

Section: D

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Assignment-4 (Unit-4)

1.) Consider $R = \{A, B, C, D, E, F, G, H\}$ with a set of FD's $F = \{CD \rightarrow A, EC \rightarrow H, GHB \rightarrow AB, C \rightarrow D, EG \rightarrow A, H \rightarrow B, BE \rightarrow CD, EC \rightarrow B\}$
find all candidate keys of R.

2.) $F = (A \rightarrow BC, CD \rightarrow E, E \rightarrow C, D \rightarrow A \oplus H, ABH \rightarrow BD, DH \rightarrow BC)$
find minimal cover of FD.

3.) $R = (A, B, C, D)$
 $F = (C \rightarrow D, C \rightarrow A, B \rightarrow C)$

1. Identify the best NF that R satisfies
2. Decompose R into BCNF.

4.) Given, $R = (X, Y, Z)$ & $FD = (X \rightarrow Y \text{ \& } Y \rightarrow Z)$
determine if R is in 3NF? If not convert to 3NF.

5.) $R(A, B, C, D, E)$ & $FD = (A \rightarrow BC, C \rightarrow DE)$
find if it is in BCNF or not.

Answers:

1.)
 $(A)^+ = \{A\}$ $(C)^+ = \{C, D, A\}$ $(E)^+ = \{E\}$
 $(B)^+ = \{B\}$ $(D)^+ = \{D\}$ $(F)^+ = \{F\}$
 $(G)^+ = \{G\}$ $(H)^+ = \{H, B\}$

2.) $F = (A \rightarrow BC, CD \rightarrow E, E \rightarrow C, D \rightarrow A \text{ and } ABH \rightarrow BD, DH \rightarrow BC)$

$A \rightarrow BC$

$CD \rightarrow E$

~~$BD \rightarrow$~~

$E \rightarrow C$

$D \rightarrow A \text{ and } H$

$ABH \rightarrow BD$

$DH \rightarrow BC$

Step 1:

$F: \{ A \rightarrow B, A \rightarrow C, CD \rightarrow E, E \rightarrow C, D \rightarrow A, D \rightarrow E, D \rightarrow H, ABH \rightarrow B, ABH \rightarrow D, DH \rightarrow B, DH \rightarrow C \}$

Step 2: $CD \rightarrow E$ Can be replaced with $D \rightarrow E$ (C is extra).

- $ABH \rightarrow B$: $B \rightarrow B$ is implied & hence is a extra FD.
- $ABH \rightarrow D$: No other FD derives D, hence no extra.
- $DH \rightarrow B$

(3)

$$\bullet ABH \rightarrow D$$

$$\textcircled{X} \text{ know } A \rightarrow B : \bullet \text{ but } D \Rightarrow H$$

$$AH \rightarrow D \quad \text{thus } D \rightarrow B$$

$$\bullet DH \rightarrow C$$

$$\text{But } D \Rightarrow H$$

$$\text{thus } D \rightarrow C$$

$$F: \{ A \rightarrow B, A \rightarrow C, D \rightarrow E, E \rightarrow C, D \rightarrow A, \\ D \rightarrow H, AH \rightarrow D, D \rightarrow B, D \rightarrow C \}$$

Step 3: redundant FD's

$$F: \{ A \rightarrow B, A \rightarrow C, D \rightarrow E, D \rightarrow H, D \rightarrow A, \\ E \rightarrow C, AH \rightarrow D \}$$

$$3) \text{ ~~2NF~~ } F: \{ C \rightarrow A, C \rightarrow D, B \rightarrow C \}$$

2NF:

Candidate key: $\{ B \}$

As all of all FD's are only one. all FD's of non prime's are fully functionally dependent.

2NF: \checkmark

3NF:

here A is "transitively dependent" on B which is a key.

3NF: \times

BCNF: \times as 3NF is \times .

4) $FD = \{ x \rightarrow y, y \rightarrow z \}$

Candidate key = $\{ x \}$

2NF:

FD's of all non-primes are fully FD
 \therefore 2NF: \checkmark

3NF:

z being a non-prime attr but transitively dependant on x
 hence 3NF: \times

Convert to 3NF:

FD: $\{ x \rightarrow y, x \rightarrow z \}$

5) $F = \{ A \rightarrow BC, C \rightarrow DE \}$
 $= \{ A \rightarrow B, A \rightarrow C, C \rightarrow D, C \rightarrow E \}$

2NF: Candidate key = $\{ A \}$

non primes = $\{ B, C, D, E \}$

non prime FD:

$C \rightarrow D$ both are fully fd.
 $C \rightarrow E$

3NF:

D is non prime but transitively dependant on A

$A \rightarrow C \rightarrow D$
 \therefore no 3NF & no BCNF.

3) Cont.

2)

~~Step 1: minimal cover,~~~~Step 1:~~

~~$$F: \{C \rightarrow D, C \rightarrow A, B \rightarrow C\}$$~~

 ~~$C \rightarrow D$ & $C \rightarrow A$ violate BCNF, thus decompose to 2 new relation~~

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

$$F: \{C \rightarrow AD, B \rightarrow C\}$$

 $C \rightarrow AD$ violates BCNF

thus 2 decomp's:

A B C D AD

 $R_1 = AD$ & $R_2 = BC$

$$R_2 = (B, C) \quad R_3 = (C, A, D)$$

So $FD = \{B \rightarrow C\}$ or satisfies BCNF form!

$$FD = \{C \rightarrow AD\}$$