

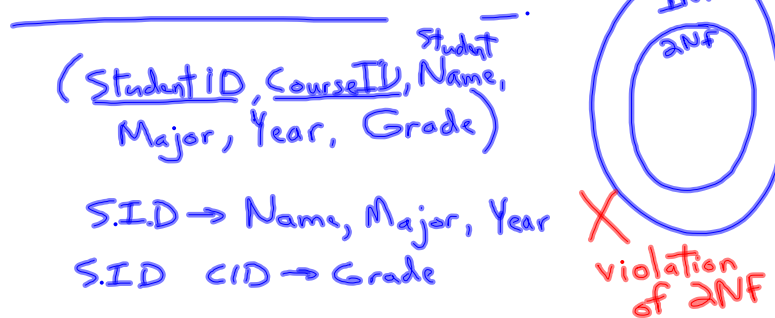
Functional Dependencies

$$A \rightarrow B$$

1NF - def. of Relation

2NF - every non-prime attrib
is fully functionally dep.
on some candidate key

$$R(\underline{A}, \underline{B}, C, D)$$
$$AB \rightarrow CD$$
$$B \rightarrow C \quad X$$



Decompose:

$$R_1(\underline{S.I.D.}, \text{Name, Major, Year})$$
$$R_2(\underline{S.I.D.}, \underline{C.I.D.}, \text{Grade})$$
$$R = R_1 \times R_2$$

Incorrect Decomposition

$$R_1(\underline{S.I.D.}, \text{Name, Major, Year})$$
$$R_2(\underline{C.I.D.}, \text{Grade})$$
$$R_3(\underline{S.I.D.}, \underline{C.I.D.})$$

spurious tuples

$$R_1$$

1, Bob, CS, 2011
2, Sue, CS, 2012

$$R_3$$

1, CS360
2, CS360

$$R_2$$

CS360, B
CS360, A

Trivial FD $A \rightarrow A$

(custID, Name, SalesRep, Region)

✓ $\text{custID} \rightarrow \text{Name, SalesRep, Region}$
 $\text{SalesRep} \rightarrow \text{Region}$ X 3NF
✓ $\text{custID} \rightarrow \text{Region}$ violation

3NF any non-trivial FD $X \rightarrow A$
either:

- a) X is a superkey of R
- b) A is a prime attribute

Decompose:

$R_1(\text{SalesRep}, \text{Region})$
 $R_2(\text{SalesRep}, \text{custID}, \text{name})$



$R(\underline{A}, \underline{B}, C, D, E)$

$A, B \rightarrow C, D, E$
 $C, D \rightarrow A, B, E$
 $E \rightarrow C$

BCNF: Boyce-Codd Normal Form
 every non-trivial FD of R
 $X \rightarrow A$, X is a superkey of R

(SID, CourseName, Grade, Room, Day, Time)

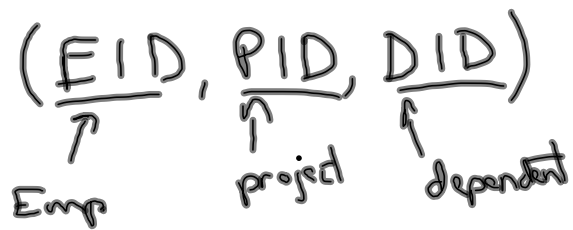
✓ SID, CourseName \rightarrow Grade, Room, Day, Time
 violate BCNF X Room, day, time \rightarrow CourseName

R1 (Room, day, time, courseName)

R2 (Room, day, time, SID, Grade)

(SID, CID, grade, rm, day, time, cName, section)

2NF violation CID \rightarrow rm, day, time, cName, section
 BCNF violation rm; day, time \rightarrow CID, cName, section



Multivalued Dep. $v \rightarrow t \rightarrow e1$

EID	PID	DID
e1	p1	d2
u	e1	p2
		d2
e1	p1	d1
e1	p2	d1

$EID \twoheadrightarrow PID$
 $EID \twoheadrightarrow DID$



for every pair of tuples $t, u \in R$
 we can find $v \in R$

1. v agrees w/ t, u on the values of A
2. v agrees w/ t on the B attrib.s
3. v agrees w/ u on the C attrib.s.