Ebin Jose

DATABASE MANAGEMENT SYSTEM

1.Given the basic ER and relational models, which of the following is INCORRECT?

a) An attribute of an entity can have more than one value
b) An attribute of an entity can be composite
c) In a row of a relational table, an attribute can have more than one value
d) In a row of a relational table, an attribute can have exactly one value or a NULL value

Answer : **C**

Ebin Jose

An ER model of a database consists of entity types A and B. These are connected by a relationship R which does not have its own attribute. Under which one of the following conditions, can the relational table for R be merged with that of A?

A. Relationship R is one-to-many and the participation of A in R is total
B. Relationship R is one-to-many and the participation of A in R is partial
C. Relationship R is many-to-one and the participation of A in R is total
D. Relationship R is many-to-one and the participation of A in R is partial

Ans: C

Explanation:
The relation table for R should always be merged with the entity that has total participation and relationship should be many to one.

Ebin Jose

3)

Employee	Department	OT allowance
RAMA	Mechanical	5000
GOPI	Electrical	2000
SINDHU	Computer	4000
MAHESH	Civil	1500

What is the output of the following SQL query?

```
select count(*) from
   ((select Employee, Department from Overtime_allowance)
   natural join
   (select Department, OT_allowance from Overtime_allowance)
   as T);
```

A 16

B 4

C 8

D None of the above

Ans : B

Ebin Jose

4)

The following relation records the age of 500 employees of a company, where $empNo$ (indicating the employee number) is the key:

$$empAge(\underline{empNo}, age)$$

Consider the following relational algebra expression:

$$\Pi_{empNo}(empAge \bowtie_{(age>age1)} \rho_{empNo1,age1}(empAge))$$

What does the above expression generate?

(2021)

A. Employee numbers of only those employees whose age is the maximum
B. Employee numbers of only those employees whose age is more than the age of exactly one other employee
C. Employee numbers of all employees whose age is not the minimum
D. Employee numbers of all employees whose age is the minimum

Ans : C

Ebin Jose

5)

Consider a relation scheme $R = (A, B, C, D, E, H)$ on which the following functional dependencies hold: $\{A \rightarrow B, BC \rightarrow D, E \rightarrow C, D \rightarrow A\}$. What are the candidate keys R?

A. AE, BE
B. AE, BE, DE
C. AEH, BEH, BCH
D. AEH, BEH, DEH

(GATE CSE 2005)

Ans : D

Edwin M S

1.) Consider the entities 'hotel room', and 'person' with a many to many relationship 'lodging' as shown below:

If we wish to store information about the rent payment to be made by person (s) occupying different hotel rooms, then this information should appear as an attribute of

A.)Person
B.)Hotel Room
C.)Lodging
D.)None of these

Ans.)Option C
...

Solution

Since it is many to many, rent cannot be an attribute of room or person entities alone. If depending on number of persons sharing a room the rent for each person for the room will be different. Otherwise rent can be attribute of room. hence i go for attribute of Lodging.

2.) Consider the following statements S1 and S2 about the relational data model:

S1: A relation scheme can have at most one foreign key.

S2: A foreign key in a relation scheme R cannot be used to refer to tuples of R

Which one of the following choices is correct?

A. Both $S1$ and $S2$ are true
B. $S1$ is true and $S2$ is false
C. $S1$ is false and $S2$ is true
D. Both $S1$ and $S2$ are false

Ans)Option D

Solution

Both $S1$ and $S2$ are FALSE.

In a relation scheme multiple foreign attributes can be present referring to primary keys of other relation schemes. A typical example is an $\mathrm{EXAM\_RESULTS(sid,eid,marks)}$ scheme where sid and eid are foreign keys referring to the primary keys in $\mathrm{STUDENT}$ and EXAM schemes respectively.

$S2$ is FALSE because a foreign key can refer to the same scheme (self-referencing foreign key). A typical example is an $\mathrm{EMPLOYEE(eid,\ mid,\ \ldots)}$ scheme where mid is the Manager ID referring to the primary key eid of the same scheme.

...

