Q1: BCNF is not used for cases where a relation has

1. Two (or more) candidate keys
2. Two candidate keys and composite
3. The candidate key overlap
4. Two mutually exclusive foreign keys

Answer: 4. Two mutually exclusive foreign keys

Explanation:

A relation is in Boyce-Codd normal form if all attributes which are determinants are also candidate keys. Transformation into Boyce-Codd normal form deals with the problem of overlapping keys.

Q2:

What is the highest normal form of a relation R(A, B, C, D, E) with FD set?

{B → A, A → C, BC → D, AC→ BE}

Options:

1. 2NF
2. 3NF
3. BCNF
4. 4NF

Answer: 2. 3NF

Explanation:

B → A

A → C

BC → D

AC → BE

B+ = BACDE

A+ = ACBED

So A & B are Candidate key.

There is no partial dependency, so in 2NF.

But in the BC → D, neither BC is key nor D is prime attribute, hence not in 3NF.

Note: Official Key given option-C is correct.

Q3: Consider the following relational schemas for a library database : Book (Title, Author, Catalog_no, Publisher, Year, Price) Collection(Title, Author, Catalog_no) with the following functional dependencies :
I. Title, Author → Catalog_no
II. Catalog_no → Title, Author, Publisher, Year
III. Publisher, Title, Year → Price Assume (Author, Title) is the key for both schemas. Which one of the following is true ?

Options:

1. Both Book and Collection are in BCNF.
2. Both Book and Collection are in 3NF.
3. Book is in 2NF and Collection in 3NF.
4. Both Book and Collection are in 2NF.

Answer: 3. Book is in 2NF and Collection in 3NF.

Explanation:
Book (Title, Author, Catalog_no, Publisher, Year, Price)
(Author, Title) is the key .
Title, Author → Catalog_no
Catalog_no →Publisher
Here we are having a transitive dependency
(Key→non-key
Non-key→ non-Key)
Hence this relation is not in 3NF.
Collection(Title, Author, Catalog_no)
(Author, Title) is the key
Catalog_no → Title, Author
Since here LHS is not a Key so it is not in BCNF but since the RHS having prime key attribute so it is in 3NF.

Q4: Consider the schemaR = {S, T, U, V} and the dependencies
S → T, T → U, U → V and V → S If R = (R1 and R2)
be a decomposition such that R1 ∩ R2 = ϕ then the decomposition is

Options:
1. not in 2NF
2. in 2NF but not in 3NF
3. in 3NF but not in 2NF
4. in both 2NF and 3NF

Answer: 1. not in 2NF
Explanation:
Decomposition of a relation R into R1 and R2 is said to be lossless only if $R1 \cap R2 \neq \phi$ and the common attribute of R1 and R2 should be the primary key in any of the two decomposed relations(i.e.R1 and R2).
A relation which is in 2NF is always lossless.
In question, it is given that $R1 \cap R2 = \phi$ which is violating lossless decomposition condition.
Hence the given relation R is not in 2NF.

Q5: Relation R is decomposed using a set of functional dependencies, F, and relation S Is decomposed using another set of functional dependencies, G. One decomposition is definitely BCNF, the other is definitely 3NF, but it is not known which is which.
To make a guaranteed identification, which one of the following tests should be used on the decompositions? (Assume that the closure of F and G are available).

Options:
1. Lossless-join
2. BCNF definition
3. 3NF definition
4. Dependency-Preservation

Answer:
2. BCNF definition

Explanation:
Since one decomposition is in 3NF so it will not satisfy the BCNF conditions. Hence BCNF tests should be used on the decompositions.

Q6: "The relation scheme student performance(name, courseno, rollNo, grade) has the following functional dependencies:

Name, courseNo → grade

rollNo, courseNo → grade

Name → rollNo

rollNo → name

The highest normal form of this relation scheme is

Options:

1. 2NF

2. BCNF

3. 4NF

4. 3NF

Answer: 4. 3NF

Explanation:

Student Performance (name, courseNo, rollNo, grade)

name, courseNo → grade →(I)

rollNo, courseNo → grade →(II)

name → rollNo →(III)

rollNo → name →(IV)

Candidate keys: name, courseNo (or) rollNo

Its is not BCNF, because the relation III, there is no relationship from super key.

name → rollNo

It is not BCNF, name is not super key.

It belongs to 3NF, because if X→Y, Y is prime then it is in 3NF.

Q6: A many-to-one relationship exists between entity sets r1 and r2. How will it be represented using functional dependencies if Pk(r) denotes the primary key attribute of relation r?

Options:

1. Pk(r1) → Pk(r2)

2. Pk(r2) → Pk(r1)

3. Pk(r2) → Pk(r1) and Pk(r1) → Pk(r2)

4. Pk(r2) → Pk(r1) or Pk(r1) → Pk(r2)

Answer: 1. Pk(r1) → Pk(r2)

Explanation:

Here, we have a many to one relationship between between Set(r1) and Set(r2).

