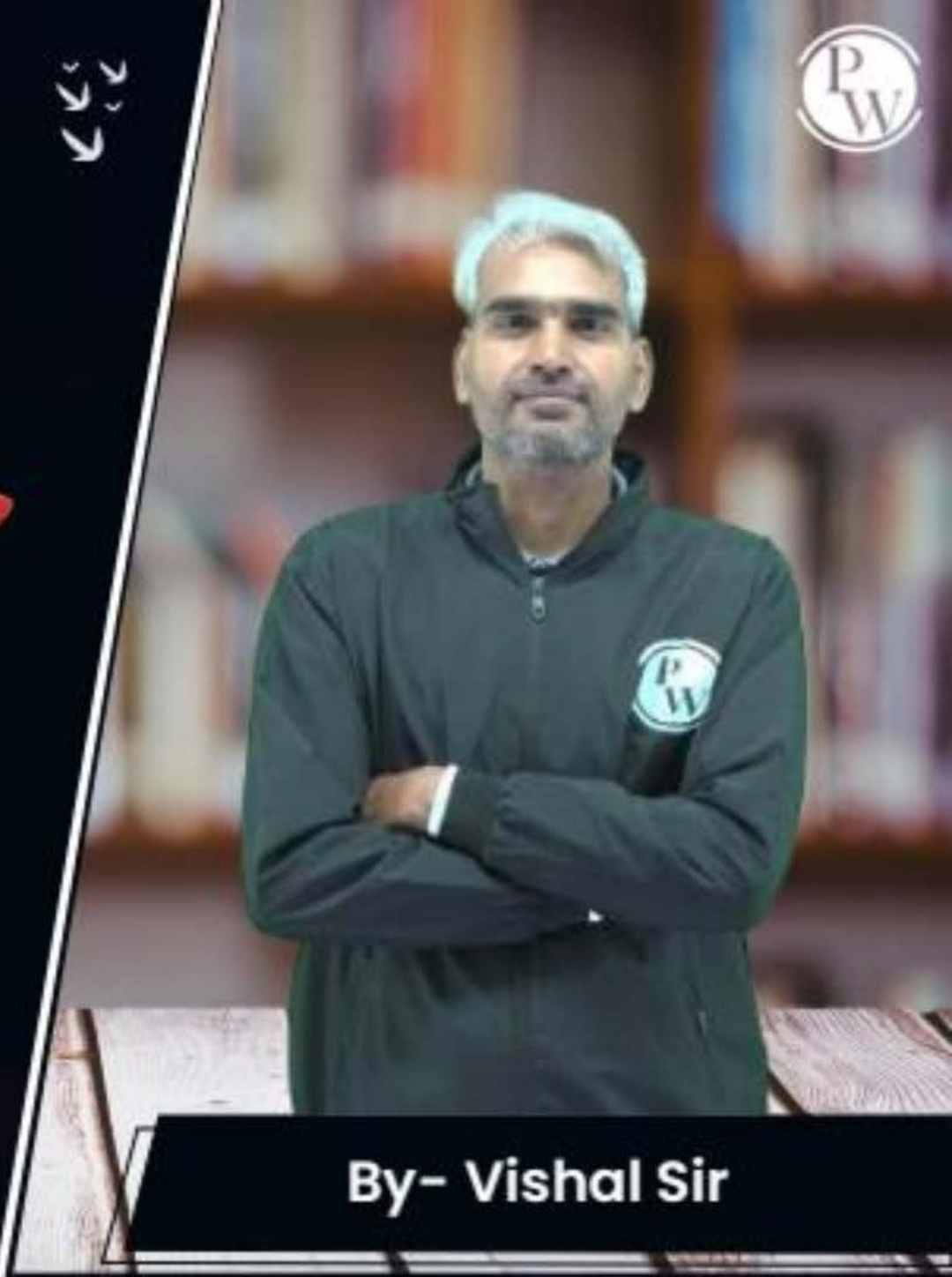
GATE
DS & AI

Database Management System

Super 1500+

Lecture No. 01



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Topics to be Covered

- Topic: Functional dependencies
- Topic: Closure of a set of attributes
- Topic: Number of Candidate keys and Super keys

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#Q.1 Consider the following relational instance for a relation R

A	B	C
1	1	1
1	2	1
2	4	3
3	5	4
4	17	5
5	3	6

12

$A \to B$ ✗
$A \to C$ ✓
$B \to C$ ✓
$B \to A$ ✓
$C \to A$ ✓
$C \to B$ ✗

$A \to BC$ ✗
$B \to AC$ ✓
$C \to AB$ ✗

$AB \to C$ ✓
$AC \to B$ ✗
$BC \to A$ ✓

Let 'm' is the total number of non-trivial functional dependencies possible over three attributes A, B and C, and 'n' is the number of functional dependencies that are guaranteed to not exist in relation R based on given relational instance, then |m-n| is 12-5=7

n → 5

#Q.2 Consider the relation R(ABCD)with set of functional dependencies

MSQ

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

$(B)^+$ w.r.t. F: {B}

$\therefore B \rightarrow C$ is not a member

Which of the following statement is/are false?

