REDUNDANCY ✗

1) REDUNDANCY STORAGE ✓

2) UPDATE ANOMALIES ✓ INCONSISTANCY

FIRST NORMAL FORM

ATOMIC

3) INSERTION ANOMALIES

NAME ✓

ROLL NO. – STRING

CS101

↓

↳ (! – ? –)

4). DELETION ANOMALIES

(? / BRANCH) – L-15 / delete

NULL

Q:

DECOMPOSITION

1). LOSSLESS - JOIN ✓

2). DEPENDENCY - PRESERVATION.

A	B	C
a_1	b_1	c_1
a_2	b_2	c_2
a_3	b_1	c_3

r

A	B
a_1	b_1
a_2	b_2
a_3	b_1

$r_1 = \Pi_{AB}(r)$

B	C
b_1	c_1
b_2	c_2
b_1	c_3

$r_2 = \Pi_{BC}(r)$

$R = (A, B, C)$

$R_1 = (A, B)$

$R_2 = (B, C)$

$r \neq r_1 \bowtie r_2$ ⟹

A	B	C
a_1	b_1	c_1
a_1	b_1	c_3

$\Pi_{ABC}(\sigma_{r_1.B = r_2.B}(r_1 \times r_2))$

FUNCTIONAL DEPENDENCIES:

R, $\alpha \subseteq R$, $\beta \subseteq R$

FD $\alpha \rightarrow \beta$ holds on R

$t_1, t_2 \in r$

$$t_1[\alpha] = t_2[\alpha] \Rightarrow t_1[\beta] = t_2[\beta]$$

	A	B
t_1	1	4
t_2	1	5
t_3	3	7

$R = (A, B)$

$A \subseteq R$, $B \subseteq R$

$A \rightarrow B$ FD? X

$t_1[A] = t_2[A] \Rightarrow \underline{t_1[B] = t_2[B]}$

$4 \neq 5$

$B \rightarrow A$ FD? ✓

$t_1[B]$, $t_2[B]$, $t_3[B]$

$R = (A, B, C, D)$

	A	B	C	D
t_1	a_1	b_1	c_1	d_1
t_2	a_1	b_1	c_1	d_2
t_3	a_1	b_2	c_2	d_1
t_4	a_2	b_1	c_3	d_1

r

$AB \to C$ FD ? ✓

$t_1[AB] = t_2[AB]$

$\Rightarrow t_1[C] \stackrel{?}{=} t_2[C]$

$A \to D$ FD ? ✗ $d_1 \stackrel{?}{\neq} d_2$

$t_1[A] = t_2[A] \Rightarrow t_1[D] \stackrel{?}{=} t_2[D]$

$t_1[A] = t_3[A] \Rightarrow t_1[D] \stackrel{?}{=} t_3[D]$

$t_2[A] = t_3[A] \Rightarrow t_2[D] \stackrel{?}{=} t_3[D]$

$A \to CD$ FD ? ✗

$t_1[A] = t_2[A] \not\Rightarrow t_1[CD] = t_2[CD]$

SUPERKEY :

$r(R)$

$K \subseteq R$ if,

$t_1, t_2 \in r$

$t_1 \neq t_2$ then $t_1[K] \neq t_2[K]$

> K value uniquely identify a tuple in r

	A	B	C
t_1	a_1	b_1	c_1
t_2	a_2	b_2	c_1
t_3	a_1	b_1	c_2

$K \rightarrow R$

$AB \rightarrow ABC$ FD ? ✗

$t_1[K] = t_3[K]$

$\not\Rightarrow t_1[R] = t_3[R]$

$R = (A, B, C)$

$K = AB \subseteq R$

K is super key if,

FD $K \rightarrow R$ holds on $r(R)$

i.e., $t_1[K] = t_2[K] \Rightarrow t_1[R] = t_2[R]$

for any $t_1, t_2 \in r$.

Candidate key

1) $K \rightarrow R$ holds

2) For no $\alpha \subset K$,

$\alpha \rightarrow R$ holds.