→ Elements of Set(r2) can't identify elements of Set(r1) because one value element in Set(r2) is pointing to more than one element of Set(r1).

→ So, we can't say Pk(r2) → Pk(r1) but elements of Set(r1) are pointing to exactly one element of Set(r2) so we can say that Pk(r2) → Pk(r1) because r1 is uniquely identifying r2.

Q7: For a database relation R(a, b, c, d) where the domains of a, b, c and d include only atomic values, and only the following functional dependencies and those that can be inferred from them hold :

a → c

b → d

The relation is in

Options:

1. First normal form but not in second normal form

2. Second normal form but not in third normal form

3. Third normal form

4. BCNF

Answer: 1. First normal form but not in second normal form

Explanation: Primary key of given relation is "ab".

And there is a partial dependency exist in given FD's so the given relation is in 1NF but not in second normal form.

Q8: Which of the following relation schemas is definitely in BCNF?

Options:

1. R1(A,B)

2. R4(A,B,C,D,E)

3. R3(A,B,C,D)

4. R2(A,B,C)

Answer: 1. R1(A,B)

Explanation:

BCNF properties

1. BCNF is free from redundancy.

2. If a relation is in BCNF, then 3NF is also also satisfied.

3. Every Binary Relation (a Relation with only 2 attributes) is always in BCNF.

4. Sometimes going for BCNF form may not preserve functional dependency.

Q9: A relation is in ____ form if every field consists only of atomic values, that is, not lists or sets.

Options:

1. First normal

2. Third normal

3. Second normal

4. Fourth normal

Answer: 1. First normal

Explanation:

If every field consists only of atomic values (i.e. no composite values) ,then that relation is in first normal form.

Q10: A table has fields Fl, F2, F3, F4, F5 with the following functional dependencies

F1 → F3,

F2→ F4,

(F1.F2) → F5

In terms of Normalization, this table is in

Options:

1. 1 NF

2. 2 NF

3. 3 NF

4. None

Answer: 1. 1 NF

Explanation:

F1 → F3 .....(i)

F2 → F4 .....(ii)

(F1·F2) → F5 .....(iii)

F1F2 is the candidate key.

F1 and F2 are the prime key.

In (i) and (ii) we can observe that the relation from P → NP which is partial dependency. So this is in 1NF.

Q11: An instance of a relational scheme R(A, B, C) has distinct values for attribute A.

Can you conclude that A is a candidate key for R?

Options:

1. Yes

2. No

Answer: 2. No

Explanation:

Because FD\'s are defined on the schema itself, not the instance. So, based on the state of the instance we cannot say what holds for schema (there can be many instances for R).

Q12:

Consider a relational table R that is in 3NF, but not in BCNF. Which one of the following statements is TRUE?

Options:

1. A cell in R holds a set instead of an atomic value.

2. R has a nontrivial functional dependency X→A, where X is not a superkey and A is a non-prime attribute and X is not a proper subset of any key.

3. R has a nontrivial functional dependency X→A, where X is not a superkey and A is a non-prime attribute and X is a proper subset of some key.

4. R has a nontrivial functional dependency X→A, where X is not a superkey and A is a prime attribute.

Answer: 4. R has a nontrivial functional dependency X→A, where X is not a superkey and A is a prime attribute.

Explanation:

R(ABCD)

FDs:

AB → C

BC → A

(BD)+ = BD ✖

(ABD)+ = ABDC ✔

(CBD)+ = CBDA ✔

Candidate keys = {ABD, CBD}

• The relation R is in 3NF, as there are no transitive dependencies.

• The relation R is not in BCNF, because the left side of both the FD's are not Super keys.

• In R, BC → A is a non-trivial FD and in which BC is not a Super key and A is a prime attribute."

Q13: Consider the following functional dependencies in a database:

Data_of_Birth → Age

Age → Eligibility

Name → Roll_number

Roll_number → Name

Course_number → Course_name

Course_number → Instructor

(Roll_number, Course_number) → Grade

The relation (Roll_number, Name, Date_of_birth, Age) is:

Options:

1. in second normal form but not in third normal form

2. in third normal form but not in BCNF

3. in BCNF

4. in none of the above

Answer: 4. in none of the above

Explanation:

Three FD's are valid from the above set of FD\'s for the given relation.

Date_of_Birth → Age

Name → Roll_number

Roll_number → Name

Candidate keys for the above are:

(Date_of_Birth, Name) and (Date_of_Birth, Roll_number)

Clearly, there is a partial dependency,

Date_of_Birth → Age

So, it is only in 1NF.

Q14: Consider the following relational schema:

Suppliers(sid:integer, sname:string, city:string, street:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

Assume that, in the suppliers relation above, each supplier and each street within a city has a unique name, and (sname, city) forms a candidate key. No other functional dependencies are implied other than those implied by primary and candidate keys. Which one of the following is TRUE about the above schema?

