Problem 38. Consider the relation schema R = {P, Q, S, T, U, V} and the functional dependencies FD = {PQ → S, PS → Q, PT → U, Q → T, QS → P, U → V

Consider also the relation schemas

R1 = {P, Q, S}, R2 = {P, Q, S, U, V} and R3 = {P, Q, S, T}

1. Write the projection of the FDs on R1.
2. The set of dependencies FD given above is a minimal cover.
3. R1 is in 3NF.
4. R1 is in BCNF.
5. Write the projection of the FDs on R2.
6. All the canditate keys of R2 are {PQU, QSU}.
7. R2 is in BCNF.
8. Consider the decomposition of R2 {PQU, PQS, UV}. The new relations are in BCNF.
9. Write the projection of the FDs on R3.
10. The candidate keys of R3 are {PQ, QS, PS}.
11. R3 is not in BCNF. Give all the dependencies of FD that violate the BCNF.
12. R3 is in 1NF.
13. Consider the decomposition of R3 to {PQS, QT}. The new relations are in BCNF.

Solution.

1. {PQ → S, PS → Q, QS → P}
2. True.
3. True.
4. True. PQ, PS and QS are the candidate keys for R1.
5. {PQ → S, PS → Q, QS → P, U → V}
6. False. The keys are {PQU, PSU, QSU}.
7. False. It is not even in 2NF as U is a proper subset of the subset keys and the FD U → V exists.
8. True.
9. {PQ → S, PS → Q, Q → T, QS → P}
10. True.
11. Q is a proper subset of a key, but the dependency Q → T exists.
12. True.
13. True.

TEST YOUR KNOWLEDGE

True/False

1. If all Y-values are different and all X-values are the same in all possible r(R), then does Y → X in R?
2. Every relation which is in 3NF is in BCNF.

3. Every relation which is in BCNF is in 3NF.
4. Every relation which is in BCNF is in 4NF.
5. In order to meet performance requirements, you may have to denormalize portions of the database design.
6. Every relation which is in 4NF is in BCNF.
7. If a relation R is in BCNF, it is also in 3NF.
8. If a relation R is not in BCNF, we can always obtain its BCNF by applying lossless-join decomposition on R.
9. If a relation R is not in BCNF, we can always obtain its BCNF by applying decomposition which is dependency preserving on R.
10. Dependencies can be identified with the help of the dependency diagram.
11. Dependencies that are based on only a part of a composite primary key are called transitive dependencies.
12. If a relation R is not in 3NF, we can always obtain its 3NF by applying lossless-join decomposition on R.
13. If a relation R is not in 3NF, we can always obtain its 3NF by applying decomposition which is dependency preserving on R.
14. 2NF applies only to the tables with composite primary keys.
15. X, Y are sets of attributes, if $X \rightarrow Y$ then the set X^+ contains Y^+ .
16. X, Y are sets of attributes, if X, $Y \rightarrow Z$ then $X \rightarrow Z$.
17. X, Y are sets of attributes, if $X \rightarrow Y$ and Y, $U \rightarrow V$ then X, $U \rightarrow V$.
18. X, Y are sets of attributes, if the set X^+ is contained in Y^+ then X is contained in Y.
19. A dependency of one nonprime attribute on another nonprime attribute is a partial dependency.
20. It is possible for a table in 2NF to exhibit transitive dependency, where one or more attributes may be functionally dependent on non-key attributes.
21. A determinant is any attribute whose value determines other values within a column.
22. If (A, B) -> C, then can we say that A-> C?
23. If A -> (B, C), then can we say that A -> B?
24. According to the dependency theory, it is possible for a relation not to have a key.
25. According to dependency theory, it is always bad if a relation has more than one key.
26. You should be always able to come up with lossless, dependency preserving, BCNF relations of the given schema.
27. According to dependency theory, it is bad if the only key for a relation is all of its attributes together.
28. If your schema is in 3NF but not in 4NF, then you probably need to revise it.
29. If decomposition is not lossless, then you should not use it for the application schema.
30. If decomposition does not preserve dependencies, then you should not use it for the application schema.
31. Every table with 2 single valued attributes is in 1NF, 2NF, 3NF and BCNF.
32. If every attribute of a table functionally depends on the primary key, the table is in 3NF.
33. A table is in the second normal form (2NF) if every attribute is determined by every candidate key, but is not determined by any pure subset of a candidate key.

