

COMPUTER SCIENCE



Database Management System

FD's & Normalization

Lecture_03

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An orange diamond-shaped sign with a black border, mounted on a white pole. The sign contains the text 'TOPICS TO BE COVERED' in black capital letters.

**TOPICS
TO BE
COVERED**

A small red diamond-shaped marker with a white border, containing the number '01' in white.

01

Keys Concept

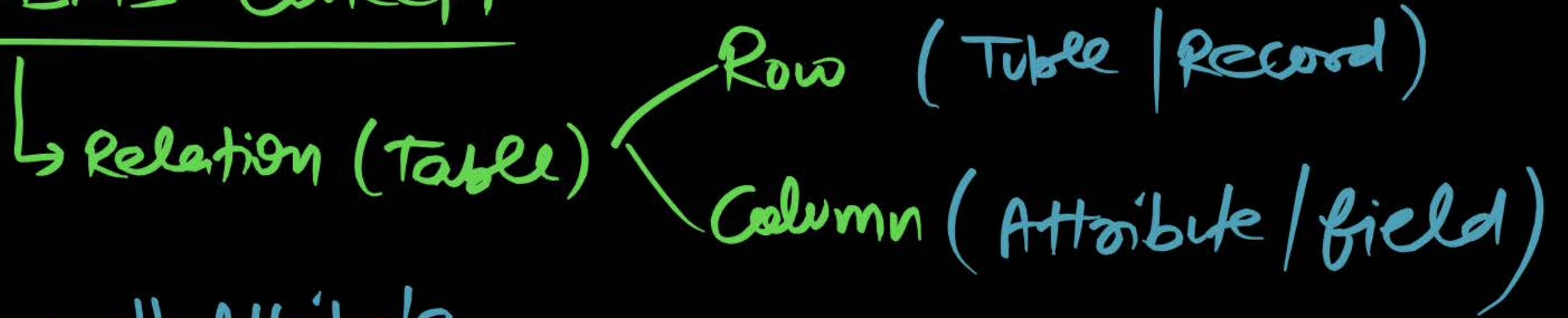
A small red diamond-shaped marker with a white border, containing the number '02' in white.

02

Finding Candidate keys



RDBMS Concept



Degree / Arity : # Attribute

Cardinality : # Tuples

Relational Schema : STUDENT (Roll No, Name Branch, CGPA)

Relational Instance / extension : set of Record

FD (Functional Dependency)

$X \rightarrow Y$

If $t_1.X = t_2.X$ then $t_1.Y = t_2.Y$ must be same.

Trivial FD

✓ Non Trivial FD

Semi Non Trivial FD

Attribute Closure

Super key

Q.9

$A \rightarrow B, B \nrightarrow C$

① B does not functionally determine C .

Conclude {

- ① Rule out the FD Based on the Table.
- ② Trivial FD are always valid.

Keys Concept

SUPER KEY

Minimal

→ Candidate key

(Assume G.C.K)

1 select as Primary key
Remain ck secondary key
except pk Alternate
scr

Keys Concept

Candidate key : Minimal of Super key.

