

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 ($B \rightarrow E$):

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

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 Dependencies (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
- $\Pi_{S_1}(R) \bowtie \Pi_{S_2}(R) \bowtie \cdots \Pi_{S_k}(R) = R$

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:

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

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

A	B	C	D
a	b ₁	c ₁	d
a	b ₂	c	d ₂
a ₃	b	c	d

a_i represents arbitrary value

Represents S₁ = {A,D}

Represents S₂ = {B,C}

Represents S₃ = {A,C}

Step 1: $A \rightarrow B$

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

A	B	C	D
a	b ₁	c ₁	d
a	b ₁	c	d ₂
a ₃	b	c	d

1. The value of a is the same

2. Change the value of b₂ to b₁

Step 2: $B \rightarrow C$

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

1. The value of b is the same

2. Change the value of c_1 to c

A	B	C	D
a	b_1	c	d
a	b_1	c	d_2
a_3	b	c	d

Step 3: $CD \rightarrow A$

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

2. Change the value of a_3 to a (e.g. a_3 to a)

1. The value of c and d are the same

3. The value of a, b, c, d the same as (a, b, c, d) in R !

A	B	C	D
a	b_1	c	d
a	b_1	c	d_2
a	b	c	d

So, we can conclude the join is lossless.