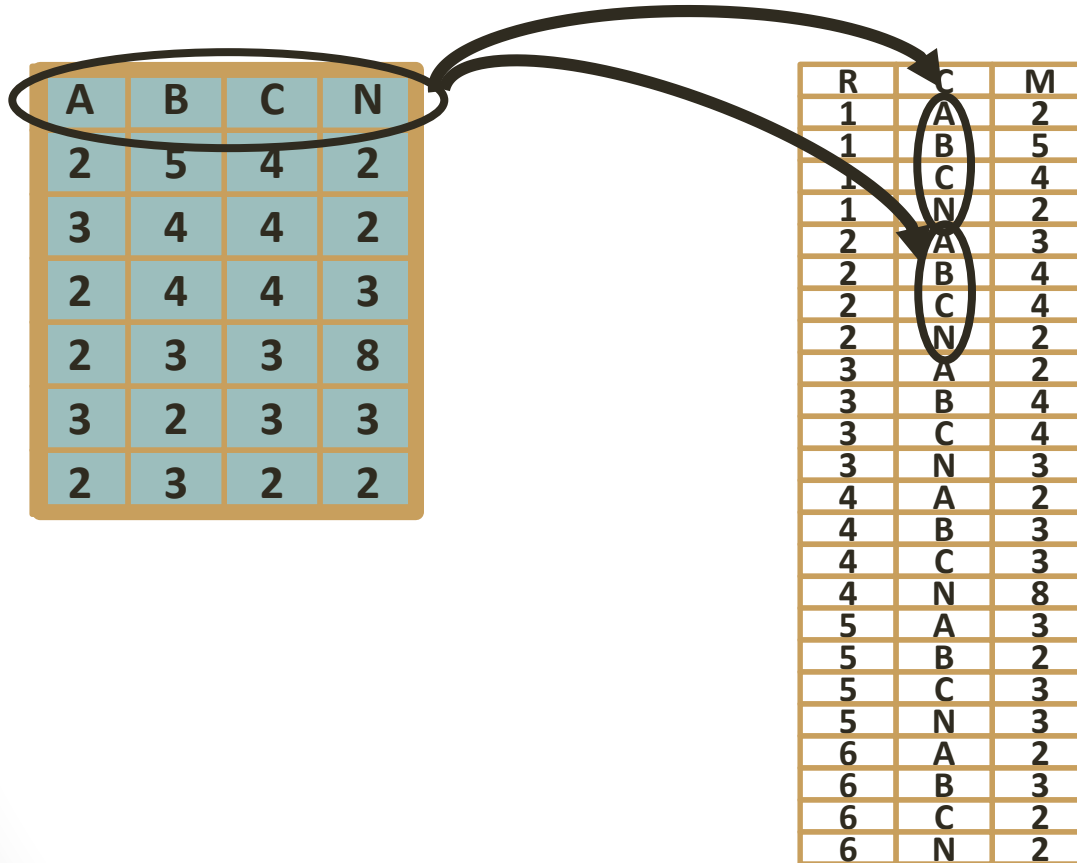
A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

R	C	M
1	A	2
1	B	5
1	C	4
1	N	2
2	A	3
2	B	4
2	C	4
2	N	2
3	A	2
3	B	4
3	C	4
3	N	3
4	A	2
4	B	3
4	C	3
4	N	8
5	A	3
5	B	2
5	C	3
5	N	3
6	A	2
6	B	3
6	C	2
6	N	2

Schema Change Proved



Schema Change Proved



Schema Change Proved

A	B	C	N
2	5	4	2
3	4	4	2
2	4	4	3
2	3	3	8
3	2	3	3
2	3	2	2

R	C	M
1	A	2
1	B	5
1	C	4
1	N	2
2	A	3
2	B	4
2	C	4
2	N	2
3	A	2
3	B	4
3	C	4
3	N	3
4	A	2
4	B	3
4	C	3
4	N	8
5	A	3
5	B	2
5	C	3
5	N	3
6	A	2
6	B	3
6	C	2
6	N	2

EAV Format Schema Change