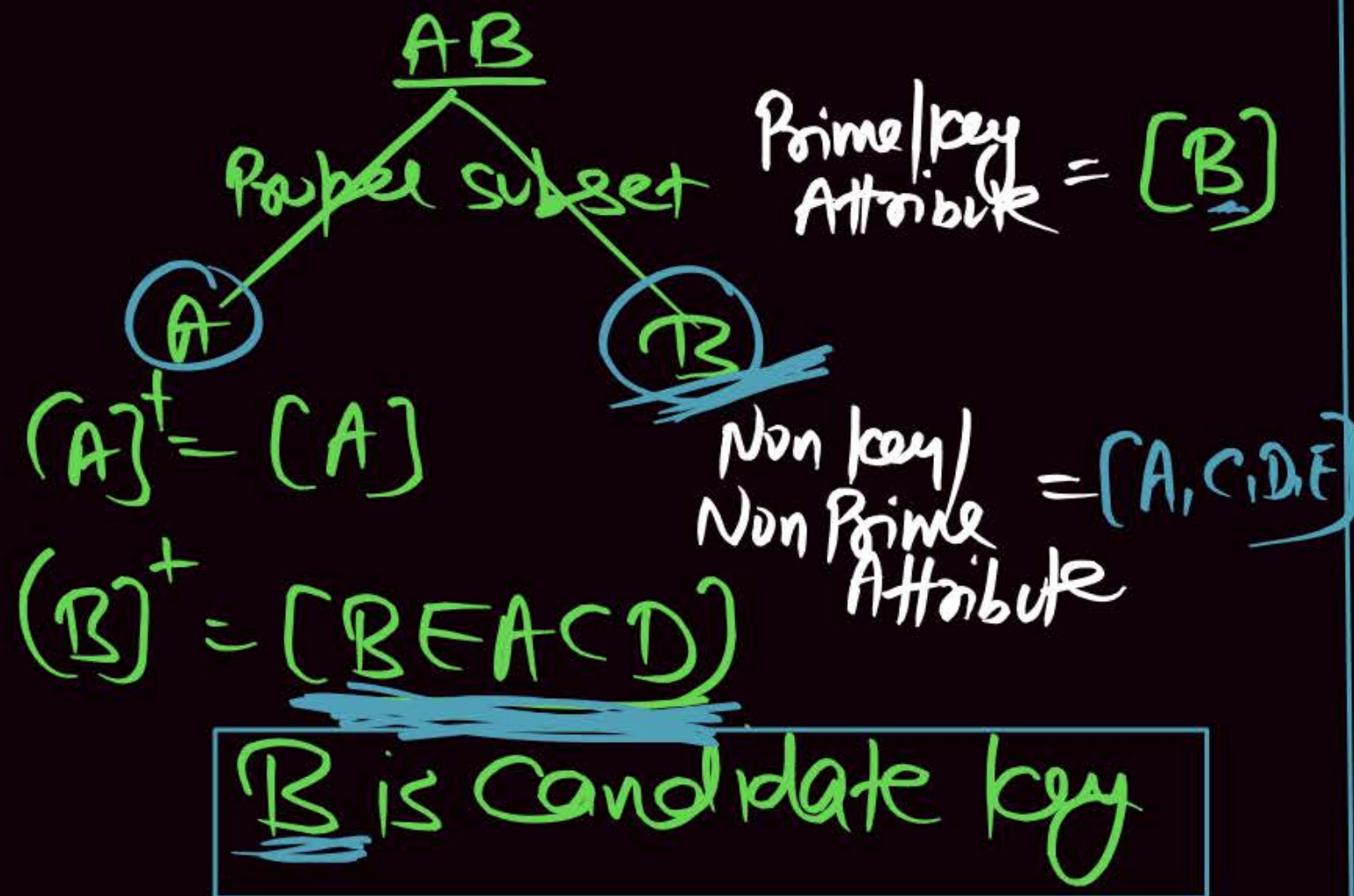
or

If Any Proper Subset of Super key is also Super key then that Proper Subset is called Candidate key (& so on)

eg 1
solⁿ
R(ABCDE) (AB → C, C → D, B → EA)