Options:

1. The schema is in BCNF

2. The schema is in 3NF but not in BCNF

3. The schema is in 2NF but not in 3NF

4. The schema is not in 2NF

Answer: 1. The schema is in BCNF

Explanation:

From the given data the FDs will be

(Sid, Street) → Sname

As Sid is a primary key, then

(Sid, Street) will be super key.

Hence, it is in BCNF.

Q15: Consider the following relational schemes for a library database:

Book(Title, Author, Catalog_ no, Publisher, Year, Price)

Collection (Title, Author, Catalog_no)

with in the following functional dependencies:

I. Title Author → Catalog_no

II. Catalog_no → Title Author Publisher Year

III. Publisher Title Year → Price

Assume {Author, Title} is the key for both schemes. Which of the following statements is true?

Options:

1. Both Book and Collection are in BCNF

2. Both Book and Collection are in 3NF only

3. Book is in 2NF and Collection is in 3NF

4. Both Book and Collection are in 2NF only

Answer: 3. Book is in 2NF and Collection is in 3NF

Explanation:

Given that

Book(Title, Author, Catalog_no, Publisher, Year, Price)

Collection(Title, Author, Catalog_no)

I) Title Author ⟶ Catalog_no ⟶ BCNR

II) Catalog_no ⟶ Title, Author, Publisher, Year ⟶ 3NF

III) Publisher Title Year ⟶ Price ⟶ 2NF

Book's in 2NF

Collection is in 3NF.

Q16: Consider the schema R = (S T U V) and the dependencies S → T, T → U, U → V and V → S.

Let R = (R1 and R2) be a decomposition such that R1 ∩ R2 ≠ ∅ .

The decomposition is

Options:

1. not in 2NF

2. in 2NF but not 3NF

3. in 3NF but not in 2NF

4. in both 2NF and 3NF

Answer: 4. in both 2NF and 3NF

Explanation:

Since R1 ∩ R2 ≠ ∅, so the decomposition is lossless join. Now since all the attributes are keys, so R1 ∩ R2 will be a key of the decomposed relation.

And since every attribute is key so the decomposed relation will be in BCNF and hence in 3NF.

Q17: For a database relation R(a,b,c,d), where the domains a, b, c, d include only atomic values, only the following functional dependencies and those that can be inferred from them hold:

inferred = anuman lgana

a → c

b → d

This relation is

Options:

1. in first normal form but not in second normal form

2. in second normal form but not in third normal form

3. in third normal form

4. None of the above

Answer: 1. in first normal form but not in second normal form

Explanation: Candidate key is ab.

Since all a, b, c, d are atomic. So the relation is in 1NF.

Checking the FD\'s

a → c

b → d

We can see that there is partial dependencies. So it is not 2NF.

So answer is option (A).

Q18: Given the following two statements:

S1: Every table with two single-valued attributes is in 1NF, 2NF, 3NF and BCNF.

S2: AB->C, D->E, E->C is a minimal cover for the set of functional dependencies

AB->C, D->E, AB->E, E->C.

Which one of the following is CORRECT?

Options: 1. S1 is TRUE and S2 is FALSE.

2. Both S1 and S2 are TRUE.

3. S1 is FALSE and S2 is TRUE.

4. Both S1 and S2 are FALSE.

Answer: 1. S1 is TRUE and S2 is FALSE.

Explanation: S1: True

If we can prove the relation is in BCNF then by default it would be in 1NF, 2NF, 3NF also.

Let R(AB) be a two attribute relation, then

If {A→B} exists then BCNF since {A}+ = AB = R

If {B→A} exists then BCNF since {B}+ = AB = R

If {A→B, B→A} exists then BCNF since A and B both are Super Key now.

If {No non-trivial Functional Dependency} then default BCNF.

Hence it's proved that a Relation with two single-valued attributes is in BCNF hence it's also in 1NF, 2NF, 3NF.

S2: False

The canonical cover for the given FD set is {AB→C, D→E, AB→E, E→C}. As we can see AB→E is not covered in minimal cover since {AB}+ = ABC in the given cover {AB→C, D→E, E→C}

Q19: If a relation is an 2NF and 3NF forms, then

Options:

1. no non-prime attribute is functionally dependent on other non-prime attributes

2. no non-prime attribute is functionally depend on the prime attributes

3. all attributes are functionally independent

4. prime attribute is functionally independent of all non-prime attributes Even table is in bcnf then also it is not true.

Answer: 1. no non-prime attribute is functionally dependent on other non-prime attributes

Explanation: If a relation is an 2NF and 3NF forms, then no non-prime attribute is functionally dependent on other non-prime attributes because for 3NF the condition is that for A->B , either A is a super key or B is a prime attribute.

Q20: Partial dependencies are removed to achieve which normal form?

Options:

1. First normal form

2. Second normal form

3. BCNF

4. Third normal form

Answer: 2. Second normal form

Explanation: In 2NF partial dependencies are not allowed. Hence partial dependencies are removed to achieve second normal form.
