

## 1NF

## (NORMAL FORM)

Relational Schema R is in 1NF, if R doesn't contain any multivalued attribute.

Multivalued Attribute: For a single tuple, there may exist a column having more than one value.

Sid	Sname	Cname
S1	A	C/C++
S2	A	Java
S3	B	C/Java

Not in 1NF



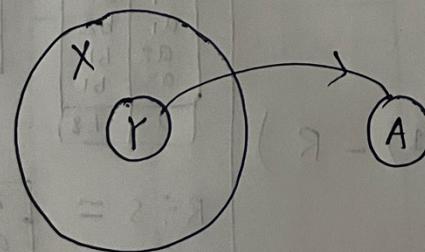
Sid	Sname	Cname
S1	A	C
S1	A	C++
S2	A	Java
S3	B	C
S3	B	Java

gt is in 1NF

## 2NF

- (i) R should be in 1NF
- (ii) R should not contain any partial dependency.

PD



X : Any CK of R

(P.A)Y : proper subset of CKs

A : Non-prime attributes (NPA)

Ex R(A B C D E)

$$\{AB \rightarrow C, C \rightarrow D, B \rightarrow E\}$$

Ex  $R(ABCDEF)$

$A \rightarrow BCDEF$ ,  $BC \rightarrow ADEF$

$B \rightarrow F$ ,  $D \rightarrow E$

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3NF

- (i)  $R$  should be in 2NF and
- (ii)  $R$  should not contain any transitive dependency

$X \rightarrow Y$

a)  $X$  is not CK or SK  
AND  
b)  $Y$  is not prime attribute

Transitive Dependency

But remember  
like this

$X \rightarrow Y$

a)  $X$  should be CK or SK  
OR  
b)  $Y$  should be prime attribute.

Ex  $R(ABCDE)$

$$\{ A \rightarrow BCDE, BC \rightarrow ADE, D \rightarrow E \}$$

CK : { }

BCNF:

◻ R should be in 3NF.

◻  $X \rightarrow Y$   
X should be CK or SK.

◻ O.Y. redundancy.

Ex1  $R(ABCDE)$

$$\{ A \rightarrow BC, AD \rightarrow E, B \rightarrow C \}$$

Problems Find highest Normal form

1)  $R(ABCDE)$

$$\{AB \rightarrow C, C \rightarrow D, D \rightarrow E, E \rightarrow A, D \rightarrow B\}$$

$AB^+$

$EB^+$

$D^+$

$C^+$

2)  $R(ABCDEFGH)$

$$\{ABC \rightarrow DE, E \rightarrow GH, H \rightarrow G, G \rightarrow H, ABCD \rightarrow EF\}$$

$ABC^+$

3)  $R(ABCDEF)$

$\{AB \rightarrow C, CD \rightarrow E, E \rightarrow F\}$

4)  $R(ABCDEF)$

$\{AB \rightarrow CD, D \rightarrow E, E \rightarrow F, E \rightarrow A\}$

5)  $R(ABCDEFG)$

$\{AB \rightarrow CD, DE \rightarrow F, C \rightarrow E, F \rightarrow C, B \rightarrow G\}$

6) Book (Title, Author, Catno, Pub, Yr, Price)  
Collection (Title, Author, catno)

FD's

1. Title, Author  $\rightarrow$  Catno ,
2. Catno  $\rightarrow$  Title Author Pub Yr ,
3. Pub Title Yr  $\rightarrow$  Price

Assume {Author, Title} is the key (CK) for both the schemas.

- Book is in 2NF       Collection is in 3NF      } True / False