$$(AB)^+ = \underline{ABCDE}$$

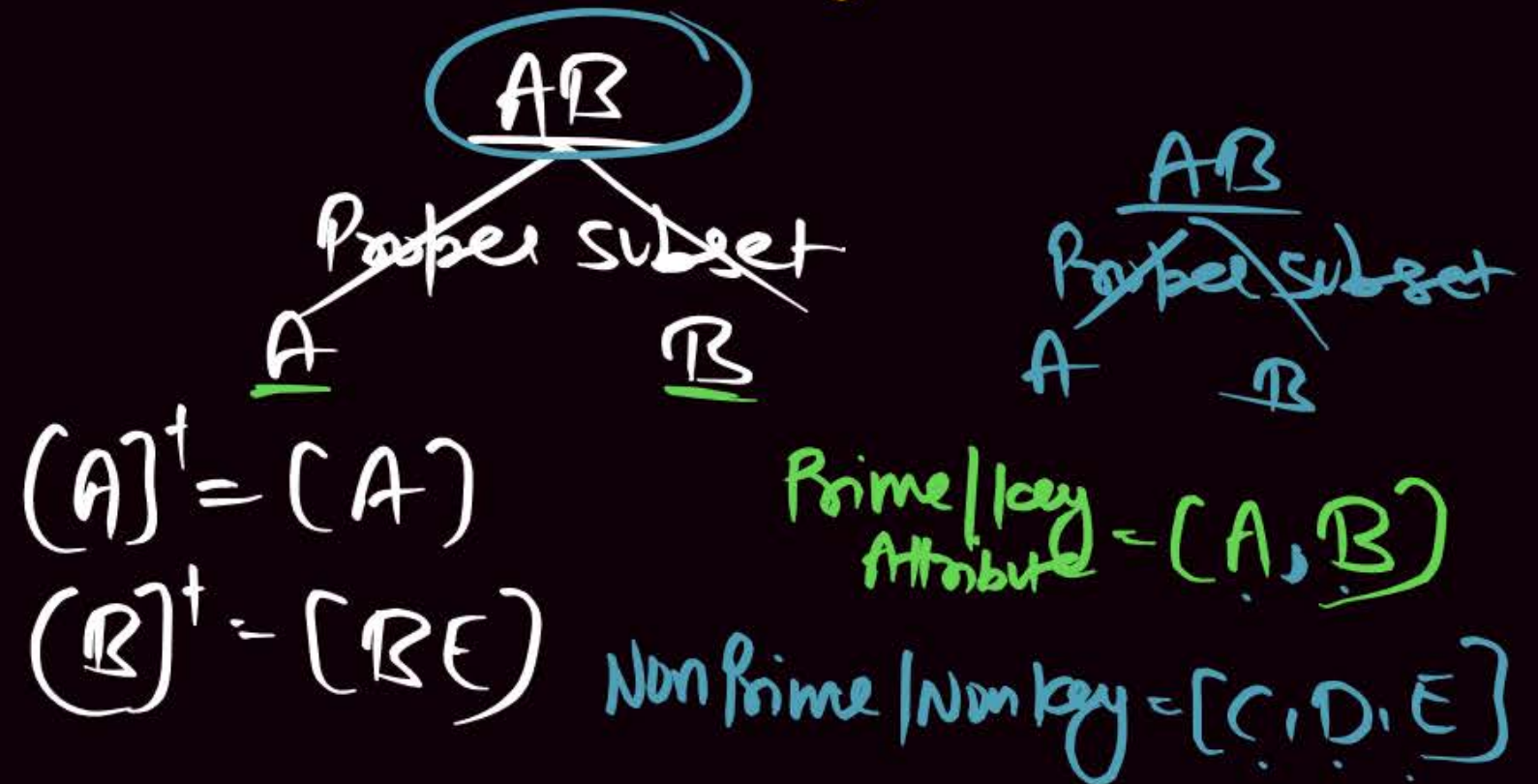
AB is Super key



② R(ABCDE) (AB → C, C → D, B → E)

$$(AB)^+ = \underline{ABCDE}$$

AB is Super key



AB is Candidate key

- B is Candidate key.
 - ↳ Any Super Set of B
 - ↳ B is Super key.

(B)

Any Super Set of Super key is also Super key.

