

Relational Methods for Efficient Analytical Processing

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HDMS 2005



Σχισιακές Μέθοδοι για Αποδοτική Αναλυτική Επεξεργασία

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Γιάννης Ιωαννίδης

ΕΣΔΔ 2005

Περιεχόμενα

- Άμεση αναλυτική επεξεργασία
- Ο ρόλος του κύβου δεδομένων
- Ο κύκλος ζωής του κύβου δεδομένων
 - Κατασκευή και Αποθήκευση
 - Απάντηση ερωτήσεων
 - Ενημέρωση
- Συμπεράσματα

Άμεση αναλυτική επεξεργασία

- Μετάφραση του όρου On-Line Analytical Processing (OLAP)
- Εξυπηρετεί διαφορετικές ανάγκες από την άμεση επεξεργασία δοσοληψιών (OLTP)

Άμεση αναλυτική επεξεργασία

Παράδειγμα



SELECT πλοίο, προορισμός, avg(επιβάτες)
FROM Κρατήσεις
WHERE μήνας = 'Αύγουστος'
GROUP BY πλοίο, προορισμός

Ο ρόλος του κύβου δεδομένων

- Μεγάλος όγκος δεδομένων ⇒
Μεγάλοι χρόνοι απόκρισης
- Λύση: Υπολογισμός και αποθήκευση αποτελεσμάτων συναθροιστικών επερωτήσεων εκ των προτέρων
- Η δομή που προκύπτει ονομάζεται
Κύβος Δεδομένων

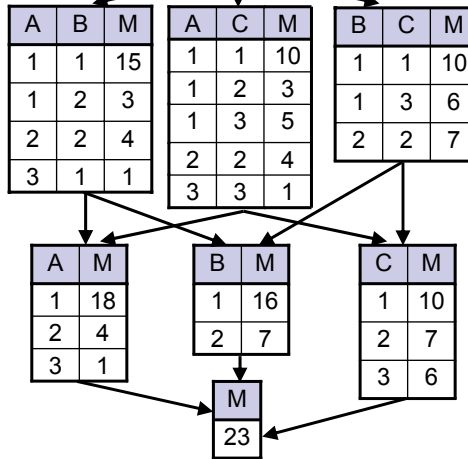
Ο ρόλος του κύβου

SELECT A, B, C, SUM(M)
FROM R
GROUP BY A, B, C

R			
A	B	C	M
1	1	1	10
2	2	2	4
1	2	2	3
1	1	3	5
3	1	3	1

Κύβος

A	B	C	M
1	1	1	10
1	1	3	5
1	2	2	3
2	2	2	4
3	1	3	1



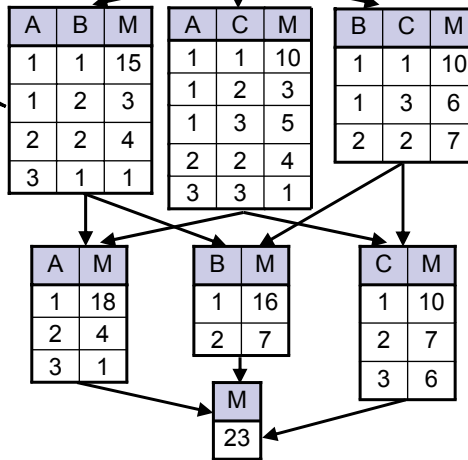
Ο ρόλος του κύβου

SELECT A, B, SUM(M)
FROM R
GROUP BY A, B

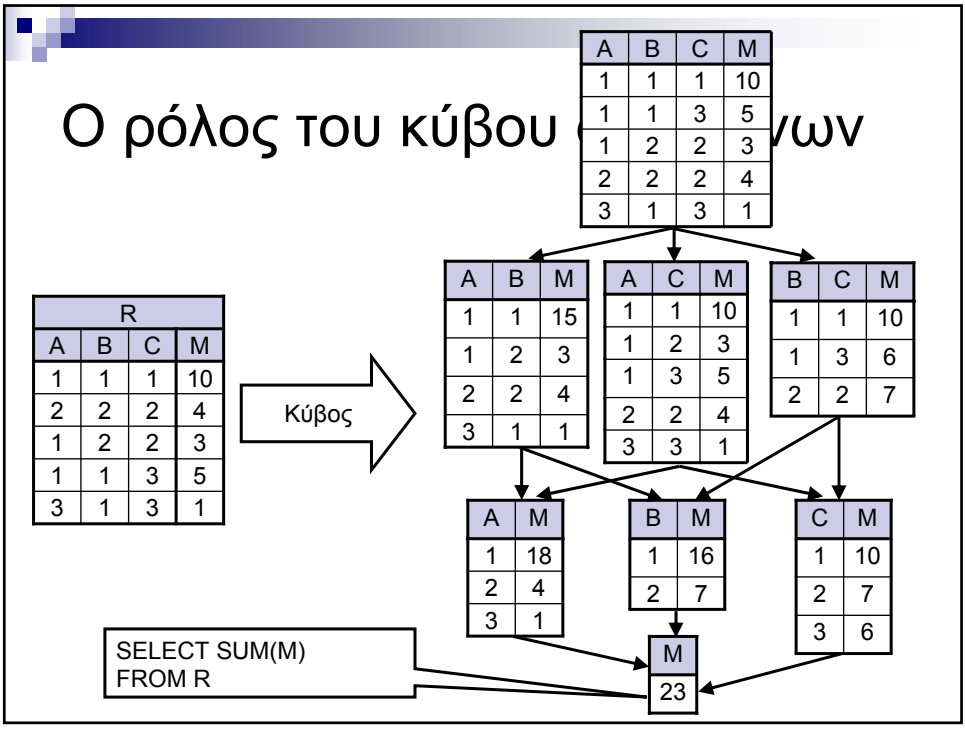
R			
A	B	C	M
1	1	1	10
2	2	2	4
1	2	2	3
1	1	3	5
3	1	3	1

Κύβος

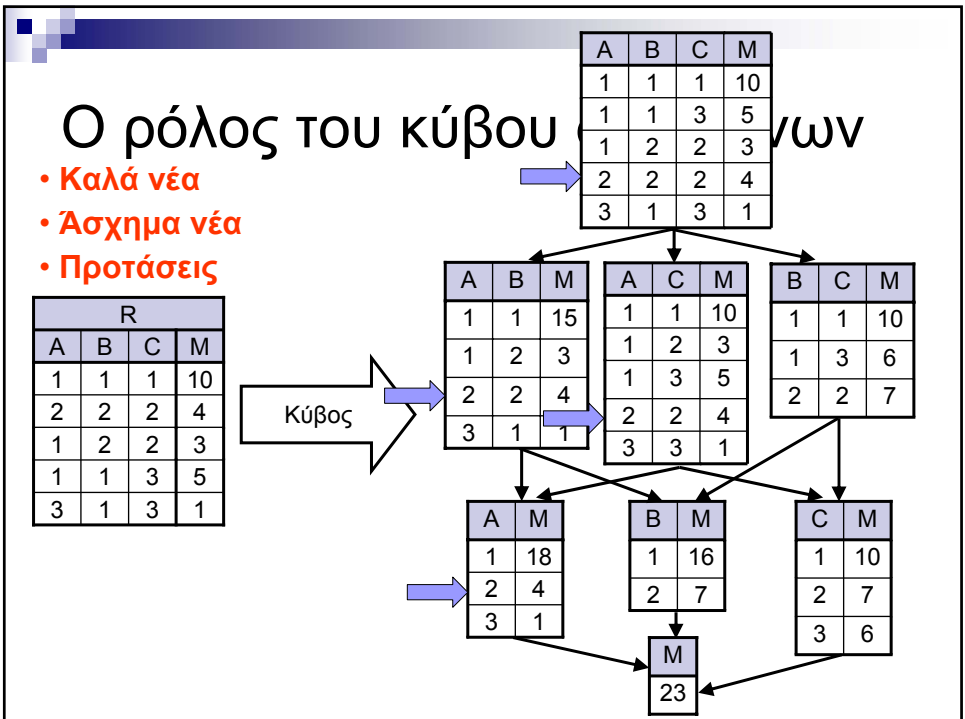
A	B	C	M
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1	1	3	5
1	2	2	3
2	2	2	4
3	1	3	1



Ο ρόλος του κύβου



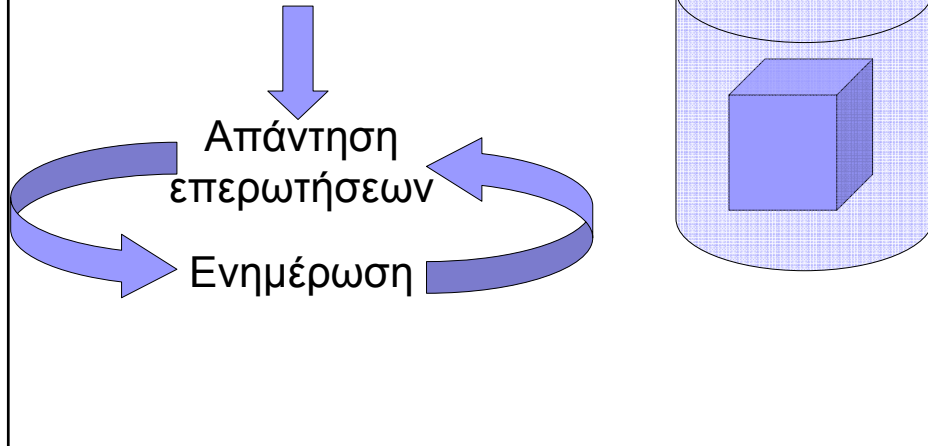
Ο ρόλος του κύβου



- Καλά νέα
- Άσχημα νέα
- Προτάσεις

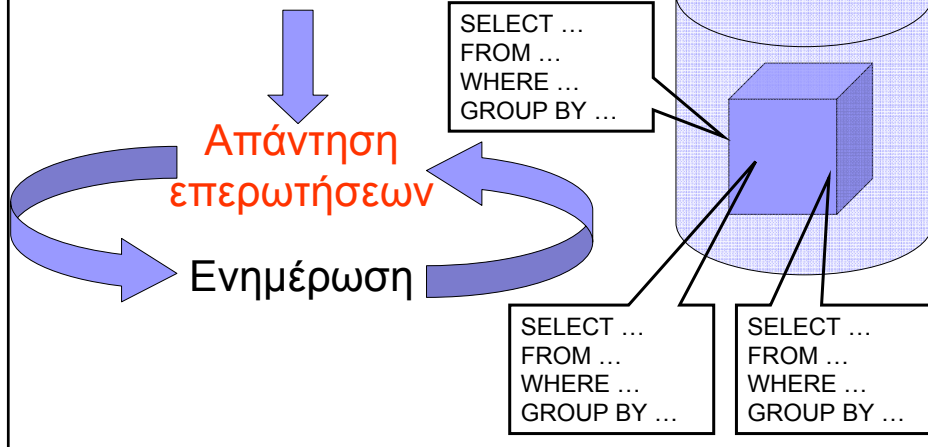
Ο κύκλος ζωής του κύβου δεδ/ων

Κατασκευή και Αποθήκευση



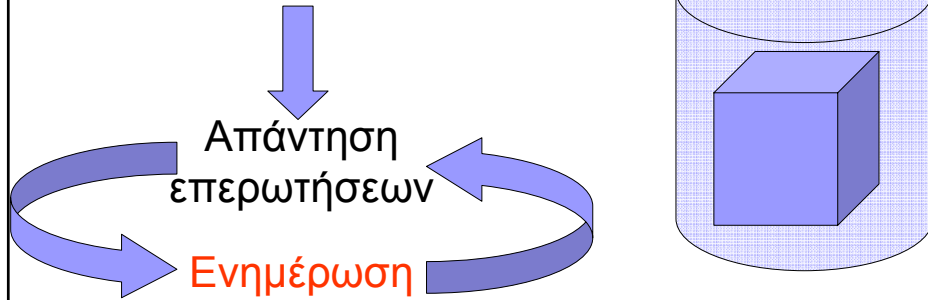
Ο κύκλος ζωής του κύβου δεδ/ων

Κατασκευή και Αποθήκευση



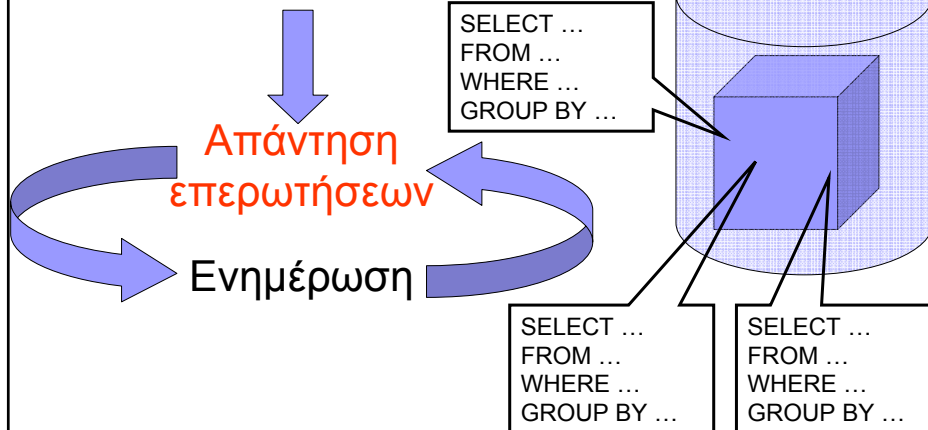
Ο κύκλος ζωής του κύβου δεδομένων

Κατασκευή και Αποθήκευση



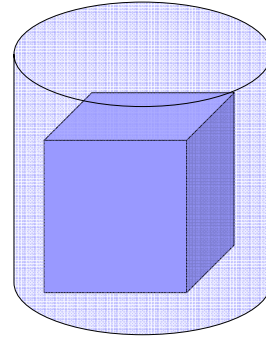
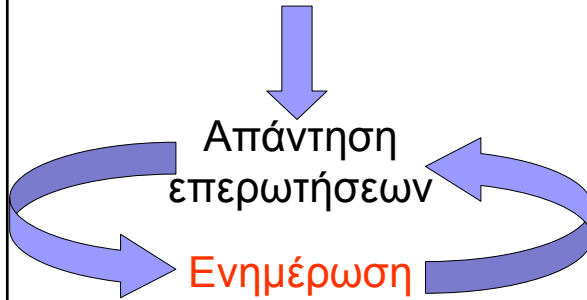
Ο κύκλος ζωής του κύβου δεδομένων

Κατασκευή και Αποθήκευση



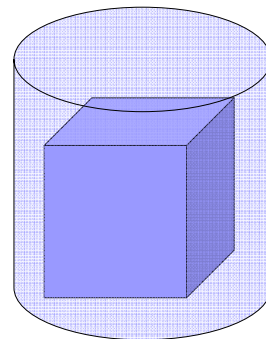
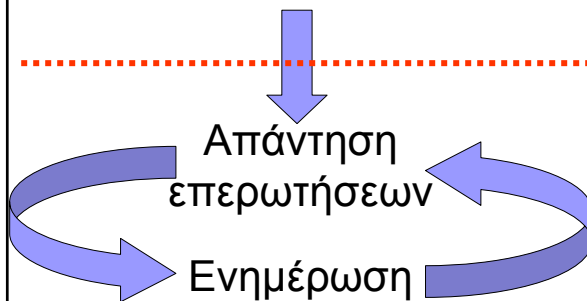
Ο κύκλος ζωής του κύβου δεδ/ων

Κατασκευή και Αποθήκευση



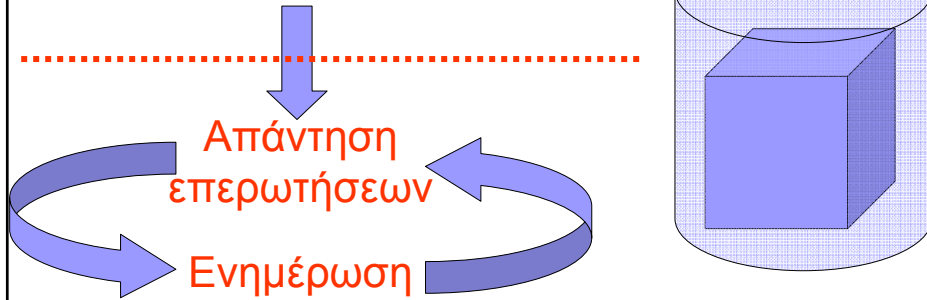
Ο κύκλος ζωής του κύβου δεδ/ων

Κατασκευή και Αποθήκευση



Ο κύκλος ζωής του κύβου δεδ/ων

Κατασκευή και Αποθήκευση



Ο κύκλος ζωής του κύβου δεδ/ων

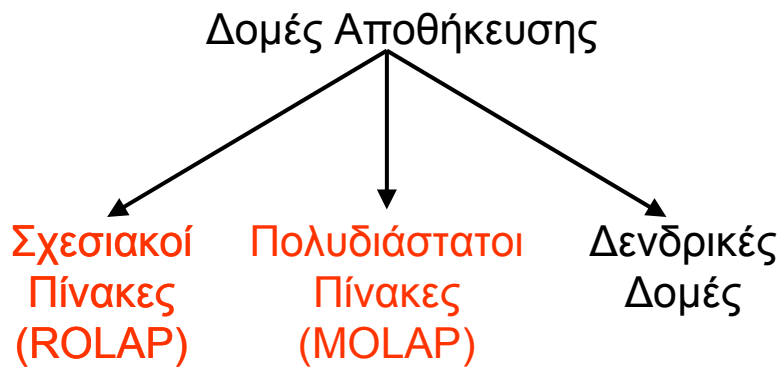
Δομές Αποθήκευσης

Σχεσιακοί
Πίνακες
(ROLAP)

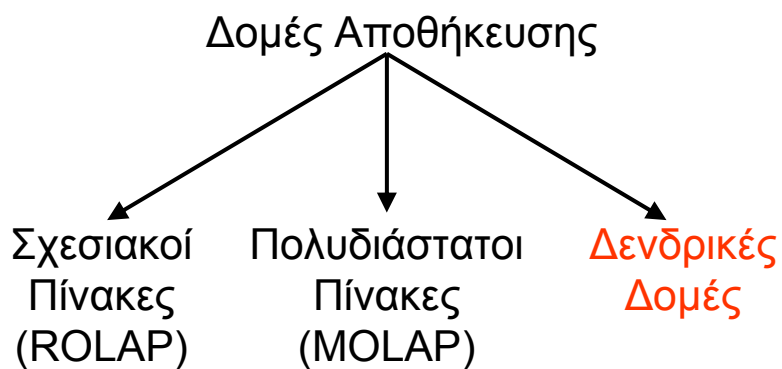
Πολυδιάστατοι
Πίνακες
(MOLAP)

Δενδρικές
Δομές

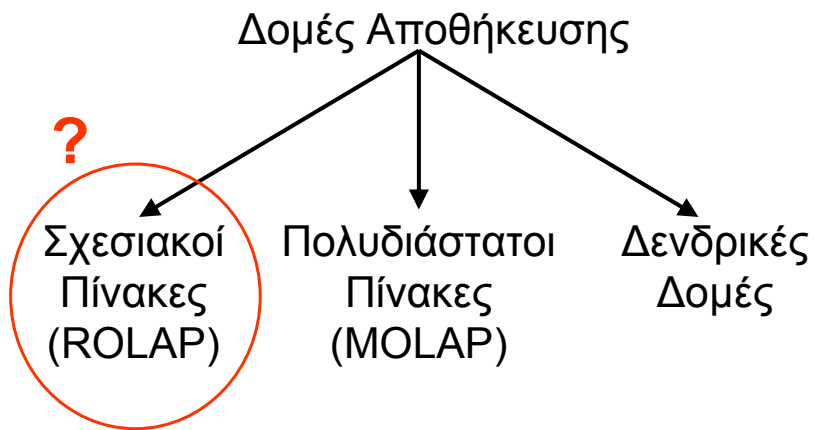
Ο κύκλος ζωής του κύβου δεδ/ων



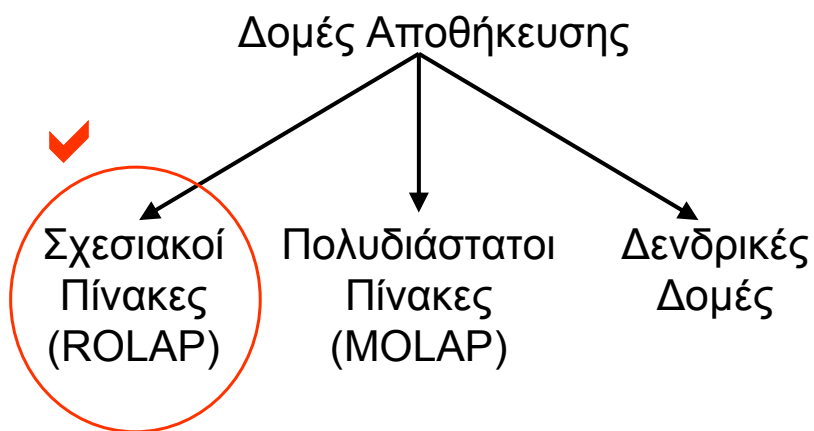
Ο κύκλος ζωής του κύβου δεδ/ων



Ο κύκλος ζωής του κύβου δεδ/ων



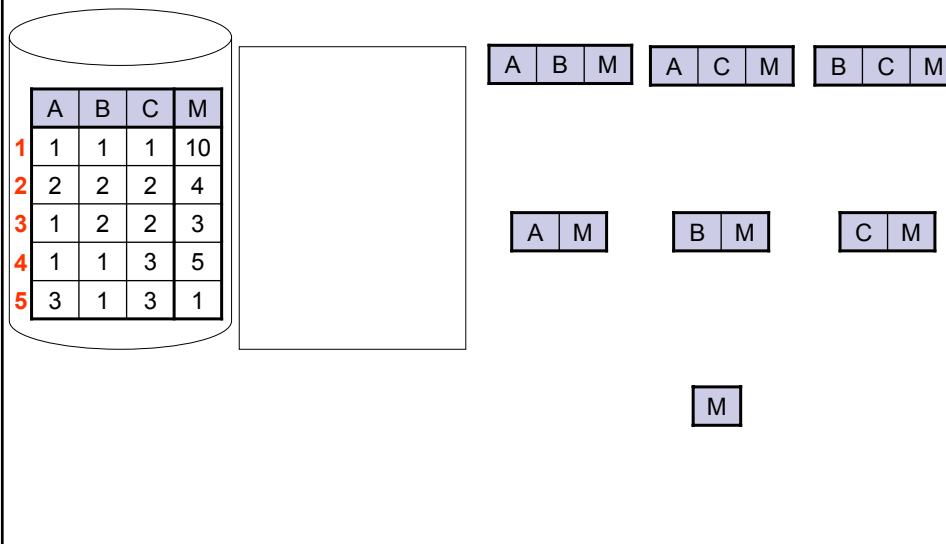
Ο κύκλος ζωής του κύβου δεδ/ων

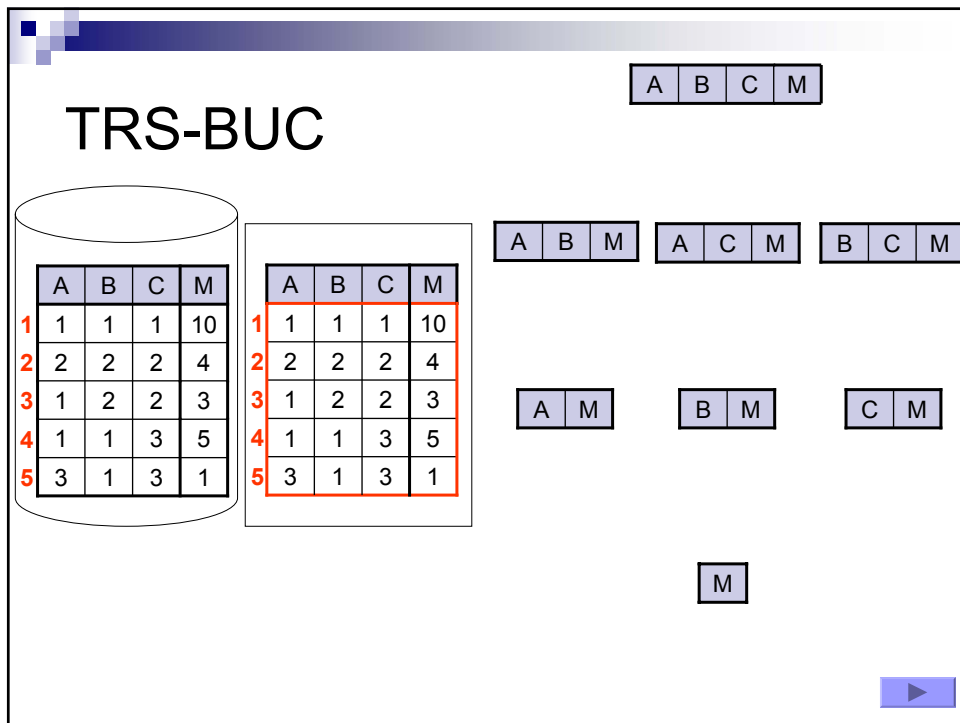
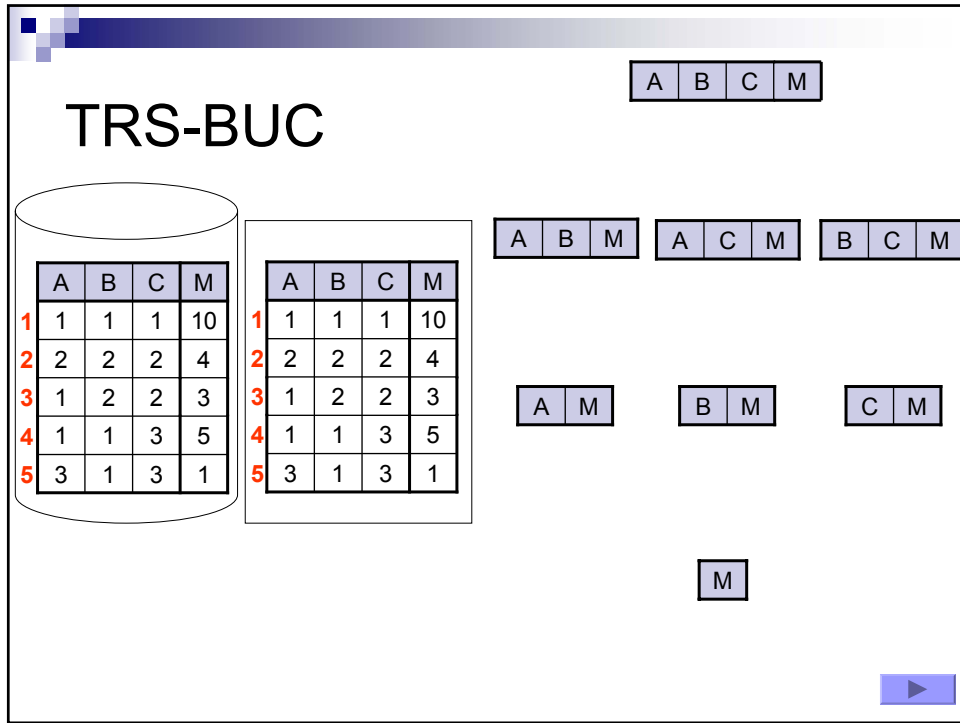