A) $B \rightarrow C$ is a member of F^+

B) $A \rightarrow D$ is a member of F^+ True

C) $CD \rightarrow B$ is a member of F^+

D) $AB \rightarrow D$ is a member of F^+ True

#Q.3 Given a relation R(A, B, C, D, E) and functional dependencies

$B \rightarrow D$ $AB \rightarrow CE$ $D \rightarrow E$

Which of the following FD can not be inferred

A) $BC \rightarrow D$ $(BC)^+ = \{B, C, D, E\}$ ∴ Can be inferred $D \in (BC)^+$

B) $AD \rightarrow CE$ $(AD)^+ = \{A, D, E\}$ ∴ Can not be inferred

$C \notin (AB)^+$

C) $B \rightarrow E$ $(B)^+ = \{B, D, E\}$ ∴ Can be inferred

D) $AB \rightarrow D$ $(AB)^+ = \{A, B, C, E, D\}$ ∴ Can be inferred.

#Q.4 Given a relation R(A, B, C, D, E) and functional dependencies

$B \rightarrow D$ $AB \rightarrow CE$ $D \rightarrow E$

How many super keys exists in relation R?

AB are essential

$(AB)^+ = \{A, B, C, E, D\}$

AB is a C.K. and it is the only C.K

{ Any Super set of C.K is a S.K. }