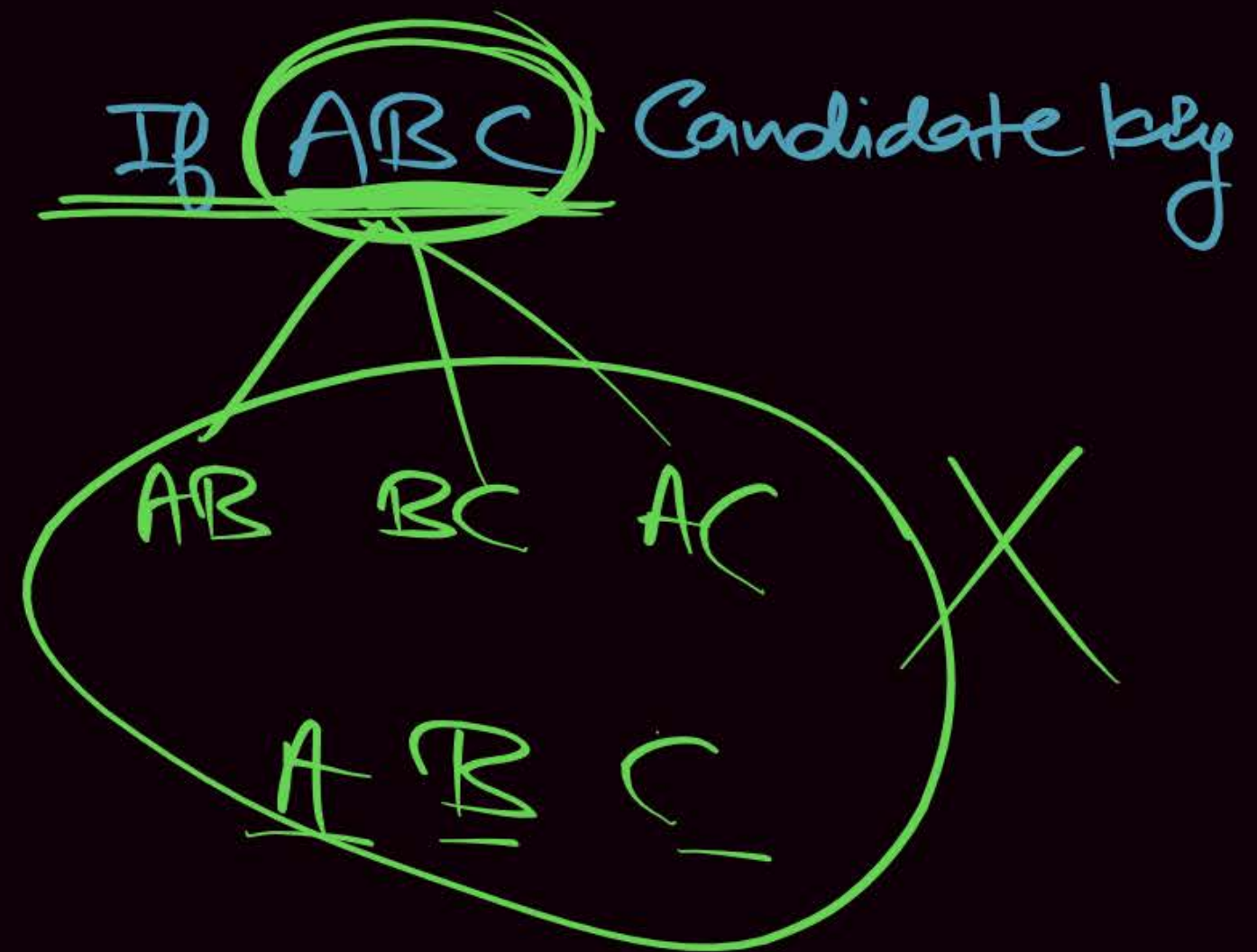
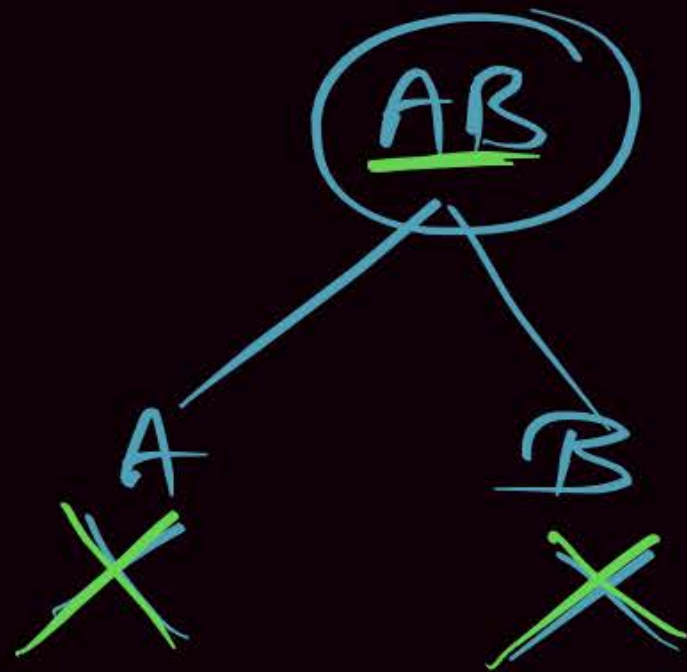
ABCDE
Super key

B: is C.K

B
B A
B C
B AC
⋮
B ACDE

Super key

If AB is Candidate key.



Keys Concept

Super key

↳ Any super set of super key is also super key.

Candidate key : minimal of super key.

Note

- Every Candidate key is a Super key.

Note

But every Super key is Not a Candidate key.

Because Candidate key is a Minimal of Super key

Prime/key Attribute : Set of Attributes that Present/belongs to Any/some Candidate key.

Non Prime/Non key Attribute : Set of Attribute that Not Present/
Not belongs to Any Candidate key.