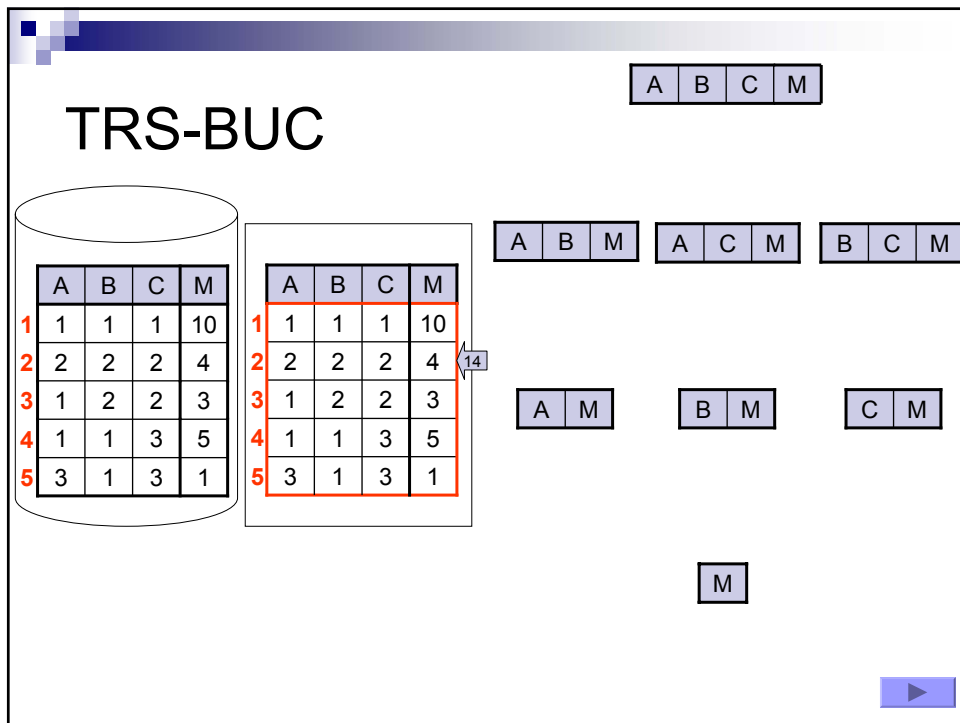
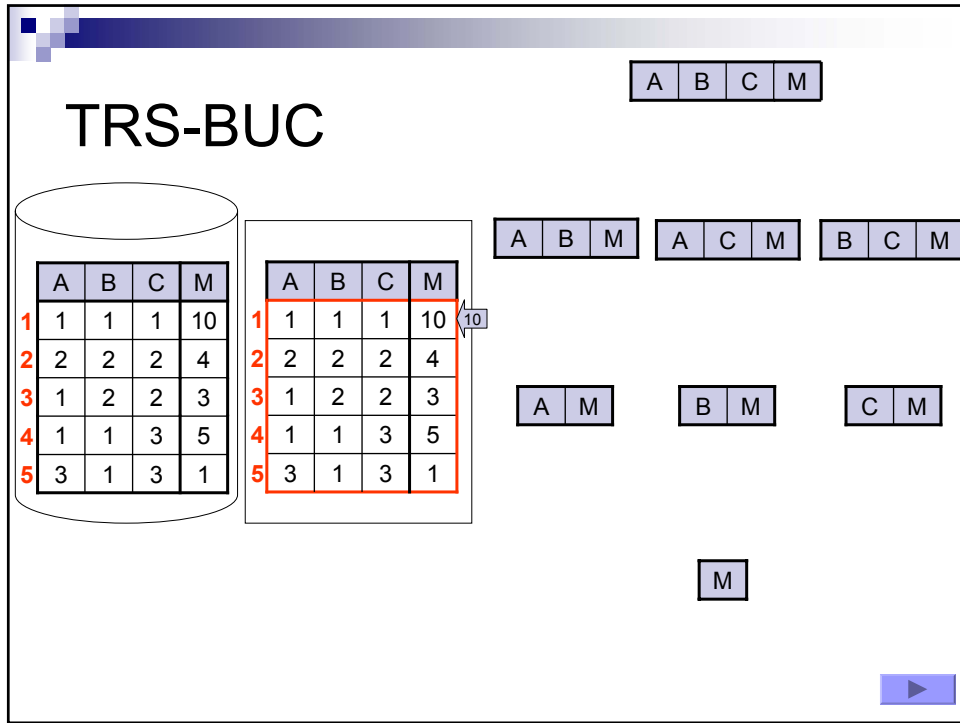
Κατασκευή και Αποθήκευση

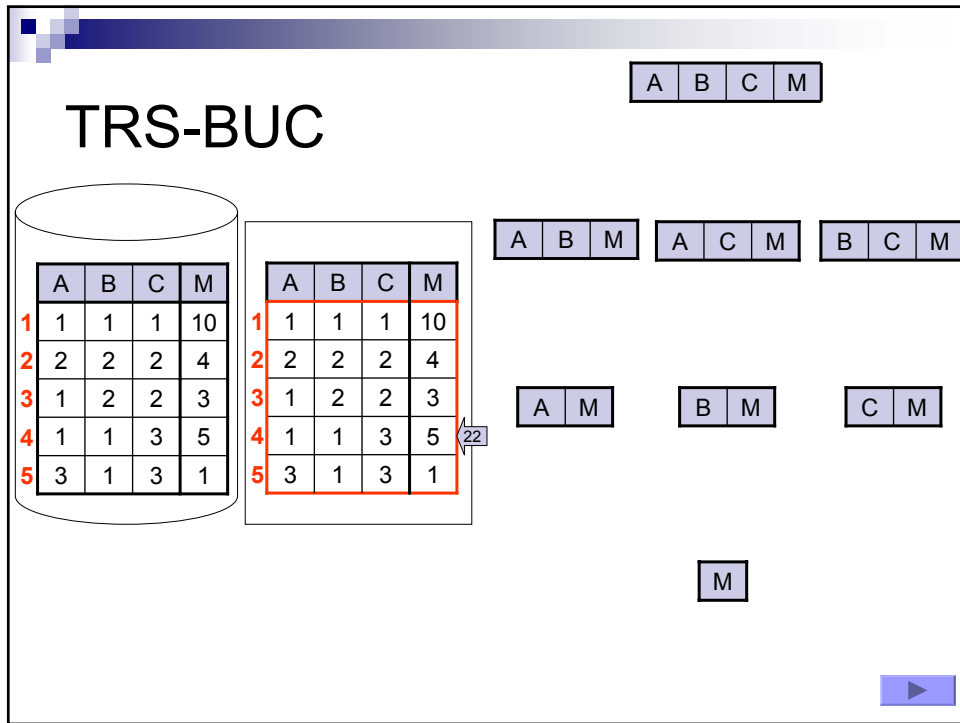
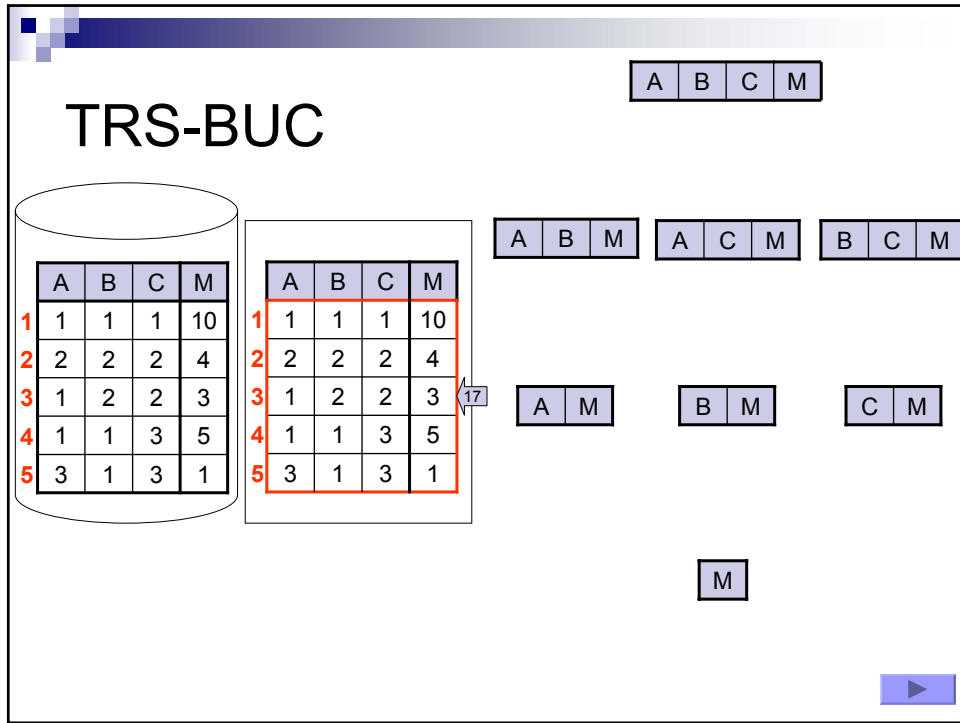
- Υπάρχοντες «πρωταθλητές» κατασκευής:
 - BottomUpCube (BUC [Beyer, Ramakrishnan])
 - PartitionedCube (PC [Ross, Srivastava])
- Αφαίρεση πλεονασμού
 - Bottom-Up-BST (BU-BST [Wang, Lu, Feng, Yu])
- Προτεινόμενοι αλγόριθμοι
 - TRS-BUC
 - PRS-PC

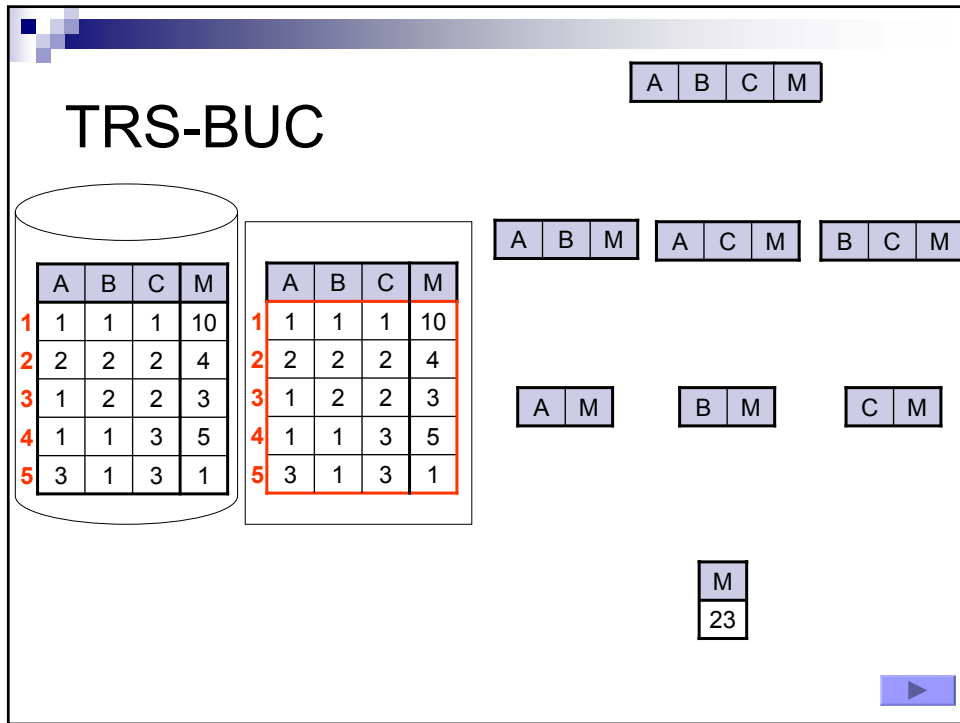
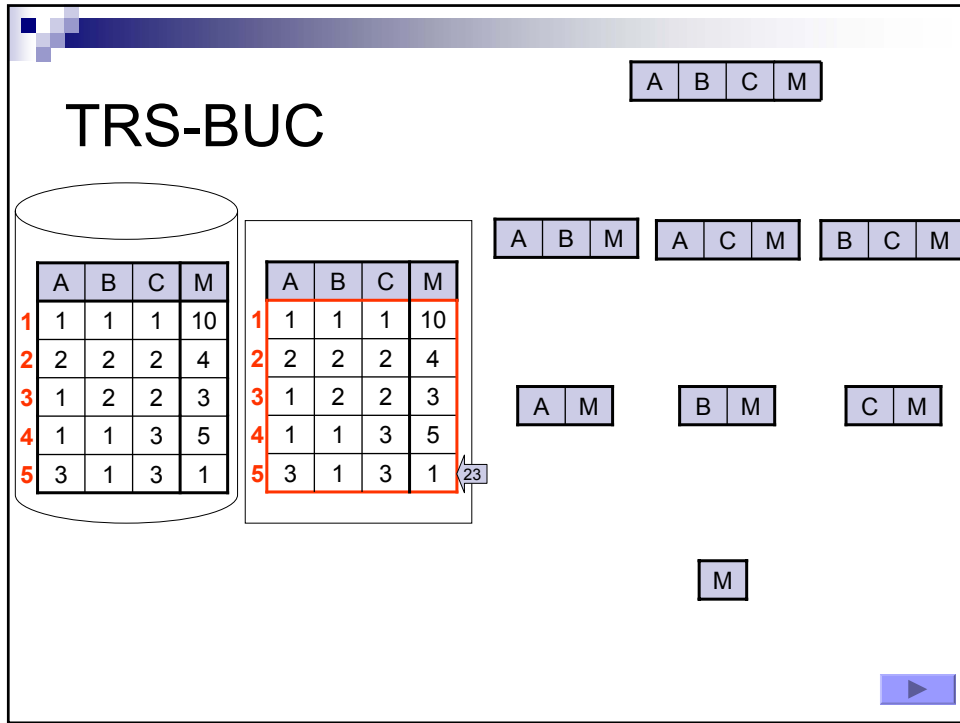
TRS-BUC











TRS-BUC

A	B	C	M
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A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

A	M
---	---

B	M
---	---

C	M
---	---

M
23

▶

TRS-BUC

A	B	C	M
---	---	---	---

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
3	1	2	3
4	1	1	3
2	2	2	4
5	3	1	3

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

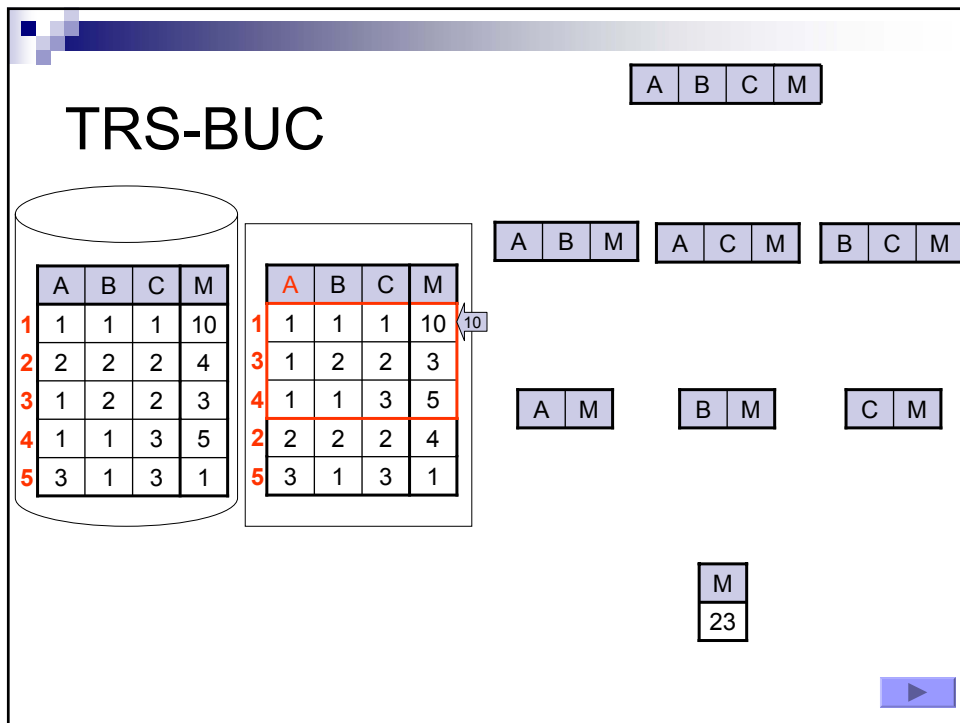
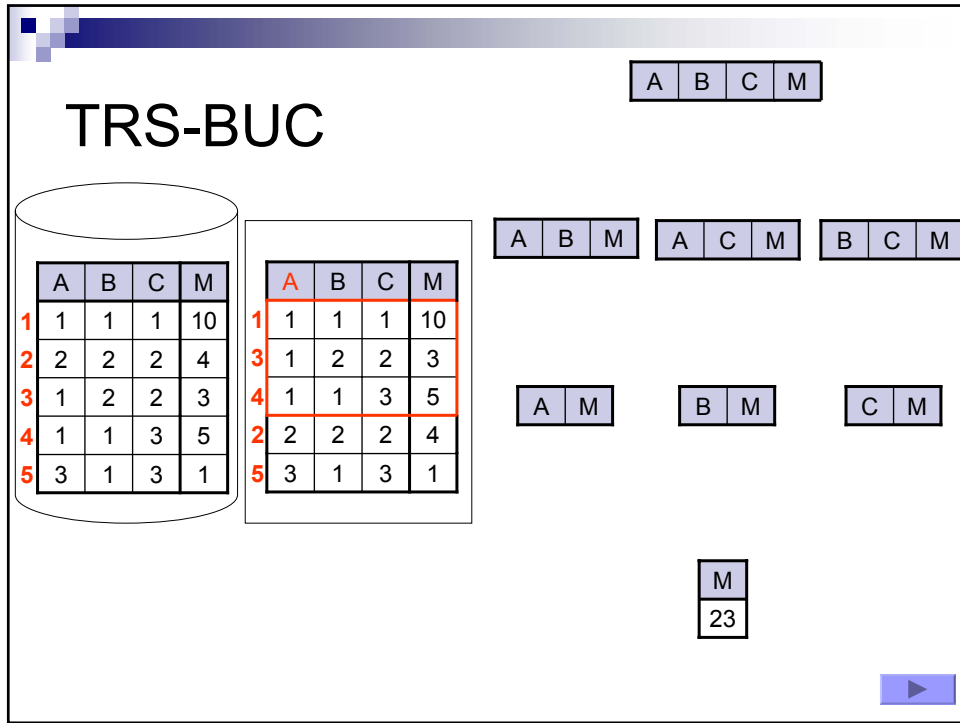
A	M
---	---

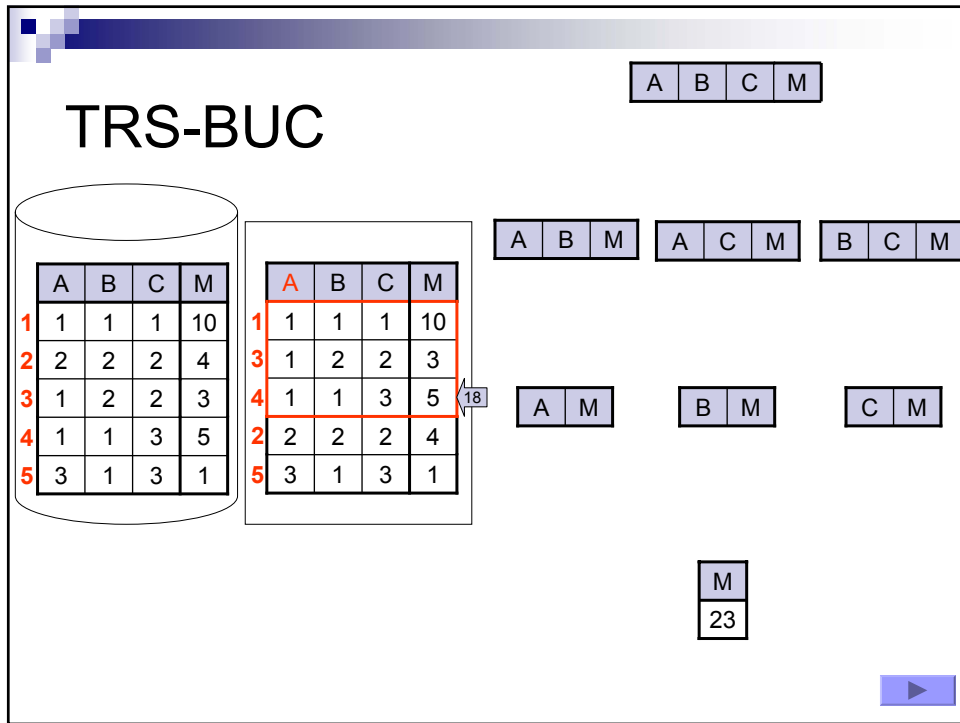
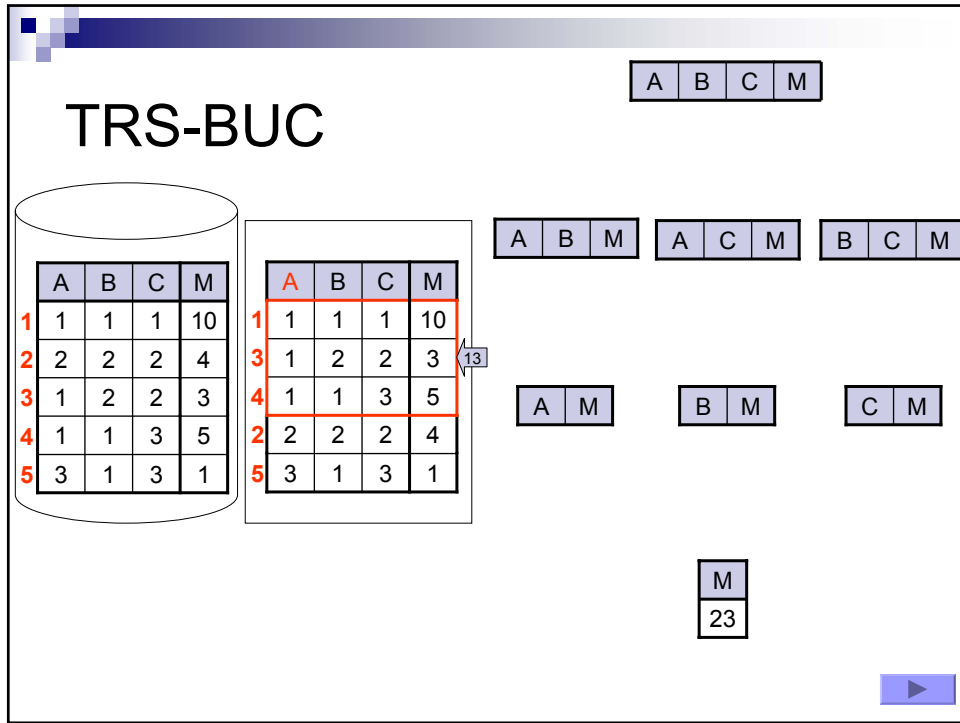
B	M
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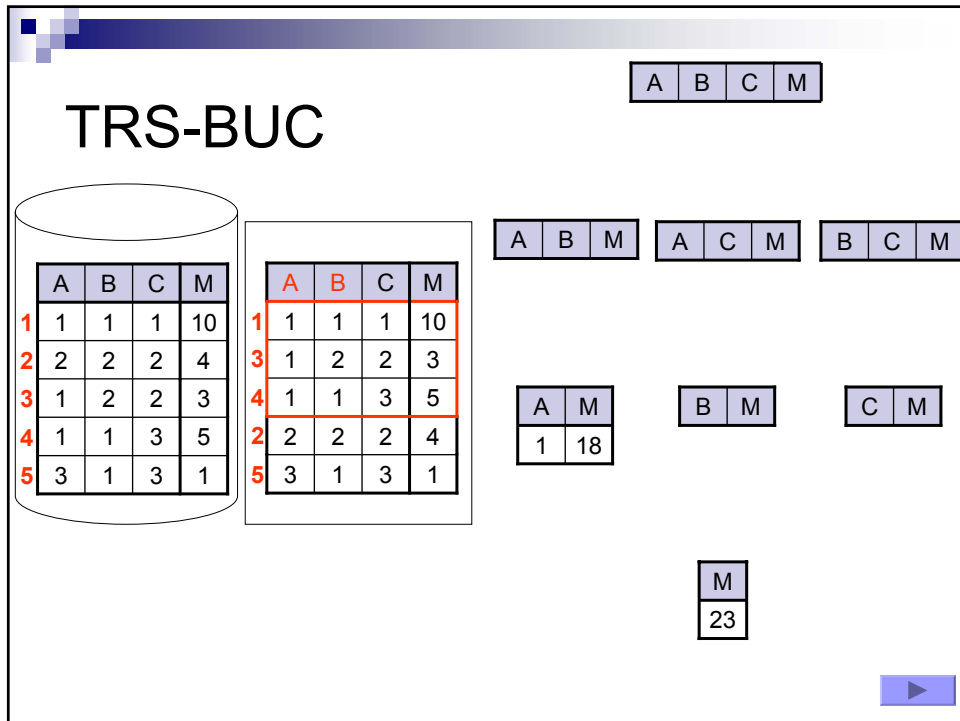
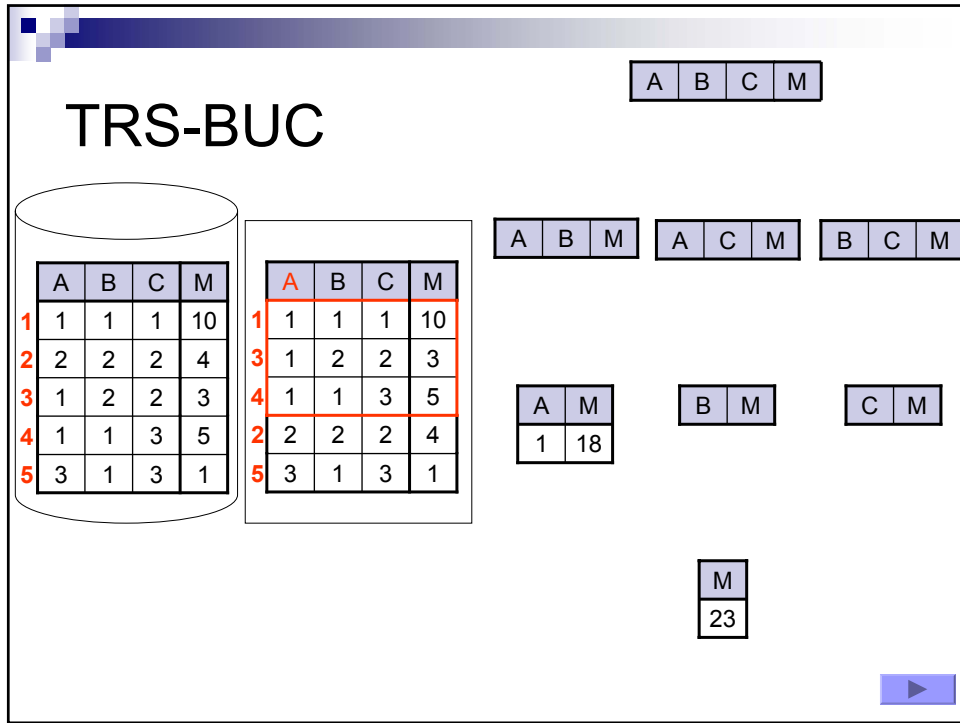
C	M
---	---