34. De-normalization can increase the chance of errors and inconsistencies and can force reprogramming if business rules change.
35. De-normalization produces a lower normal form.

Fill in the Blanks

1. All relations are in _____ normal form.
2. A table that has all key attributes defined, has no repeating groups, and all its attributes are dependent on the primary key, is said to be in _____.
3. An attribute that cannot be further divided is said to display _____.
4. A functional dependency X → Y is a _____, if removal of any attribute A from X, means that the dependency does not hold any more.
5. If A → BC holds than A → B and A → C holds is called _____.
6. One of the requirements of the 3NF is that the functional dependency (FD) is a ____.
7. A functional dependency of the form $x \rightarrow y$ is _____ if y subset x.
8. A relation that has no partial functional dependencies is in _____ normal form.
9. Fourth normal form deals with _____.
10. _____ is the process of organizing data to minimize redundancy and remove ambiguity.
11. If R is a 3NF then every non-prime attribute is _____ and non-transitively dependent on any key.
12. A relation is in _____ if every determinant is a candidate key.
13. _____ is the process of organizing data to minimize redundancy and remove ambiguity.
14. A function dependency between two or more non-key attribute in a relation is _____.
15. A relation is in _____ if it is BCNF and it has at the most only one independent multi-valued dependency.
16. When a non-key attribute is the determinant of a key attribute the table is in 3NF but not _____.
17. Any attribute that is at least part of a key is known as a(n) _____.
18. The collection of three rules called_____ are used to find logically implied functional dependencies.
19. An _____ occurs when it is not possible to store certain information unless some other, unrelated, information is stored as well.
20. The decomposition of R into UV and R – V is _____ if U → V holds over R.
21. _____ is the process of increasing redundancy in the database either for convenience or to improve performance.
22. Design relation schemas so that they can be _____ conditions on attributes that are either primary keys or foreign keys in a way which guarantees that no ____ tuples are generated.
23. Match the following:

(1) No Partial Dependencies ____	(*a*) 1NF
(2) No multi-value attributes ____	(*b*) 2NF
(3) No dependency between non-key attributes ____	(*c*) 3NF
(4) No multi-value dependencies ____	(*d*) 4NF
(5) All attributes are dependent on the key _____	

(6) All attributes are dependent on the whole key _____	
(7) All attributes are dependent on nothing but the key _____	
(8) Similar to BCNF _____	
(9) No transitive dependencies _____	
(10) For a table to be considered a relation, it must at least satisfy _____	

Multiple Choice Questions

1. Which one of the following statements if FALSE? (*GATE 2006*)
   (*a*) Any relation with two attributes is in BCNF.
   (*b*) A relation in which every key has only one attribute is in 2NF.
   (*c*) A prime attribute can be transitively dependent on a key in a 3 NF relation.
   (*d*) A prime attribute can be transitively dependent on a key in a BCNF relation.
2. The following functional dependencies are given: (*GATE 2006*)
   AB→CD, AF→D, DE→F, C→G, F→E, G→A
   Which one of the following options is false?
   (*a*) CF^+ = {ACDEFG} (*b*) BG^+ = {ABCDG}
   (*c*) AF^+ = {ACDEFG} (*d*) AB^+ = {ABCDFG}
3. Consider a relation scheme R = (A, B, C, D, E, H) on which the following functional dependencies hold: {A–>B, BC–> D, E–>C, D–>A}. What are the candidate keys of R? (*GATE 2005*)
   (*a*) AE, BE (*b*) AE, BE, DE
   (*c*) AEH, BEH, BCH (*d*) AEH, BEH, DEH
4. Which one of the following statements about normal forms is FALSE? (*GATE 2005*)
   (*a*) BCNF is stricter than 3NF
   (*b*) Lossless, dependency-preserving decomposition into 3NF is always possible
   (*c*) Lossless, dependency-preserving decomposition into BCNF is always possible
   (*d*) Any relation with two attributes is in BCNF
5. Desirable properties of relational database design include
   (*a*) minimizing insertion/deletion anomalies
   (*b*) minimizing redundancy
   (*c*) minimizing update anomalies
   (*d*) all of the above
6. The functional dependency A -> B for relation schema R(A, B, C, D) implies that
   (*a*) no two tuples in R can have the same value for attribute B
   (*b*) no two tuples in R can have the same value for attribute A
   (*c*) any two tuples in R that have the same value for B must have the same value for A
   (*d*) any two tuples in R that have the same value for A must have the same value for B
7. If AB -> CD is one of the functional dependencies for relation schema R(A, B, C, D) then which of the following will always hold?
   (*a*) AB is a candidate key for R

