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Solution Report For Databases-1

Represent whole test solution with correct and incorrect answers.

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Q. No	Question Status
Q.1	**Consider the following relation:** **R(Doctor #, Patient #, Date, Diagnosis, Treat_Code, Charge)** **In this relation, a tupple describes a visit of a patient to a doctor along with a treatment code and a daily, charge. Assume that each unique visit of a patient to a doctor on a particular date can reveal the diagnosis, treat_code and charge. Assume that each treatment code has fixed charge (regardless of patient). The relation R is** a. In first normal form but not in second normal form b. In second normal form but not in third normal form c. In third normal form d. None of the above

Attempt | Incorrect | Your Ans. c | Correct Ans. b | FAQ? | Have any doubt? | bookmark

Solution. 1

(b)

From the question it can be concluded that:

{Doctor #, Patient #, Date} → {Diagnosis, Treat_code, charge}

Treat_code → charge

Since there is no partial dependency, hence the relation is in 2NF, but since, 'Treat_code' a non-p attribute. Hence the relation is not in 3NF.

Q.2

Consider the relation $r_1(P, Q, R)$ and $r_2(R, U, V)$ with primary keys R and U respectively. The relation r_1 contains 1500 tupples and r_2 contains 2000 tupples. The maximum size of the join $r_1 \bowtie r_2$ is:

a. 1500
b. 2000
c. 3500
d. 5000

Attempt | Correct | Correct Ans. | b | FAQ? | Have any doubt? | bookmark

Solution. 2

(b)

The common attribute between the two relations is 'R' which is the primary key of one of the two relati hence acting as a foreign key in another relation.

Since r_1 has 1500 tupples which mean that there will be 1500 different values for R. R_2 has 2000 tupp

Hence those 1500 'R' on r_1 would be associated to 2000 'R' of r_2.

Hence, the maximum size of join $r_1 \bowtie r_2 = 2000$.

Q.3

If table R has only one candidate key, then which of the following is always true?

a. R is in 2NF, but is not in 3NF
b. R is in 3NF, it is also in BCNF

c. R is in 2NF, but may not be in 3NF
d. None of these

Attempt | Correct | Correct Ans. | d | FAQ? | Have any doubt? | bookmark

Solution. 3

(d)
(1) Consider relation AB → C, B → D, R(A, B, C, D)
Key : AB
R is in 3NF, but not in BCNF.
(2) Consider another relation A → BC, B → E (A, B, C, E)
Key : A,
R is in 2NF but not in 3NF.
(3) Consider another relation A → C, B → D, R(A, B, C, D)
Key : AB:
R is not in 2NF.

Q.4

Consider the following statements:

S_1: If every attribute is a prime attribute in the relation, then it will always be in 3NF.

S_2: If every attribute is a prime attribute in the relation, then it will always be in BCNF.

S_3: If every candidate key of a relation is simple, then it will always be in 2NF.

Which of the following statements is false?

a. Only S_1
b. Only S_1 and S_3
c. Only S_3
d. Only S_2

Attempt | Correct | Correct Ans. | d | FAQ? | Have any doubt? | bookmark

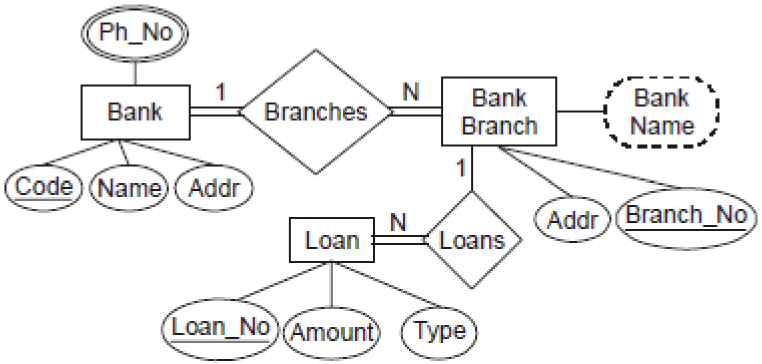
Solution. 4

(d)

- If every attribute is prime, then there will be no transitive dependency, hence the relation will al be in 3NF.
- If every attribute is prime, that doesn't mean the L.H.S. of the functional dependency is a key. H BCNF is not necessary.
- If every candidate key will be simple, then there will be no partial dependency, hence relation w in 2 NF.

Q.5

Consider the following ER diagram:



The minimum number of tables needed to represent ER-diagram are __________ such that the relational database satisfies 1NF.

Attempt | Correct | Correct Ans. | 4 | FAQ? | Have any doubt? | bookmark

Solution. 5

4

Minimum number of tables required are 4.