M
23

▶







TRS-BUC

A	B	C	M
---	---	---	---

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23

TRS-BUC

A	B	C	M
---	---	---	---

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
---	---	---

A	C	M
---	---	---

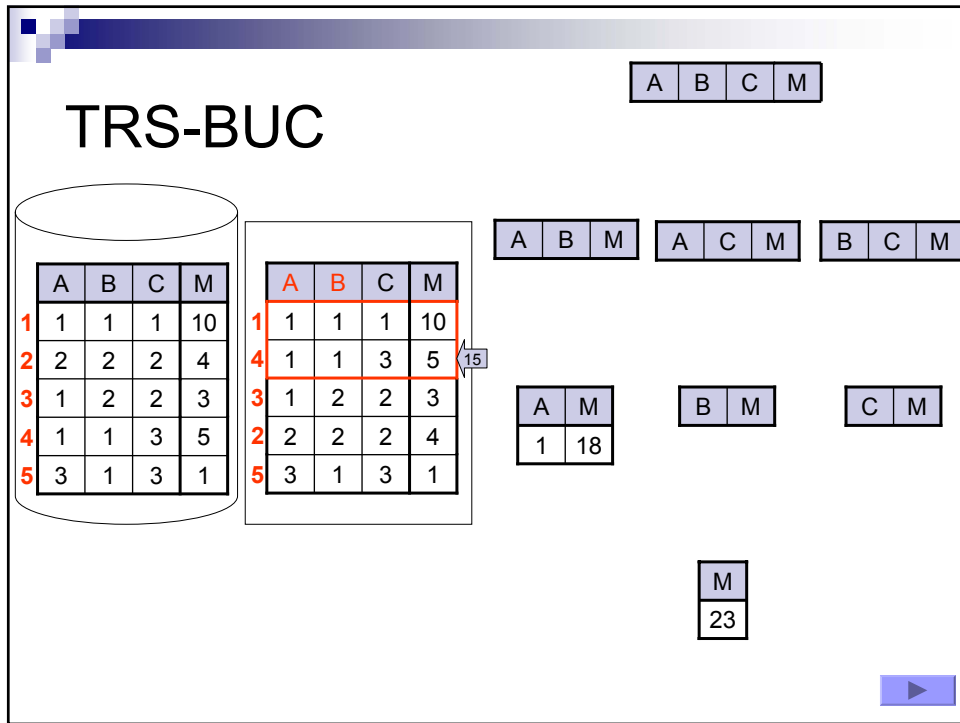
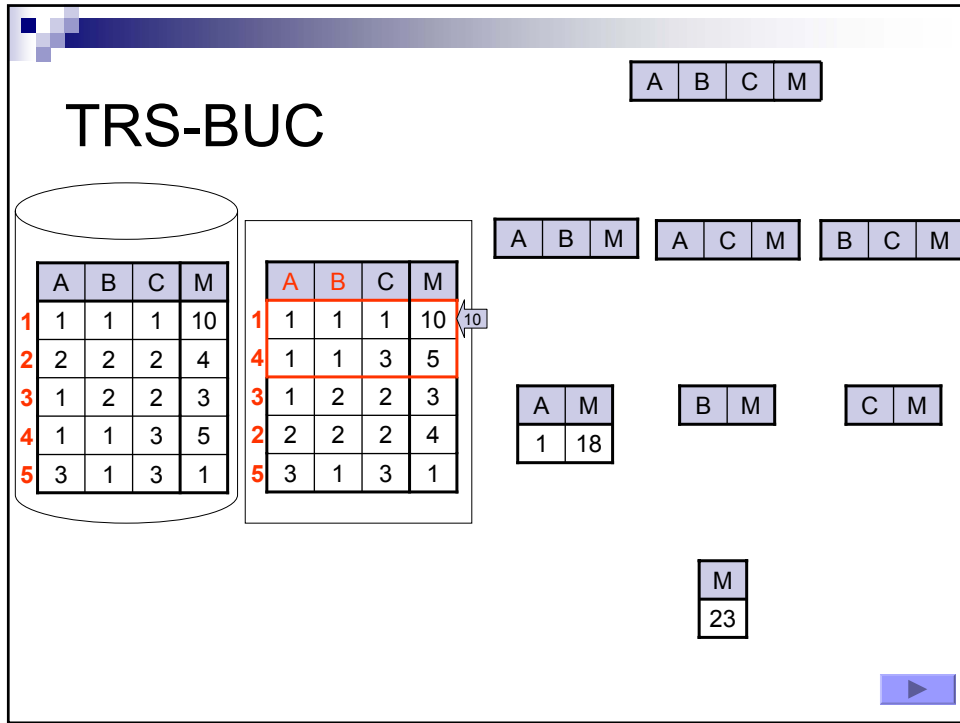
B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23



TRS-BUC

A	B	C	M
---	---	---	---

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23

▶

TRS-BUC

A	B	C	M
---	---	---	---

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23

▶

TRS-BUC

A	B	C	M
---	---	---	---

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23

▶

TRS-BUC

A	B	C	M
1,1			

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

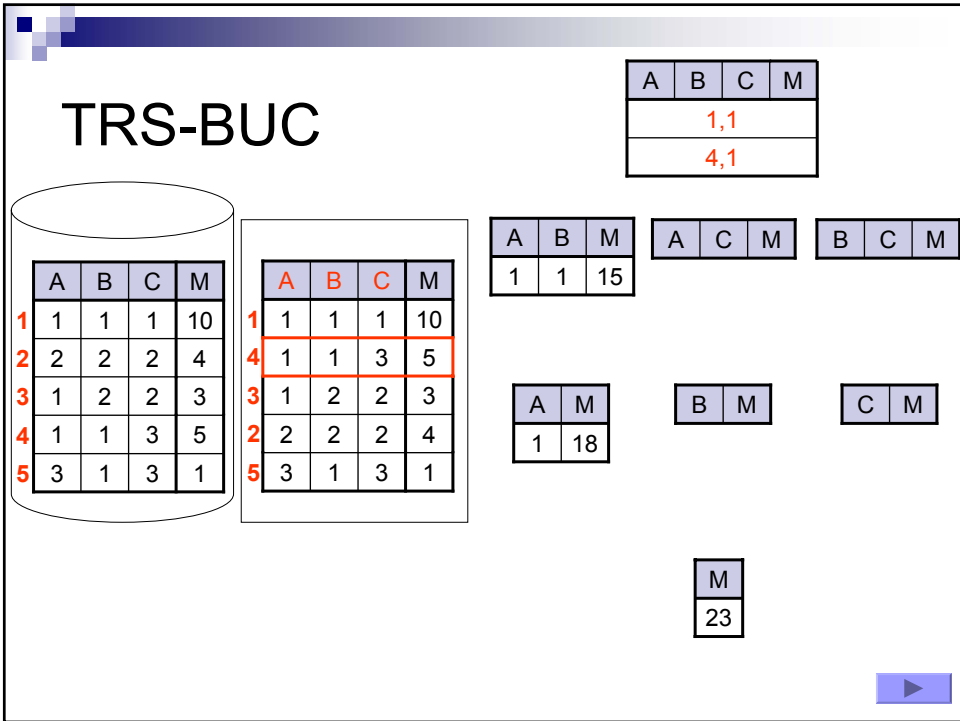
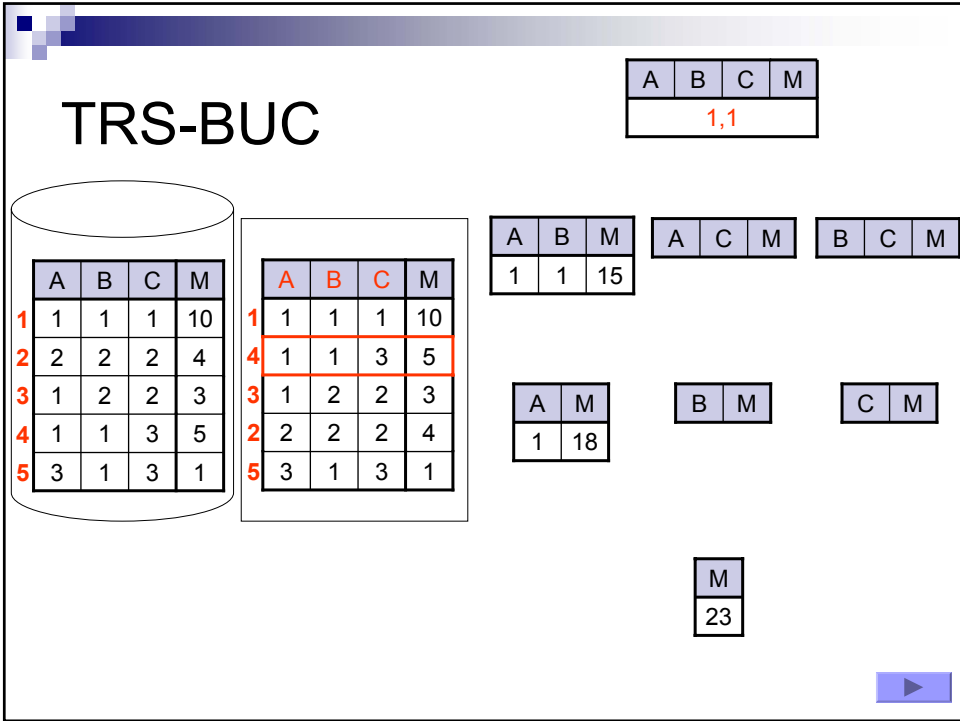
A	M
1	18

B	M
---	---

C	M
---	---

M
23

▶



TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains two tables. The first table has columns A, B, C, M and rows 1-5. The second table has columns A, B, C, M and rows 1-5, with rows 1 and 4 highlighted in red. To the right, several smaller tables are arranged: a table with columns A, B, C, M and rows 1,1 and 4,1; a table with columns A, B, M and row 1,1,15; a table with columns A, C, M; a table with columns B, C, M; a table with columns A, M and row 1,18; a table with columns B, M; a table with columns C, M; and a table with column M and row 23. A blue play button is in the bottom right corner.

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	C	M
1,1			
4,1			

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23

TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains two tables. The first table has columns A, B, C, M and rows 1-5. The second table has columns A, B, C, M and rows 1-5, with rows 3 and 4 highlighted in red. To the right, several smaller tables are arranged: a table with columns A, B, C, M and rows 1,1 and 4,1; a table with columns A, B, M and row 1,1,15; a table with columns A, C, M; a table with columns B, C, M; a table with columns A, M and row 1,18; a table with columns B, M; a table with columns C, M; and a table with column M and row 23. A blue play button is in the bottom right corner.

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	C	M
1,1			
4,1			

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M
23

TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains two tables. The first table has columns A, B, C, M and rows 1-5. The second table has columns A, B, C, M and rows 1-5, with the third row highlighted in red. To the right, several smaller tables represent components and their connections:

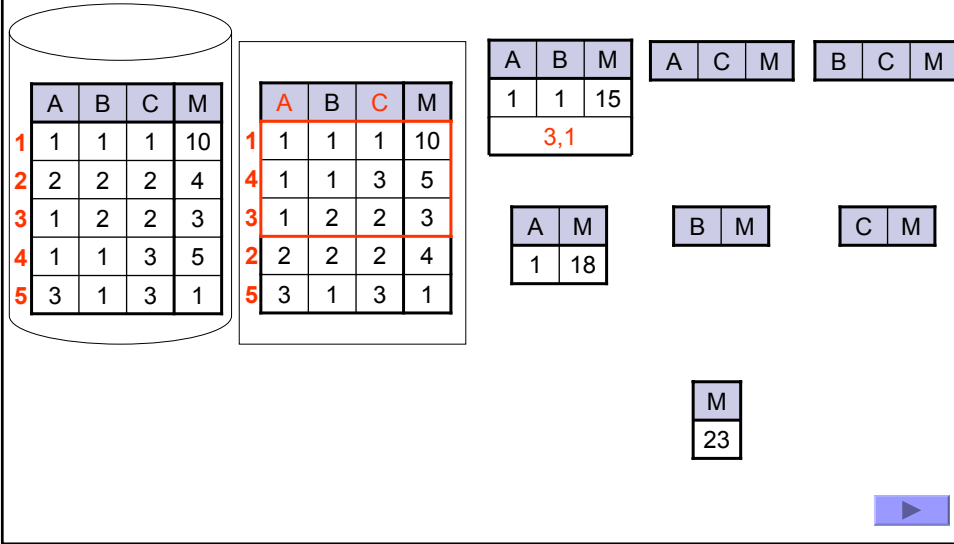
- A table with columns A, B, C, M and rows 1,1 and 4,1.
- A table with columns A, B, M and rows 1, 1, 15 and 3,1.
- A table with columns A, C, M and rows 1, 18.
- A table with columns B, C, M and rows 1, 18.
- A table with columns C, M and rows 1, 18.
- A table with columns B, M and rows 1, 18.
- A table with columns M and rows 23.

TRS-BUC

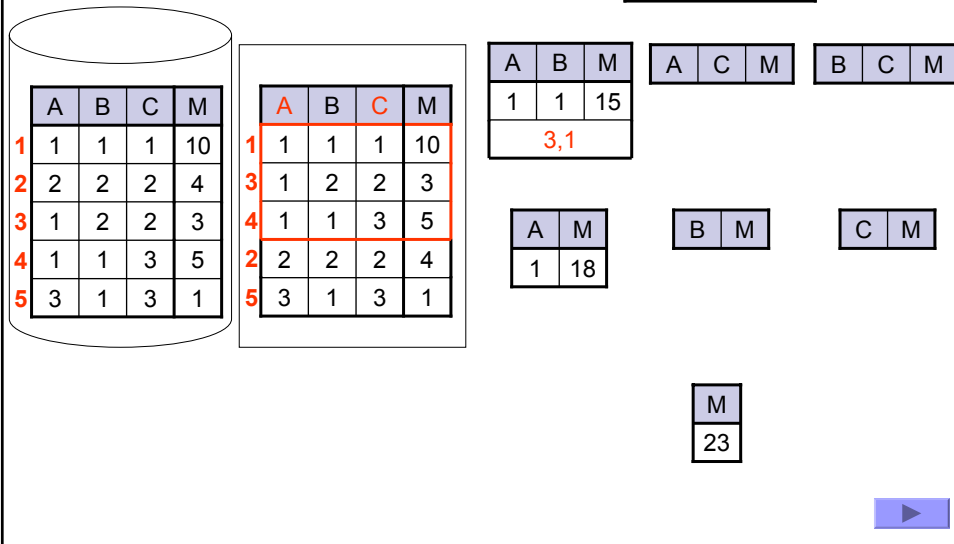
The diagram illustrates a TRS-BUC system. On the left, a cylinder contains two tables. The first table has columns A, B, C, M and rows 1-5. The second table has columns A, B, C, M and rows 1-5, with the third row highlighted in red. To the right, several smaller tables represent components and their connections:

- A table with columns A, B, C, M and rows 1,1 and 4,1.
- A table with columns A, B, M and rows 1, 1, 15 and 3,1.
- A table with columns A, C, M and rows 1, 18.
- A table with columns B, C, M and rows 1, 18.
- A table with columns C, M and rows 1, 18.
- A table with columns B, M and rows 1, 18.
- A table with columns M and rows 23.

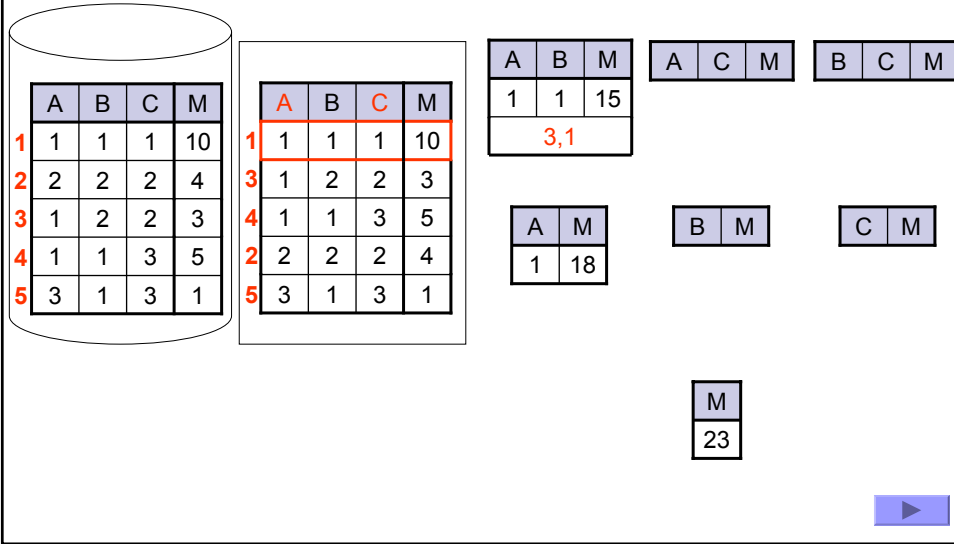
TRS-BUC



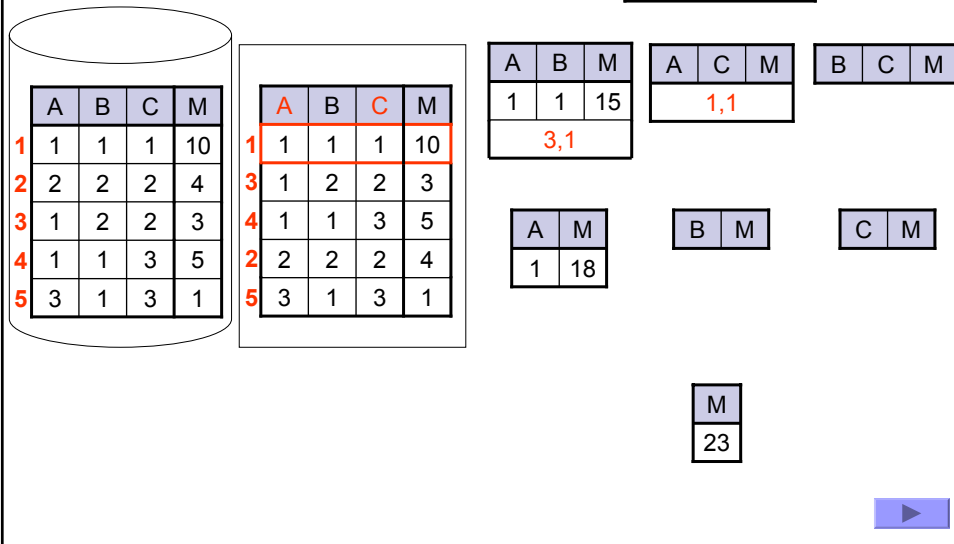
TRS-BUC



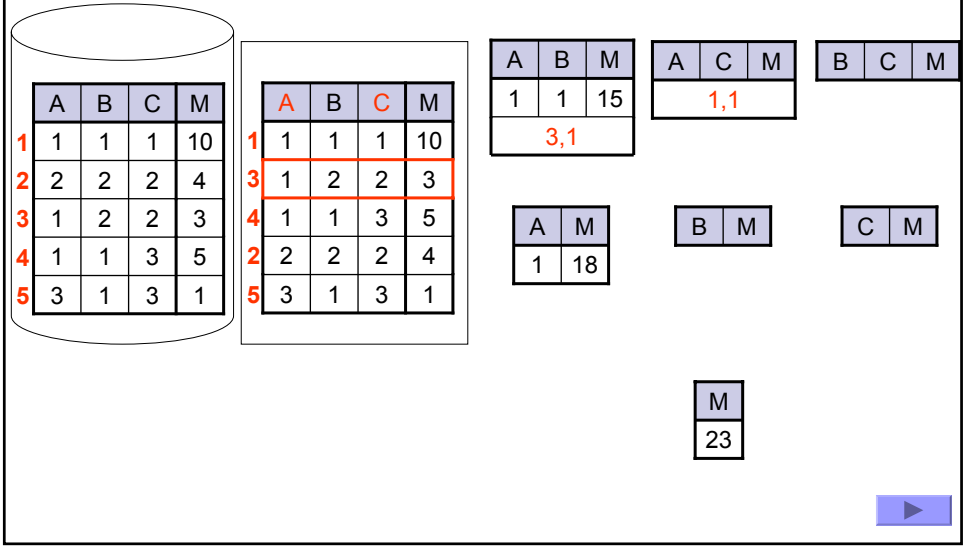
TRS-BUC



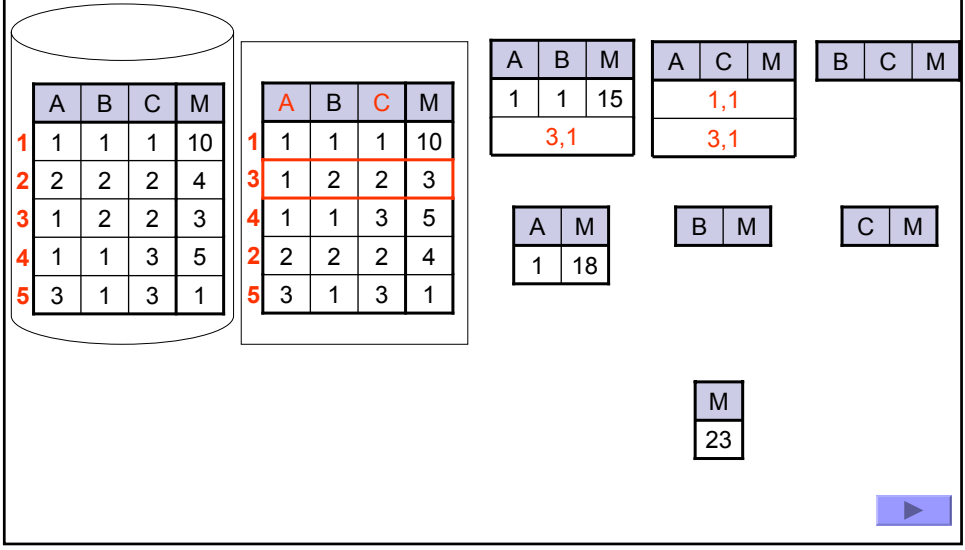
TRS-BUC



TRS-BUC



TRS-BUC



TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains two tables:

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
3	1	2	2	3
4	1	1	3	5
2	2	2	2	4
5	3	1	3	1

Other components and their connections are shown as follows:

A	B	C	M
			1,1
			4,1

A	B	M
1	1	15
		3,1

A	C	M
		1,1
		3,1

B	C	M

A	M
1	18

B	M

C	M

M
23

A blue play button is located in the bottom right corner.

TRS-BUC

The diagram illustrates a TRS-BUC system, similar to the one above but with a different connection value for the A-C-M component:

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
3	1	2	2	3
4	1	1	3	5
2	2	2	2	4
5	3	1	3	1

Other components and their connections are shown as follows:

A	B	C	M
			1,1
			4,1

A	B	M
1	1	15
		3,1

A	C	M
		1,1
		3,2

B	C	M

A	M
1	18

B	M

C	M

M
23

A blue play button is located in the bottom right corner.

TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains a 5x4 grid with columns A, B, C, and M. The rows are numbered 1 to 5. To its right is another 5x4 grid with the same columns. The rows are numbered 1 to 5. The cells in the first three rows of this grid are highlighted with a red border. To the right of these are several smaller grids:

- A 2x4 grid with columns A, B, C, M. The first row contains 1, 1, 15, and the second row contains 3, 1.
- A 2x3 grid with columns A, C, M. The first row contains 1, 1, and the second row contains 3, 2.
- A 1x3 grid with columns B, C, M.
- A 2x2 grid with columns A, M. The first row contains 1, 18.
- A 1x2 grid with columns B, M.
- A 1x2 grid with columns C, M.
- A 2x1 grid with column M. The first row contains M, and the second row contains 23.

A blue play button is located in the bottom right corner.

TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains a 5x4 grid with columns A, B, C, and M. The rows are numbered 1 to 5. To its right is another 5x4 grid with the same columns. The cells in the second and third rows of this grid are highlighted with a red border. To the right of these are several smaller grids:

- A 2x4 grid with columns A, B, C, M. The first row contains 1, 1, 15, and the second row contains 3, 1.
- A 2x3 grid with columns A, C, M. The first row contains 1, 1, and the second row contains 3, 2.
- A 1x3 grid with columns B, C, M.
- A 2x2 grid with columns A, M. The first row contains 1, 18.
- A 1x2 grid with columns B, M.
- A 1x2 grid with columns C, M.
- A 2x1 grid with column M. The first row contains M, and the second row contains 23.

A blue play button is located in the bottom right corner.

TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains a 5x5 grid with columns A, B, C, and M. The rows are numbered 1 to 5. The values are: Row 1: (1,1)=1, (1,2)=1, (1,3)=1, (1,4)=10; Row 2: (2,1)=2, (2,2)=2, (2,3)=2, (2,4)=4; Row 3: (3,1)=1, (3,2)=2, (3,3)=2, (3,4)=3; Row 4: (4,1)=1, (4,2)=1, (4,3)=3, (4,4)=5; Row 5: (5,1)=3, (5,2)=1, (5,3)=3, (5,4)=1.

To the right of the cylinder is another 5x5 grid with columns A, B, C, and M. The rows are numbered 1 to 5. The values are: Row 1: (1,1)=1, (1,2)=1, (1,3)=1, (1,4)=10; Row 2: (2,1)=1, (2,2)=2, (2,3)=2, (2,4)=3; Row 3: (3,1)=1, (3,2)=1, (3,3)=3, (3,4)=5; Row 4: (4,1)=2, (4,2)=2, (4,3)=2, (4,4)=4; Row 5: (5,1)=3, (5,2)=1, (5,3)=3, (5,4)=1.

Several smaller grids represent data blocks:

- A 2x4 grid with columns A, B, C, M: Row 1: (1,1)=1, (1,2)=1, (1,3)=1, (1,4)=15; Row 2: (2,1)=3, (2,2)=1, (2,3)=2, (2,4)=3.
- A 2x3 grid with columns A, C, M: Row 1: (1,1)=1, (1,2)=1, (1,3)=15; Row 2: (2,1)=3, (2,2)=2, (2,3)=2.
- A 1x3 grid with columns B, C, M: (1,1)=1, (1,2)=1, (1,3)=15.
- A 2x2 grid with columns A, M: Row 1: (1,1)=1, (1,2)=18; Row 2: (2,1)=2, (2,2)=1.
- A 1x2 grid with columns B, M: (1,1)=1, (1,2)=18.
- A 1x2 grid with columns C, M: (1,1)=1, (1,2)=18.
- A 1x1 grid with column M: (1,1)=23.

A blue play button is located in the bottom right corner.

TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains a 5x5 grid with columns A, B, C, and M. The rows are numbered 1 to 5. The values are: Row 1: (1,1)=1, (1,2)=1, (1,3)=1, (1,4)=10; Row 2: (2,1)=2, (2,2)=2, (2,3)=2, (2,4)=4; Row 3: (3,1)=1, (3,2)=2, (3,3)=2, (3,4)=3; Row 4: (4,1)=1, (4,2)=1, (4,3)=3, (4,4)=5; Row 5: (5,1)=3, (5,2)=1, (5,3)=3, (5,4)=1.

To the right of the cylinder is another 5x5 grid with columns A, B, C, and M. The rows are numbered 1 to 5. The values are: Row 1: (1,1)=1, (1,2)=1, (1,3)=1, (1,4)=10; Row 2: (2,1)=1, (2,2)=2, (2,3)=2, (2,4)=3; Row 3: (3,1)=1, (3,2)=1, (3,3)=3, (3,4)=5; Row 4: (4,1)=2, (4,2)=2, (4,3)=2, (4,4)=4; Row 5: (5,1)=3, (5,2)=1, (5,3)=3, (5,4)=1.

Several smaller grids represent data blocks:

- A 2x4 grid with columns A, B, C, M: Row 1: (1,1)=1, (1,2)=1, (1,3)=1, (1,4)=15; Row 2: (2,1)=3, (2,2)=1, (2,3)=2, (2,4)=3.
- A 2x3 grid with columns A, C, M: Row 1: (1,1)=1, (1,2)=1, (1,3)=15; Row 2: (2,1)=3, (2,2)=2, (2,3)=2.
- A 1x3 grid with columns B, C, M: (1,1)=1, (1,2)=1, (1,3)=15.
- A 2x2 grid with columns A, M: Row 1: (1,1)=1, (1,2)=18; Row 2: (2,1)=2, (2,2)=1.
- A 1x2 grid with columns B, M: (1,1)=1, (1,2)=18.
- A 1x2 grid with columns C, M: (1,1)=1, (1,2)=18.
- A 1x1 grid with column M: (1,1)=23.