(*b*) no two tuples in R can have the same values for A and B

(*c*) AB is a primary key for R

(*d*) all of the above

8. Given the functional dependencies, {AB -> CDE and A -> E}, for relation scheme R = (A, B, C, D, E) we can infer the following:

(*a*) A is a key for R (*b*) BE is a key for R

(*c*) AB is a key for R (*d*) none of the above

9. Given the functional dependencies {AB -> C, C -> D} for the relation schema R(ABCD), the dependency A -> D can be inferred by

(*a*) the reflexive rule (*b*) the augmentation rule

(*c*) the transitive rule (*d*) none of the above

10. Consider the following relational schemes for a library database: (*GATE 2008*)

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

Collection (Title,Author,Catalog_ no) with the following functional dependencies:

I. Title Author $\rightarrow$ Catalog_no

II. Catalog_no $\rightarrow$ Title Author Publisher Year

III. Publisher $\rightarrow$ Title Year Price

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

(*a*) Both book and collection are in BCNF

(*b*) Both book and collection are in 3NF only

(*c*) Book is in 2NF and collection is in 3NF

(*d*) Both book and collection are in 2NF only

11. Which of the following is TRUE? (*GATE 2012*)

(*a*) Every relation is 3NF is also in BCNF.

(*b*) A relation R is in 3NF if every non-prime attribute of R is fully functionally dependent on every key of R.

(*c*) Every relation in BCNF is also in 3NF.

(*d*) No relation can be in both BCNF and 3NF.

12. Given the following relation instance (*GATE 2000*)

X	Y	Z
1	4	2
1	5	3
1	6	3
3	2	2

Which of the following functional dependencies are satisfied by the instance?

(*a*) XY $\rightarrow$ Z and Z $\rightarrow$ Y (*b*) YZ $\rightarrow$ X and Y $\rightarrow$ Z

(*c*) YZ $\rightarrow$ X and X $\rightarrow$ Z (*d*) XZ $\rightarrow$ Y and Y $\rightarrow$ X

13. Consider a schema R(A, B, C, D) and functional dependencies A $\rightarrow$ B and C $\rightarrow$ D. Then the decomposition of R into R_1(AB) and R_2(CD) is (*GATE 2001*)

(*a*) dependency preserving and loss less join

(*b*) loss less join but not dependency preserving

(*c*) dependency preserving but not loss less join

(*d*) not dependency preserving and not loss less join

14. R (A, B, C, D) is a relation. Which of the following does not have a loss less join, dependency preserving BCNF decomposition? (*GATE 2001*)

(*a*) A → B, B → CD (*b*) A → B, B → C, C → D

(*c*) AB → C,C → AD (*d*) A → BCD

15. Relation R is decomposed using a set 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 closures of F and G are available). (*GATE 2002*)

(*a*) Dependency-preservation (*b*) Loss less-join

(*c*) BCNF definition (*d*) 3NF definition

16. From the following instance of a relation schema R (A,B,C), we can conclude that: (*GATE 2002*)

A	B	C
1	1	1
1	1	0
2	3	2
2	3	2

(*a*) A functionally determines B and B functionally determines C

(*b*) A functionally determines B and B does not functionally determine C

(*c*) B does not functionally determine C

(*d*) A does not functionally determine B and B does not functionally determine C

17. Consider the following functional dependencies in a database: (*GATE 2003*)

Date _ 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

(*a*) in second normal form but not in third normal form

(*b*) in third normal form but not in BCNF

(*c*) in BCNF

(*d*) in none of the above

18. Consider a schema R(A, B, C, D) and functional dependencies A→B and C→D. Then the decomposition R1(A, B) and R2(C, D) is (*UGC-NET*)