1. Bank {Code, Ph No, Name, Addr} where code, Ph_No. is primary key.
2. Branches {Branch No, Code} where branch number or code is the primary key.
3. Bank_Branch {Addr, Branch_No, Bank_Name}
4. Loan Taken {Loan_No, Amount, Type, Branch_No.} where Loan No as the primary key.

Here we can not merge Branches relation and Bank Branch entity because foreign key "code" is no candidate key of Bank entity. So, we can not combined these two.

Q.6

Consider a table having tupple (A, C) with attributes A and C, where A is the primary key and C is the foreign key referencing A with on-delete cascade.

Tupples of the table are (3, 5) (4, 5) (5, 4) (6, 3) (8, 3) (10, 6) (7, 5)

The number of elements in the set of tupples that must be additional deleted to preserve referential integrity when the tupple (3, 5) is deleted _______.

Attempt Correct **Correct Ans.** 3

FAQ? Have any doubt? bookmark

Solution. 6

3

The table will be as follows:

A	C
3	5
4	5
5	4
6	3
8	3
10	6
7	5

On, deleting the tupple (3, 5), where 3 was the primary key, so, there is a need to delete the tupples w have '3' as the foreign key. So (6, 3) and (8, 3) got deleted now '6' and '8' can not be used as foreigr Hence, (10, 6) will be deleted. So, total 3 additional tupples are deleted.

Q.7

Given a relation R{A, B, C, D, E, H} and having the following functional dependencies :

{A → BC, CD → E, E → C, D → AEH, ABH → BD, DH → BC}

The number of candidate keys for relation R is ________.

Attempt	Incorrect	Your Ans.	1	Correct Ans.	2	FAQ?	Have any doubt?	bookmark

Solution. 7

2

$D^+ = ABCDEH$

D candidate key

$(ABH)^+ = ABCDEH$

$(AH)^+ = ABCDEH$

So, there are only 2 candidate keys i.e., D, AH.

Q.8

Consider a schema with two relations R(A, B) and S(B, C) where all values are integers. Make no assumption about the keys. Consider the following three relational algebra expression:

1. $\pi_{A,C}(R \bowtie \sigma_{B=1} S)$

2. $\pi_A(\sigma_{B=1}R) \times \pi_C(\sigma_{B=1} S)$

3. $\pi_{A,C}(\pi_A R \times \sigma_{B=1} S)$

Which of the above queries are equivalent?

a. 1 and 2
b. 1 and 3
c. 2 and 3
d. 1, 2 and 3

Attempt	Incorrect	Your Ans.	c	Correct Ans.	a	FAQ?	Have any doubt?	bookmark

Solution. 8

(a)

Let R = {(3, 4)} and S = {(1, 2)}

- Produce empty result, since no common attribute value is there for natural join.
- $\phi \times (1, 2) \rightarrow \phi$ {empty result}
- Produce (3, 2) as output

Hence query 3 is different.

Q.9

Consider the schema R(A, B, C, D, E) and functional dependencies {A → BC, CD → E, B → D, E → A}. Then the decomposition of R into R_1(ABC) and R_2(ADE) is

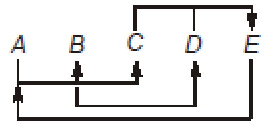
a. dependency preserving and lossless join
b. lossless join but not dependency preserving
c. dependency preserving but not lossless join
d. not dependency preserving and not lossless join

Attempt Correct **Correct Ans.** b FAQ? Have any doubt? bookmark

Solution. 9

(b)

Calculating the key for R(A, B, C, D, E)



$A^+ \rightarrow ABCDE$ {key}
$B^+ \rightarrow BD$
$C^+ \rightarrow C$
$D^+ \rightarrow D$
$E^+ \rightarrow EABCD$ {key}

Taking 2-attributes:

$(BC)^+ \rightarrow BCDEA$ {key}
$(BD)^+ \rightarrow BD$
$(CD)^+ \rightarrow CDEAB$ {key}

Key of the relation R = {A, E, BC, CD}.
R is decomposed as R_1(ABC) and R_2(ADE)
$\{R_1 \cap R_2\} \rightarrow \{A\}$
Since A is the candidate key for R_1. Hence the decomposition is a lossless decomposition.
But, this relation is not dependency preserving since the dependency $CD \rightarrow E$ and $B \rightarrow D$ are preserved.