A blue play button is located in the bottom right corner.

TRS-BUC

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
3	1	2	2	3
4	1	1	3	5
2	2	2	2	4
5	3	1	3	1

A	B	C	M
			1,1
			4,1

A	B	M
1	1	15
		3,1

A	C	M
		1,1
		3,2

B	C	M
---	---	---

A	M
1	18
	2,1
	5,1

B	M
---	---

C	M
---	---

M
23



TRS-BUC

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
3	1	2	2	3
4	1	1	3	5
2	2	2	2	4
5	3	1	3	1

A	B	C	M
			1,1
			4,1

A	B	M
1	1	15
		3,1

A	C	M
		1,1
		3,2

B	C	M
---	---	---

A	M
1	18
	2,1
	5,1

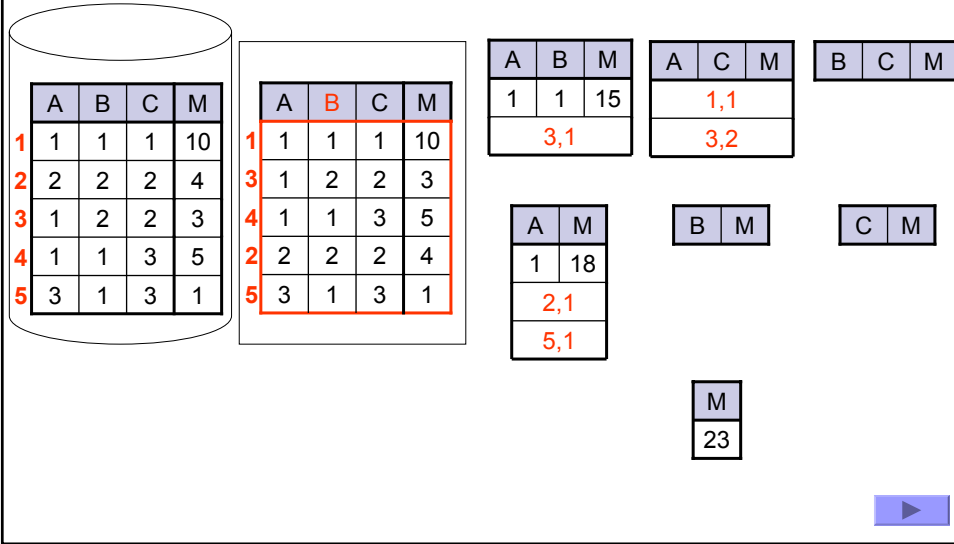
B	M
---	---

C	M
---	---

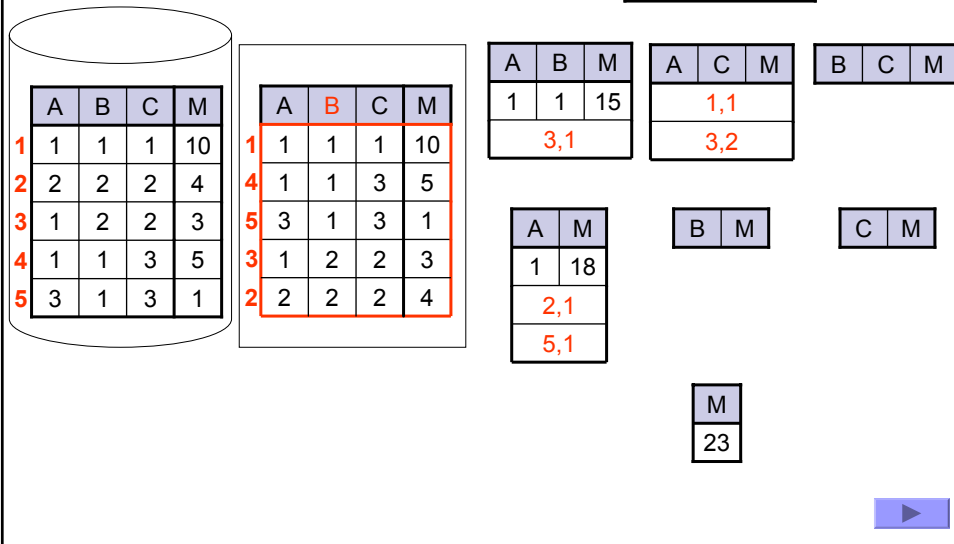
M
23



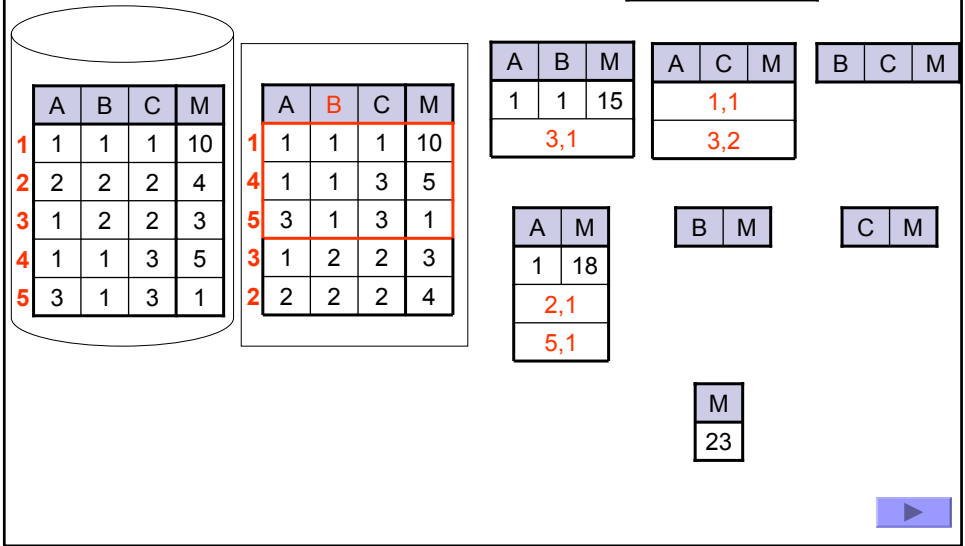
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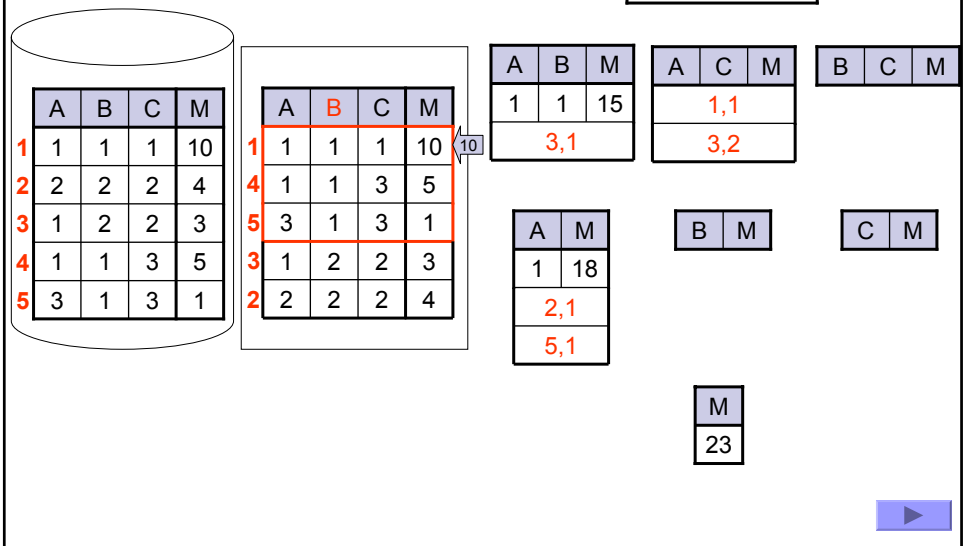
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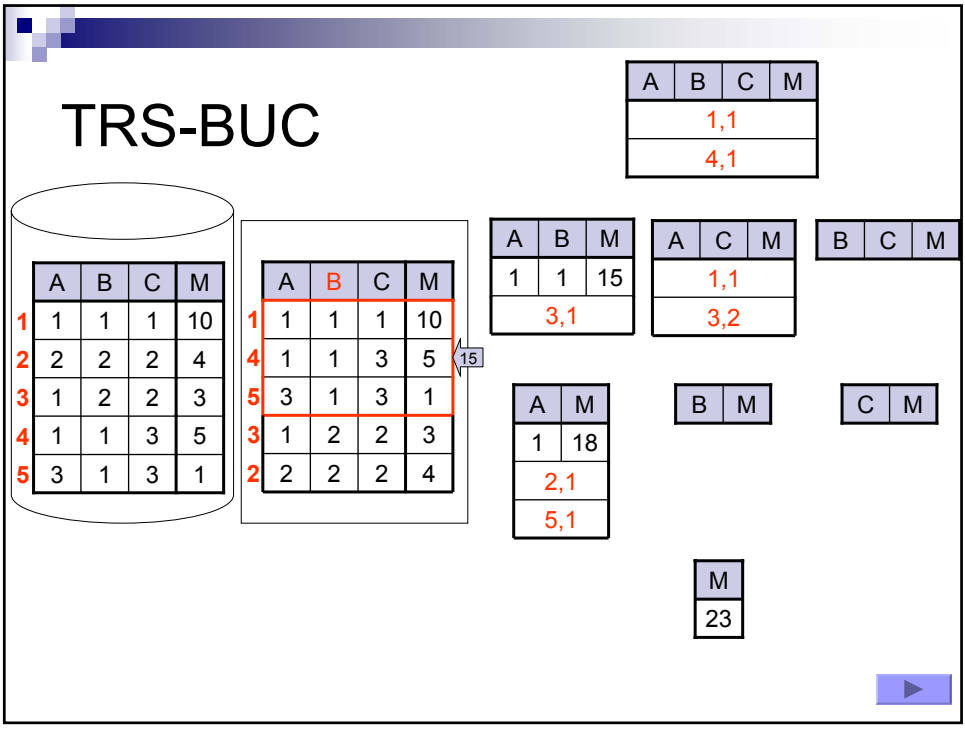
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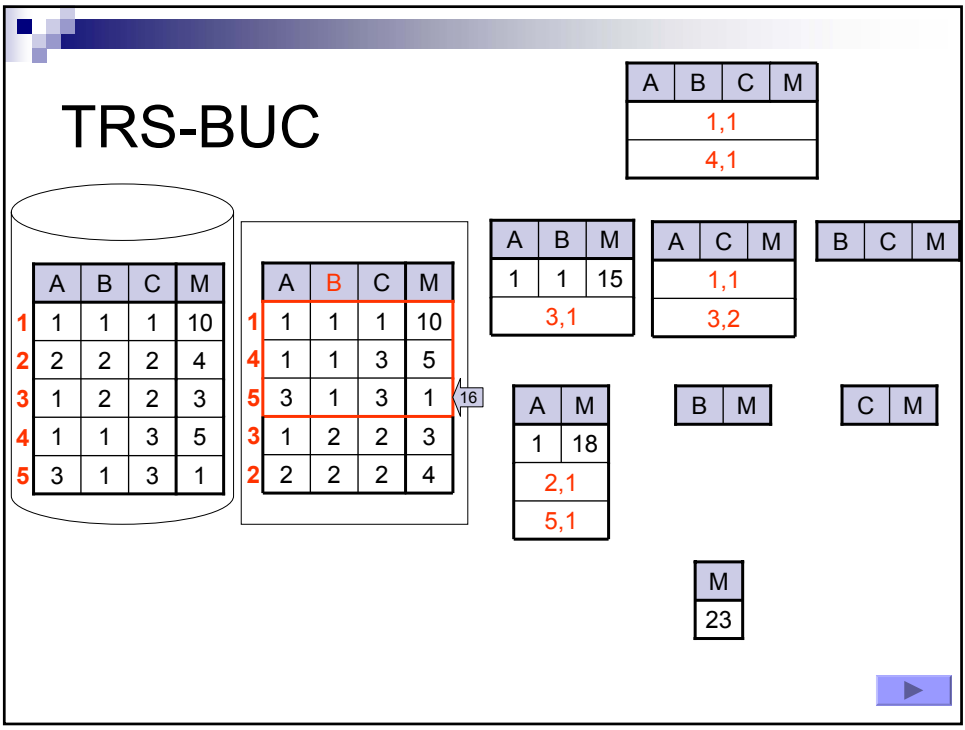
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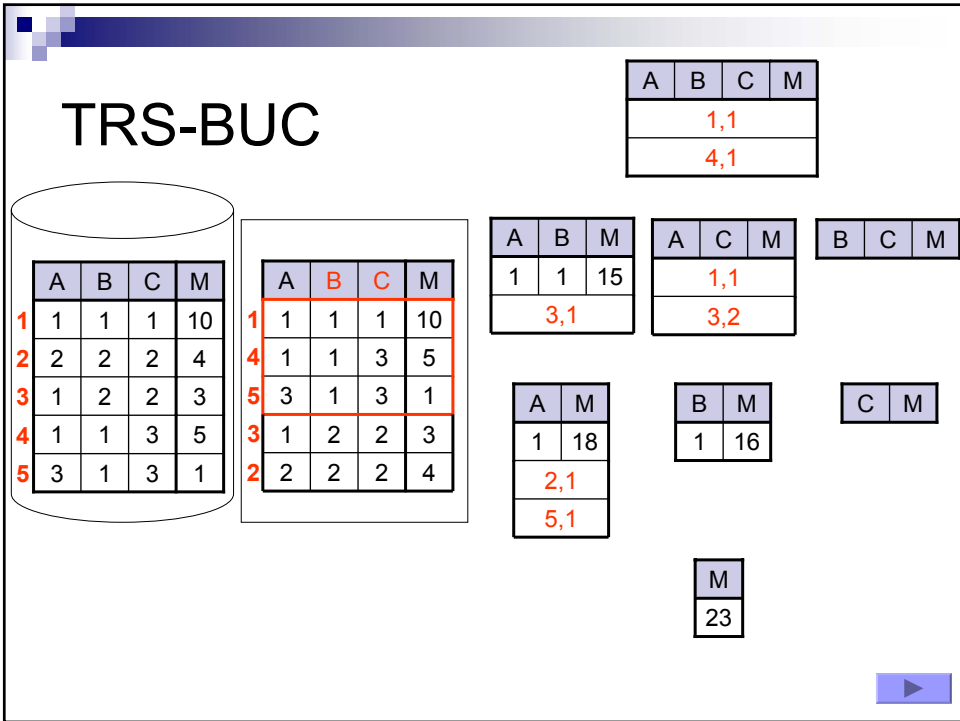
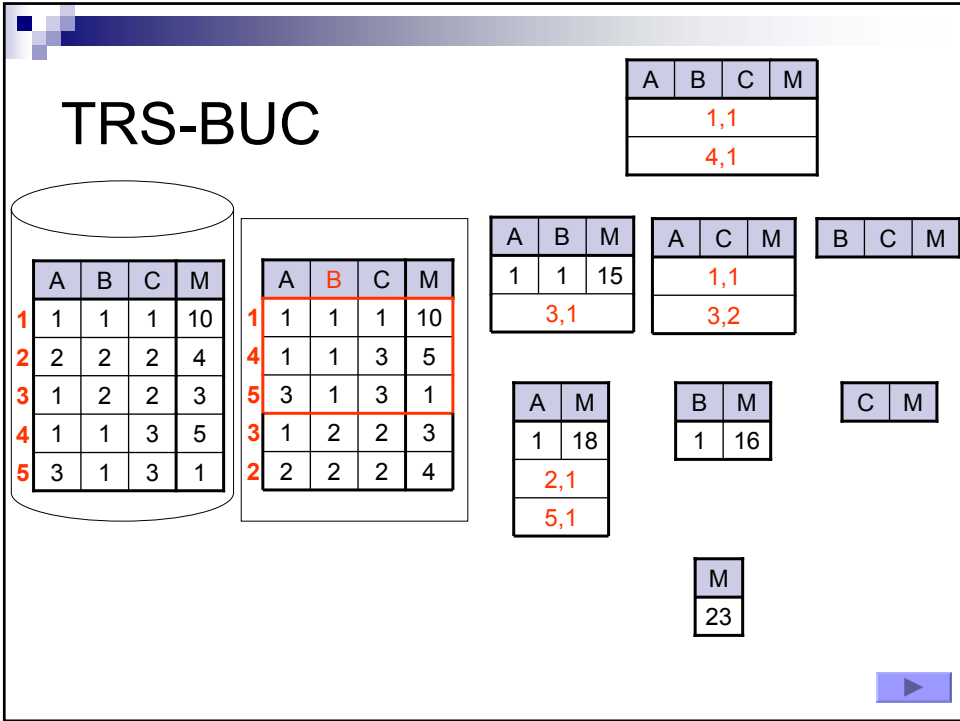


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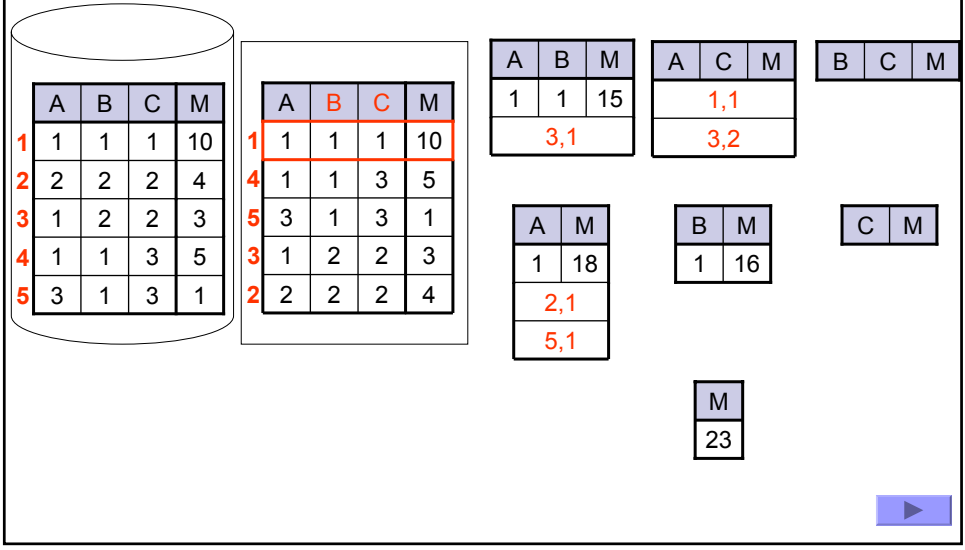


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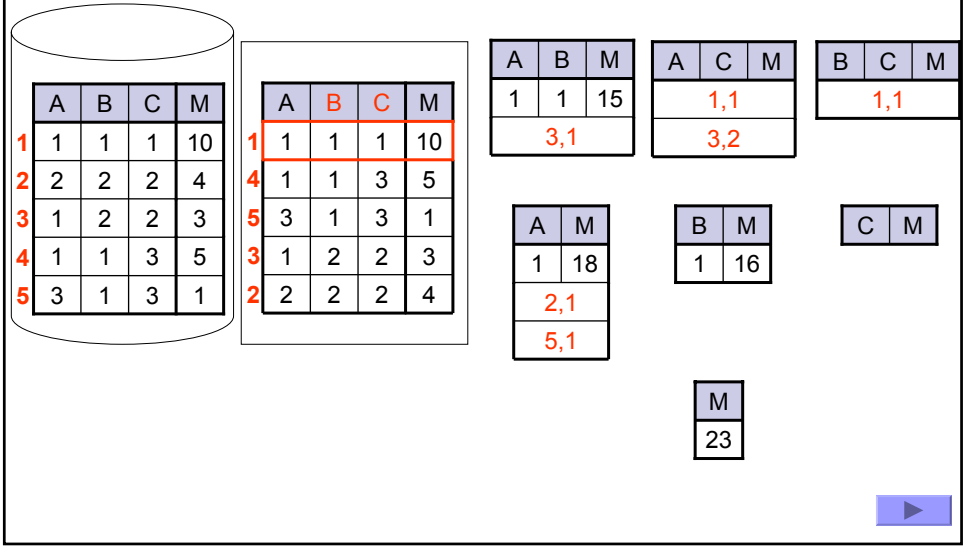


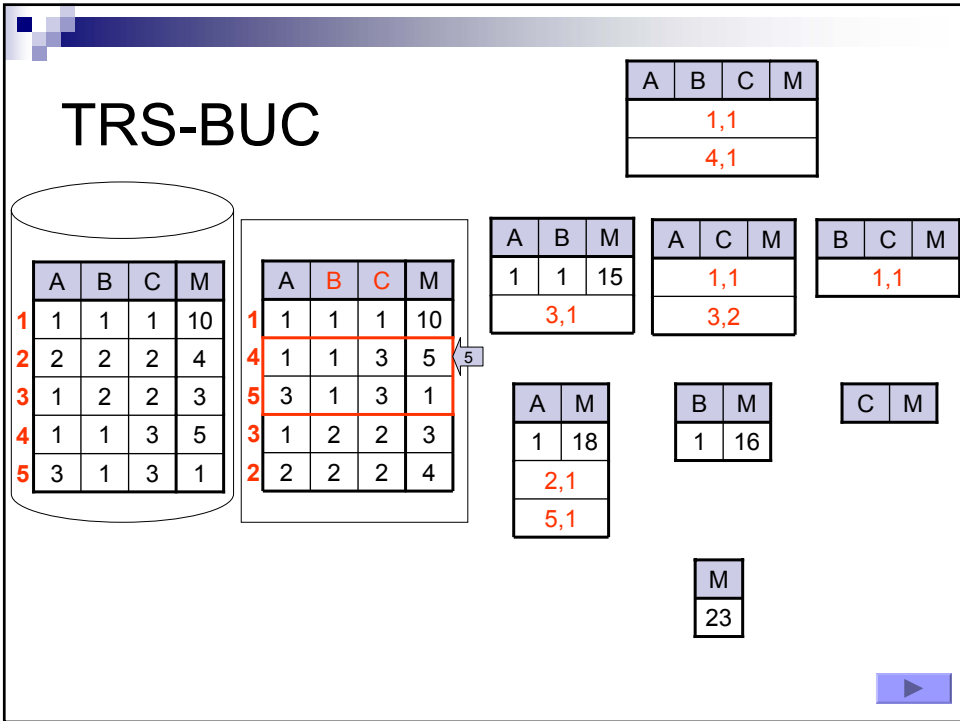
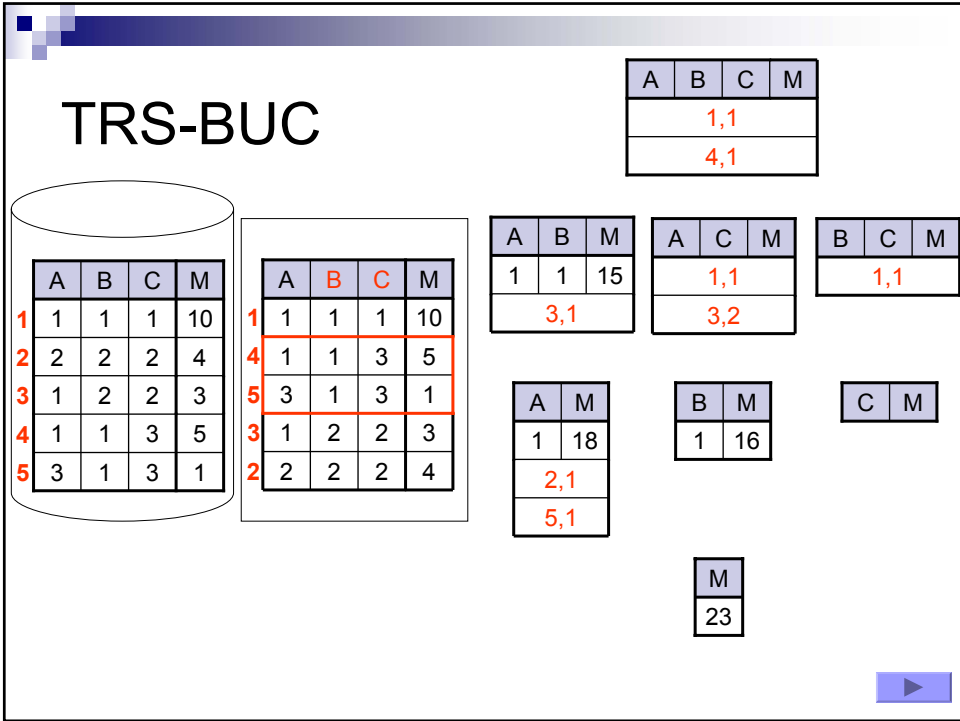


