

COMPUTER SCIENCE



Database Management System

FD's & Normalization

Lecture_05



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An orange diamond-shaped sign with a black border and the text 'TOPICS TO BE COVERED' in black capital letters.

TOPICS
TO BE
COVERED

A red diamond-shaped sign with a white border and the number '01' in white.

01

Finding Candidate keys





RDBMS Concept

FD Concept

FD type

PYQ'S & Question

Key Concept

Super Key

Candidate Key

→ Prime/Key Attribute

→ Non Prime/Non Key Attribute

Finding multiple C.K.

Keys Concept

Finding Multiple C.K

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

Multiple C.K possible.

Q.5

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

Find all candidate key of R?

[HOMEWORK]

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

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

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

AB is C.K — ①

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

$$\underline{D \rightarrow B}$$

$$(AD)^+ = [ADBC]$$

$$(D)^+ = [DB]$$

AD is C.K — ②

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

$$C \rightarrow B$$

$$(AC)^+ = [ACBD]$$

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

AC is C.K — ③

Non Prime = 0

AB
AD
AC

Ans

Q.7



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

Find Candidate keys for the Relation R?

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

E is Not Present in FD

$$(ABE)^+ = \{ABCDE\}$$

ABE is CK Ans

Q.8



$R(\underline{ABCDEFG}) : \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow E, F \rightarrow G\}$

Find Candidate keys for the Relation R?

[HOMEWORK]

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

$$[F]^+ = [FG]$$

$$[AF]^+ = [ABCDEFG]$$

AF is Candidate key. - (1)

Prime /
Key Attribute = (A, F)

Non Prime /
Non Key
Attribute = (B, C, D, E, G)

Q.9



$R(ABCDEFGH) : \{AB \rightarrow C, AC \rightarrow B, AD \rightarrow E, B \rightarrow D, BC \rightarrow A, E \rightarrow G\}$

Find Candidate keys for the Relation R?

$$(AB)^+ = [ABCDEG]$$

$$PA = [F, H, A, B, C]$$

F, H Not Present in FD then Make a part of ck.

$$(ABFH)^+ = [ABCDEFGH]$$

ABFH is Candidate key — (1)

$$(BCFH)^+ \xrightarrow{BC \rightarrow A}$$

$$(ACFH)^+ \xrightarrow{AC \rightarrow B}$$

ABFH
ACFH
BCFH

Ans

3 marks
Q.10



$R(ABDCPT)$, $\{B \rightarrow PT, T \rightarrow L, A \rightarrow D\}$

Find candidate keys for the relation R?

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

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

C is not present in FD.

ABC is Candidate Key. Ans

Prime/Key Attribute = $[A, B, C]$.

No Multiple C.K.

3 Marks
Q.10



$R(ABDLPT), \{B \rightarrow PT, T \rightarrow L, A \rightarrow D\}$

Find candidate keys for the relation R?

$$[AB]^+ = [ABDLPT]$$

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

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

Prime/Key
Attribute = $[A, B]$

AB is Candidate Key. Ans

No Multiple C.K.

Q.11

$R(ABCDEFGHIJ) = \{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}$



Find candidate keys for the relation R?

$$(AB)^+ = [A B C D E F G H I J]$$

$$(A)^+ = [A D E I J]$$

$$(B)^+ = [B F G H]$$

Key/Prime Attribute = $[A, B]$

AB is Candidate key. Ans

Non Prime Attribute = $[C, D, E, F, G, H, I, J]$
 \rightarrow 8

Q.12

R(ABCDEFGG)

[A → B, B → A, C → D, D → E, E → FG]

Find candidate keys for the relation R?

$$[AC]^+ = [ABCDEFGG]$$

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

$$[C]^+ = [CDEFGG]$$

AC is Candidate key - ①

$$\text{Key/Prime Attribute} = [C, A, B]$$

$$\underline{B \rightarrow A}$$

$$[BC]^+ = [BCADEFGG]$$

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

BC is Candidate key - ②

AC
BC

Ans

Q.13



$R(ABCDEFGG) \{AB \rightarrow CDEF, C \rightarrow ADE, \underline{D \rightarrow EBF}, \underline{F \rightarrow DA}, BE \rightarrow AF\}$

Find candidate keys for the relation R?

