

Prime Attribute :

Attribute that appear in at least one candidate key.

AB - C~~E~~

2NF

Partial Dependency :

FD $\alpha \rightarrow \beta$ call partial dependency, if

$\exists \gamma \subset \alpha \ni \gamma \rightarrow \beta$ holds.

ABC \rightarrow DE
AB \rightarrow (DE)

Then β called partially dependent on α .

2NF : Each attribute A in R follow one of the following

(1) It appears in candidate key

or (2) It is not partially dependent on a candidate key.

EX: $R = (A, B, C, D)$

$F = \{ \underline{AB \rightarrow D}, \underline{AB \rightarrow C}, C \rightarrow A, D \rightarrow B \}$

Q: Find candidate key.

$(ABCD)^+ = \underline{ABCD}$ - Super Key.

We have to find extraneous attributes.

$(AB)^+ = ABCD$ - Super Key.

$(A)^+ = A$
 $(B)^+ = B$ } Not super keys.

$\therefore AB$ candidate key.

Not: complexity to find all candidate keys
is $O(2^n)$.

Ex:

$R = (A, B, C, D, E, F)$

$F = \{A \rightarrow \underline{B}, B \rightarrow \underline{C}, C \rightarrow \underline{D}, D \rightarrow \underline{E}\}$

Find all candidate key?

$(\cancel{A}\cancel{B}\cancel{C}\cancel{D}\cancel{E}F)^+ = ABCDEF$

$(AF)^+ = AFBCDE$

check AF is candidate key.?

$(A)^+ = ABCDE$
 $(F)^+ = F$

Not
super key.

\therefore AF - candidate key - only one.

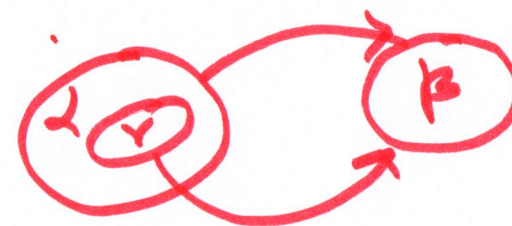
prime attribute = $\{A, F\}$

{ check whether prime attribute presented in right-side of any FDs.

Non-prime attribute
 $\{B, C, D, E\}$

$A \rightarrow ? : A \rightarrow B$ in F
 $F \rightarrow ?$

Not in 2NF



Ex: $R = (A, B, C, D)$

$F = \{AB \rightarrow CD, C \rightarrow A, D \rightarrow B\}$

$$(ABCD)^+ = ABCD$$

$$(AB)^+ = ABCD - \text{super key.}$$

$$\left. \begin{array}{l} (A)^+ = A \\ (B)^+ = B \end{array} \right\} \begin{array}{l} \text{Not} \\ \text{super keys.} \end{array}$$

$\therefore AB$ is candidate key.

prime Attribute: $\{A, B\}$

check prime attribute present right-side
of any FD in F .

$$C \rightarrow \boxed{A}$$

$$D \rightarrow \boxed{B}$$

CB - Super key.

$(C)^+ = CA$
 $(B)^+ = B$ } Not Super keys.

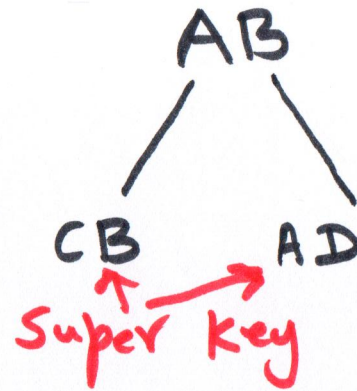
\therefore CB - Candidate key.

AD - Super key.

$(A)^+ = A$
 $(D)^+ = DB$ } Not Super keys

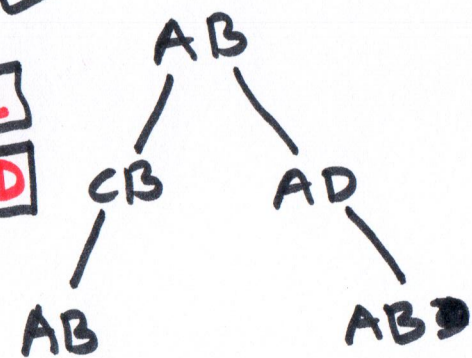
\therefore AD - Candidate key.

Now, prime attributes : $\{A, B, C, D\}$



2NF.

$C \rightarrow A$ ✓
 $D \rightarrow B$ ✓
 $AB \rightarrow C$ C
 $AB \rightarrow D$ D



Stop.

Hence, 3 Candidate key : AB, CB, AD

EX:

$R = (A, B, C, D)$

$F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D\}$

$(\cancel{A}\cancel{B}\cancel{C}D)^+ = ABCD$

$(A)^+ = ABCD$

prime attributes: $\{A\}$.

$(K) \rightarrow B$

A - super key.

- candidate key.

Non-prime attributes: $\{B, C, D\}$

A - proper subset ϕ .

2NF.

Ex:

$R = (A, B, C, D)$

$F = \{ AB \rightarrow C, BC \rightarrow D, CD \rightarrow A \}$

Find all candidate keys. ?