(*a*) dependency preserving but not lossless join

(*b*) dependency preserving and lossless join

(*c*) lossless join but not dependency preserving

(*d*) lossless join

19. Third normal form is based on the concept of (*UGC-NET*)
    (*a*) Closure Dependency (*b*) Transitive Dependency
    (*c*) Normal Dependency (*d*) Functional Dependency
20. Decomposition help in eliminating some of the problems of bad design (*UGC-NET*)
    (*a*) redundancy (*b*) inconsistencies
    (*c*) anomalies (*d*) all of the above
21. Referential integrity is directly related to (*UGC-NET*)
    (*a*) Relation key (*b*) Foreign key (*c*) Primary key (*d*) Candidate key
22. Which normal form is considered as adequate for usual database design? (*UGC-NET*)
    (*a*) 2NF (*b*) 3NF (*c*) 4NF (*d*) 5NF
23. Which of the following is true? (*UGC-NET*)
    (*a*) A relation in 3NF is always in BCNF
    (*b*) A relation in BCNF is always in 3NF
    (*c*) BCNF and 3NF are totally different
    (*d*) A relation in BCNF is in 2NF but not in 3NF
24. If a relation is in 2NF and 3NF forms then (*UGC-NET*)
    (*a*) No non-prime attribute is functionally dependent on other non-prime attributes.
    (*b*) No non-prime attribute is functionally dependent on prime attributes.
    (*c*) All attribute are functionally independent.
    (*d*) Prime attribute is functionally independent of all non-prime attributes.
25. Match the following: (*UGC-NET*)

1. 2NF	(*a*) Transitive dependencies eliminated
2. 3NF	(*b*) multivalued attribute removed
3. 4NF	(*c*) contains no partial functional dependencies
4. 5NF	(*d*) contains no join dependency

    (*a*) 1. (*a*), 2. (*c*), 3. (*b*), 4. (*d*) (*b*) 1. (*d*), 2. (*c*), 3. (*a*), 4. (*b*)
    (*c*) 1. (*c*), 2. (*a*), 3. (*b*), 4. (*d*) (*d*) 1. (*a*), 2. (*b*), 3. (*c*), 4. (*d*)
26. Multivalued dependency among attribute is checked at which level? (*UGC-NET*)
    (*a*) 2NF (*b*) 3NF (*c*) 4NF (*d*) 5NF
27. If a relation is in 2NF then (*UGC-NET*)
    (*a*) every candidate key is a primary key
    (*b*) every non-prime attribute is fully functionally dependent on each relation key
    (*c*) every attribute is functionally independent
    (*d*) every relational key is a primary key.
28. A super key for an entity consists of (*UGC-NET*)
    (*a*) one attribute only (*b*) at least two attributes
    (*c*) at most two attributes (*d*) one or more attributes
29. A relation R = {A, B, C, D, E, F} is given with the following set of functional dependencies: F = {A→B, AD→C, B→F, A→E}
    Which of the following is a candidate key? (*UGC-NET*)
    (*a*) A (*b*) AC (*c*) AD (*d*) None of these

30. If a relation with a schema R is decomposed into two relations R_1 and R_2 such that $(R_1 \cup R_2) = R_1$ then which one of the following is to be satisfied for a lossless join decomposition (*UGC-NET*)
    (*a*) $(R_1 \cap R_2) \rightarrow R_1$ or $R_1 \cap R_2 \rightarrow R_2$
    (*b*) $R_1 \cap R_2 \rightarrow R_1$
    (*c*) $R_1 \cap R_2 \rightarrow R_2$
    (*d*) $R_1 \cap R_2 \rightarrow R_1$ and $R_1 \cap R_2 \rightarrow R_2$
31. Suppose R is relation schema and DF is a set of functional dependencies on R. Further, suppose R_1 and R_2 form a decomposition of R. Then the decomposition is a lossless join decomposition of R provided that (*UGC-NET*)
    (*a*) $R_1 \cap R_2 \rightarrow R_1$ is in F^+
    (*b*) $R_1 \cap R_2 \rightarrow R_2$ is in F^+
    (*c*) both $R_1 \cap R_2 \rightarrow R_1$ and $R_1 \cap R_2 \rightarrow R_2$ functional dependencies are in F^+
    (*d*) at least one from $R_1 \cap R_2 \rightarrow R_1$ and $R_1 \cap R_2 \rightarrow R_2$ is in F^+
32. In general upto which normal form the relations are processed?
    (*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5
33. Which of the following yields better performance?
    (*a*) Denormalization (*b*) Normalization
    (*c*) Dependency (*d*) Compression
34. What is an update anomaly? Choose one of the following:
    (*a*) One transaction reads an element that was updated by an earlier, uncommitted transaction.
    (*b*) The application wants to update a foreign key to a new value that does not exists in the referenced relation.
    (*c*) The same information is stored redundantly in the database, and only some, but not all copies are updated.
    (*d*) None of these
35. Which of the following statements best describes the main reason for representing a relational database in 1^{st} normal form?
    (*a*) To achieve physical data independence.
    (*b*) To remove data anomalies (insertion, update, deletion anomalies).
    (*c*) To save space on disk.
    (*d*) All of the above
36. Which of the following statements best describes the main reason for representing a relational database in BCNF?
    (*a*) To achieve physical data independence.
    (*b*) To remove data anomalies (insertion, update, deletion anomalies).
    (*c*) To save space on disk.
    (*d*) None of these
37. Which one of the following is correct?
    (*a*) All functional dependencies are many to many relationship.
    (*b*) All functional dependencies are many to one relationship.
    (*c*) All functional dependencies are one to one relationship.
    (*d*) None of these.