G is Not Part of FD, so must be present in each C.K.

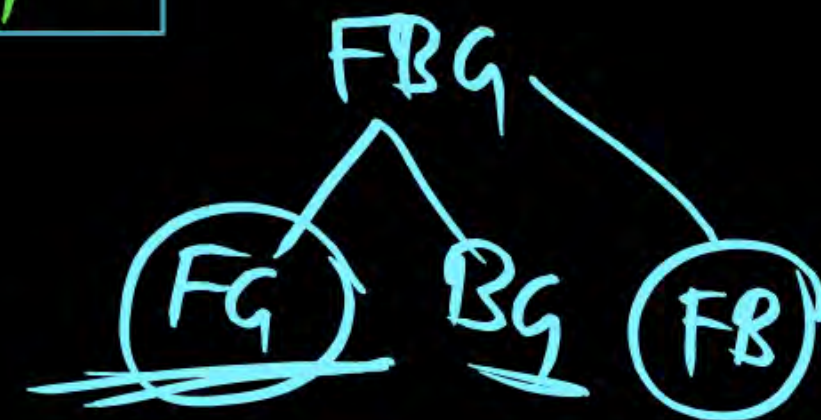
5 Candidate key
(Minimal)

out of 5, one select as Primary key.

Primary key = (Unique + NOT NULL)

ABG
BEG
FG
DG
CG

Ans



Q.14

$R(ABCDEFGH) \{A \rightarrow BC, B \rightarrow DEF, DE \rightarrow AGH\}$

Find candidate keys for the relation R?

3 C.K

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

A is Candidate key — ①

$$DE \rightarrow \underline{A}GH$$

$$[DE]^+ = [DEAGHBCF]$$

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

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

DE is CK — ②

Prime /
Key Attribute = (A, D, E, B)

$$\underline{B} \rightarrow DEF$$

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

B is Candidate key — ③

Ans

A
DE
B

A
B
DE

- Total 3 Candidate key.
- 2 Candidate keys are Single-Single Attribute ^(A, B) Attribute.
 - 1 Candidate key (DE) are Composite ^{Attribute} key.

Q.15

$R(ABCDE) \{A \rightarrow BC, CD \rightarrow E, \underline{B \rightarrow D}, E \rightarrow A\}$

Find candidate keys for the relation R?

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

Prime Attribute = $\{A, E, C, D, B\}$

A is Candidate key. - (1)

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

$$\underline{E \rightarrow A}$$

$$(E)^+ = [EABCD]$$

E is Candidate key - (2)

$$\underline{CD \rightarrow E}$$

$$(CD)^+ = [CDEAB]$$

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

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

CD is Candidate key. - (3)

$$\underline{B \rightarrow D}$$

$$(CB)^+ = [ABCDE]$$

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

CB is CK - (4)

4 CK

A
E
CD
CB

Ans

2 minutes
Q.16



R(ABCDEFGH)

{ $AB \rightarrow CD$, $D \rightarrow EG$, $F \rightarrow H$, $C \rightarrow EF$, $H \rightarrow A$, $G \rightarrow B$, $A \rightarrow B$ }

Find candidate keys for the relation R ?

4 C.K

A, H, F, C. Ans

Prime Attribute = (A, H, F, C)

Q.1

Consider the relation scheme $R(A,B,C)$ with the following functional dependencies



$AB \rightarrow C$

$C \rightarrow A$

Determine the minimal keys of relations R.

[1995: 2 Marks]

2 Candidate key = $[AB, CB]$.

OR

$[AB, BC]$

Q.2

Let $R = (A, B, C, D, E, F)$ be a relation scheme with the following dependencies $C \rightarrow F$, $E \rightarrow A$, $EC \rightarrow D$, $A \rightarrow B$. Which of the following is a key for R ?