Finding Candidate key :

$R(AB\bar{C}\bar{D}\bar{E}\bar{F})$ $\{AB \rightarrow C, C \rightarrow D, D \rightarrow E, E \rightarrow \bar{F}\}$

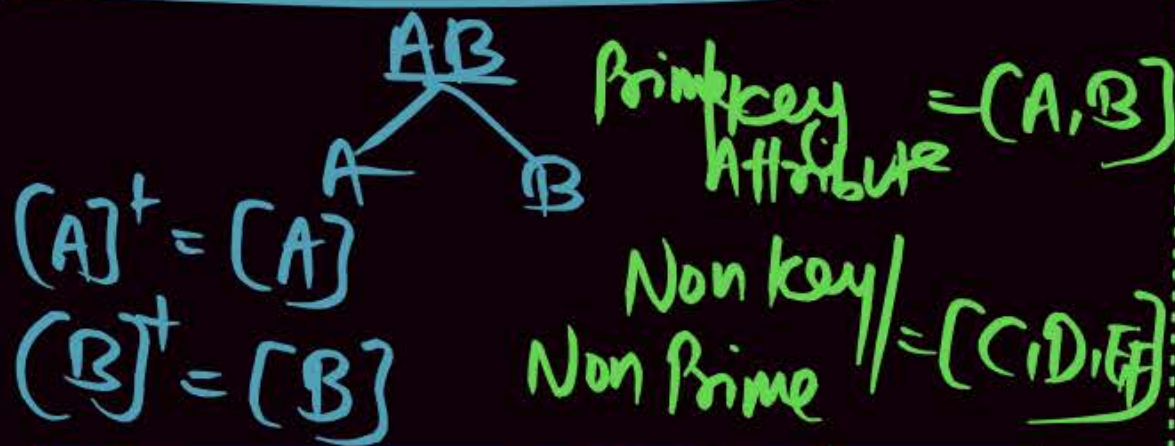
$$[AB]^+ = [AB\bar{C}\bar{D}\bar{E}\bar{F}]$$

$$[AB]^+ = [AB\bar{C}\bar{D}\bar{E}\bar{F}]$$

$$[A]^+ = [A]$$

$$[B]^+ = [B]$$

AB is Super key



AB is Candidate key

AB is Candidate key

The Attribute which is Not Present in Right Hand Side (R.H.S) that Attribute must be Present in Candidate key.

Finding Multiple candidate key:

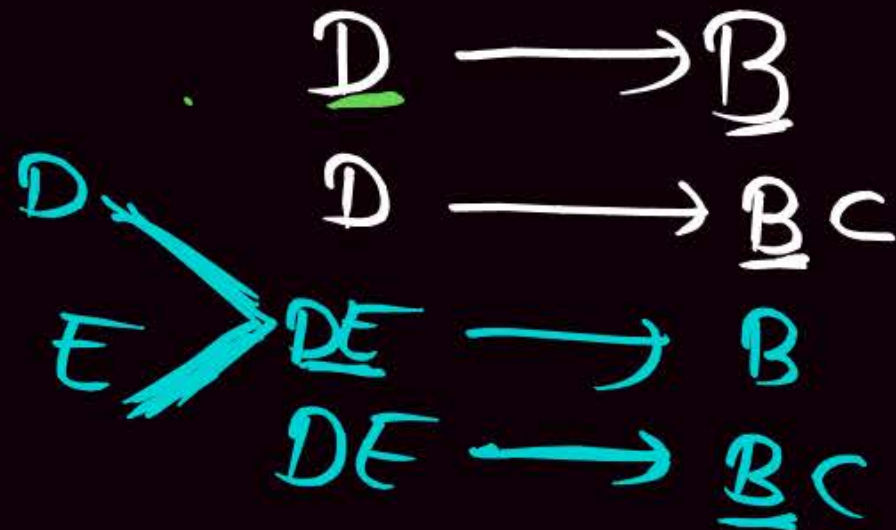
Procedure:

First Find Any One Candidate key, then that Attribute (which Present in that C.K) is called Prime Attribute.

If X Attribute \longrightarrow [Prime Attribute] then multiple Candidate key are there.

Assume

eg) B is Candidate key.



$D \rightarrow B$ Prime/Key Attribute = {B,

$[D]^+ = [D \underline{B} A \dots \dots]$

$[DE]^+ = [DE \underline{B} A \dots \dots]$

$[D]^+ = [E]^+$

Q.1

R(ABCDEF) {A \rightarrow B, B \rightarrow C, D \rightarrow CEF}

Find candidate keys for the relation R ?