Q.10

Let R_1, R_2, . . ., R_n be a decomposition of schema U. Let u(U) be a relation, and the $r_i = \Pi r_i(U)$. the following holds true?

a. $u \subseteq r_1 \bowtie r_2 \bowtie r_3, \ldots, \bowtie r_n$

b. $u = r_1 \bowtie r_2 \bowtie r_3, \ldots, \bowtie r_n$

c. $u \supseteq r_1 \bowtie r_2 \bowtie r_3, \ldots, \bowtie r_n$

d. None of these

Attempt | **Incorrect** | **Your Ans.** c | **Correct Ans.** a | FAQ? | Have any doubt? | bookmark

Solution. 10

(a)

$$r_i = \Pi r_i(U) \text{ implies that } t[R_i] \in r_i,\ 1 \le i \le n.$$

Thus, $t[R_1] \bowtie t[R_2] \bowtie t[R_3] \ldots \bowtie t[R] \in r_1 \bowtie r_2 \ldots \bowtie r_n$

By the definition of natural Join,

$$t[R_1] \bowtie t[R_2] \bowtie \ldots \bowtie t[R_n] = \pi_a[\sigma_\beta(t[R_1] \times t[R_2] \times \ldots \times t[R_n]])$$

where condition β is satisfied if values of attributes one tupple. The Cartesian product of single tu generates one tupple. The selection process is satisfied because all attributes with the same name have the same value since they are projection from the same tupple. Finally, the projection clause rer duplicate attribute name.

By the definition of decomposition, $U = R_1 \cup R_2 \cup \ldots \cup R_n$, what mean that all attributes of t $t[R_1] \bowtie t[R_2] \bowtie \ldots \bowtie t[R_n]$.

That is, t is equal to result of this join. Since t is any arbitrary tupple in u.

$$u \subseteq r_1 \bowtie r_2 \bowtie \ldots \bowtie r_n$$

Q.11

Consider the following relational schema.

Student (Sid: integer, Sname: string, address: string)

Course (Cid: integers, Cname: string, branch: string)

Enrols (Sid: integers, Cid: integer, employee: integer)

Which of the following queries are equivalent to this query in English? "Find the Sid of students who are enrolled in some courses of 'CS' branch and some courses of 'IT' branch".

1. $\rho(R_1, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'CS'}(Course)) \bowtie Enrols))$
   $\rho(R_2, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'IT'}(Course)) \bowtie Enrols))$
   $R_1 \cap R_2$
2. $\{T \mid \exists T_1 \in enrols(\exists x \in courses(x.branch = 'CS' \wedge x.cid = T_1.cid) \wedge \exists T_2 \in Enrols(\exists y \in courses(y.branch = 'IT' \wedge y.cid = T_2.cid) \wedge T_2.sid = T_1.sid) \wedge T.sid = T_1.sid)\}$
3. Select Sid
   From courses P, Enrols C
   where P.branch='CS' AND P.cid = C.cid AND EXISTS (Select Sid
   From courses P2, Enrol C2
   where P2.branch = 'IT' AND C2.sid = C.sid
   AND P2.cid = C2.cid)

a. only 1 and 2
b. only 3 and 4
c. only 2 and 3
d. all of the above

Not Attempt | **Correct Ans.** | d | FAQ? | Have any doubt? | bookmark

Solution. 11

(d)

1. $\rho(R_1, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'CS'}(Course)) \bowtie Enrols))$
$\rho(R_2, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'IT'}(Course)) \bowtie Enrols))$
$R_1 \cap R_2$

Find the Sid who enrolled atleast one course of CS branch then find the Sid who enrolled atleast one co
of IT branch. Then take inter-section both Sid.

2. $\{T \mid \exists T_1 \in enrols\ (\exists x \in courses\ (x.branch = 'CS' \wedge x.cid = T_1.cid) \wedge \exists T_2 \in Enrols\ (\exists y \in courses\ (y.br$
$= 'IT' \wedge y.cid = T_2.cid) \wedge T_2.sid = T_1.sid) \wedge T.sid = T_1.sid)\}$

Find the Sid who enrolled atleast one course of CS branch then find the Sid who enrolled atleast one co
of IT branch with same Sid. Then return Sid.

3. Select Sid
From courses P, Enrols C
where P.branch='CS' AND P.cid = C.cid AND EXISTS (Select Sid
From courses P2, Enrol C2
where P2.branch = 'IT' AND C2.sid = C.s
AND P2.cid = C2.cid)

Find the Sid who enrolled atleast one course of CS branch then find the same Sid enrolled for atleas
course of IT branch and return it.

Q.12

With respect to relational algebra, which of the following options is correct?