[1999: 1 Mark]

A CD

☒ B EC

C AE

D AC

ISRO

a) $[CD]^+ = [CDF]$

☒ b) $[EC]^+ = [ECFADB] \Rightarrow [ABCDEF]$

c) $[AE]^+ = [AEB]$

d) $[AC]^+ = [ACBF]$

Q.3

The relation scheme student Performance (name course No, rollNo, grade) has the following functional dependencies:



name, courseNo \rightarrow grade

[1999: 1 Mark]

RollNo, courseNo \rightarrow grade

name \rightarrow rollNo

rollNo \rightarrow name

Find candidate keys?

2 Candidate key

(RollNo Course No, Name Course No.)

Q.4

Consider a relation scheme $R = (A, B, C, D, E, H)$ on which of the following functional dependencies hold:

$\{A \rightarrow B, BC \rightarrow D, E \rightarrow C, D \rightarrow A\}$

What are the candidate keys of R ? [2005: 2 Marks]

A

AE, BE

B

AE, BE, DE

C

AEH, BEH, BCH

D

AEH, BEH, DEH

Q.5

Let $R(A,B,C,D,E,F,P,G)$ be a relational schema in which of the following functional dependencies are known to hold:

$A \rightarrow BCD$, $DE \rightarrow P$, $C \rightarrow E$, $P \rightarrow C$ and $B \rightarrow G$.

Find candidate key of Relations R?

$\{AF\}$ is Candidate key



Q.6

Consider a relation R with five attributes V, W, X, Y, and Z. The following functional dependencies hold : $VY \rightarrow W$, $WX \rightarrow Z$, and $ZY \rightarrow V$. Which of the following is a candidate key for R?

[2006: 2 Marks]

A

VXZ

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

B

VXY

$$(VXY)^+ = [VXY.WZ]$$

C

VWXY

D

VWXYZ

} Not Candidate Key.

Q.7



Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values.

$F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$ is a set of functional dependencies (FDs) so that F is exactly the set of FDs that hold for R.

How many candidate keys does the relation R have? [2013: 2 Marks]

A 3

☒ B 4

C 5

D 6

AD
ED
FD
BD

4 candidate key (minimal)

1 selected Primary key (Unique + NOT NULL)
Remaining \rightarrow Alternative/secondary key.
ck

Q.8



Consider the relation scheme $R = (E, F, G, H, I, J, K, L, M, N)$ and the set of functional dependencies $\{ \{EF\} \rightarrow \{G\}, \{F\} \rightarrow \{I, J\}, \{E, H\} \rightarrow \{K, L\}, \{K\} \rightarrow \{M\}, \{L\} \rightarrow \{N\} \}$ on R . What is the key of R ?

- ☐ A $\{E, F\}$ ☒ B $\{E, F, H\}$
☐ C $\{E, F, H, K, L\}$ ☐ D $\{E\}$

↓
Candidate key.

[2014: 1 Mark]

$$(EF)^+ = \{E, F, G, I, J\}$$

$$(EFH)^+ = \{E, F, H, G, I, J, K, L, M, N\}$$

Q.9



A prime attribute of a relation scheme R is an attribute that appears

[2014: 1 Mark]

- ☐ A In all candidate keys of R.
- ☒ B In some candidate key of R.
- ☐ C In a foreign key of R.
- ☐ D Only in the primary key of R.

Ans (B)

eg) If CK
[A, E, BC]

Prime Attribute = (A, B, C, E)

eg) Prime Attribute
A is Not Present in all C.K

B is Not " " " "

C " Not " " " "

E is Not " " " "

[some] Any Candidate key But Not
all CK. Present in all C.K.

So Prime Attribute Appear in

Q.10



Which of the following is NOT a superkey in a relational schema with attributes V, W, X, Y, Z and primary key VY? [2016: 1 Mark]

A VXYZ

☒ B VWXZ → VY is Not Present So ^{Even} VWXZ is Not Candidate key.

C VWXY

D VWXYZ

Any Doubt ?



**THANK
YOU!**

