

4NF and MVD : (multi valued dependency)

4NF  $\Rightarrow$  BCNF

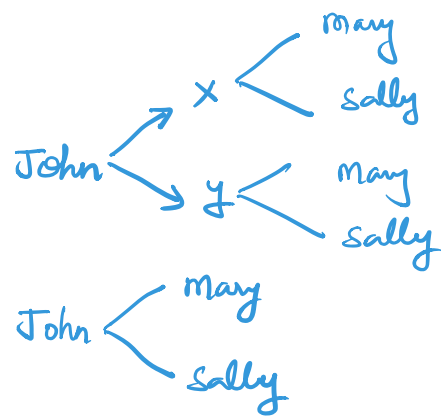
Emp (name, pname, dependent)

\* John works on projects X, Y  
has dependents Mary, Sally

\* Bob works on project X  
has dependents Jill, Jake, Mary

\* Sue works on projects X, Y, Z  
has dependents Ann, Tim

Ename	Pname	Dependent
John	X	Mary
John	X	Sally
John	Y	Mary
John	Y	Sally
Bob	X	Jill
Bob	X	Jake
Bob	X	Mary
Sue	X	Ann
Sue	X	Tim
Sue	Y	Ann



Sue	Y	Tim
Sue	Z	Ann
Sue	Z	Tim

$Ename \twoheadrightarrow Pname$   
 $Ename \twoheadrightarrow Dependent$

}  $Ename \twoheadrightarrow Pname | Dependent$

$Emp(\underline{Ename}, \underline{Pname}, \underline{Dependent})$  not in 4NF

$R1(\underline{Ename}, \underline{Pname})$

$R2(\underline{Ename}, \underline{Dependent})$

$Emp = R1 \bowtie R2$

$R1, R2$  in 4NF

Example :

A	B	C
a1	b1	c1
a1	b2	c1

$A \twoheadrightarrow B$

A	B	C
a1	b1	c1
a1	b1	c2
a1	b2	c1
a1	b2	c2

Does  $A \twoheadrightarrow C$  ?

yes

$a1 \rightarrow c1 \begin{cases} b1 \\ b2 \end{cases}$

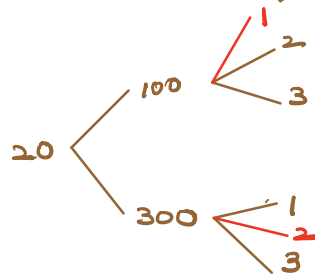
$a1 \rightarrow c2 \begin{cases} b1 \\ b2 \end{cases}$

Example :

$R(a, b, c)$

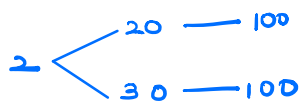
A	B	C
100	30	2
100	20	2
100	20	3
200	20	3
300	20	1

Does  $b \twoheadrightarrow a$  ? No

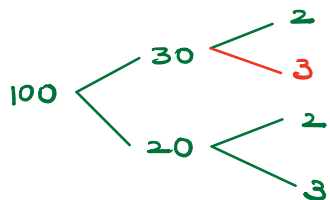


$b \twoheadrightarrow c$  No

Does  $c \twoheadrightarrow b$  ? yes  $\Rightarrow c \twoheadrightarrow a$



Does  $a \twoheadrightarrow b$  No  $\Rightarrow a \nrightarrow c$  No



Example :  $R(a, b, c, d)$

A	B	C	D
1	10	100	X

1	20	100	y
1	20	100	X
1	10	100	y
2	10	200	X
2	30	300	X
2	30	200	X
2	10	300	X

①  $a \Rightarrow b$  ?