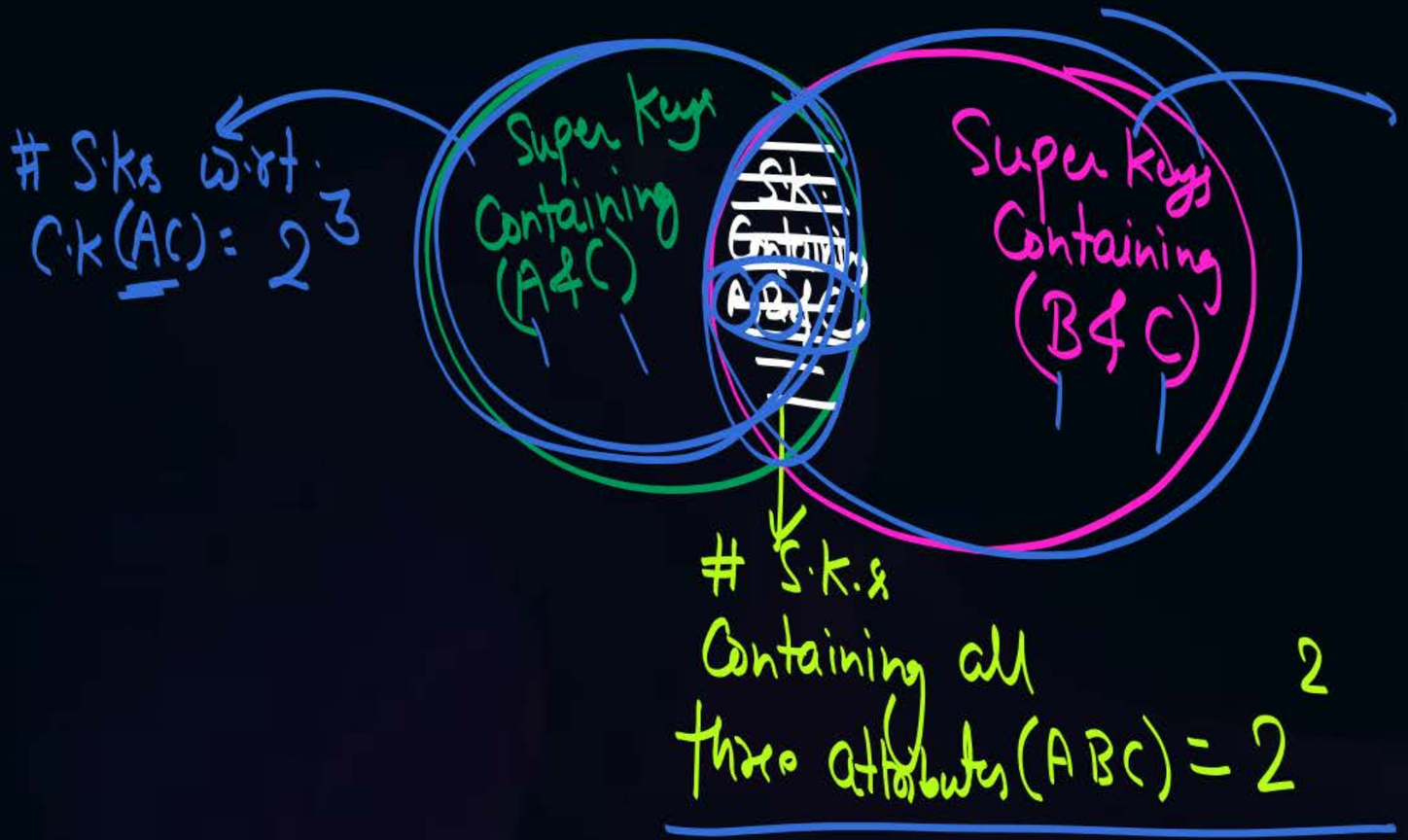
Attributes of Relⁿ : A, B, C, D, E

Possible Choices w.r.t. SK = $1 \times 1 * \underbrace{2 \times 2 \times 2}_{\text{May or may not be present}} = 2^3 = 8$, i.e. 8 Super keys.

1 → Must be present

- If a C.K Consists of 'k' attributes and there are 'n' attributes (in total) in the relation, then number of Super keys containing the given Candidate key will be $= 2^{n-k}$

#Q.5 Let R(A, B, C, D, E) is a relation and AC and BC are the only two candidate keys of relation R, then how many super keys exist in relation R.



i. Total no. of Super key

$= n(AC) + n(BC) - n(AC \cap BC)$

$= 2^3 + 2^3 - 2^2$

$= 8 + 8 - 4$

$= 12$ Ans

. A & B are two subsets of universal set U,

if $|A| = 10$, & $|B| = 7$, and $|A \cap B| = 2$

then $|A \cup B| = ?$

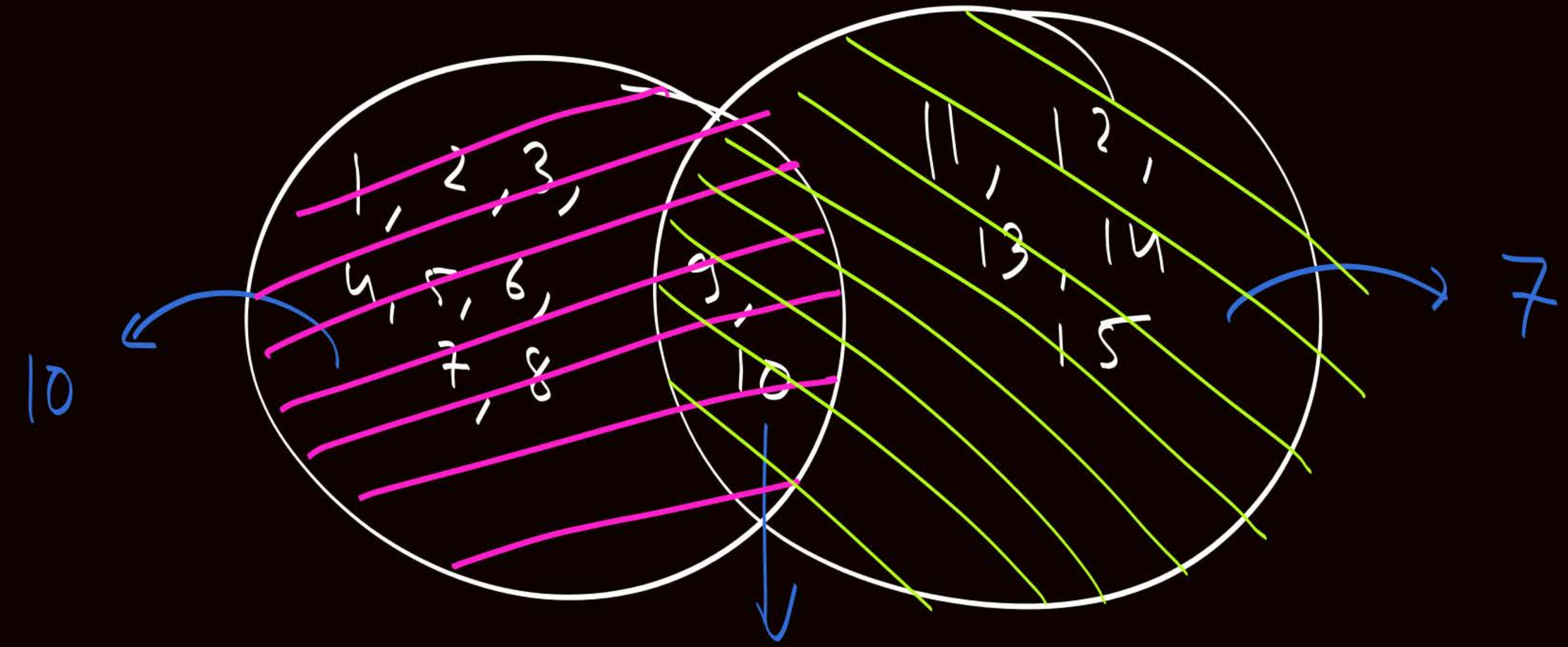
$A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$B = \{9, 10, 11, 12, 13, 14, 15\}$