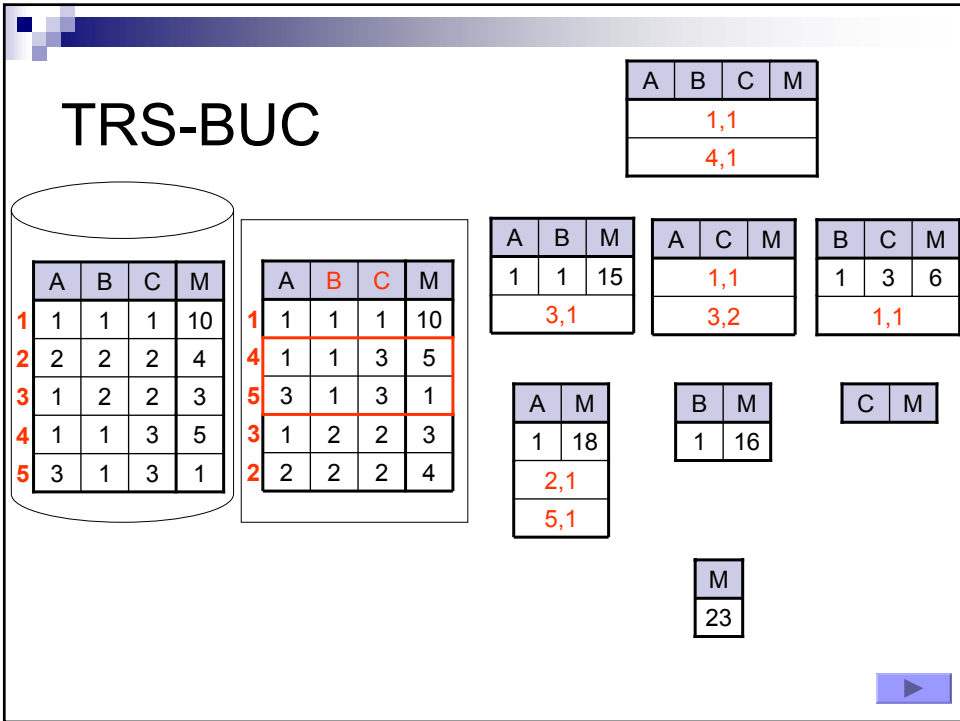
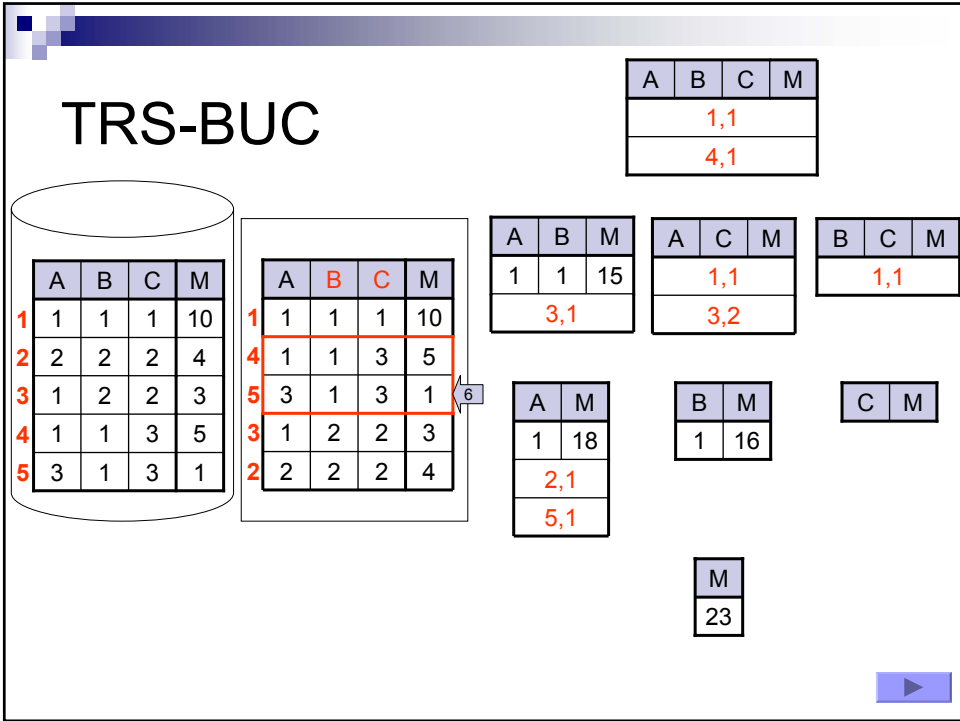
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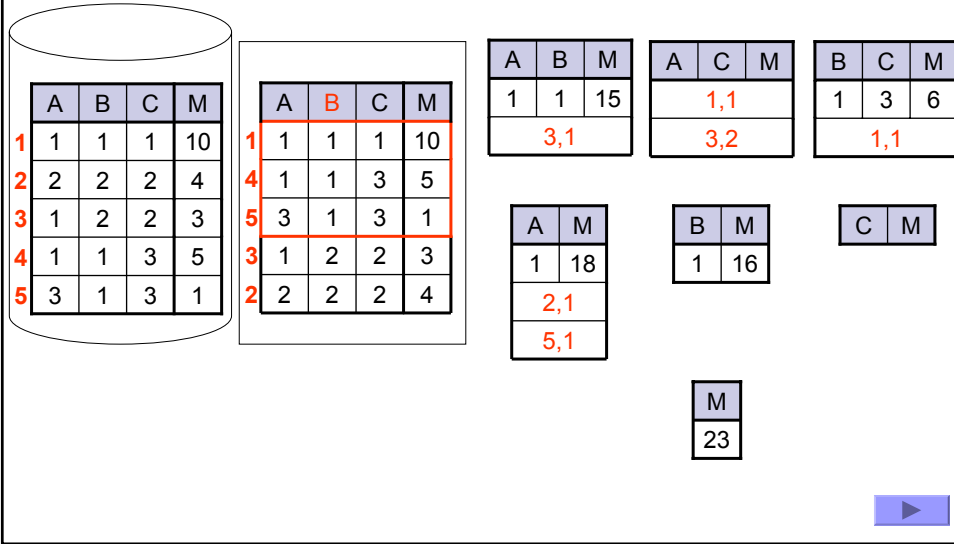
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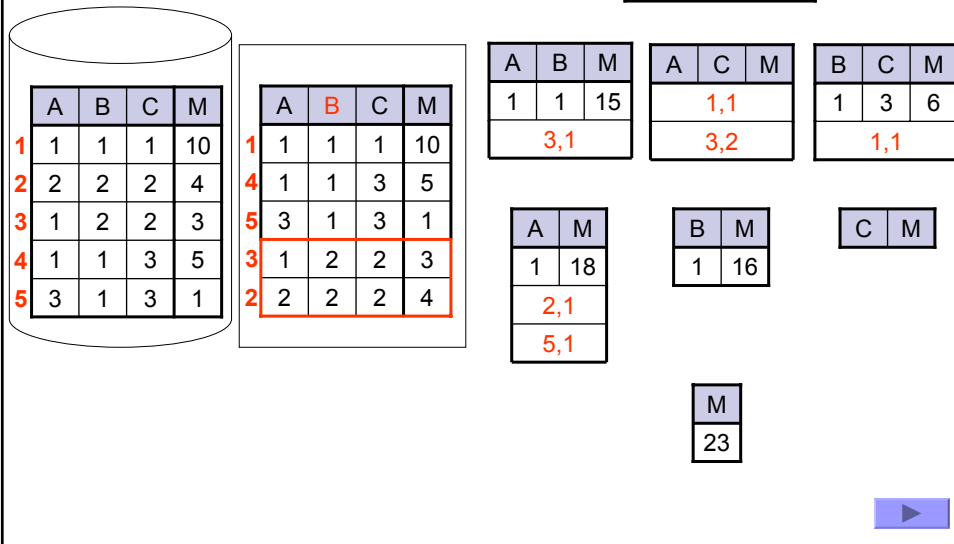




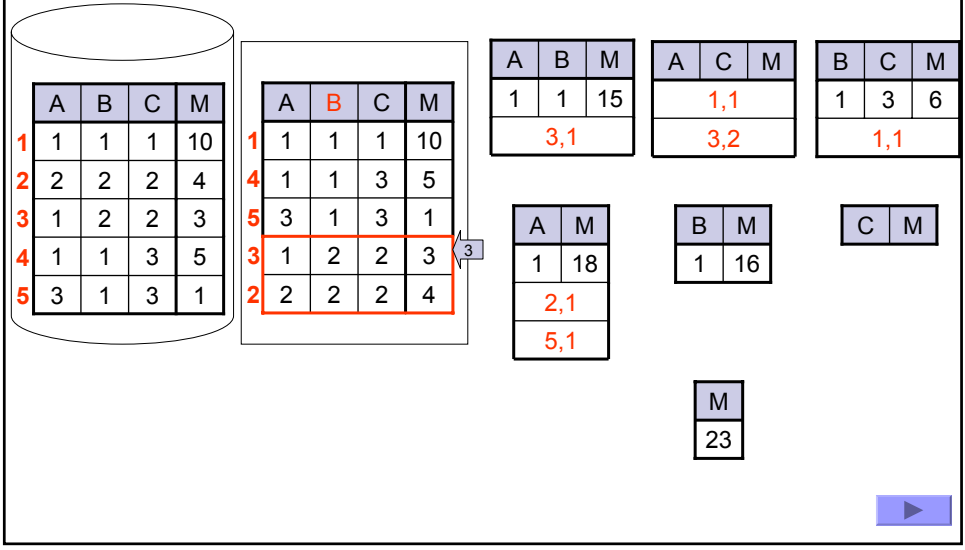
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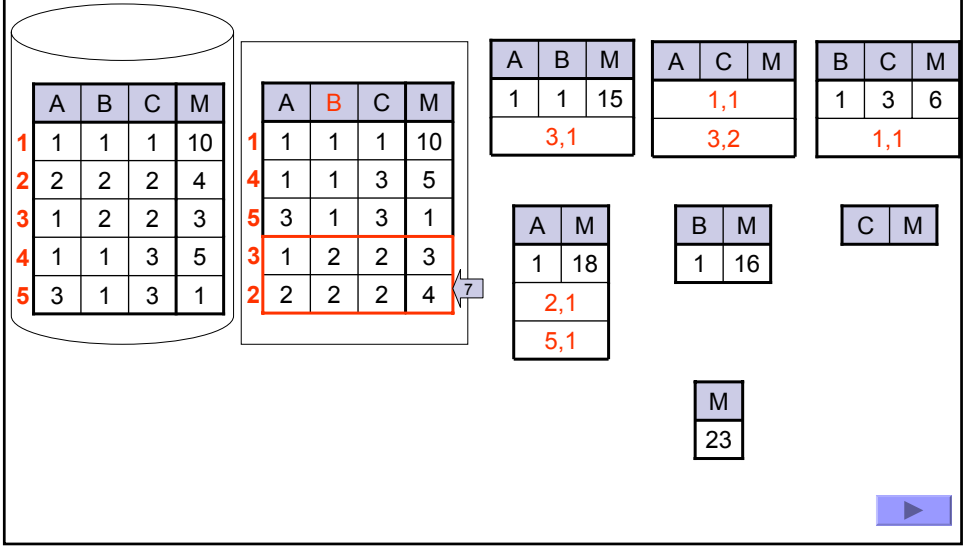
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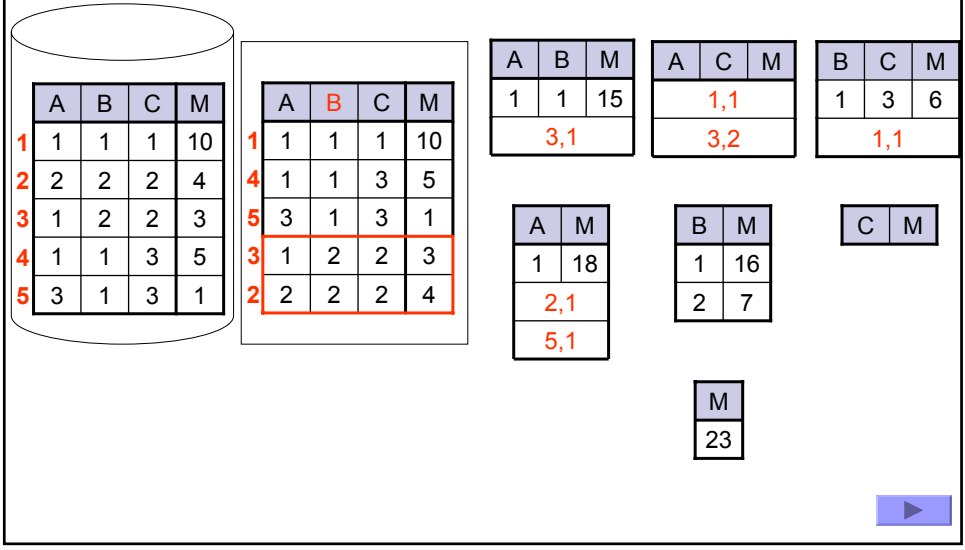
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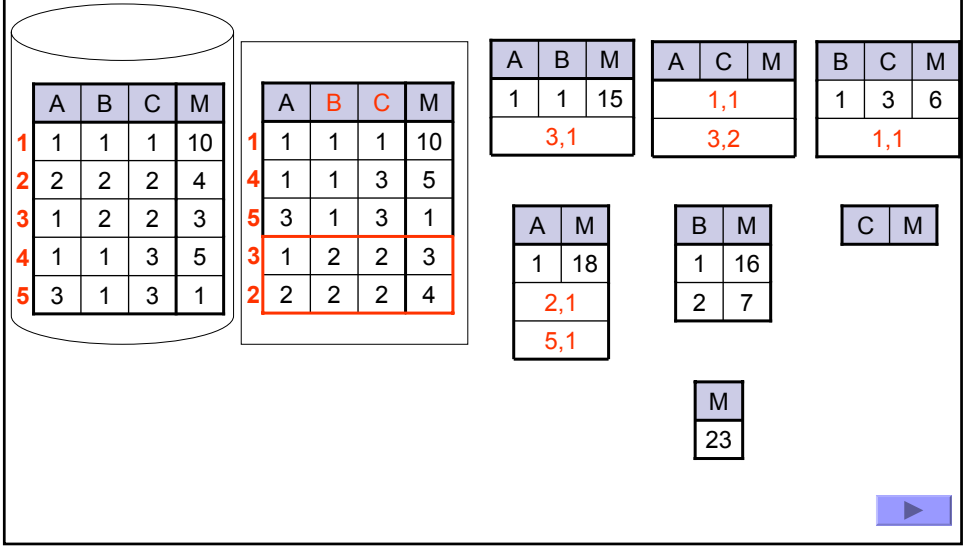
TRS-BUC



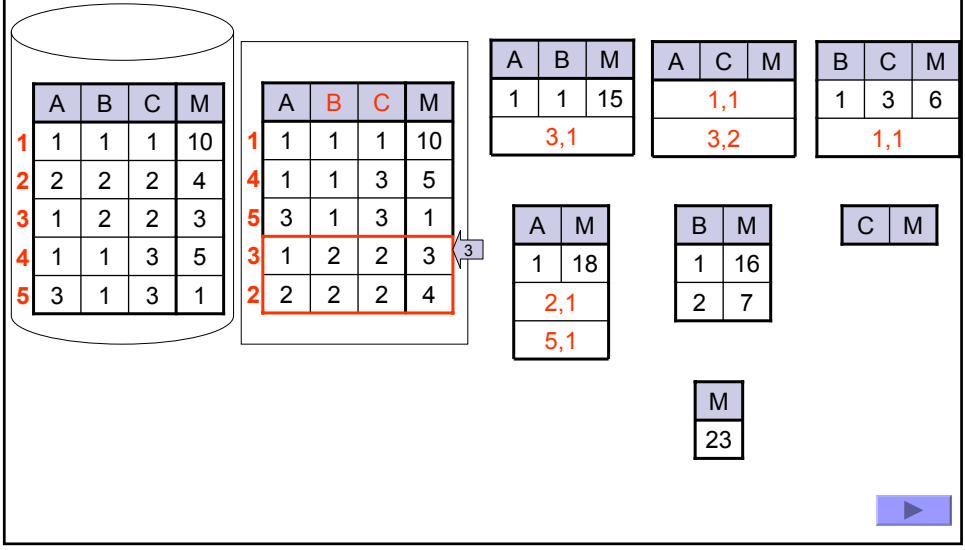
TRS-BUC



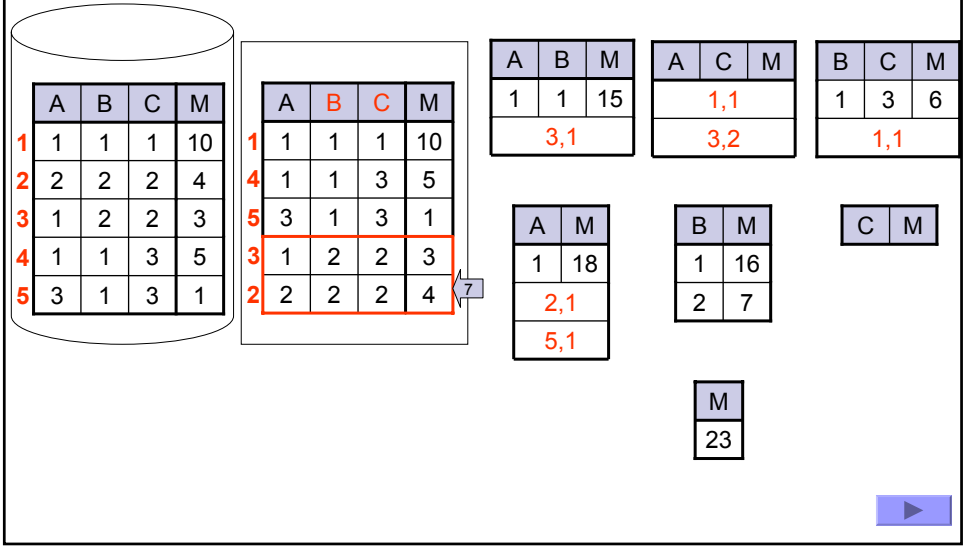
TRS-BUC



TRS-BUC



TRS-BUC



TRS-BUC

The diagram illustrates a TRS-BUC system. It consists of a cylinder containing two tables and several smaller tables representing different views. The tables are as follows:

- Cylinder Table 1:**

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1
- Cylinder Table 2:**

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
5	3	1	3	1
3	1	2	2	3
2	2	2	2	4
- Table 1 (A, B, M):**

A	B	M
1	1	15
3,1		
- Table 2 (A, C, M):**

A	C	M
1,1		
3,2		
- Table 3 (B, C, M):**

B	C	M
1	3	6
2	2	7
1,1		
- Table 4 (A, M):**

A	M
1	18
2,1	
5,1	
- Table 5 (B, M):**

B	M
1	16
2	7
- Table 6 (C, M):**

C	M
---	---
- Table 7 (M):**

M
23

Red highlights in the tables indicate specific data points or relationships. A blue play button is located in the bottom right corner.

TRS-BUC

The diagram illustrates a TRS-BUC system. It consists of a cylinder containing two tables and several smaller tables representing different views. The tables are as follows:

- Cylinder Table 1:**

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1
- Cylinder Table 2:**

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
5	3	1	3	1
3	1	2	2	3
2	2	2	2	4
- Table 1 (A, B, M):**

A	B	M
1	1	15
3,1		
- Table 2 (A, C, M):**

A	C	M
1,1		
3,2		
- Table 3 (B, C, M):**

B	C	M
1	3	6
2	2	7
1,1		
- Table 4 (A, M):**

A	M
1	18
2,1	
5,1	
- Table 5 (B, M):**

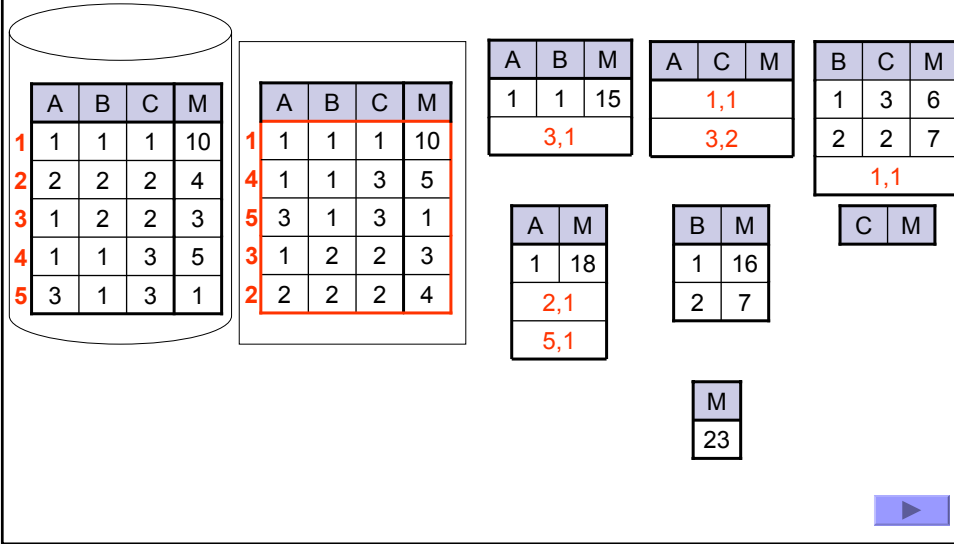
B	M
1	16
2	7
- Table 6 (C, M):**

C	M
---	---
- Table 7 (M):**

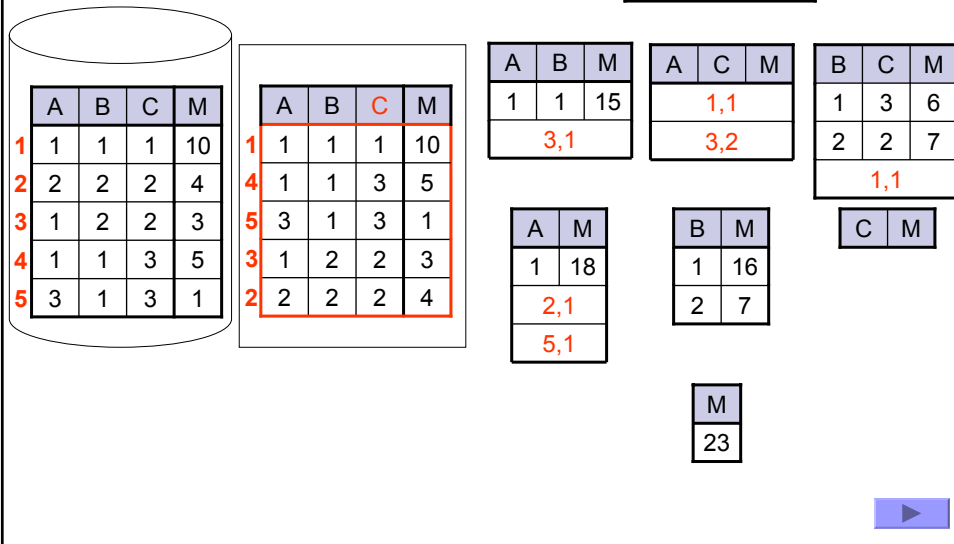
M
23

Red highlights in the tables indicate specific data points or relationships. A blue play button is located in the bottom right corner.

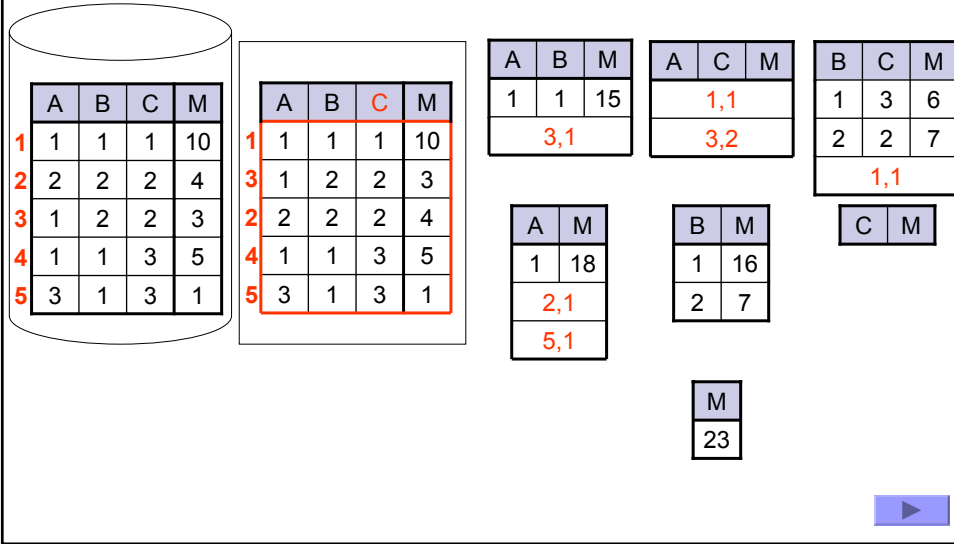
TRS-BUC



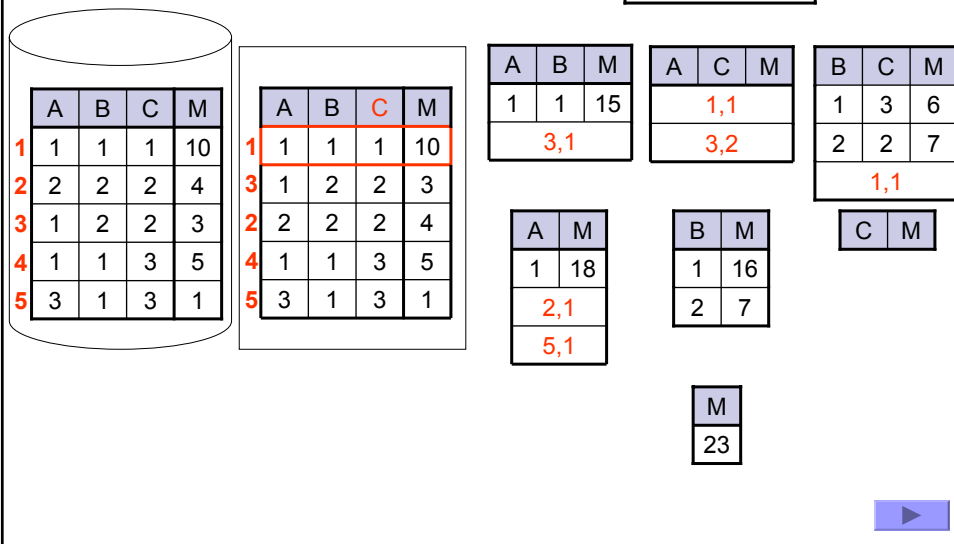
TRS-BUC



TRS-BUC



TRS-BUC



TRS-BUC

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M	
1	1	1	10	
3	1	2	2	3
2	2	2	2	4
4	1	1	3	5
5	3	1	3	1

A	B	M
1	1	15
3	1	

A	C	M
1	1	
3	2	

B	C	M
1	3	6
2	2	7
1	1	

A	M
1	18
2	1
5	

B	M
1	16
2	7

C	M
1	1

M
23

TRS-BUC

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M	
1	1	1	10	
3	1	2	2	3
2	2	2	2	4
4	1	1	3	5
5	3	1	3	1

A	B	M
1	1	15
3	1	

A	C	M
1	1	
3	2	

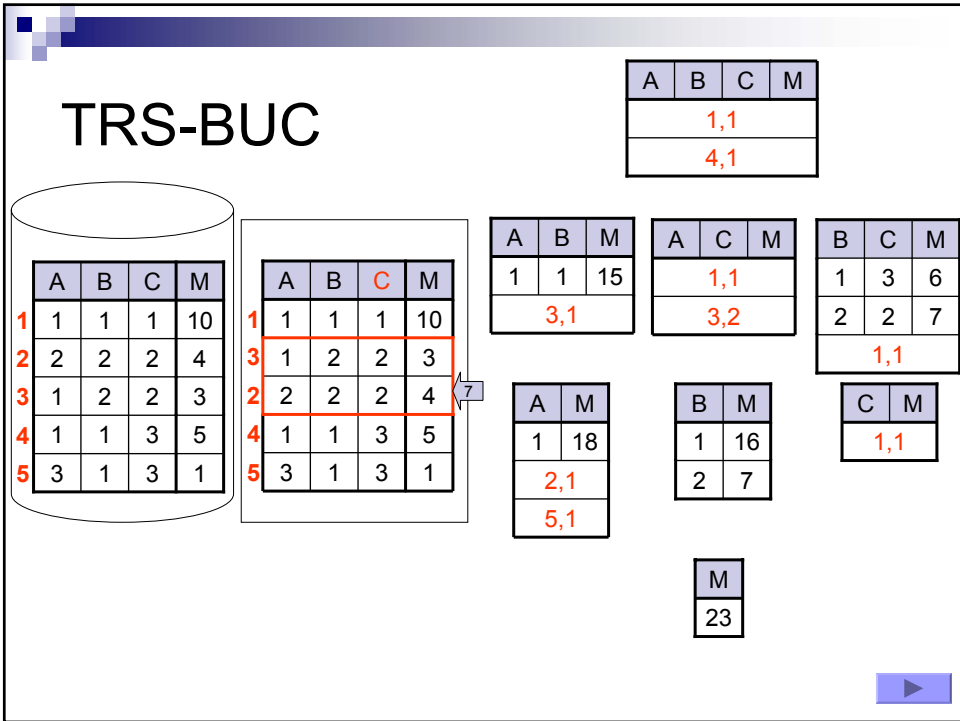
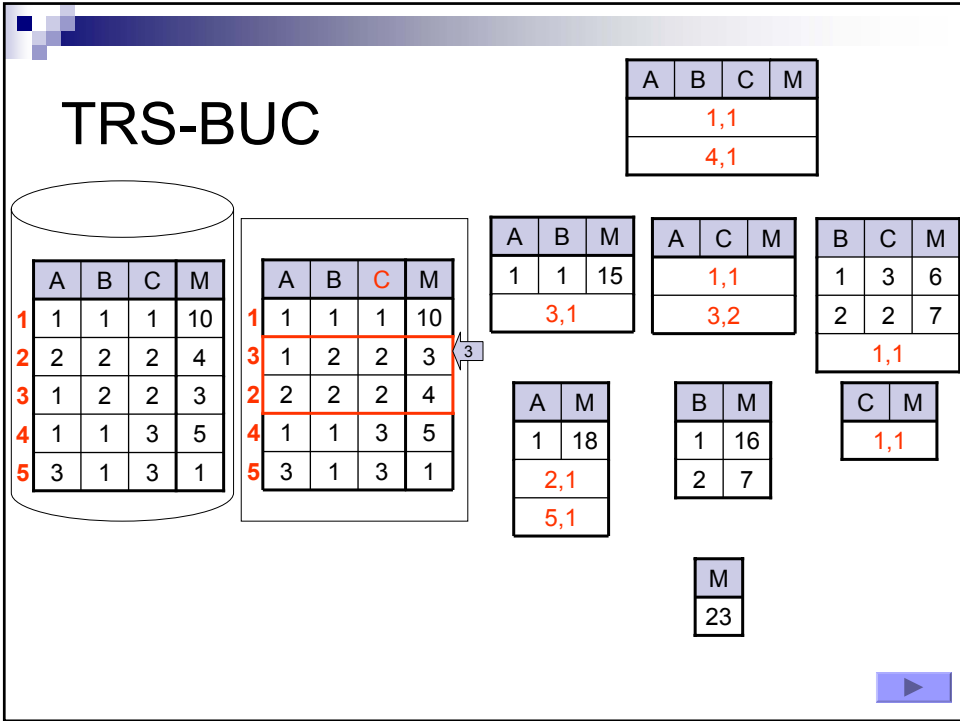
B	C	M
1	3	6
2	2	7
1	1	

A	M
1	18
2	1
5	

B	M
1	16
2	7

C	M
1	1

M
23



TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains a table with columns A, B, C, and M, and rows 1 through 5. To its right is another table with the same columns and rows, where rows 3, 2, 4, and 5 are highlighted with red borders. In the center and right, several smaller tables represent components and their interactions:

- A table with columns A, B, C, M and rows 1,1 and 4,1.
- A table with columns A, B, M and rows 1,1,15 and 3,1.
- A table with columns A, C, M and rows 1,1 and 3,2.
- A table with columns B, C, M and rows 1,3,6 and 2,2,7, with a 1,1 interaction below.
- A table with columns A, M and rows 1,18 and 2,1,5,1.
- A table with columns B, M and rows 1,16 and 2,7.
- A table with columns C, M and rows 2,7 and 1,1.
- A table with column M and row 23.

