

## ✓ Non-Trivial MVD

An MVD that satisfies neither (a) nor (b),  
is called a nontrivial MVD.

Eg:  $R(A, B, C)$  be a relation schema  
and  $F = \{ A \twoheadrightarrow B, A \rightarrow C \}$  is non-trivial  
as  $A \cup B \neq R$ .

## ✓ Definition of 4NF

A relation schema  $R$  is in 4NF w.r.t a  
set of dependencies  $F$  (that includes FDs and  
MVDs) if, - for every nontrivial MVD  $X \twoheadrightarrow Y$   
in  $F^+$ ,  $X$  is a superkey for  $R$ .

- All MVDs are trivial.

## ✓ Inference Rules for FDs and MVDs

$R = \{A_1, A_2, \dots, A_n\}$

$X, Y, Z, W \subseteq R$

- 1) IR1 (Reflexive Rule for FDs): If  $X \supseteq Y$ , then  $X \rightarrow Y$
- 2) IR2 (Augmentation Rule for FDs):  $\{X \rightarrow Y\} \models XZ \rightarrow YZ$
- 3) IR3 (Transitive Rule for FDs):  $\{X \rightarrow Y, Y \rightarrow Z\} \models X \rightarrow Z$
- 4) IR4 (Complementation Rule for MVDs)  
 $\{X \twoheadrightarrow Y\} \models \{X \twoheadrightarrow (R - (X \cup Y))\}$
- 5) IR5 (Augmentation Rule for MVDs):  
If  $X \twoheadrightarrow Y$  and  $W \supseteq Z$ , then  $WX \twoheadrightarrow YZ$
- 6) IR6 (Transitive Rule for MVDs):  
 $\{X \twoheadrightarrow Y, Y \twoheadrightarrow Z\} \models X \twoheadrightarrow (Z - Y)$
- 7) IR7 (Replication Rule for FD to MVD):  
 $\{X \rightarrow Y\} \models X \twoheadrightarrow Y$

Armstrong's  
Axioms