$A \cap B = \{9, 10\}$

$A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

$|A \cup B| = 15$



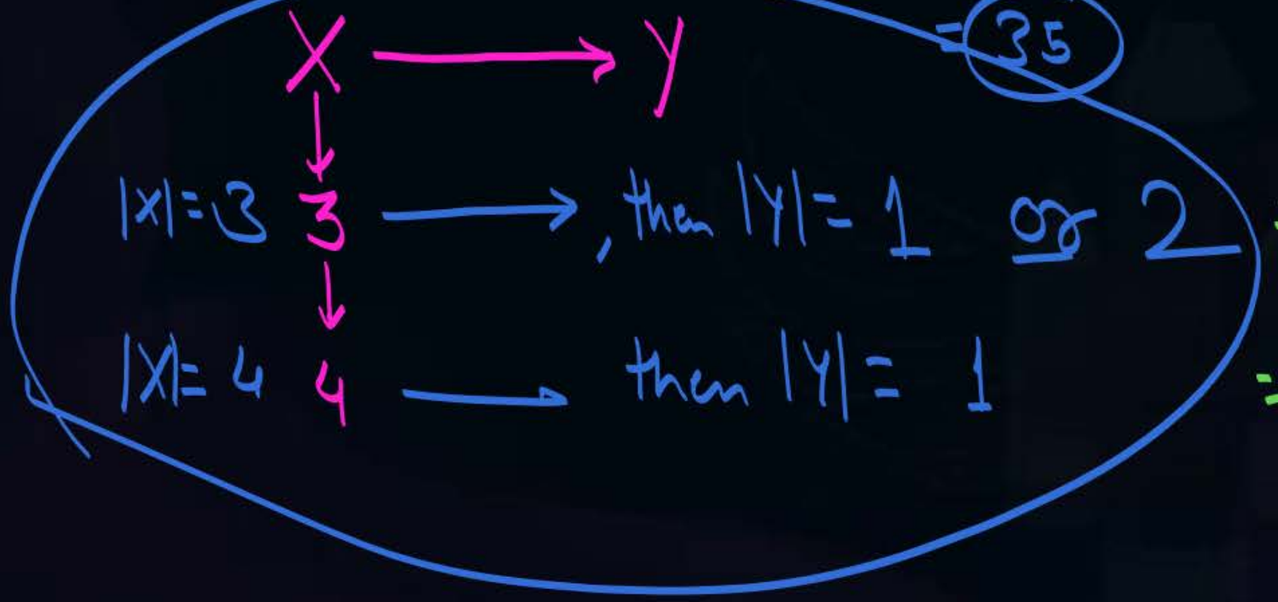
$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$= 10 + 7 - 2 = 15$$

(5)

#Q.6 Functional dependency (FD) X→Y is called a useful FD iff X and Y are non-empty sets of attributes and $X \cap Y = \emptyset$.

How many such useful FDs X→Y can exist over relation R(A, B, C, D, E) if size of attributes set X is restricted to be larger than two and size of attributes set Y is restricted to be smaller than 3 ___



$= {}^{5}C_{3} * \left({}^{2}C_{1} + {}^{2}C_{2}\right)$

$= {}^{5}C_{4} * \left({}^{1}C_{1}\right)$

$5 * 1 = 5$

(5) (1) = 30+5 = 35

$10 * 3 = 30$

H.W. Topic for tomorrow :-

1. Minimal Cover (Canonical Cover)
2. Relationship b/w FD set.
3. FD set of sub relations
4. Normal form of given relation

2 mins Summary

Topic Functional dependencies

Topic Closure of a set of attributes

Topic Number of Candidate keys and Super keys

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THANK - YOU