3.) Consider the relational schema given below, where **eId** of the relation dependent is a foreign key referring to **empId** of the relation employee. Assume that every employee has at least one associated dependent in the dependent relation.

employee (empId, empName, empAge)

dependent (depId, eId, depName, depAge)

Consider the following relational algebra query:

$$\Pi_{empId}\,(employee) - \Pi_{empId}\,(employee \bowtie_{(empId=eID)\wedge(empAge\leq depAge)} dependent)$$

The above query evaluates to the set of empIds of employees whose age is greater than that of

A. some dependent.
B. all dependents.
C. some of his/her dependents.
D. all of his/her dependents.

Ans.) option D

...

Solution

The inner query selects the employees whose age is less than or equal to at least one of his dependents. So, subtracting from the set of employees, gives employees whose age is greater than all of his dependents.

4.)Let R1(A,B,C) and R2(D,E) be two relation schema, where the primary keys are shown underlined, and let C be a foreign key in R1 referring to R2.Suppose there is no violation of the above referential integrity constraint in the corresponding relation instances r1 and r2. Which of the following relational algebra expressions would necessarily produce an empty relation?

A. $\Pi_D(r_2) - \Pi_C(r_1)$

B. $\Pi_C(r_1) - \Pi_D(r_2)$

C. $\Pi_D\left(r_1 \bowtie_{C \neq D} r_2\right)$

D. $\Pi_C\left(r_1 \bowtie_{C=D} r_2\right)$

Ans.) Option B

Solution

C in R1 is a foreign key referring to the primary key D in R2. So, every element of C must come from some D element

...

Edwin M S

5.) Let r and s be two relations over the relation schemes R and S respectively, and let A be an attribute in R. The relational algebra expression $\sigma_{A=a}(r \bowtie s)$ is always equal to

A. $\sigma_{A=a}(r)$
B. r
C. $\sigma_{A=a}(r) \bowtie s$
D. None of the above

Ans.) Option C

...

Eldho George

1) In an Entity-Relationship (ER) model, suppose ***R*** is a many-to-one relationship from entity set **E1** to entity set **E2.** Assume that **E1** and **E2** participate totally in ***R*** and that the cardinality of E1 is greater than the cardinality of **E2.**

Which one of the following is true about **R**?

1. Every entity in **E1** is associated with exactly one entity in **E2**
2. Some entity in **E1** is associated with more than one entity in **E2**
3. Every entity in **E2** is associated with exactly one entity in **E1**
4. Every entity in **E2** is associated with at most one entity in **E1**

Answer:Option A

Since it is a many to one relationship from E1 to E2, therefore:

1. **No entity in E1 can be related to more than one entity in E2. (** ***hence B is incorrect*****)**
2. **An entity in E2 can be related to more than one entity in E1.(*hence C and D are incorrect*).**

Option (A) is correct: Every entity in E1 is associated with exactly one entity in E2.

2) Let **R(a,b,c)** and **S(d,e,f)** be two relations in which **d** is the foreign key of **S** that refers to the primary key of **R**. Consider the following four operations **R** and **S**

I. Insert into **R**

II. Insert into **S**

III. Delete from **R**

IV. Delete from **S**

Which of the following can cause violation of the referential integrity constraint above?

A. Both I and IV

B. Both II and III

C. All of these

D. None of these

R

a (PK)	b	c
1		
2		

S

d (FK referring to PK of R)	e	f
2		
1		

- Insert into R cannot cause any violation.
- Insert into S can cause violation if any value is inserted into d of S, which value is not in a of R.
- Delete from S cannot cause any violation.
- Delete from R can cause violation if any tuple is deleted, and as a result a value in 'a' gets deleted which is referenced to by 'd' in S.

Correct Answer: B

Eldho George

Which of the following statements are TRUE about an SQL query?
P : An SQL query can contain a HAVING clause even if it does not have a GROUP BY clause

Q : An SQL query can contain a HAVING clause only if it has a GROUP BY clause

R : All attributes used in the GROUP BY clause must appear in the SELECT clause
S : Not all attributes used in the GROUP BY clause need to appear in the SELECT clause

A P and R

B P and S

C Q and R

D Q and S

Correct answer:-C

Eldho George

4) Suppose $R_1(\underline{A},B)$ and $R_2(\underline{C},D)$ are two relation schemas. Let r_1 and r_2 be the corresponding relation instances. **B** is a foreign key that refers to **C** in R_2 .If data in r_1 and r_2 satisfy referential integrity constraints, which of the following is **ALWAYS TRUE**?

