Computer Science & Information Technology

Database Management System

DPP: 1

Q1 In a relation R(X,Y), we can say that a functional dependency X → Y holds if:
(A) All values of X are unique in R
(B) All values of Y are unique in R
(C) For every pair of tuples in R, if the X values are the same, then the Y values are also the same
(D) For every pair of tuples in R, if the Y values are the same, then the X values are also the same

Q2 Given A → B, which of the following can be inferred using augmentation?
(A) B → A (B) AC → BC
(C) C → A (D) AB → C

Q3 Relation R(A, B, C, D) has FDs:
A → B
B → C
Which of the following is NOT derivable using Armstrong's axioms?
(A) A → C
(B) A → BC
(C) AD → BCD
(D) C → A

Q4 Consider relation R(A, B, C, D) with candidate keys: {AB}, {BCD}.
Which of the following best explains why {AB} is considered a minimal key?
(A) Because {AB} has fewer attributes than {BCD}
(B) Because no proper subset of {AB} is a key
(C) Because {AB} determines all attributes of R
(D) None of the above

Q5 Consider a relation R(A, B, C, D) with the following functional dependencies:
A → B
C → D
AC → BCD
Which of the following is a candidate key of R?
(A) AC (B) A
(C) C (D) ABC

Q6 Consider a relation R(A, B, C, D, E, F) with the following set of functional dependencies:
F = {A → B, B → C, CD → E, E → F, F → A}
How many candidate keys does relation R have?

Q7 Consider relation Employee(EmpID, Dept, Project, Manager, Location) with the following functional dependencies:
1. EmpID → Dept, Project
2. Project, Manager → Location
3. Location → EmpID
Which of the following is/are prime attribute of Employee?
(A) Project (B) Manager
(C) Dept (D) Location

Q8 Consider a relation R(A, B, C, D, E) with the following set of functional dependencies F:
a. A → B
b. B → C
c. CD → E
Which of the following functional dependencies is/are NOT the member of F^+ (i.e., implied by the given FD set)?
(A) A → C (B) A → E
(C) AB → C (D) BD → E

Q9 Consider relation R(A, B, C, D, E) with the following two FD sets:
F1:
1. A → BC
2. B → D
3. CD → E
F2:
1. A → B
2. A → C
3. B → D
4. C → E,

5. D → E

Which of the following is correct?

(A) F1 and F2 are equivalent (i.e., they imply the same set of FDs)

(B) F1 ⊂ F2 (F1 is a subset of F2, but not equivalent)

(C) F2 ⊂ F1 (F2 is a subset of F1, but not equivalent)\

(D) F1 and F2 are not comparable

Q10 Consider relation R(P, Q, R, S, T) with the following functional dependencies:

a. P → Q

b. R → S

c. P → T

How many superkeys does R have?

Answer Key

Q1	(A, C)
Q2	(B)
Q3	(D)
Q4	(B)
Q5	(A)
Q6	5~5
Q7	(A, B, D)
Q8	(B)
Q9	(B)
Q10	8~8

Hints & Solutions

Q1 Text Solution:
Because FD X → Y means: X uniquely determines Y. i.e., if two tuples agree on X, they must also agree on Y.

Q2 Text Solution:
Augmentation: If X → Y, then XZ → YZ.

Q3 Text Solution:
We can derive A → C (transitivity), A → BC (union), and AD → BCD (adding D using augmentation).
But C → A cannot be derived.

Q4 Text Solution:
A candidate key is minimal if none of its proper subsets is a key.

Q5 Text Solution:
Check closure of AC:
AC^+= {A, C} ∪ {B (from A → B), D (from C → D)} = {A, B, C, D} = all attributes → AC is a superkey.
Now check minimality:
A^+ = {A, B} (not all attributes).
C^+ = {C, D} (not all attributes).
Neither A nor C alone is a key → AC is minimal.
Option D (ABC) is a superkey too, but not minimal since AC ⊆ ABC

Q6 Text Solution:
AD^+ = {A, B, C, D, E, F}
Along with AD, the following are also candidate keys:
FD
ED
CD
BD

Q7 Text Solution:
The candidate keys of the relation are {EmpID, Manager}, {Location, Manager}, and {Project, Manager}.

Q8 Text Solution:
(A) A → C
- A → B (given)
- B → C (given)
- So by transitivity: A → C (implied, in F^+)

(B) A → E
- From A, we get B (via 1) and then C (via 2).
- But to get E, we need CD → E. We don't have D from A.
- So A → E (NOT implied, NOT in F^+)

(C) AB → C
- AB contains A. From A → C (as shown in A).
- So AB → C (implied, in F^+)

(D) BD → E
- From BD, we already have B and D.
- From B → C, we get C.
- Now we have C and D → E (via 3).
- So BD → E (implied, in F^+)

Q9 Text Solution:
Step 1: Minimal Cover of F1
- A → BC can be split: A → B, A → C
- So F1 becomes: {A → B, A → C, B → D, CD → E}

Step 2: Compare with F2
- F2 is: {A → B, A → C, B → D, C → E, D → E}
- From CD → E in F1, we can't separately derive C → E or D → E (both needed together).
- So F2 allows more dependencies than F1.

Conclusion: F1 is not equivalent to F2; instead, F2 is strictly stronger.

Q10 Text Solution:
The candidate key of this relation is PR. So, the remaining three attributes Q, S, and T have 2 choices each.
Hence, there are 8 superkeys possible