A blue play button is located in the bottom right corner.

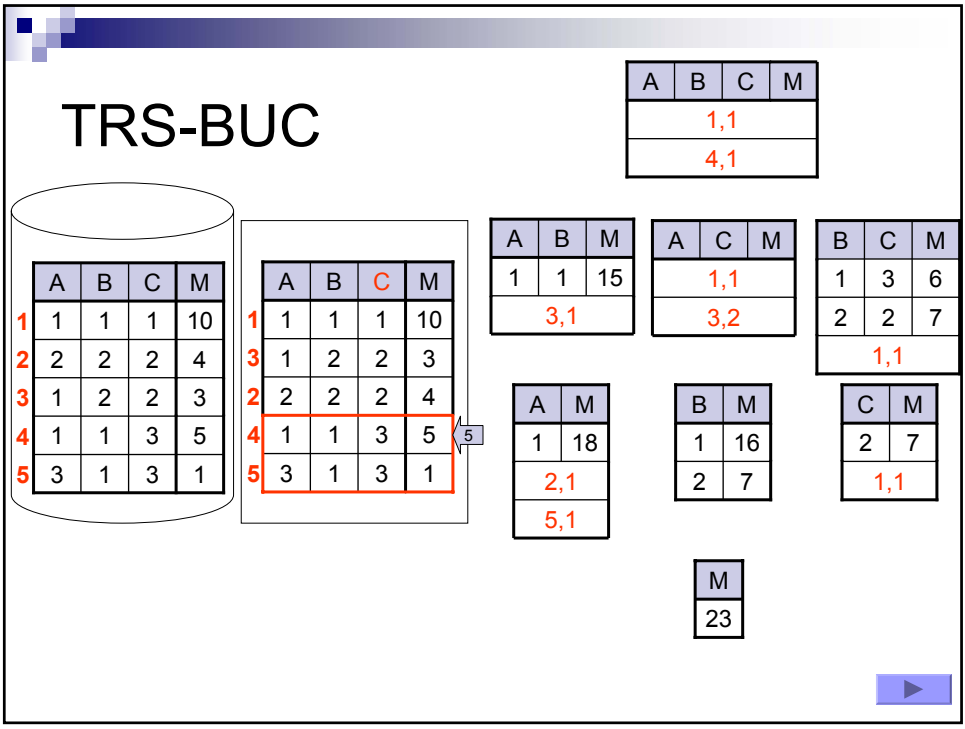
TRS-BUC

The diagram illustrates a TRS-BUC system. On the left, a cylinder contains a table with columns A, B, C, and M, and rows 1 through 5. To its right is another table with the same columns and rows, where rows 3, 2, 4, and 5 are highlighted with red borders. In the center and right, several smaller tables represent components and their interactions:

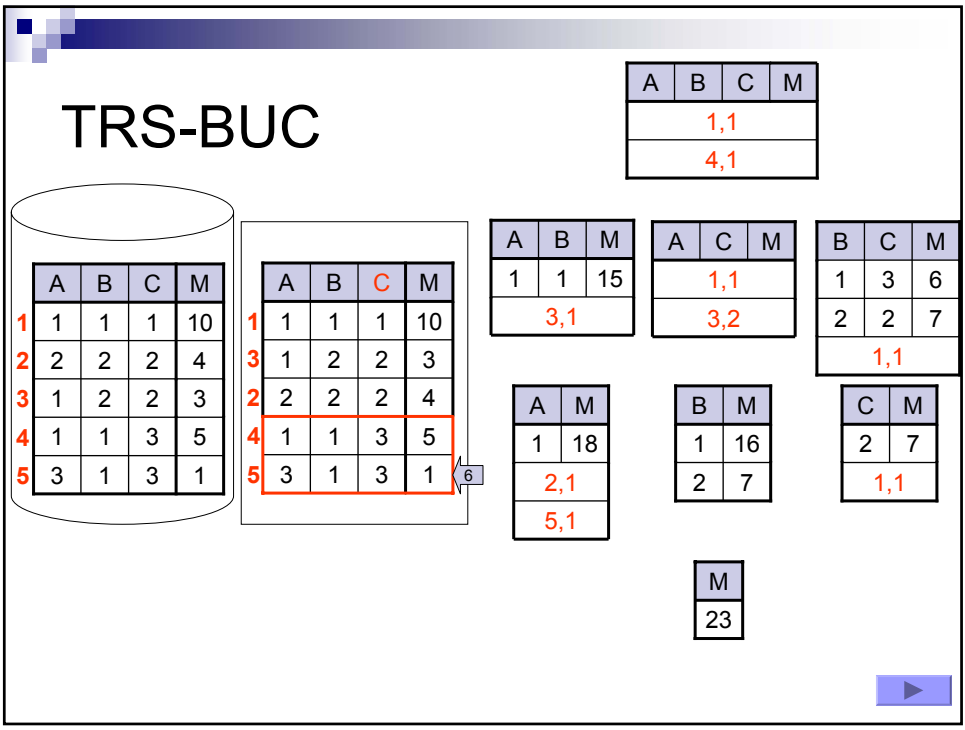
- A table with columns A, B, C, M and rows 1,1 and 4,1.
- A table with columns A, B, M and rows 1,1,15 and 3,1.
- A table with columns A, C, M and rows 1,1 and 3,2.
- A table with columns B, C, M and rows 1,3,6 and 2,2,7, with a 1,1 interaction below.
- A table with columns A, M and rows 1,18 and 2,1,5,1.
- A table with columns B, M and rows 1,16 and 2,7.
- A table with columns C, M and rows 2,7 and 1,1.
- A table with column M and row 23.

A blue play button is located in the bottom right corner.

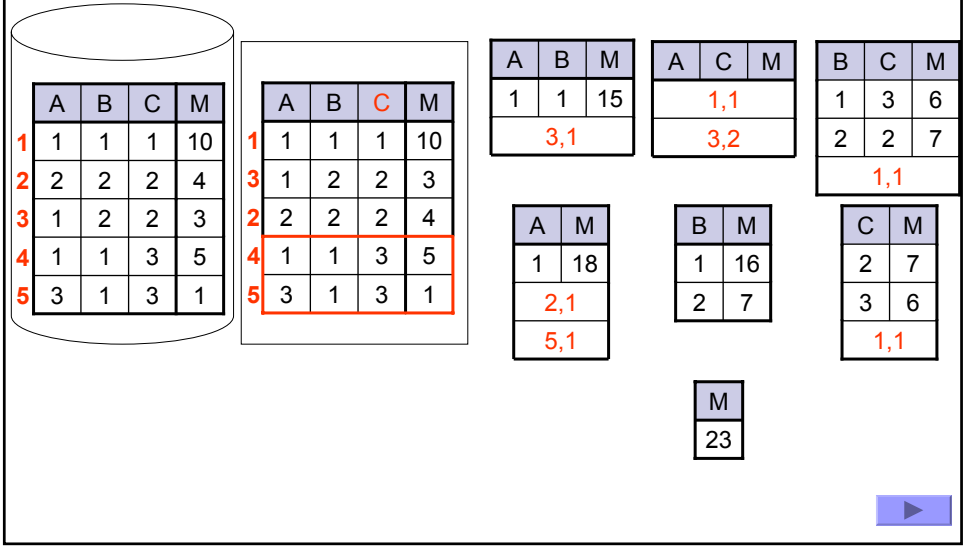
TRS-BUC



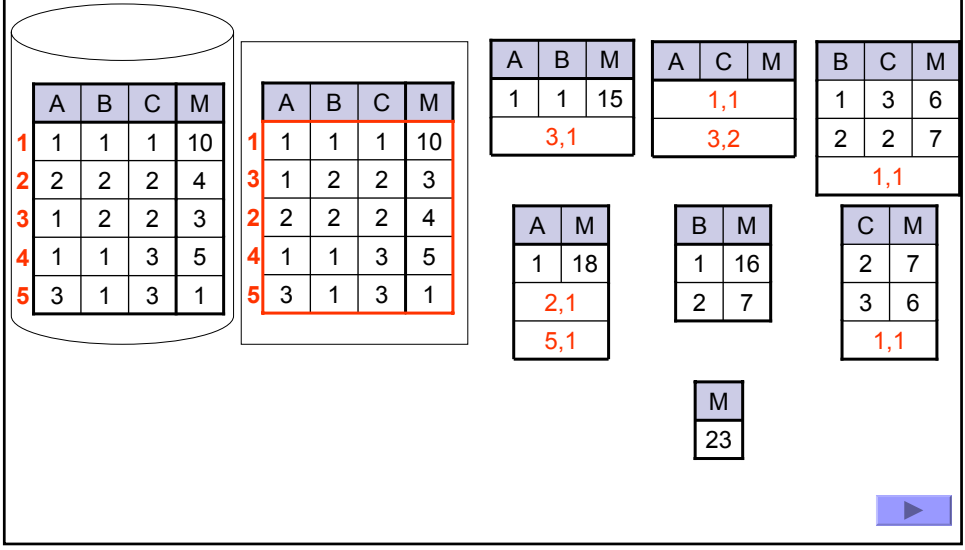
TRS-BUC

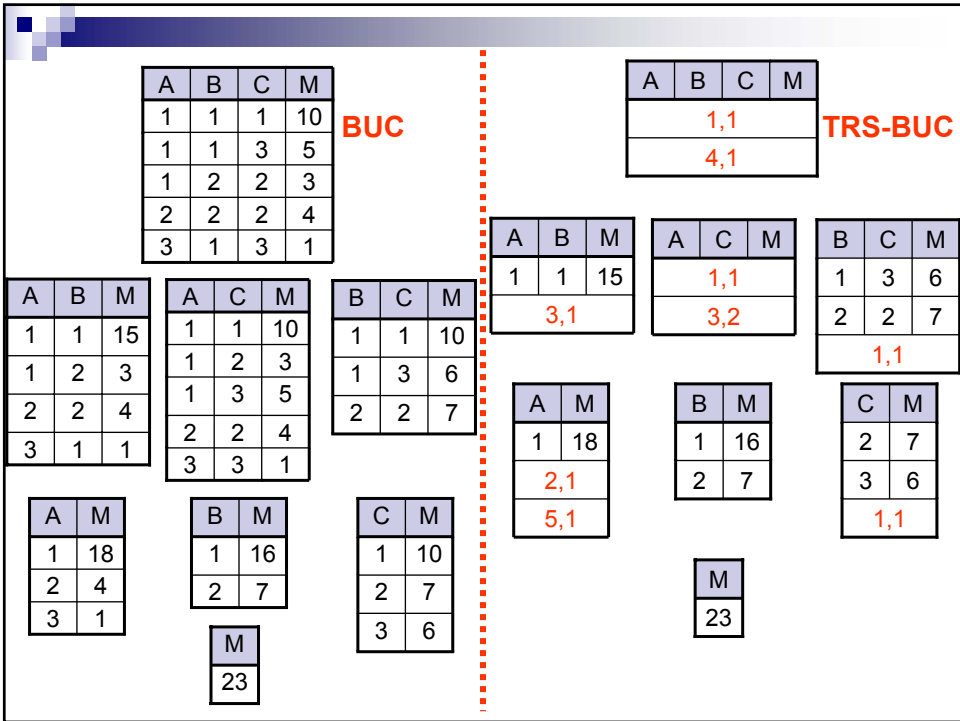
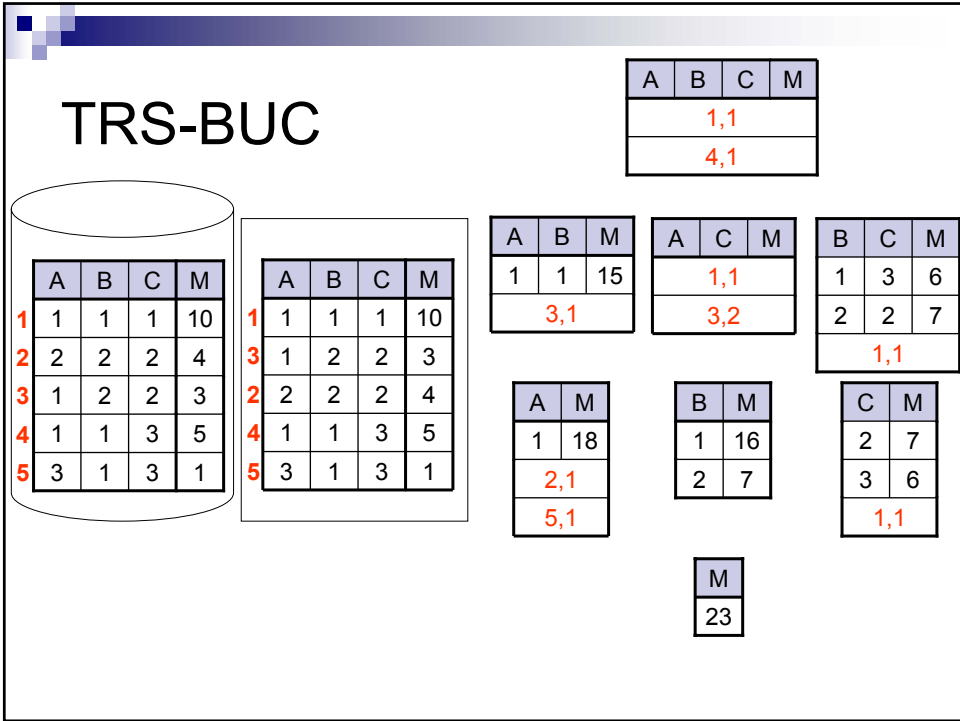


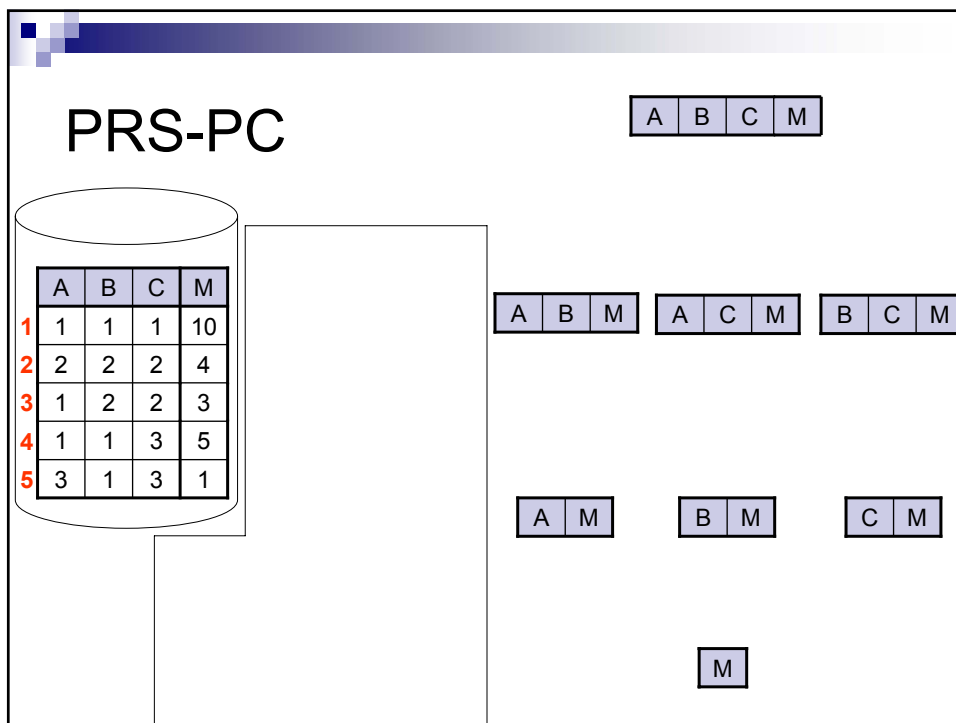
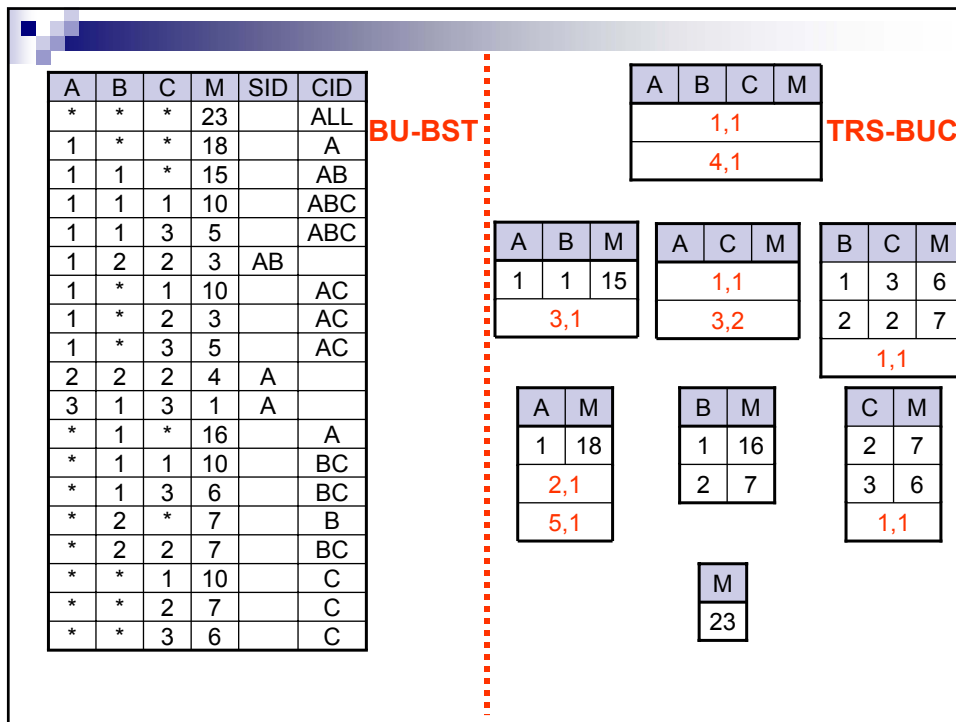
TRS-BUC

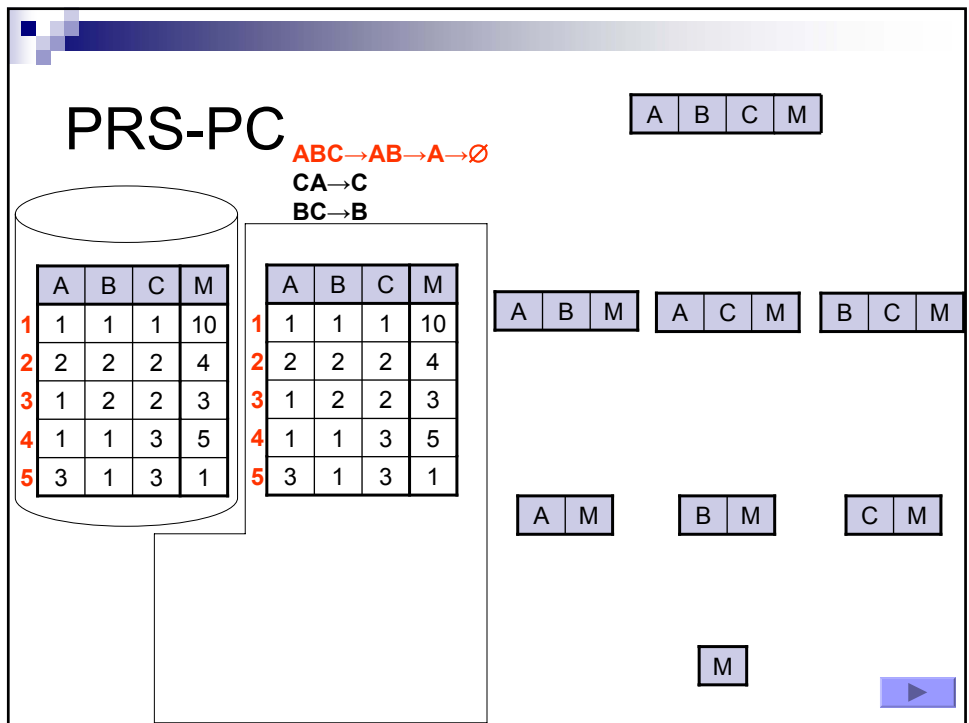
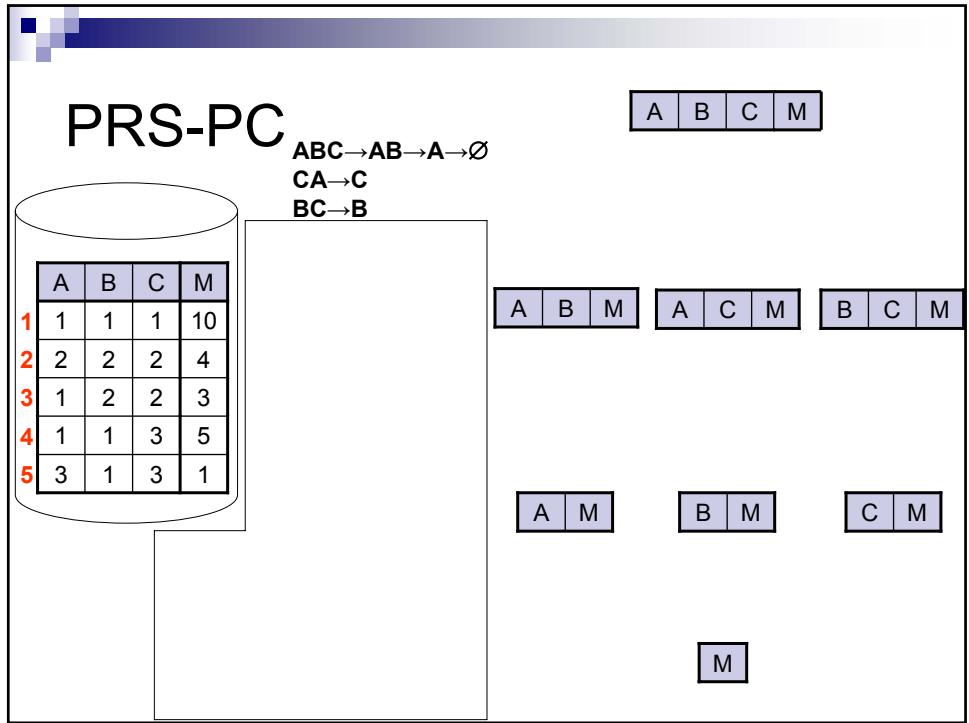


TRS-BUC









PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A B C M

A B M A C M B C M

A M B M C M

M

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A B C M

A B M A C M B C M

A M B M C M

M

ABC -,0,F

AB -,0,F

A -,0,F

\emptyset -,0,F

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

ABC:

1	1	1	10
---	---	---	----

 R,1,F
 AB:

--	--	--

 -,0,F
 A:

--	--

 -,0,F
 \emptyset :

--

 -,0,F

A B C M

A B M A C M B C M

A M B M C M

M

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

	A	B	C	M
1	1	1	1	10
2	2	2	2	4
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

	A	B	C	M
1	1	1	1	10
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

ABC:

1	1	1	10
---	---	---	----

 R,1,F
 AB:

--	--	--

 -,0,F
 A:

--	--

 -,0,F
 \emptyset :

--

 -,0,F

A B C M

A B M A C M B C M

A M B M C M

M

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
R,1,1			

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

A	M
---	---

B	M
---	---

C	M
---	---

M

ABC	1	1	1	10	R,1,F
AB					-,0,F
A					-,0,F
∅					-,0,F

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
R,1,1			

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

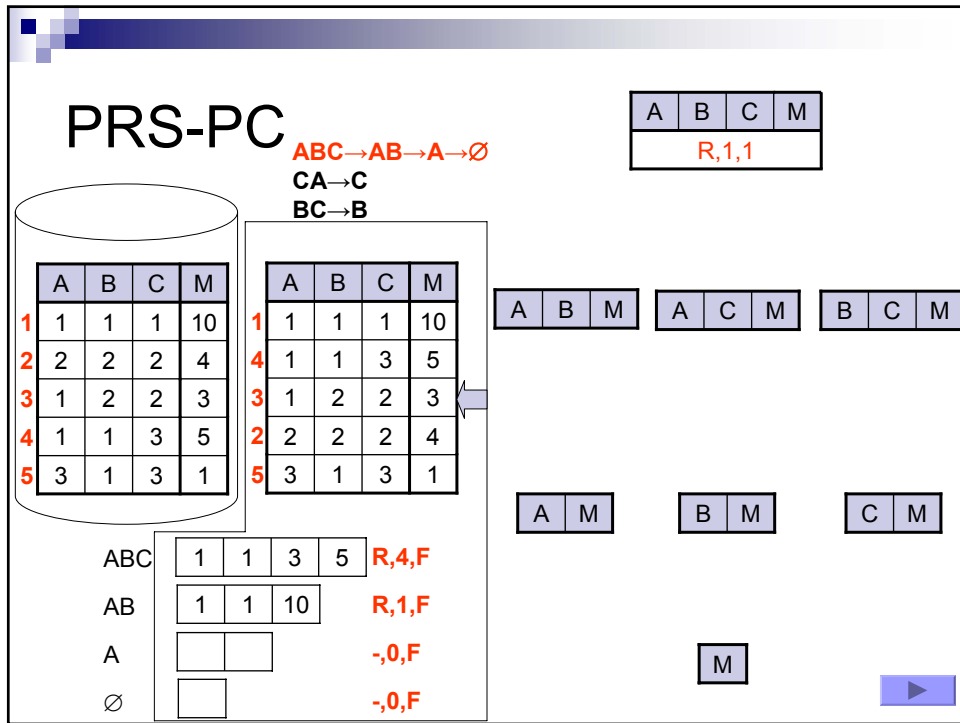
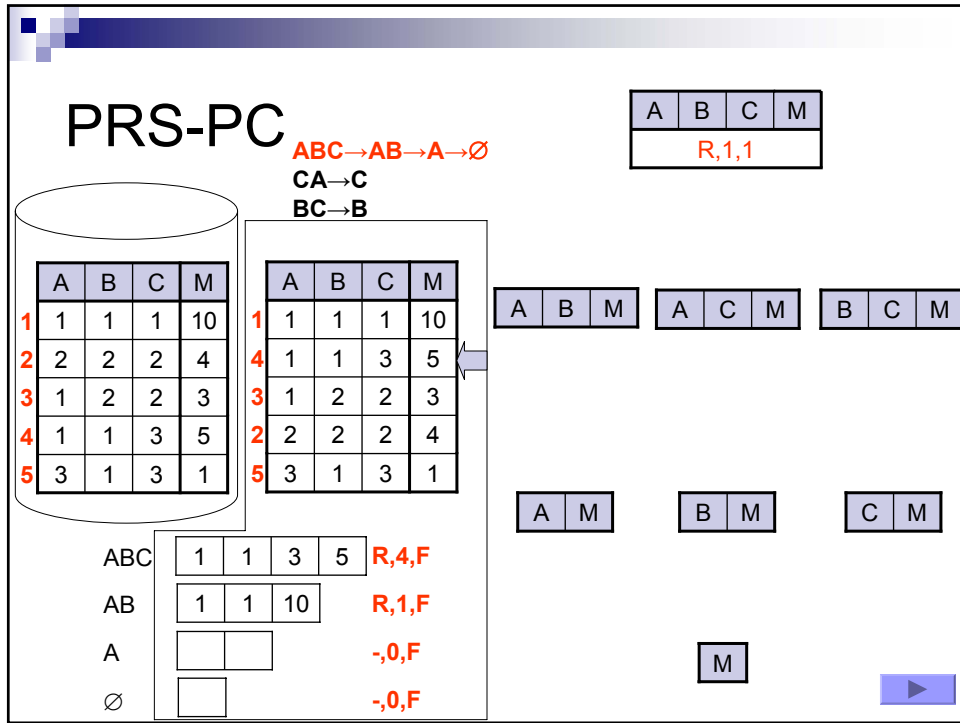
A	M
---	---

