Loss less decomposition

- Generally the original relation is recovered by forming the natural join of the new relations.
- If we can recover the original relation , we say that the decomposition is lossless
- If the relation can not be recovered we say that the decomposition is lossy

Example

Admn No	Name	Email
MDL18CS0030	Arjun	As@mec.ac.in
MDL18CS0031	Arjun	Ap@mec.ac.in
MDL18CS0084	NIKHIL	N@mec.ac.in
MDL18CS0037	Bharath M	B@mec.ac.in

AdmnNo→Name
Email→Name

Admn No	Name	Email
MDL18CS0030	Arjun	As@mec.ac.in
MDL18CS0031	Arjun	Ap@mec.ac.in
MDL18CS0084	NIKHIL	N@mec.ac.in
MDL18CS0037	Bharath M	B@mec.ac.in

AdmnNo→Name
Email→Name

R1

Admn No	Name
MDL18CS0030	Arjun
MDL18CS0031	Arjun
MDL18CS0084	NIKHIL
MDL18CS037	Bharath M

R2

Name	Email
Arjun	As@mec.ac.in
Arjun	Ap@mec.ac.in
NIKHIL	N@mec.ac.in
Bharath M	B@mec.ac.in

AdmnNo→Name
Email→Name

R1

Admn No	Name
MDL18CS0030	Arjun
MDL18CS0031	Arjun
MDL18CS0084	NIKHIL
MDL18CS037	Bharath M

R2

Name	Email
Arjun	As@mec.ac.in
Arjun	Ap@mec.ac.in
NIKHIL	N@mec.ac.in
Bharath M	B@mec.ac.in

R1 * R2

Admn No	Name	Email
MDL18CS0030	Arjun	As@mec.ac.in
MDL18CS0030	Arjun	Ap@mec.ac.in
MDL18CS0031	Arjun	As@mec.ac.in
MDL18CS0031	Arjun	Ap@mec.ac.in
MDL18CS0084	NIKHIL	N@mec.ac.in
MDL18CS037	Bharath M	B@mec.ac.in

Additional tuples that were not in the relation is called Spurious tuples

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- Consider the relation R(X,Y,Z,W,Q) and F={X→Z,Y→Z,Z→W,WQ→Z,ZQ→X}and the decomposition of R into relations R1(X,W),R2(X,Y),R3(Y,Q),R4(Z,W,Q) AND R5(X,Q) using the lossless join algorithm determine if the decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1					
R2					
R3					
R4					
R5					

R1(X,W)

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1			a4	
R2					
R3					
R4					
R5					

R1(X,W), R2(X,Y)

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1			a4	
R2	a1	a2			
R3					
R4					
R5					

R1(X,W),R2(X,Y),R3(Y,Q),R4(Z,W,Q) AND R5(X,Q)

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1			a4	
R2	a1	a2			
R3		a2			a5
R4			a3	a4	a5
R5	a1				a5

R1(X,W),R2(X,Y),R3(Y,Q),R4(Z,W,Q) AND R5(X,Q)

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b23	b24	b25
R3	b31	a2	b32	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b53	b54	a5

X→Z

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b23	b24	b25
R3	b31	a2	b32	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b53	b54	a5

X→Z

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	b24	b25
R3	b31	a2	b32	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	b54	a5

$Y \rightarrow Z$

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	b24	b25
R3	b31	a2	b32	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	b54	a5

Y→Z

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	b24	b25
R3	b31	a2	b13	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	b54	a5

Y→Z

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	b24	b25
R3	b31	a2	b13	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	b54	a5

Z→W

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	b24	b25
R3	b31	a2	b13	b34	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	b54	a5

Z→W

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	B12	b13	a4	b15
R2	a1	a2	b13	a4	b25
R3	b31	a2	b13	a4	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	a4	a5

WQ→Z

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	a4	b25
R3	b31	a2	b13	a4	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	b13	a4	a5

WQ→Z

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	a4	b25
R3	b31	a2	a3	a4	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	a3	a4	a5

ZQ → X

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	a4	b25
R3	b31	a2	a3	a4	a5
R4	b41	b42	a3	a4	a5
R5	a1	b52	a3	a4	a5

ZQ→X

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	a4	b25
R3	a1	a2	a3	a4	a5
A1	a1	b42	a3	a4	a5
R5	a1	b52	a3	a4	a5

Since the row r3 contain a1a2a3a4a5 . So the decomposition is lossless

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	b12	b13	a4	b15
R2	a1	a2	b13	a4	b25
R3	a1	a2	a3	a4	a5
A1	a1	b42	a3	a4	a5
R5	a1	b52	a3	a4	a5

Consider the relation R(X,Y,Z) and its decomposition R1(X,Y) and R2(Y,Z).Assume that X→Y and Z→Y.Use lossless join algorithm to determine if this decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)
R1			
R2			