$\rightarrow [A]^+ = [ABC]$
 $\rightarrow [D]^+ = [DCEF]$
 $[AD]^+ = [ABCDEF]$

AD is Candidate key — ①

Prime Attribute = [A, D]

If X Attribute \rightarrow [Prime Attribute]

No Multiple Candidate key

Only One C.K

AD Ans

Q.2



$R(ABCDE) \{AB \rightarrow C, C \rightarrow D, D \rightarrow E, B \rightarrow A, C \rightarrow B\}$

Find candidate keys for the relation R?

key/Prime Attribute = $[B, C]$

$$[AB]^+ = [ABCDE]$$

AB is Super key

$$[A]^+ = [A]$$

$$[B]^+ = [BACDE]$$

B is Candidate key — ①

If $X_{\text{Attribute}} \rightarrow [\text{Prime Attribute}]$

$$C \rightarrow B$$

$$[C]^+ = [CBAD E]$$

C is Candidate key — ②

$(AB) \rightarrow C$
A (B) already C.K. Taken

∴ Candidate key
B
C
Ans

Q.3

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

Find candidate keys for the relation R?

Solⁿ 3

$(A)^+ = (ABCD)$

A is Candidate key — ①

If $X_{\text{Attribute}} \rightarrow (\text{Prime Attribute})$

$D \rightarrow A$

$(D)^+ = (DABC)$

D is Candidate key — ②

Prime Attribute = (A, D, C, \underline{B})

$\underline{C \rightarrow D}$

$(C)^+ = (CDAB)$

C is CK — ③

$B \rightarrow C$

$(B)^+ = (BCDA)$

B is CK — ④

- 4 Candidate key**
- ① A
 - ② B
 - ③ C
 - ④ D.

Q.4

$R(ABCDEF) \{ \underline{A} \rightarrow BCDE, BC \rightarrow \underline{AD}, D \rightarrow \underline{EF} \}$

Find candidate keys for the relation R?

Solⁿ

$$(A)^+ = [ABCDEF]$$

Prime Attribute = $\{ \check{A}, \check{B}, \check{C} \}$

A is Candidate key — (1)

If X Attribute \rightarrow [Prime Attribute]

$$\underline{BC} \rightarrow AD$$

$$(BC)^+ = [BC \underline{AD} EF]$$

$$\checkmark (B)^+ = [B]$$

$$\checkmark (C)^+ = [C]$$

BC is Candidate key — (2)

2 Candidate key

① A

② BC

Q.4

$R(ABCDEF) \{ \underline{A} \rightarrow BCDE, BC \rightarrow \underline{AD}, D \rightarrow EF \}$

Find candidate keys for the relation R ?

Solⁿ

$$(A)^+ = [ABCDEF]$$

$$\text{Prime Attribute} = [\overset{\checkmark}{A}, \overset{\checkmark}{B}, \overset{\checkmark}{C}]$$

A is Candidate key — (1)

If X Attribute \rightarrow [Prime Attribute]

$$\underline{BC} \rightarrow \underline{AD}$$

$$(BC)^+ = [BC \underline{AD} EF]$$

$$(B)^+ = [B]$$

$$(C)^+ = [C]$$

BC is Candidate key. — (2)

2 Candidate key

① A

② BC.

Q.5

R(ABCD) F: {AB \rightarrow C, B \rightarrow D, C \rightarrow B, D \rightarrow B}

Find all candidate key of R?



Prime Attribute = [A, B, D, C] [HOMEWORK]

Solⁿ 5

$$[AB]^+ = [ABCD]$$

$$[A]^+ = [A]$$
$$[B]^+ = [BD]$$

AB is Candidate Key — (1)

D \rightarrow B

$$[AD]^+ = [ADBC]$$
$$[A]^+ = [A]$$
$$[D]^+ = [DB]$$

AD is C.K — (2)

C \rightarrow B

$$[AC]^+ = [ACBD]$$
$$[C]^+ = [CBD]$$

AC is C.K — (3)

If X Attribute \rightarrow [Prime Attribute]

AB
AD
AC

Ans

B \rightarrow D

AB \rightarrow already taken

AD \rightarrow already taken

Q.6

Consider the following relational schema $R(ABCDEF)$ with functional dependency $\{AB \rightarrow C, C \rightarrow D, D \rightarrow E, E \rightarrow F, F \rightarrow B\}$
The number of candidate keys for relation R ?



Q.7

$R(ABCDE) : \{AB \rightarrow C, BC \rightarrow D\}$

Find Candidate keys for the Relation R?

Any Doubt ?



**THANK
YOU!**