38. Which one of the following are true? A set of functional dependencies is irreducible if and only if
    (*a*) The left hand side of every FD is just one attribute.
    (*b*) The right hand side of every FD is just one attribute.
    (*c*) Both the left and right hand side of every FD is just one attribute.
    (*d*) None of these.
39. Which of the following conversion is not an example of denormalization?
    (*a*) 3NF to 2NF (*b*) 2NF to 1NF (*c*) 3NF to 1NF (*d*) 3NF to BCNF
40. Which of the following normal forms has no practical importance or are theoretical?
    (*a*) 3NF (*b*) 2NF (*c*) BCNF (*d*) DKNF
41. Attribute A ____ attribute B if all of the rows in the table that agree in value for attribute A also agree in value for attribute B.
    (*a*) determines (*b*) derives from (*c*) controls (*d*) matches
42. Consider a relation R(A, B, C, D, E) with the following functional dependencies:
    ABC $\rightarrow$ DE and D $\rightarrow$ AB. The number of superkeys of R is
    (*a*) 2 (*b*) 7 (*c*) 10 (*d*) 12
43. Given the following relation schema ED(S, E, B, A, D, M, G) with the following dependencies F = {S $\rightarrow$ EBAD, D $\rightarrow$ MG}. What functional dependency can be inferred from F using decomposition rule?
    (*a*) S $\rightarrow$ S (*b*) S $\rightarrow$ E (*c*) S $\rightarrow$ G (*d*) D $\rightarrow$ DMG
44. Given the following relation state. Which of the following FDs may be a valid one?

A	B	C	D
a1	b1	c1	d1
a1	b2	c1	d2
a2	b2	c2	d2
a2	b3	c2	d3
a3	b3	c2	d4

    (*a*) A $\rightarrow$ B (*b*) A $\rightarrow$ C (*c*) C $\rightarrow$ A (*d*) A $\rightarrow$ D
45. Which of the following is the key for the universal relation R = {A, B, X, D, E, Y, G, H, Z}? Given the following set of functional dependencies:
    F = {BD $\rightarrow$ EY, AD $\rightarrow$ GH, A $\rightarrow$ Z, AB $\rightarrow$ X}
    (*a*) AB (*b*) ABD (*c*) ABX (*d*) BD
46. A functional dependency (Y E X), between X and Y specifies a constraint on the possible tuples that can form a relation instance *r* of R. The constraint states that for any two tuples t1 and t2 in *r* such that
    (*a*) t1[X] = t2[Y], then t1[Y] = t2[X]
    (*b*) t1[Y] = t2[Y], then t1[X] = t2[X]
    (*c*) t1[X] = t2[Y], then t1[X] = t2[Y]
    (*d*) t1[X] = t2[X], then t1[Y] = t2[Y]
47. Consider the following relation CAR-SALE(car, salesman, date-sold, commission, discount) and FDs = {date-sold $\rightarrow$ discount, salesman $\rightarrow$ commission}. The 3NF of CAR-SALE relation is

(*a*) CAR(car, salesman, date-sold, discount), COMM(salesman, commission)

(*b*) CAR(car, salesman, date-sold, commission), DATE(date-sold, discount)

(*c*) CAR(car, salesman, date-sold), COMM(salesman, commission), DATE(date-sold, discount)

(*d*) CAR-SALE(car, salesman, date-sold, commission, discount)

48. The keys that can have NULL values are

(*a*) Primary key (*b*) Unique key (*c*) Foreign key (*d*) Both (*b*) and (*c*)

