CSC343 Worksheet 13 Solution

July 4, 2020

1. a)

A	B	C	D	E
a	b	c	d_1	e_1
a_1	b	c	d_1	e_2
a	b_1	c	d_1	e

Step 1 ($B \to E$):

A	B	C	D	E
a	b	c	d_1	e_1
a_1	b	c	d_1	e_1
a	b_1	c	d_1	e

Step 2 ($CE \to A$):

A	B	C	D	E
a	b	c	d_1	e_1
a	b	c	d_1	e_1
a	b_1	c	d_1	e

So in this case, an example of an instance of R that is not lossless is:

Title	Studio Name	President	Year	President Address
Toy Story	Pixar	Steve Jobs	2000	123 ABC Street
Star Wars	Fox	Lachlan Murdoch	1977	Hollywood
Return of the Jedi	Fox	Lachlan Murdoch	1983	Hollywood

- $S_1 = \{A, B, C\}$

Title	Year	Studio Name
Toy Story	2000	Pixar
Star Wars	1977	Fox
Return of the Jedi	1983	Fox

- $S_2 = \{C, D, E\}$

Studio Name	President	President Address
Pixar	Steve Jobs	123 ABC Street
Fox	Lachlan Murdoch	Hollywood
Fox	Lachlan Murdoch	Hollywood

- $S_3 = \{C, E, A\}$

Title	Studio Name	President Address
Toy Story	Pixar	123 ABC Street
Star Wars	Fox	Hollywood
Return of the Jedi	Fox	Hollywood

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Notes:

- Decomposition: The good bad and ugly
  1) **Elimination of Anomalies** by decomposition as in Section 3
  2) **Recoverability of Information** Can we recover the original relation from the tuples in its decomposition?
  3) **Preservation of Dependences (lossless join):** Can we be sure that after reconstructing the original relation from the decompositions, the original FD's satisfy?

  BCNF: $\rightarrow$ satisfies 1) and 2) Not good. NONO
- The Chase Test for Lossless Join
  - Tests whether the decomposition is lossless

  Input:
  - A relation R
  - A decomposition of R
  - A set of functional dependencies

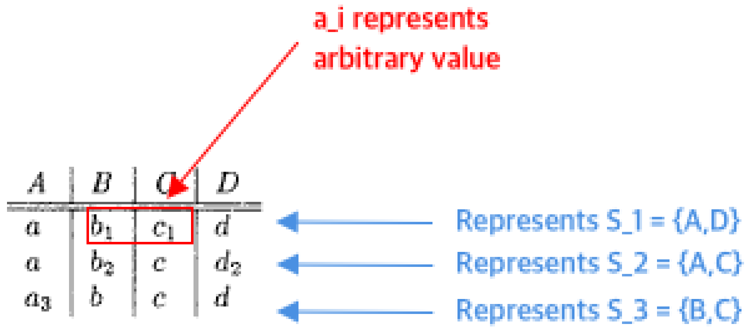
  Output:
  - Whether the decomposition is loseless or not
  - $\Pi_{S_1}(R) \bowtie \Pi_{S_2}(R) \bowtie \cdots \Pi_{S_i}(R) = R$

  Three things to remember:
  1. The natural join is associate and commutative
  2. Any tuple t in R is surely in $\pi_{S_1}(R) \bowtie \pi_{S_2}(R) \bowtie \cdots \bowtie \pi_{S_k}(R)$.
  3. We have to check to see any tuple in the $\pi_{S_1}(R) \bowtie \pi_{S_2}(R) \bowtie \cdots \bowtie \pi_{S_k}(R)$.

Example:

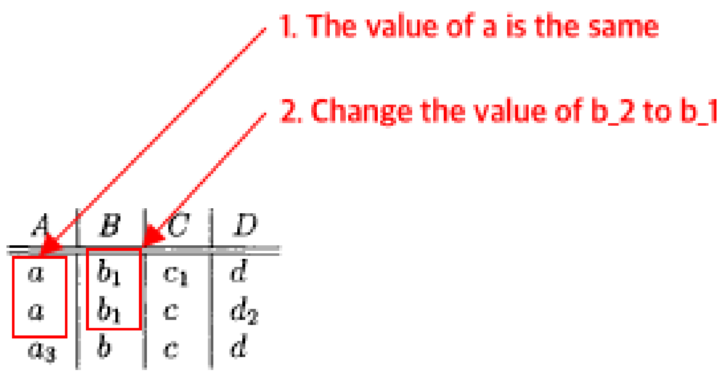
$S_1 = \{A, D\}$, $S_2 = \{B, C\}$, $S_3 = \{A, C\}$

$A \rightarrow B$, $B \rightarrow C$, $CD \rightarrow A$



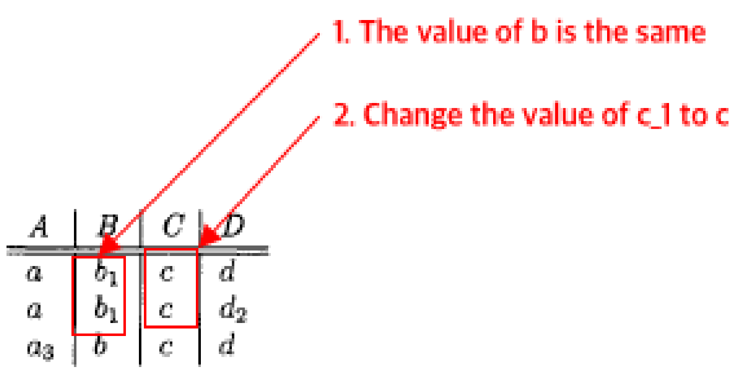
Step 1: $A \rightarrow B$

Set the value b with the same value of a to be the same. (e.g. $b_2 \rightarrow b_1$)



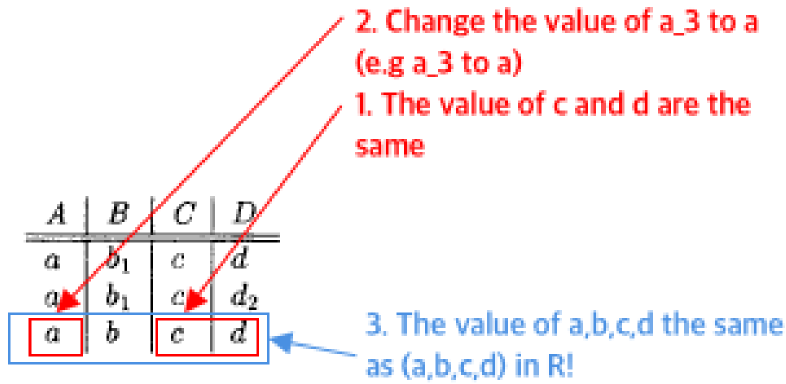
Step 2: $B \rightarrow C$

Set the value c with the same value of b to be the same. (e.g. $b_2 \rightarrow b_1$)



Step 3: $CD \rightarrow A$

Set the value a with the same value of c and d to be the same. (e.g. $a_3 \rightarrow a$)



So, we can conclude the join is lossless.