B	M
---	---

C	M
---	---

M

ABC	1	1	1	10	R,1,F
AB	1	1	10		R,1,F
A					-,0,F
∅					-,0,F



PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
R,1,1			
R,4,1			

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

A	M
---	---

B	M
---	---

C	M
---	---

M

▶

ABC	1	1	3	5	R,4,F
AB	1	1	10	R,1,F	
A				-,0,F	
\emptyset				-,0,F	

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
R,1,1			
R,4,1			

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	M
---	---	---

A	C	M
---	---	---

B	C	M
---	---	---

A	M
---	---

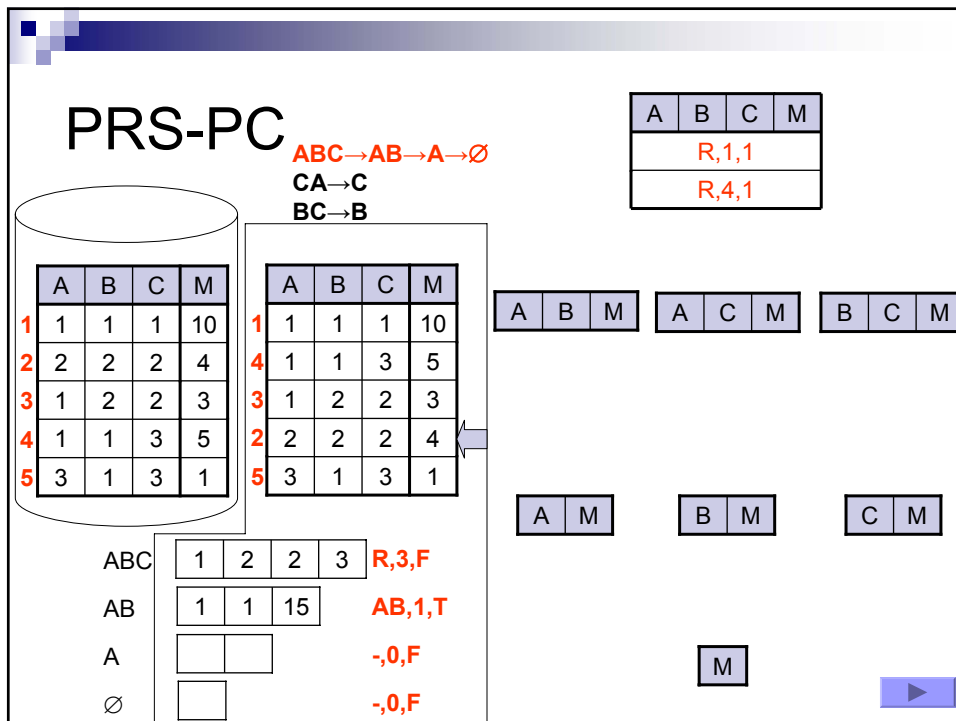
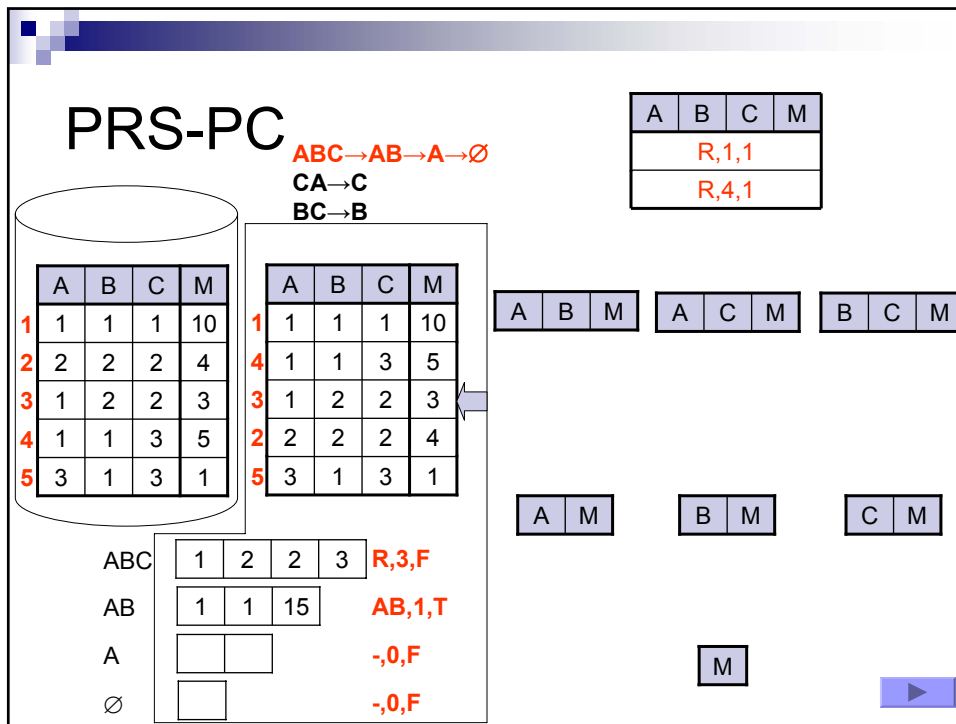
B	M
---	---

C	M
---	---

M

▶

ABC	1	1	3	5	R,4,F
AB	1	1	15	AB,1,T	
A				-,0,F	
\emptyset				-,0,F	



PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
R,1,1			
R,3,2			

A	B	C	M	
1	1	1	10	
2	2	2	4	
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

A	B	C	M	
1	1	1	10	
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M

A	C	M

B	C	M

A	M

B	M

C	M

ABC	1	2	2	3	R,3,F
AB	1	1	15	AB,1,T	
A				-,0,F	
\emptyset				-,0,F	

M

▶

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
R,1,1			
R,3,2			

A	B	C	M	
1	1	1	10	
2	2	2	4	
3	1	2	2	3
4	1	1	3	5
5	3	1	3	1

A	B	C	M	
1	1	1	10	
4	1	1	3	5
3	1	2	2	3
2	2	2	2	4
5	3	1	3	1

A	B	M
1	1	15

A	C	M

B	C	M

A	M

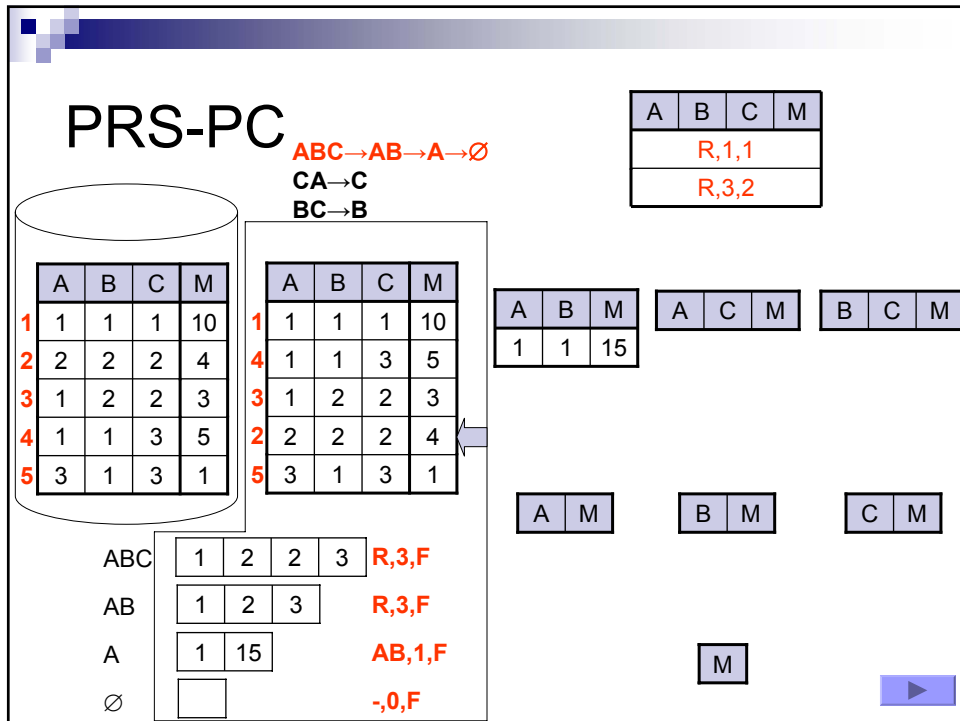
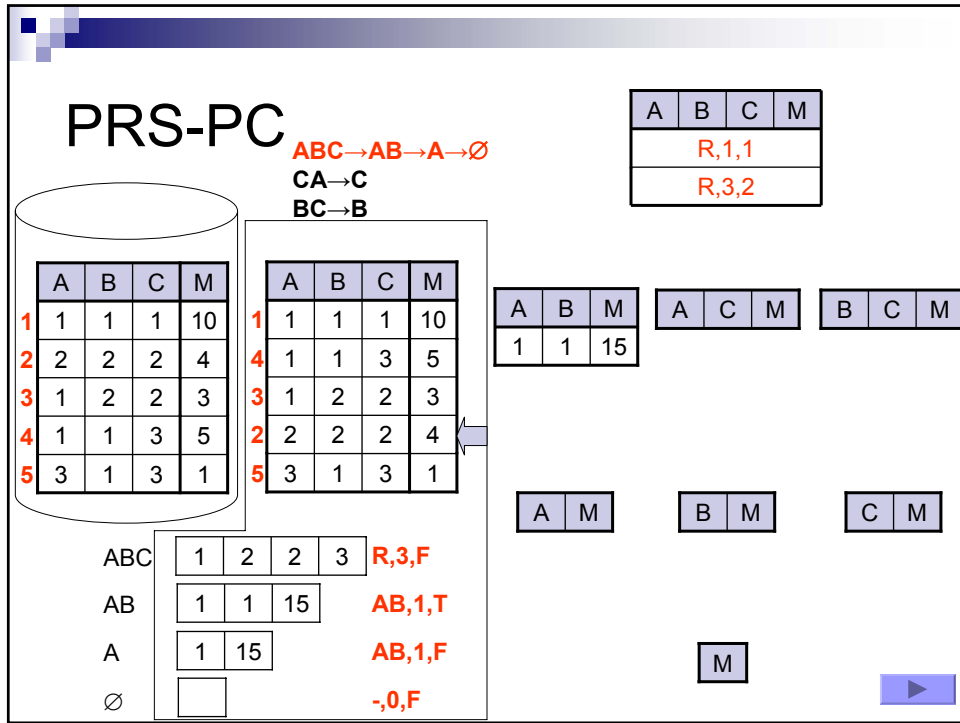
B	M

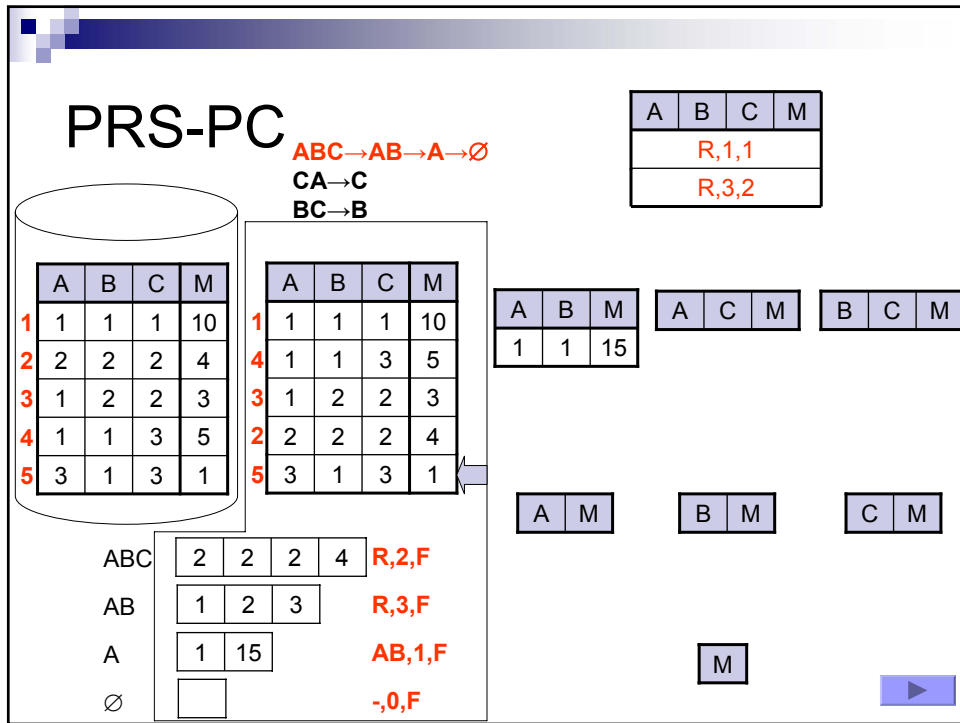
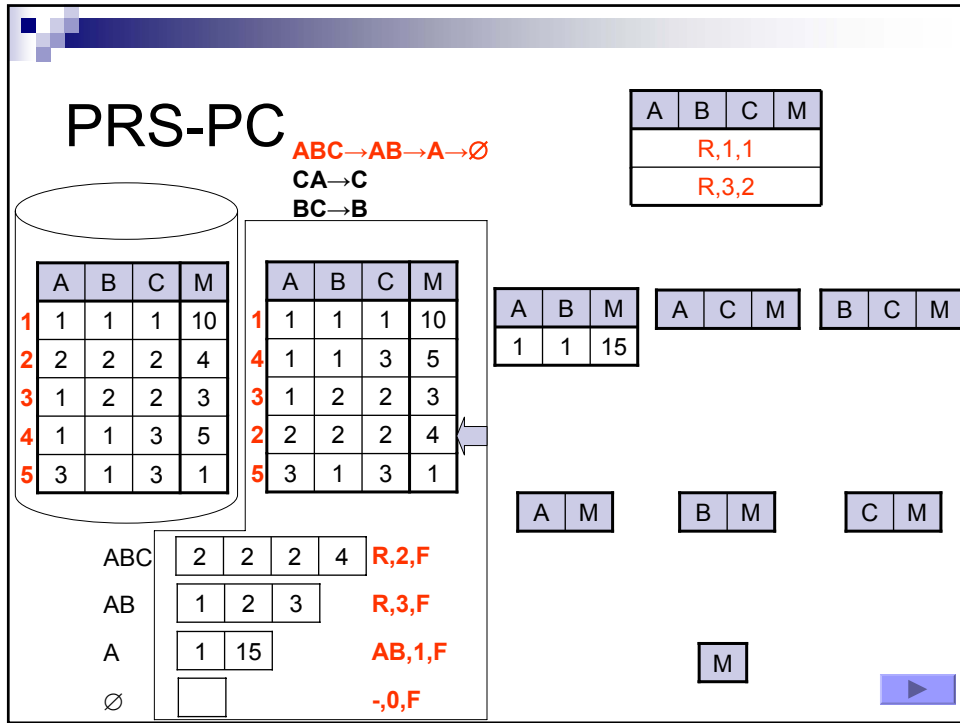
C	M

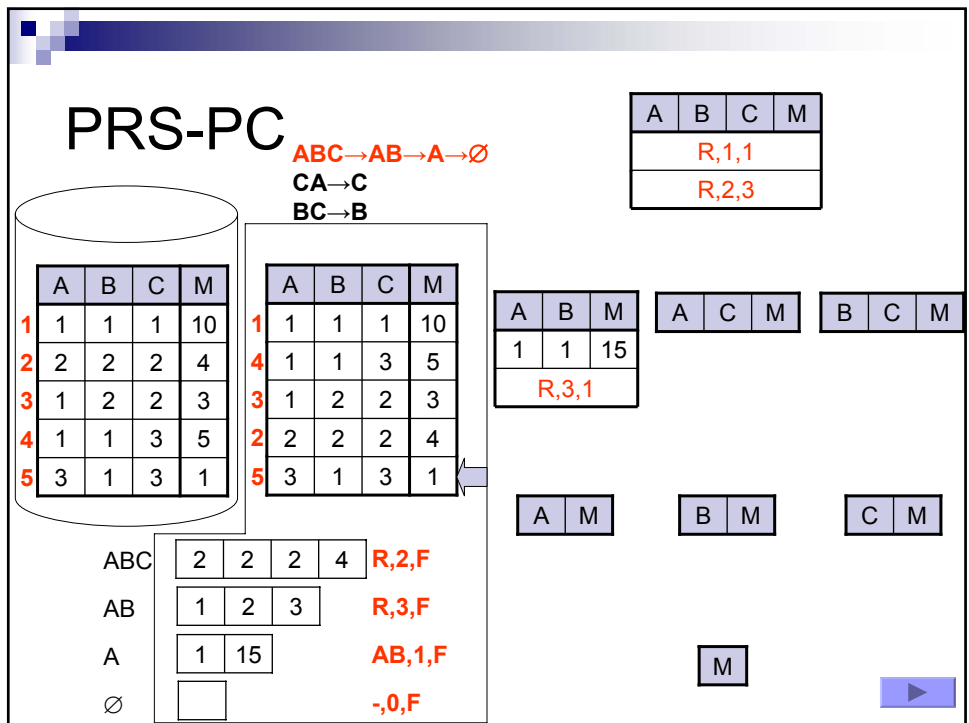
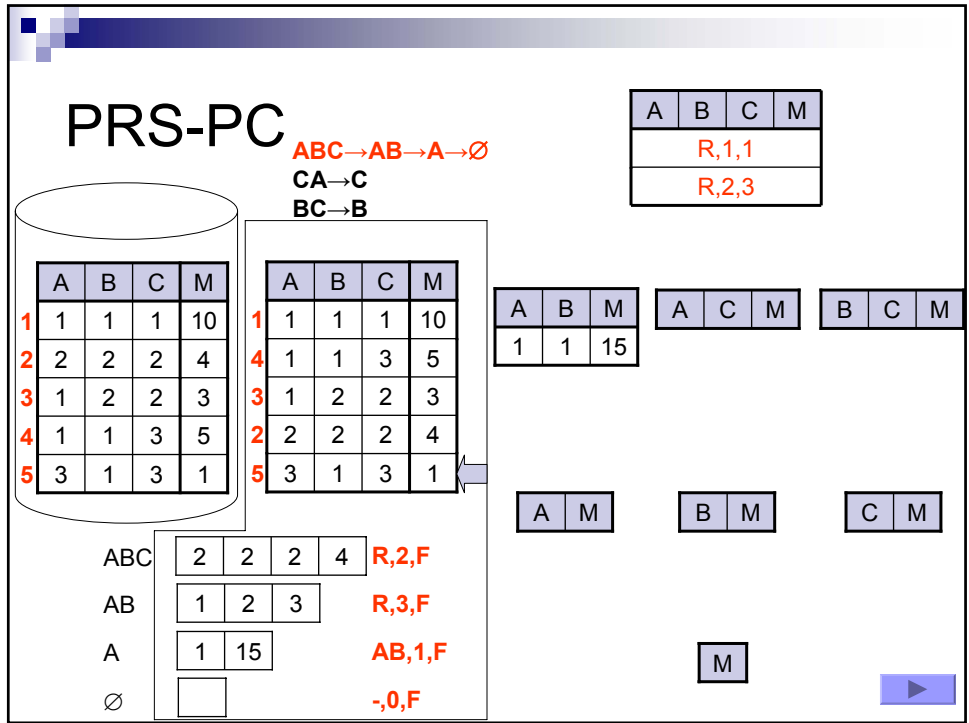
ABC	1	2	2	3	R,3,F
AB	1	1	15	AB,1,T	
A				-,0,F	
\emptyset				-,0,F	

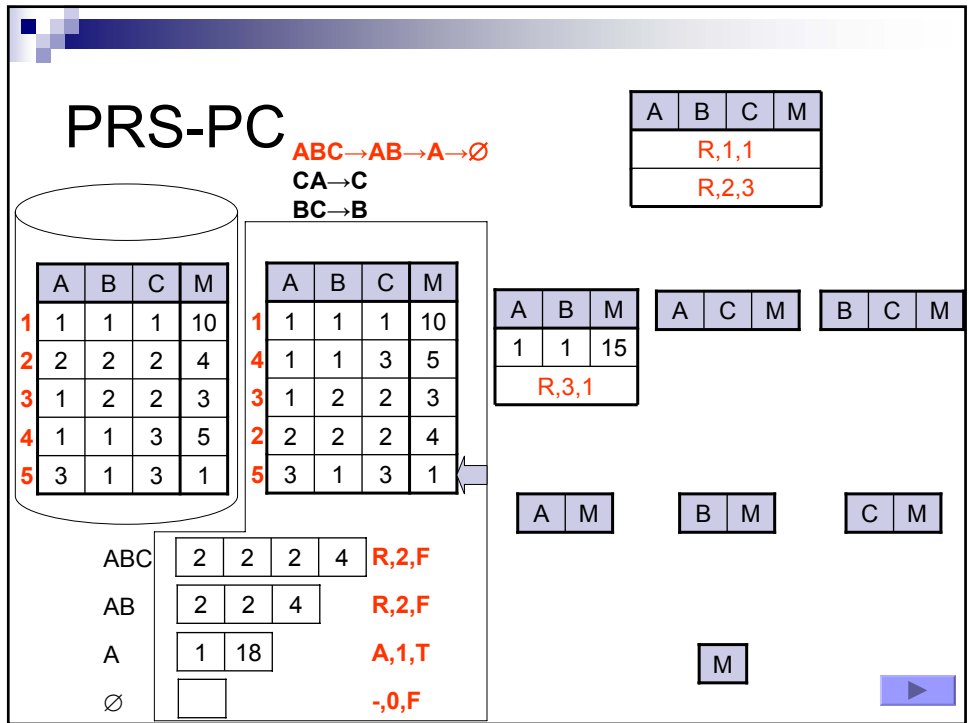
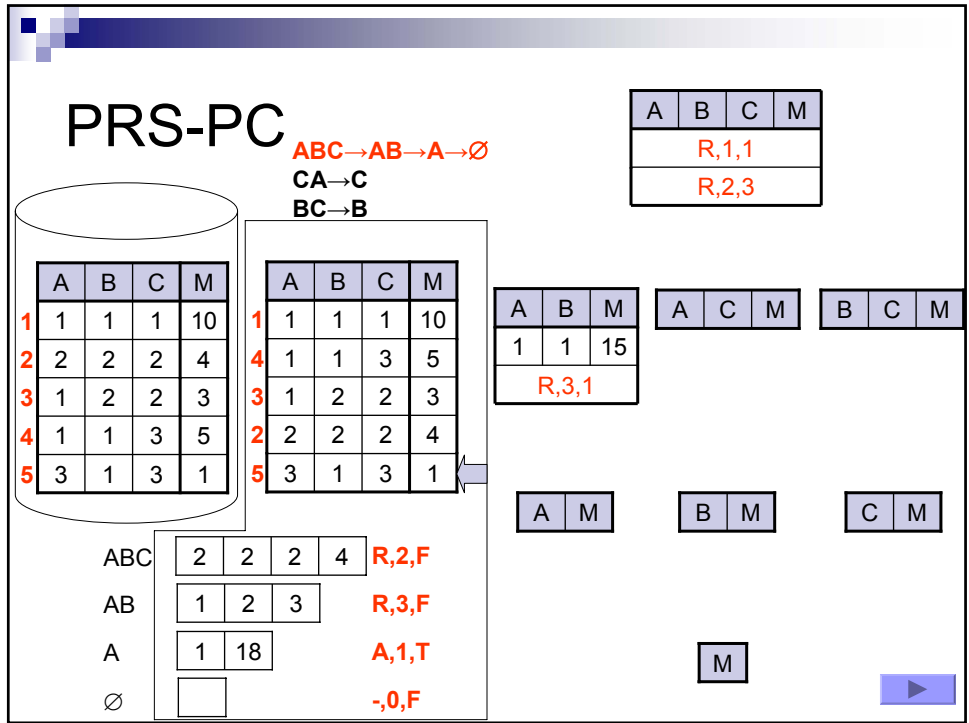
M

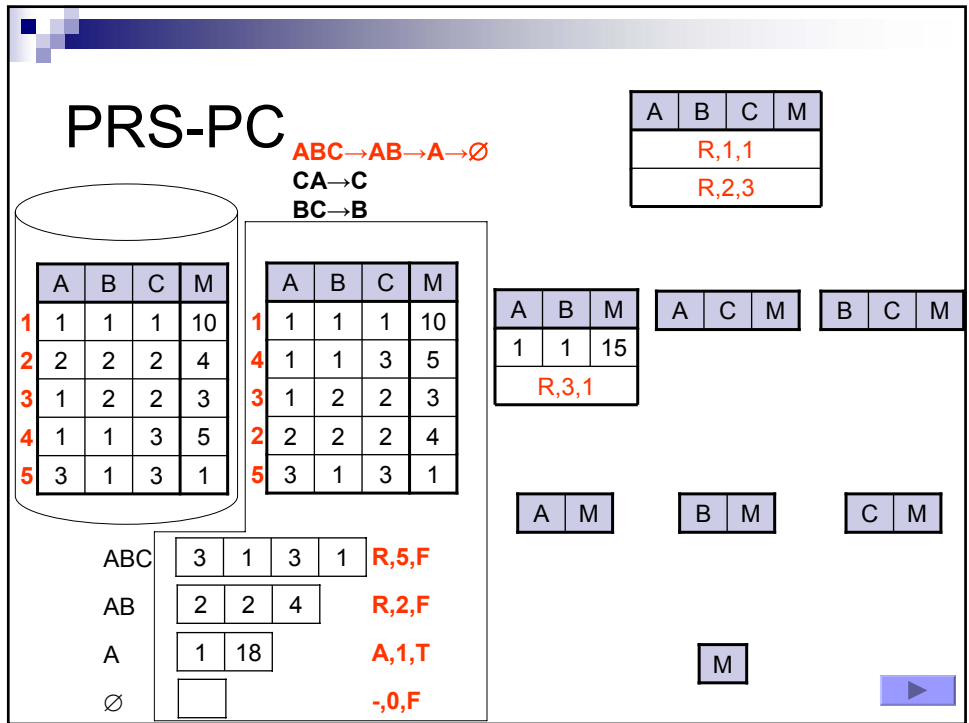
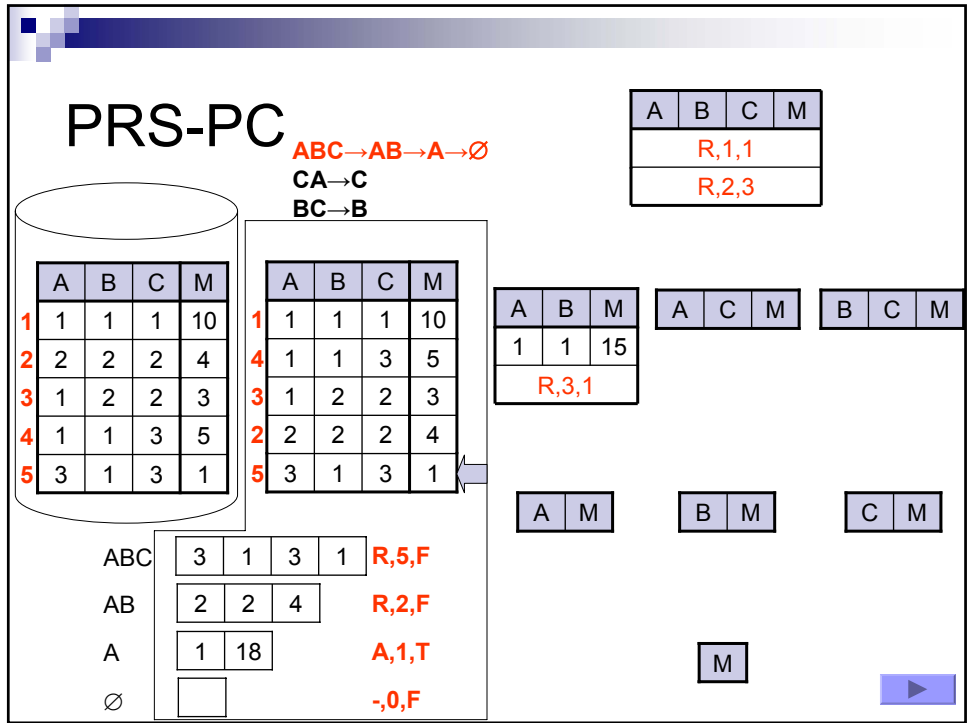
▶











PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

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

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

ABC	3	1	3	1
R,5,F				

AB	2	2	4
R,2,F			

A	1	18
A,1,T		

\emptyset	
-,0,F	

▶

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

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

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	M
1	1	15

A	C	M
---	---	---

B	C	M
---	---	---

ABC	3	1	3	1
R,5,F				

AB	2	2	4
R,2,F			

A	1	18
A,1,T		

\emptyset	
-,0,F	

▶

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M

ABC	3	1	3	1	R,5,F
AB	2	2	4	R,2,F	
A	1	18	A,1,T		
\emptyset			-0,F		

▶

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M

ABC	3	1	3	1	R,5,F
AB	2	2	4	R,2,F	
A	1	18	A,1,T		
\emptyset	18		A,1,F		

▶

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M

ABC	3	1	3	1	R,5,F
AB	2	2	4	R,2,F	
A	2	4	R,2,F		
\emptyset	18	A,1,F			

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18

B	M
---	---

C	M
---	---

M

ABC	3	1	3	1	R,5,F
AB	3	1	1	R,5,F	
A	2	4	R,2,F		
\emptyset	18	A,1,F			

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		

A	C	M
---	---	---

B	C	M
---	---	---


A	M
1	18

B	M
---	---

C	M
---	---

M

ABC -,0,F
 AB R,5,F
 A R,2,F
 \emptyset 18 A,1,F



PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	2
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		
R,5,1		

A	C	M
---	---	---

B	C	M
---	---	---


A	M
1	18

B	M
---	---

C	M
---	---

M

ABC -,0,F
 AB R,5,F
 A R,2,F
 \emptyset 18 A,1,F



PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		
R,5,1		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18
R,2,1	

B	M
---	---

C	M
---	---

M

ABC -,0,F
 AB R,5,F
 A R,2,F
 \emptyset 18 A,1,F

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		
R,5,1		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18
R,2,1	

B	M
---	---

C	M
---	---

M

ABC -,0,F
 AB R,5,F
 A R,2,F
 \emptyset 22 \emptyset ,1,T

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		
R,5,1		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18
R,2,1	

B	M
---	---

C	M
---	---

M

ABC -,0,F
 AB R,5,F
 A R,5,F
 \emptyset 22 \emptyset ,1,T

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

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

A	B	M
1	1	15
R,2,2		
R,5,1		

A	C	M
---	---	---

B	C	M
---	---	---

A	M
1	18
R,2,1	

B	M
---	---

C	M
---	---

M

ABC -,0,F
 AB -,0,F
 A R,5,F
 \emptyset 22 \emptyset ,1,T

PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	C	M
1	1	15	
R,2,2			
R,5,1			

A	C	M

B	C	M


A	M
1	18
R,2,1	
R,5,1	

B	M

C	M

M

ABC -,0,F
 AB -,0,F
 A 3 1 R,5,F
 \emptyset 22 \emptyset ,1,T



PRS-PC

$ABC \rightarrow AB \rightarrow A \rightarrow \emptyset$
 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	C	M
1	1	15	
R,2,2			
R,5,1			

A	C	M

B	C	M


A	M
1	18
R,2,1	
R,5,1	

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3	1	2	3
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3	1	2	2
2	2	2	2
5	3	1	3

A	B	C	M
1	1	15	
R,2,2			
R,5,1			

A	C	M

B	C	M

A	M
1	18
R,2,1	
R,5,1	

B	M

C	M

M

ABC -,0,F
 AB -,0,F
 A -,0,F
 \emptyset 23 $\emptyset,1,T$

PRS-PC

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 $CA \rightarrow C$
 $BC \rightarrow B$

A	B	C	M
1	1	1	10
2	2	2	4
3	1	2	3
4	1	1	3
5	3	1	3

A	B	C	M
1	1	1	10
4	1	1	3
3	1	2	2
2	2	2	2
5	3	1	3

A	B	C	M
1	1	15	
R,2,2			
R,5,1			

A	C	M

B	C	M

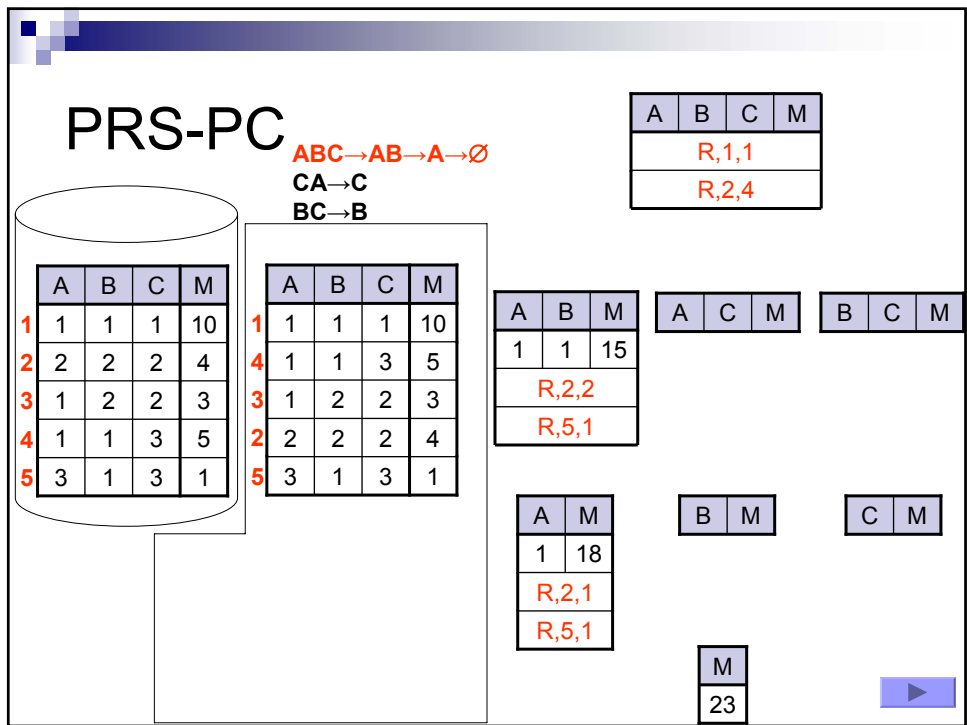
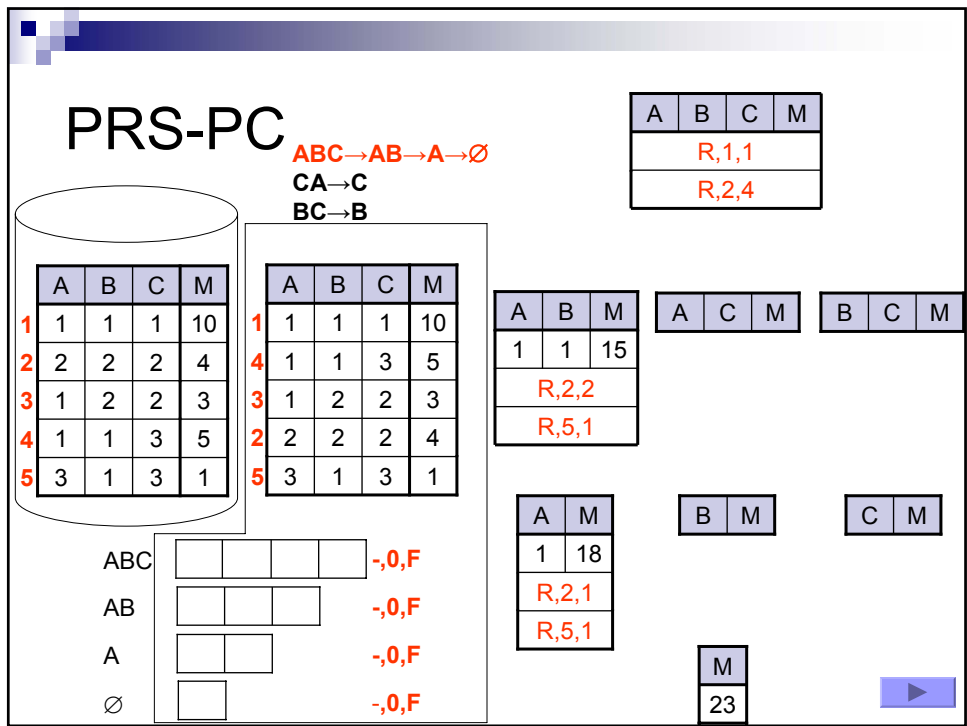
A	M
1	18
R,2,1	
R,5,1	

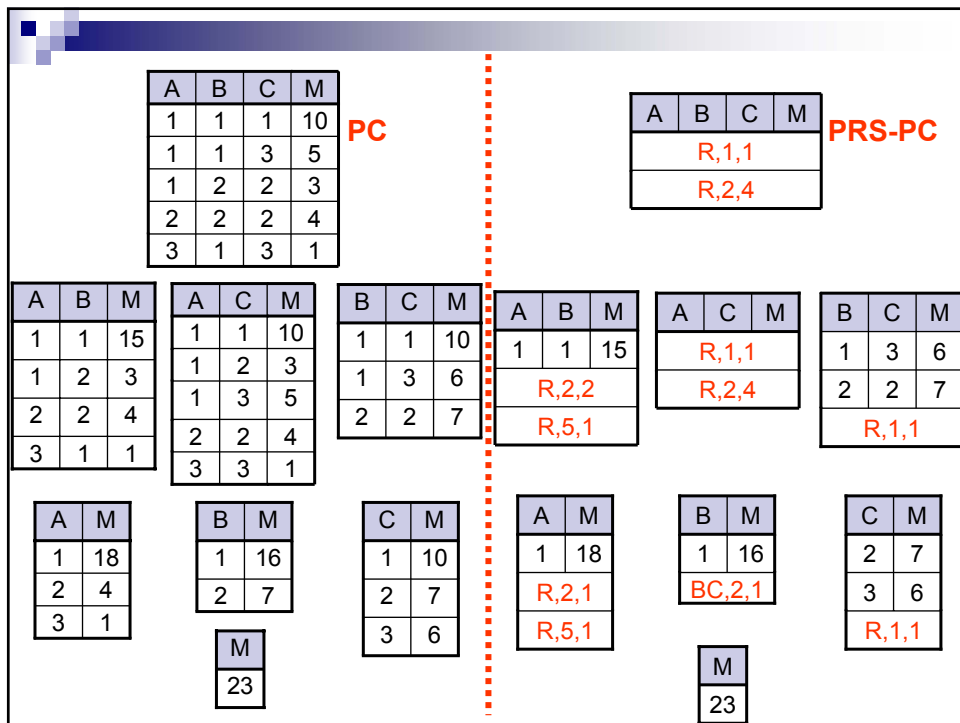
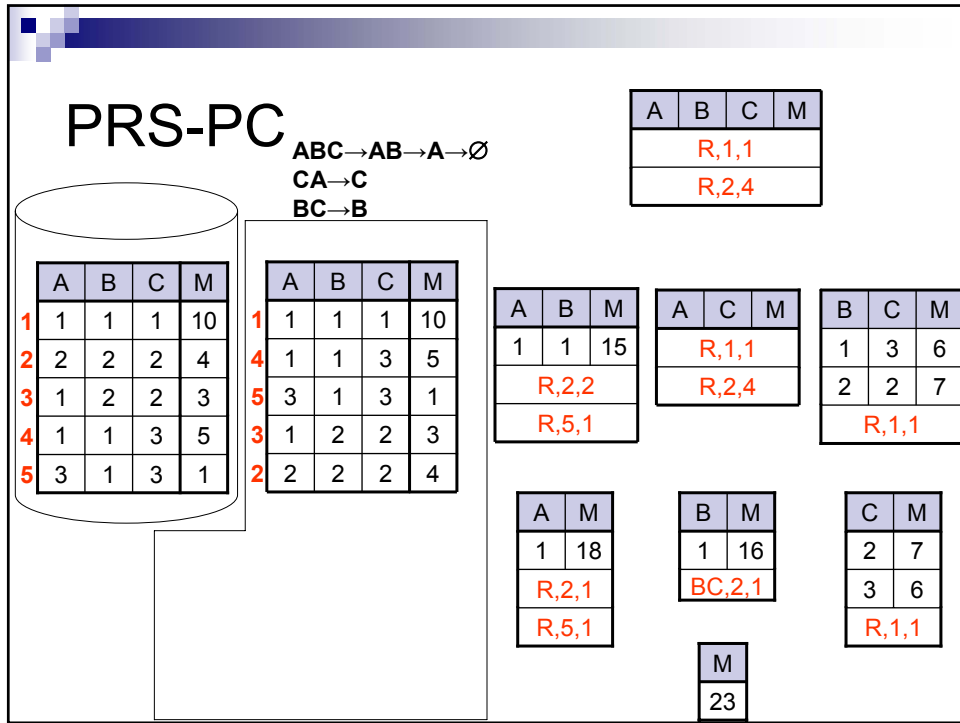
B	M

C	M

M
23

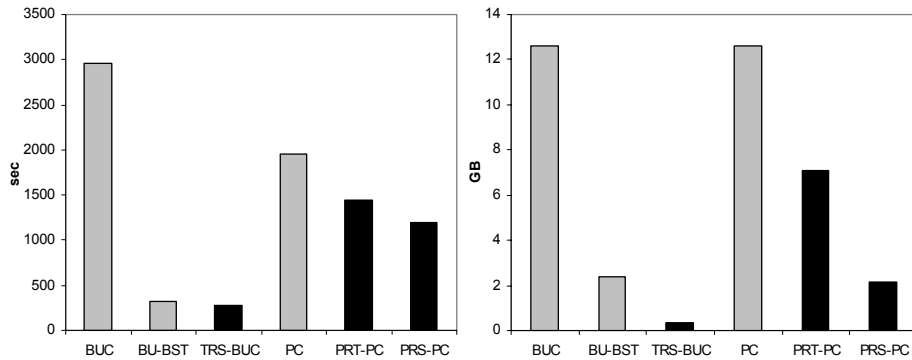
ABC -,0,F
 AB -,0,F
 A -,0,F
 \emptyset 23 $\emptyset,1,T$





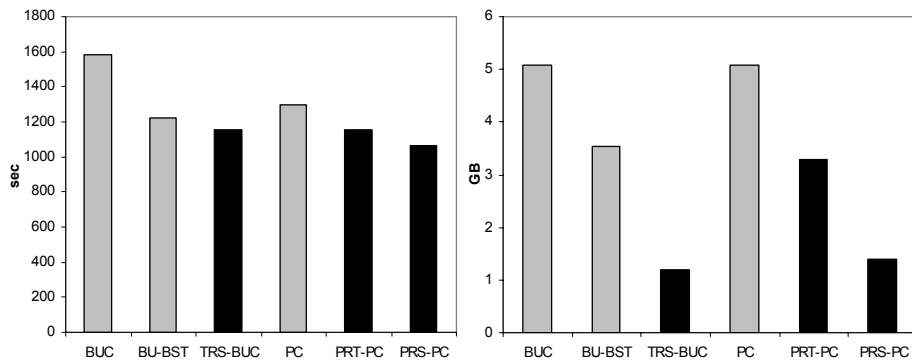
Κατασκευή και Αποθήκευση

CovType



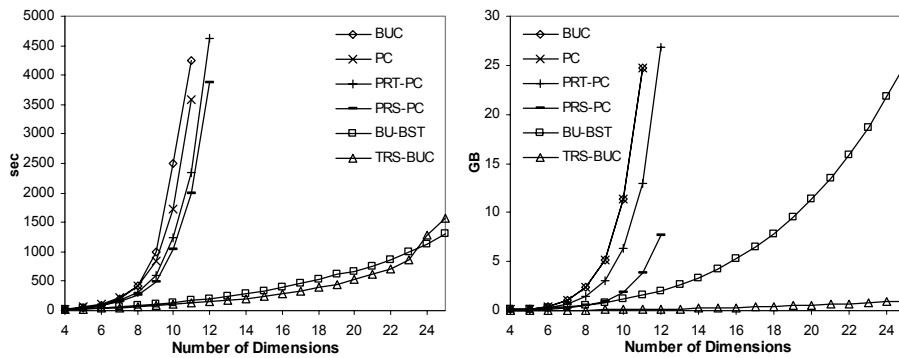
Κατασκευή και Αποθήκευση

SEP85L



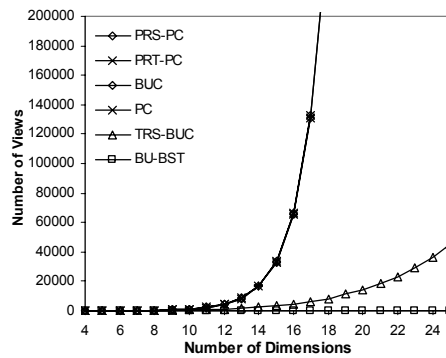
Κατασκευή και Αποθήκευση

$T=5 \times 10^5$, $Z=0.8$, $C=decr.$



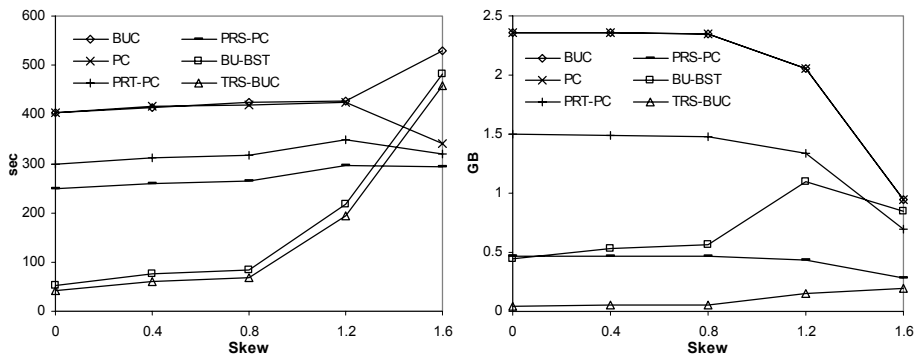
Κατασκευή και Αποθήκευση

$T=5 \times 10^5$, $Z=0.8$, $C=decr.$



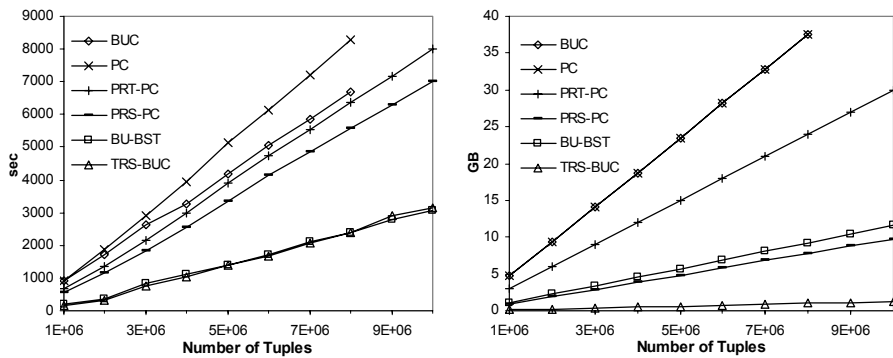
Κατασκευή και Αποθήκευση

$T=5 \times 10^5$, $D=8$, $C=decr.$



Κατασκευή και Αποθήκευση

$D=8$, $Z=0.8$, $C=decr.$



Απάντηση ερωτήσεων

- Εξαρτάται άμεσα από τη μορφή του κύβου
 - Πλεονασμός
 - Ευρετηρίαση
 - Χρήση ενδιάμεσης μνήμης

BUC/PC

A	B	C	M
1	1	1	10
1	1	3	5
1	2	2	3
2	2	2	4
3	1	3	1

A	B	M
1	1	15
1	2	3
2	2	4
3	1	1

A	C	M
1	1	10
1	2	3
1	3	5
2	2	4
3	3	1

B	C	M
1	1	10
1	3	6
2	2	7

A	M
1	18
2	4
3	1

B	M
1	16
2	7

C	M
1	10
2	7
3	6

M
23

TRS-BUC

A	B	C	M
		1,1	
		4,1	

A	B	M
1	1	15
		3,1

A	C	M
		1,1
		3,2

B	C	M
1	3	6
2	2	7
		1,1

A	M
1	18
	2,1
	5,1

B	M
1	16
2	7

C	M
2	7
3	6
	1,1

M
23

PRS-PC

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

A	B	M
1	1	15
		R,2,2
		R,5,1

A	C	M
		R,1,1
		R,2,4

B	C	M
1	3	6
2	2	7
		R,1,1

A	M
1	18
	R,2,1
	R,5,1

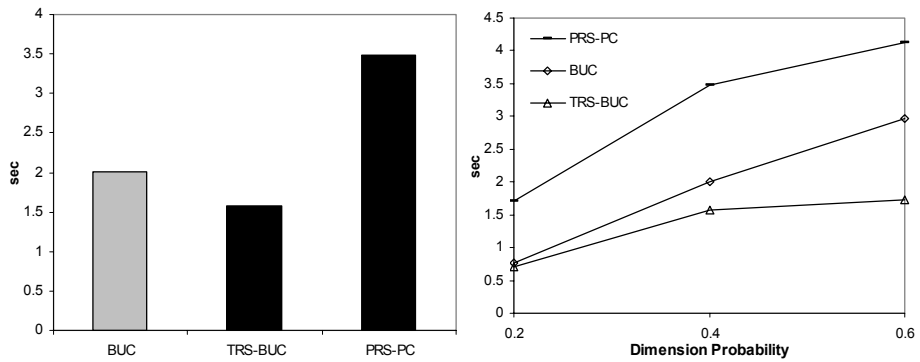
B	M
1	16
	BC,2,1

C	M
2	7
3	6
	R,1,1

M
23

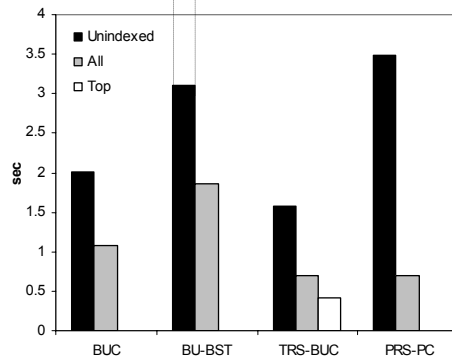
Απάντηση ερωτήσεων

CovType



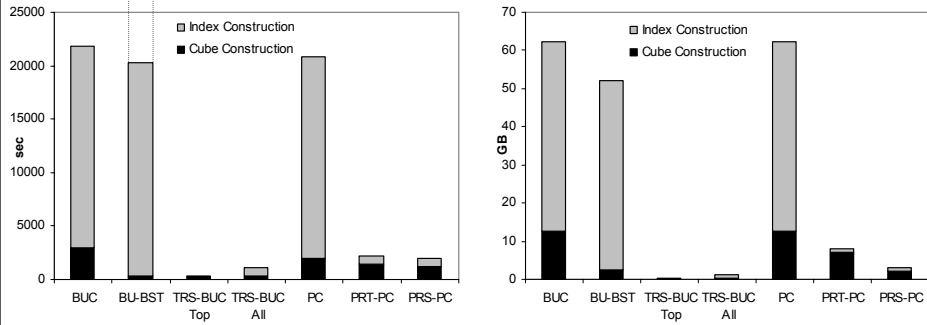
Απάντηση ερωτήσεων

CovType



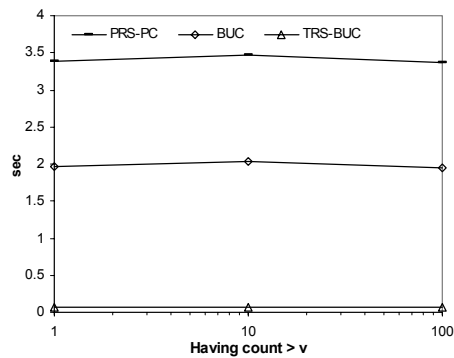
Απάντηση ερωτήσεων

CovType



Απάντηση ερωτήσεων

CovType

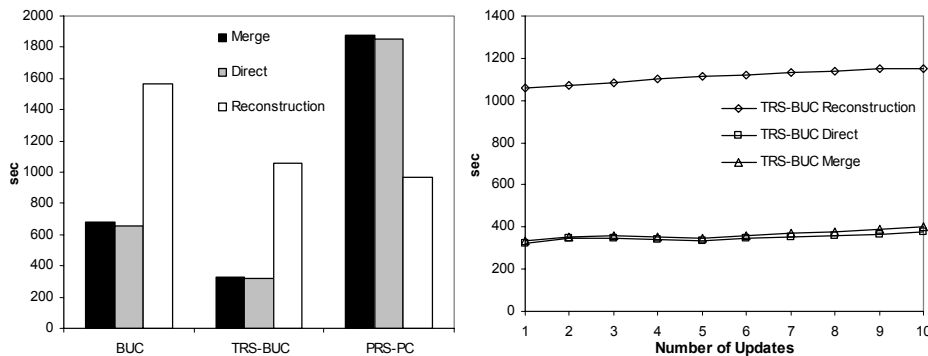


Ενημέρωση

- Εξαρτάται άμεσα από τη μορφή του κύβου
- Τρεις τεχνικές:
 - Ενημέρωση με συγχώνευση
 - Άμεση ενημέρωση
 - Πλήρης ανακατασκευή

Ενημέρωση

SEP85L (delta size = 1%)



Συμπεράσματα και μελλοντική εργασία

- Παρουσιάσαμε την πρώτη **οικογένεια** **σχεσιακών μεθόδων** που υλοποιεί αποδοτικά **όλες** τις φάσεις του κύκλου ζωής του κύβου δεδομένων
- Νέοι στόχοι:
 - Σύγκριση με υλοποιήσεις που χρησιμοποιούν δένδρικές δομές
 - Ενσωμάτωση ιεραρχιών

Ερωτήσεις

