COMPUTER SCIENCE

Database Management System

FD's & Normalization

Lecture_03

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TOPICS TO BE COVERED

01 Keys Concept

02 Finding Candidate keys

RDBMS Concept

↳ Relation (Table)
- Row (Tuple | Record)
- Column (Attribute / field)

Degree | Arity : # Attribute

Cardinality : # Tuples

Relational schema : STUDENT (RollNo, 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

Super Key

Attribute Closure

Q.9

$A \rightarrow B, \quad B \not\rightarrow C$

C 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 6 C.K)

1 select as Primary key

Remain CK except PK (5 CK) Secondary / Alternate key

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)

R(ABCDE) [$AB \to C$, $C \to D$, $B \to EA$]

eg 1

Soln

$(AB)^+ = [ABCDE]$

$\boxed{\text{AB is Super key}}$

AB

Proper subset

A B

$(A)^+ = [A]$

$(B)^+ = [BEACD]$

$\boxed{\text{B is Candidate key}}$

Prime/key Attribute = [B]

Non key/Non Prime Attribute = [A, C, D, E]

2

R(ABCDE) [$AB \to C$, $C \to D$, $B \to E$]

$(AB)^+ = [ABCDE]$

$\boxed{\text{AB is Super key.}}$

AB

Proper subset

A B

$(A)^+ = [A]$

$(B)^+ = [BE]$

AB

Proper subset

A B

Prime/key Attribute = [A, B]

Non Prime/Non key = [C, D, E]

$\boxed{\text{AB is Candidate key.}}$

- B is Candidate key.

Any super Set of B

→ B is Super key.

(B)

Any Super Set of Super key is also Super key.

B

B A

B C

B A C

⋮

B A C D E

Super key

ABCDE

super key

B : is C.K

If AB is Candidate key.

AB

A B

If ABC Candidate key

AB BC AC

A B C

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(ABCDEF) {AB → C, C → D, D → E, E → F}

$(AB)^+ = \{ABCDEF\}$

$\boxed{\text{AB is Super key}}$

AB

A B

$(A)^+ = \{A\}$

$(B)^+ = \{B\}$

Prime key Attribute = {A, B}

Non key / Non Prime = {C, D, E, F}

$\boxed{\text{AB is Candidate key}}$

$(AB)^+ = \{ABCDEF\}$

$(A)^+ = \{A\}$

$(B)^+ = \{B\}$

$\boxed{\text{AB is Candidate key.}}$

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 $\quad X_{\text{Attribute}} \longrightarrow$ [Prime Attribute] then multiple Candidate key are there.

Assume

eg. B is Candidate key.

$D \to B$ Prime/key Attribute = (B,

$D \longrightarrow B$

$D \longrightarrow BC$

$DE \longrightarrow B$

$DE \longrightarrow BC$

D, E

$(D)^+ = (DBA \ldots\ldots)$

$(DE)^+ = (DEBA \ldots)$

$(D)^+ =$

$(E)^+ =$

Q.1

R(ABCDEF) {A → B, B → C, D → CEF}

Find candidate keys for the relation R ?

$[A]^+ = [ABC]$

$[D]^+ = [DCEF]$

$[AD]^+ = [ABCDEF]$

AD is Candidate key — (1)

Prime Attribute = [A, D]

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

No Multible Candidate key

Only One C.K

AD Ans

Q.2

R(ABCDE) {AB → C, C → D, D → E, B → A, C → B}

Find candidate keys for the relation R ?

key/Prime Attribute = [B, C]

$[AB]^+ = [ABCDE]$

$\boxed{\text{AB is Super key}}$

$[A]^+ = [A]$

$[B]^+ = [BACDE]$

$\boxed{\text{B is Candidate key}}$ — ①

$\boxed{\text{If } X_{\text{Attribute}} \longrightarrow \text{[Prime Attribute]}}$

$C \rightarrow B$

$[C]^+ = [CBADE]$

$\boxed{\text{C is Candidate key}}$ — ②

$AB \rightarrow C$

A B already Taken C.K

2 Candidate key

B

C

Ans

Q.3 $R(ABCD)\ \{A \to B,\ B \to C,\ C \to D,\ D \to A\}$

Find candidate keys for the relation R ?

Soln: $(A)^+ = [ABCD]$

A is Candidate key — (1)

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

$D \to A$

$(D)^+ = [DABC]$

D is Candidate key — (2)

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

$C \to D$

$(C)^+ = [CDAB]$

C is CK — (3)

$B \to C$

$(B)^+ = [BCDA]$

B is CK — (4)

4 Candidate key

1. A
2. B
3. C
4. D.

Q.4 $R(ABCDEF)$ $\{A \to BCDE, BC \to AD, D \to EF\}$

Find candidate keys for the relation R ?

Sol^n:

$(A)^+ = [ABCDEF]$

Prime Attribute $= [A, B, C]$

A is Candidate key — ①

If $X_{Attribute} \to$ [Prime Attribute]

$BC \to AD$

$(BC)^+ = [BC\,ADEF]$

$(B)^+ = [B]$

$(C)^+ = [C]$

BC is Candidate key. — ②

2 Candidate key

① A

② BC.

Q.4 R(ABCDEF) {A → BCDE, BC → AD, D → EF}

Find candidate keys for the relation R ?

Sol^n

$(A)^+ = [ABCDEF]$

Prime Attribute = [A, B, C]

$\boxed{\underline{A} \text{ is Candidate key}}$ — 1

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

$\underline{BC} \rightarrow AD$

$(BC)^+ = [BC\ \underline{A}DEF]$

$(B)^+ = [B]$

$(C)^+ = [C]$

$\boxed{\underline{BC} \text{ is Candidate key.}}$ — 2

2 Candidate key

1. A
2. BC.

Q.5 R(ABCD) F: {AB → C, B→ D, C → B, D → B}

Find all candidate key of R?

[HOMEWORK]

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

Soln 5

$[AB]^+ = [ABCD]$

$[A]^+ = [A]$

$[B]^+ = [BD]$

AB is Candidate key — (1)

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

$D \rightarrow B$

$[AD]^+ = [ADBC]$

$[A]^+ = [A]$

$[D]^+ = [DB]$

AD is C.K — (2)

$C \rightarrow B$

$[AC]^+ = [ACBD]$

$[C]^+ = [CBD]$

AC is C.K — (3)

$B \rightarrow D$

AB already taken

AB → C

already taken.

AB
AD
AC

Ans

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!