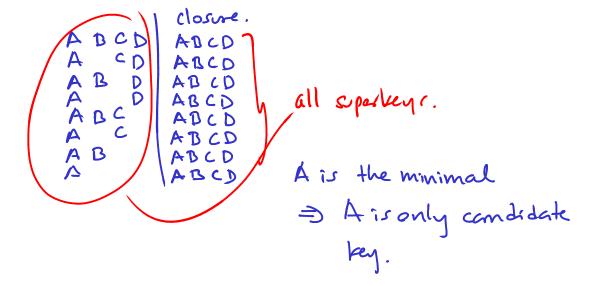
3.2.2
$$S(A,B,C,D)$$

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

b) A is never in night hand side, hence it must be part of every candidate Key.



c) Any superset of A (except 1A):

ABCD
ABCD
ABCD
ABCD
ABCC
ACC

C) Superkeys not candidate keys

ABCD

ABCD

ABCD

ABCD

Candidate Keys

U(AB,C,D)

A=B, B=C, C=D, D=A

This one is easier. We can do it

as the previous one (compte the closure of all combinations of attributes)

Dut in this case, all single attri are CK:

AAT = AABCDY

ABCDY

ABCDY

ABCDY

A, B, C, D are all candidate keyr.

c) Any combination of attributer is a superkey. Hence superkeys not CKs:

ABCD D D D D D D D D

3.24

a) Instance
$$R(A,B,C)$$
 $A \rightarrow B$ does not imply $B \rightarrow A$
 $R \rightarrow B \mid C$
 $R \rightarrow C \mid C \rightarrow C$

AB $C \rightarrow C$
 $R \rightarrow C \mid C \rightarrow C$
 $R \rightarrow$

you could have prove it

AB-012,3-5 12,2-5

hold 11.

3.2.10

Not minimal:

BC > A redundant (we can generate it using C > A)

C)
$$\mathbb{R}(ABCDE)$$
 $AB \rightarrow D$

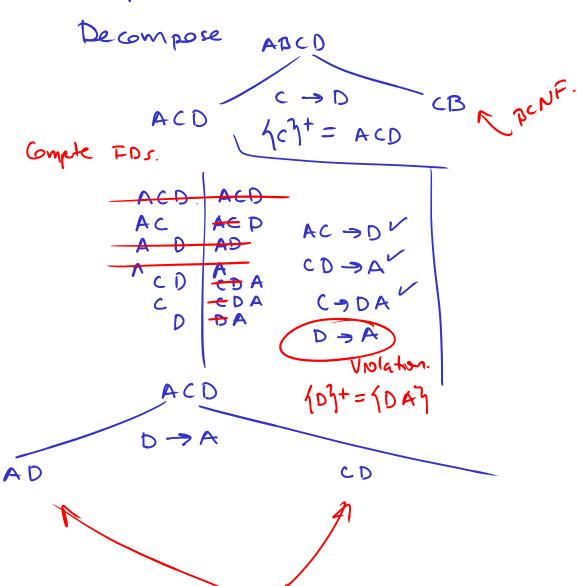
$$AC \rightarrow E$$

$$BC \rightarrow D$$

$$D \rightarrow A$$

$$E \rightarrow B$$

a)
$$R(A,B,C,D)$$
 $AB \Rightarrow C C \Rightarrow D, D \Rightarrow A$
 $AB \uparrow + = ABCD \uparrow ABCD \uparrow$



BCNF

De composition: AD, CD, CB

b)
$$R(A,B,C,D)$$
 $B \rightarrow C$, $B \rightarrow D$
 $ABCD$
 $B \rightarrow C$
 $B \rightarrow$

Decomposition: BCD, AB.

c) R(A,B,C,D) VABOC, DC >D, CD >A, AD >B.

(AB)+ = JABCD) All are SKs. 4BCJ+= 4BCDAY => table already 4CDYT= 4CDABY 4ADY = 4ADBCY

in BCNF