49. Desirable properties of relational normalization include

(*a*) minimizing insertion/deletion anomalies

(*b*) minimizing redundancy

(*c*) minimizing update anomalies

(*d*) all of the above

50. Dependencies based on only a part of a composite primary key are called ____ dependencies.

(*a*) Primary (*b*) Partial (*c*) Incomplete (*d*) Composite

51. An attribute that is part of a key is known as a(n) ____ attribute.

(*a*) important (*b*) nonprime (*c*) prime (*d*) entity

52. If you have three different transitive dependencies ____ different determinant(s) exist.

(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

53. BCNF can be violated only if the table contains more than one ____ key.

(*a*) primary (*b*) candidate (*c*) foreign (*d*) secondary

54. Suppose relation R(A, B, C, D, E) has the following functional dependencies:
A $\rightarrow$ B, B $\rightarrow$ C, BC $\rightarrow$ A, A $\rightarrow$ D, E $\rightarrow$ A, D $\rightarrow$ E. Which of the following is *not* a key?

(*a*) A (*b*) E (*c*) B, C (*d*) D

55. A relation schema R is in 3rd normal form if

(*a*) each nonprime attribute in R is fully dependent on every key

(*b*) all attributes in R have atomic domains

(*c*) R satisfies 2nd normal form and no nonprime attribute of R is transitively dependent on the primary key

(*d*) R contains only 3 keys

56. If a relation R is decomposed into {R1, R2, ..., Rn} and the decomposition is lossless then

(*a*) the natural join of R1, R2, ..., Rn will have the same number of tuples as the original relation for R

(*b*) the natural join of R1, R2, ..., Rn can have more tuples than the original relation for R

(*c*) the relations R1, R2, ...,Rn are each in 3rd normal form

(*d*) none of the above

57. If the following functional dependencies, {A -> B, B -> C} hold for database schema R(A, B) and S(B, C), then the join of R and S will be

(*a*) lossy (*b*) lossless (*c*) non lossless (*d*) none of the above

58. If we use the algorithm for producing a Dependency Preserving and Lossless Join ecomposition into 3rd normal form with the relation schema of R(A, B, C) and the set of Fds as {AB -> C, B -> A}, then the algorithm would produce as output

(*a*) a relation schema with (B, C) and a relation schema with (A, B)

(*b*) a relation schema with (A, B, C)

(*c*) a relation schema with (A, B, C) and a relation schema with (A, B)

(*d*) a relation schema with (A), a relation schema with (B) and a relation schema with (C)

59. If we use the algorithm for producing a Lossless Join Decomposition into BCNF with the relation schema of R(A, B, C) and the set of FDs as

{AB -> C, C -> A}, then the algorithm would produce as output

(*a*) a relation schema with (C, A) and a relation schema with (C, B)

(*b*) a relation schema with (A, B, C)

(*c*) a relation schema with (C, A) and a relation schema with (A, B)

(*d*) a relation schema with (A), a relation schema with (B) and a relation schema with (C)

60. We have the set of Fds, {B -> C, C -> A, B -> D}, for the relation schema R(A, B, C, D). Which of the following decompositions has the dependency preserving property?

(*a*) A decomposition with relation schemas (C, A) and (C, B, D)

(*b*) A decomposition with relation schemas (A, C, D) and (B, D)

(*c*) A decomposition with relation schemas (C, A) and (A, B, D)

(*d*) All of the above

61. Which of the following functional dependencies are redundant: {A -> B; AD -> C; DB -> E; B -> C} for the relation R(A, B, C, D, E)?

(*a*) B -> C (*b*) A -> B (*c*) AD -> C (*d*) DB -> E

62. Which of the attributes are extraneous in the functional dependency, ABC -> D, considering the relational schema R(A, B, C, D, E, G) and FDs {B -> E; C -> G; EG -> D}?

(*a*) A (*b*) B (*c*) C (*d*) None of the above

63. We have the set of FDs, F = {A, B -> C; C -> D; A, B -> D, B-> A} for the relation schema sample (A, B, C, D). Which of the following set of FDs is equivalent to F?