Consider the relation R(X,Y,Z) and its decomposition R1(X,Y) and R2(Y,Z).Assume that X→Y and Z→Y.Use lossless join algorithm to determine if this decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)
R1	a1	a2	
R2			

Consider the relation R(X,Y,Z) and its decomposition R1(X,Y) and R2(Y,Z).Assume that X→Y and Z→Y.Use lossless join algorithm to determine if this decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)
R1	a1	a2	
R2		a2	a3

Consider the relation R(X,Y,Z) and its decomposition R1(X,Y) and R2(Y,Z).Assume that X→Y and Z→Y.Use lossless join algorithm to determine if this decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)
R1	a1	a2	b13
R2	b21	a2	a3

Consider the relation R(X,Y,Z) and its decomposition R1(X,Y) and R2(Y,Z).Assume that X→Y and Z→Y.Use lossless join algorithm to determine if this decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)
R1	a1	a2	b13
R2	b21	a2	a3

Consider the relation R(X,Y,Z) and its decomposition R1(X,Y) and R2(Y,Z).Assume that X→Y and Z→Y.Use lossless join algorithm to determine if this decomposition is lossless or lossy

	X(A1)	Y(A2)	Z(A3)
R1	a1	a2	b13
R2	b21	a2	a3

- Since there is no row in the table that has all ai’s in its entries, the decomposition is lossy.

R(X,Y,Z,W,Q) and F={X→Y,XZ→W,YW→Q} . Check whether the decomposition R1(X,Y),R2(X,Z,W),R3(Y,W,Q) is lossless or not

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2			
R2	a1		a3	a4	
R3		a2		a4	a5

R(X,Y,Z,W,Q) and F={X→Y,XZ→W,YW→Q} . Check whether the decomposition R1(X,Y),R2(X,Z,W),R3(Y,W,Q) is lossless or not

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	b12	a3	a4	b25
R3	b31	a2	b33	a4	a5

X→Y

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	b12	a3	a4	b25
R3	b31	a2	b33	a4	a5

X→Y

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	a2	a3	a4	b25
R3	b31	a2	b33	a4	a5

$XZ \rightarrow W$

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	a2	a3	a4	b25
R3	b31	a2	b33	a4	a5

YW$\rightarrow$Q

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	a2	a3	a4	b25
R3	b31	a2	b33	a4	a5

YW→Q

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	a2	a3	a4	a5
R3	b31	a2	b33	a4	a5

Lossless

	X(A1)	Y(A2)	Z(A3)	W(A4)	Q(A5)
R1	a1	a2	b13	b14	b15
R2	a1	a2	a3	a4	a5
R3	b31	a2	b33	a4	a5

Comparison 3NF and BCNF

BASIS FOR COMPARISON	3NF	BCNF
Concept	No non-prime attribute must be transitively dependent on the Candidate key.	For any trivial dependency in a relation R say X->Y, X should be a super key of relation R.
Dependency	3NF can be obtained without sacrificing all dependencies.	Dependencies may not be preserved in BCNF.
Decomposition	Lossless decomposition can be achieved in 3NF.	Lossless decomposition is hard to achieve in BCNF.

Canonical cover

- Every FD should be simple.The right side of every functional dependency has only one attribute.
- It is left reduced
- It is non redundant.

Canonical cover

- E : {B → A, D → A, AB → D}
- Here all FDs are simple
- 2nd Comdition Left reduced???
- Consider AB→ D
- First remove B from it and check if it is redundant or not
- F={B→A,D→A, A→D}
- {A}+={AD} since B⊄ {A}+ . B is not redundant in AB→D
- Now check A is redundant or not?
- F={B→A,D→A, B→D}

{B}+={BAD}

So New F={B→A,D→A,B→D}

F={B→A,D→A,B→D}

- Third condition non redundant???
- Check B→A
- F={D→A,B→D}
- B→A is redundant
- New F={D→A,B→D}
- Is there any other redundant FD????????

- No
- Canonical cover is $F = \{D \rightarrow A, B \rightarrow D\}$

Given the set F={X→Z,XY→WP,XY→ZWQ,XZ->R} .Find canonical cover

- Simple FDs

- Left reduced FD
- $X \rightarrow Z$
- $XY \rightarrow W$
- $XY \rightarrow P$
- $XY \rightarrow Q$
- $XZ \rightarrow R$

- Canonical Cover
- $X \rightarrow Z$
- $XY \rightarrow W$
- $XY \rightarrow P$
- $XY \rightarrow Q$
- $XZ \rightarrow R$

- R(<u>A</u>,B,C,D) with
- F={ A$\rightarrow$B, D$\rightarrow$D}