Q-22.

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Q-1 A FD $X \rightarrow Y$ require that the value of X uniquely determines the value of Y where X and Y are set of attributes.

Option (A) holds functional dependency (FD) as column A uniquely determine the value of BC.
option (B) doesn't hold functional dependecy as for the same (4 7) value there is two different values that's are 7 and 5.

Similarly option (C) doesn't hold FD while (D) holds FD.

③ A EMP_ID
B EMP_COUNTRY
C EMP_DEPT
D DEPT_TYPE
E EMP_DEPT_NO

a) A → B
A → D
B → D ; D → B makes more sense from a logical view}
C → E

b) Candidate keys
(A, E) and (AC) can be candidate keys.

c) Table is already 1NF (no multivalued attributes)
Removing 2NF issues

A	E
264	283
364	232
264	300
364	549

A	B	D
264	India	D394
364	UK	D283

C	E
Designing	283
Testing	300
Stores	232
Developing	549

3NF can be violated by B and C as both give unique values for each other and both are non-prime attributes.
Removing 3NF discrepancies

A	E
264	283
364	232
264	300
364	549

C	E
Designing	283
Testing	300
Stores	232
Developing	549

A	B
264	India
364	UK

A	D
264	D394
364	D283

All candidate keys are determining non prime attributes hence in 3NF too and in BCNF

Q-3) Car_Sale (car-id, option-type, option-listprice, Sale-date, option-discountedprice).

car-id → Sale-date
Option-type → Option-listprice car-id
Option-type → Option-discountedprice

∀ A → B, B must be prime attribute or A is Superkey.

But in this Question :-
car-id, option-type are Prime Attributes

option-listprice, sale-date, option-discountedprice are Non-Prime attributes.

∴ On Right side FD's → All attributes are Non-Prime and On left side FD's → Not Superkeys.
So the rel^n is not in 3F.

Cond^n for 2NF ⇒ No Partial Dependency.

~~Here Option-listprice~~
⇒ option-type → option-listprice ⇒ option-listprice is determined only using option-type.

∴ Not in 2NF.

4/b ① $AB \rightarrow C$

$C \rightarrow EF$

⇒ $AB \rightarrow EF$

②

$C \rightarrow EF$

$C \rightarrow CF$

$CF \rightarrow G$

⇒ $AB \rightarrow G$

(a) Hence AB is the candidate key.

(b) CEFG is non-prime attribute.

(c) No. of superkeys $= 2^{n-2}$

$= 16 \quad (n=6)$

(d) No. of superkeys = 16

Superkeys : [A,B], [A,B,C], [A,B,E], [A,B,F], [A,B,G], [A,B,D], [A,B,C,E], [A,B,C,F], [A,B,C,G], [A,B,E,G], [A,B,F,G], [A,B,C,EF], [A,B,C,E,G], [A,B,C,F,G], [A,B,E,F,G], [A,B,C,E,F,G].