1. $\sigma_{c_1 AND\ c_2 AND \ldots c_n}(R) \equiv \sigma_{c_1}(\sigma_{c_2}(\ldots(\ldots(\sigma_{c_n}(R)\ldots))$

2. $\pi_{List_1}(\pi_{List_2}(\ldots(\pi_{List_N}(R))\ldots)) \equiv \pi_{List_1}(R)$, where $List_1 \subseteq List_2 \subseteq List_3 \ldots List_n$

3. $\pi_{A_1, A_2 \ldots A_n}(\sigma_c(R) \equiv \sigma_c(\pi_{A_1, A_2, \cdots A_n}(R))$

a. only 1 and 3 are correct
b. only 2 and 3 are correct
c. only 1 and 2 are correct
d. all 1, 2 and 3 are correct

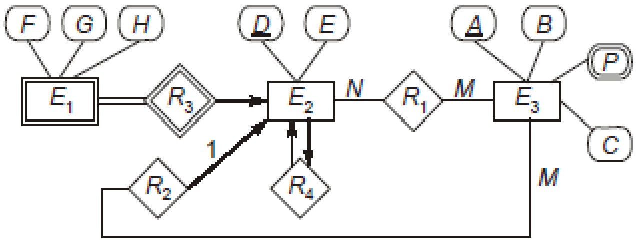
Attempt | Incorrect | Your Ans. a | Correct Ans. c | FAQ? | Have any doubt? | bookmark

Solution. 12

(c)

1. A consecutive selection condition can be broken up into a cascade / sequence of individual σ opera
2. In a cascade (sequence) of π operations, all but the last one can be ignored.
3. If the selection condition *c* involves only those attributes $A_1, A_2, \ldots, A_n$ in the projection list, th operations can be commuted.

Q.13 **Consider the following ER diagram.**



The minimum number of RDBMS tables are required for the above drawn ER diagram ________ which satisfies 3NF.

Attempt | Incorrect | Your Ans. 3 | Correct Ans. 5 | FAQ? | Have any doubt? | bookmark

Solution. 13

5

The RDBMS tables that are need to be drawn will be:

(*i*) $E_3 R_2$ which have 'A' as its candidate key.

(*ii*) $E_2 R_4$ which have 'D' as its candidate key.

(*iii*) $E_1 R_3$ which have 'D' as its candidate key.

(*iv*) R_1 which has 'AD' as the candidate key.

(*v*) $E_3 P$; since P is a multi-valued attribute, which has 'A' as its candidate key.

Q.14

Consider a relation with 3 attributes. The maximum number of candidate keys could it have atmost at the same time are ______

Attempt | Correct | **Correct Ans.** | 3 | FAQ? | Have any doubt? | bookmark

Solution. 14

3

Let $R(A, B, C)$ is a relation with 3 attributes.

Example: At a time either {A, B, C} are possible candidate keys or {AB, BC, AC} are possible.

$\therefore$ Maximum 3 candidate keys are present at a time in a relation.

Assume A, B, C are candidate keys. Taking any combination will be a super key.

Therefore, maximum 3 candidate keys are present in a relation at a time.

Q.15

Consider the following statements:

1. The redundancy in the set of relation that have been arised after decomposing a relation *R* into BCNF is zero irrespective of the type of dependencies.

2. BCNF decompositions are always lossless as well as dependency preserving.

3. A prime attribute of a relation schema *R* is an attribute that appears in all candidate key of *R*.

4. A relation *R* is in 3NF, if every non-prime attribute of *R*, is fully functionally dependent on some key of *R*.

The number of statements are correct _______.

Attempt | Correct | Correct Ans. | 1 | FAQ? | Have any doubt? | bookmark

Solution. 15

1

1. The redundancy in the set of relation that have been arised after decomposing a relation R into B(is more than zero but less than 3NF decomposition if multivalued dependencies are considered.
2. BCNF decompositions are lossless but always need not to be dependency preserving.
3. A prime attribute of a relation schema R is an attribute that appears in some candidate key of R.
4. A relation R is in 3NF, if every non-prime attribute of R, is fully functionally dependent on some because then there will be no transitive dependency.

Q.16

A set of FDs for the relation R{A, B, C} is

{A → BC, B → C, A → B, AB → C}

The size of canonical cover for above relation ________ (the number of FDs in canonical cover).

Attempt | Correct | Correct Ans. | 2 | FAQ? | Have any doubt? | bookmark

Solution. 16

2

$R = \{A, B, C\}$

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

Consider functional dependencies, $AB \rightarrow C$ and $B \rightarrow C$.

They can be combined and can be written as $AB \rightarrow C$.

Since, we already have dependency $B \rightarrow C$, hence A is extra in FD $AB \rightarrow C$.

Now, we have $\{A \rightarrow BC, B \rightarrow C\}$

It can be written as, $\{A \rightarrow B, A \rightarrow C, B \rightarrow C\}$ ($\therefore$ Decomposition rule)

Now, $A \rightarrow C$ can be obtained by applying transitivity on FDs$\{A \rightarrow B$ and $B \rightarrow C\}$.

Hence, the canonical cover obtained is $A \rightarrow B$ and $B \rightarrow C$.

So, only 2 functional dependencies will remain in the set.