(*a*) {A, B -> C; A, B -> D} (*b*) {C -> D; B -> A}

(*c*) {B -> C; C -> D; B -> A} (*d*) {A, B -> C; C -> D; A, B -> D}

64. The functional dependency between two attributes represents which kind of relationship

(*a*) One-to-one (*b*) One-to-many (*c*) Many-to-many (*d*) All of the above

65. Consider the following decomposition: {A, B, C}, {A, D, E}. Which of the following statements is true?

(*a*) The decomposition is 3NF, lossless join and dependency preserving

(*b*) The decomposition is 3NF, lossless join but not dependency preserving

(*c*) The decomposition is 3NF, dependency preserving, but not lossless join

(*d*) The decomposition is lossless join, dependency preserving but not 3NF

66. Consider the following decomposition: {A, B, C }, {A, E}, {D, E}. Which of the following statements is true?

(*a*) The decomposition is BCNF, lossless join and dependency preserving

(*b*) The decomposition is BCNF, lossless join but not dependency preserving

(*c*) The decomposition is BCNF, dependency preserving, but not lossless join

(*d*) The decomposition is lossless join, dependency preserving but not BCNF

ANSWERS

True/False

1. T
2. F
3. T
4. F
5. T
6. T
7. T
8. T
9. F
10. T
11. F
12. T
13. T
14. T
15. T
16. F
17. T
18. F
19. F
20. T
21. F
22. F
23. T
24. F
25. F
26. F
27. F
28. T
29. T
30. F
31. T
32. F
33. T
34. T
35. T

Fill in the Blanks

1. 1NF
2. INF
3. atomicity
4. Fully Functional Dependency
5. Decomposition
6. Non-Trivial
7. trivial
8. 2NF
9. Multi-valued dependency
10. Normalization
11. Independently
12. BCNF
13. Normalization
14. Partial participation
15. Fourth normal form
16. BCNF
17. key attributes
18. Armstrong's axioms
19. insertion anomaly
20. lossless-join
21. Denormalization
22. joined, equality, spurious
23. 1(*b*), 2(*a*), 3(*c*), 4(*d*), 5(*a*), 6(*b*), 7(*c*)

Multiple Choice Questions

1. (*a*)
2. (*c*)
3. (*d*)
4. (*c*)
5. (*d*)
6. (*d*)
7. (*b*)
8. (*c*)
9. (*d*)
10. (*c*)
11. (*c*)
12. (*d*)
13. (*c*)
14. (*a*)
15. (*b*)
16. (*b*)
17. (*a*)
18. (*a*)
19. (*b*)
20. (*d*)
21. (*b*)
22. (*b*)
23. (*b*)
24. (*b*)
25. (*c*)
26. (*c*)
27. (*b*)
28. (*d*)
29. (*c*)
30. (*a*)
31. (*d*)
32. (*b*)
33. (*a*)
34. (*c*)
35. (*a*)
36. (*b*)

37. (*b*) 38. (*b*) 39. (*d*)
40. (*d*) 41. (*a*) 42. (*c*)
43. (*b*) 44. (*b*) 45. (*b*)
46. (*b*) 47. (*c*) 48. (*d*)
49. (*d*) 50. (*b*) 51. (*c*)
52. (*c*) 53. (*b*) 54. (*c*)
55. (*c*) 56. (*a*) 57. (*b*)
58. (*b*) 59. (*a*) 60. (*a*)
61. (*c*) 62. (*a*) 63. (*c*)
64. (*a*) 65. (*a*) 66. (*b*)

EXERCISES

Short/Very Short Answer Questions

1. Define functional dependency.
2. When do we say a FD is trivial?
3. What is a closure of a set of FDs?
4. What are Armstrong's axioms?
5. Define the closure of a set of attributes.
6. What is a canonical cover?
7. What are the pitfalls in a poor database design?
8. Define 1NF.
9. Define 2NF.
10. Define 3NF.
11. Define BCNF.
12. Define 4NF.
13. What is multi-valued dependency?
14. What are the two properties of lossless join decomposition?
15. What is a functional dependency?
16. How to calculate closures of a give set of attributes?
17. How to find the super keys and candidate keys?
18. How to decompose a table into lossless join and BCNF tables?
19. What is a join dependency?
20. Define PJNF.
21. Mention three desirable properties of a good database design.
22. Define lossless decomposition.
23. Define dependency preserving decomposition.
24. What is de-normalization? When and why is it used?
25. Explain two major pitfalls to avoid in designing a database schema.
Redundancy: Repeating information may cause data inconsistency.
Incompleteness: It is difficult or impossible to model certain aspects of the enterprise.