A. $\prod_B(r_1) - \prod_C(r_2) = \varnothing$
B. $\prod_C(r_2) - \prod_B(r_1) = \varnothing$
C. $\prod_B(r_1) = \prod_C(r_2)$
D. $\prod_B(r_1) - \prod_C(r_2) \neq \varnothing$

B is a foreign key of R1 that refers to C(primary key) in R_2, B must be null or to be available in R2

r2(C) is a superset of r1(B)

So {subset - Superset} =Φ

So the correct answer is $\Pi_B(r_1) - \Pi_C(r_2) = \Phi$

Answer is **A.**

Referential integrity means, all the values in foreign key should be present in primary key.

$r2(c)$ is the super set of $r1(b)$

So, {subset - superset} is always empty set.

5) The order of a leaf node in a ***B+*** tree is the maximum number of (value, data record pointer) pairs it can hold. Given that the block size is 1***K*** bytes, data record pointer is 7 bytes long, the value field is 9 bytes long and a block pointer is 6 bytes long, what is the order of the leaf node?

A. 63
B. 64
C. 67
D. 68

Answer:- **A**

For **leaf** nodes order is-

n*(K+RP)+BP <= Block size

and for **non-leaf** nodes order is-

n*BP+(n-1)K <= Block size

Therefore, n*(9+7)+6 <= 1024

16n<=1018

n <= 63.6

Eldho Markose

Consider a relation $R(A, B, C, D, E)$ with the following three functional dependencies.
$AB \rightarrow C; BC \rightarrow D; C \rightarrow E;$
The number of superkeys in the relation R is .

A 12

B 8

C 6

D 5

ANS:- 8

Q.51 A relational database contains two tables Student and Performance as shown below:

Student

Roll_no.	Student_name
1	Amit
2	Priya
3	Vinit
4	Rohan
5	Smita

Performance

Roll_no.	Subject_code	Marks
1	A	86
1	B	95
1	C	90
2	A	89
2	C	92
3	C	80

The primary key of the Student table is Roll_no. For the Performance table, the columns Roll_no. and Subject_code together form the primary key. Consider the SQL query given below:

```
SELECT S.Student_name, sum(P.Marks)
FROM Student S, Performance P
WHERE P.Marks > 84
GROUP BY S.Student_name;
```

The number of rows returned by the above SQL query is _____.

ANS:2

Eldho Markose

Let R=(A,B,C,D,E,F) be a relation scheme with the following dependencies $C \to F$, $E \to A$, $EC \to D$, $A \to B$. Which of the following is a key of R?

A CD

B EC

C AE

D AC

ANS:- EC

Eldho Markose

Consider the relation scheme R = (E, F, G, H, I, J, K, L, M, N) and the set of functional dependencies {{E,F}→{G}, {F}→{I,J}, {E,H}→{K,L}, {K}→{M}, {L}→{N} } on R. What is the key for R?

A {E, F}

B {E, F, H}

C {E, F, H, K, L}

D {E}

ANS:-{E,F,H}

Eldho Markose

From the following instance of relation schema R(A,B,C), we can conclude that :

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 determines C .

C. B does not functionally determines C

D. A does not functionally B and B does not functionally determines.

ANS:- option C

Elviin Thomas Eldho

GATE CSE 2005

Q1.

Let r be a relation instance with schema R = (A, B, C, D).

We define $r_1 = \pi_{A,B,C}(r)$ and $r_1 = \pi_{A,D}(r)$. Let $s = r_1 * r_2$ where * denotes natural join. Given that the decomposition of r into r_1 and r_2 is lossy, which one of the following is TRUE?

A $s \subset r$

B $r \cup s = r$

C $r \subset s$

D $r * s = s$

Correct Answer: C

Elviin Thomas Eldho

GATE CSE 2012

Q2. Which of the following tuple relational calculus expression(s) is/are equivalent to $\forall t \in r(P(t))$?

I. $\neg \exists t \in r(P(t))$

II. $\exists t \notin r(P(t))$

III. $\neg \exists t \in r(\neg P(t))$

IV. $\exists t \notin r(\neg P(t))$

A. I only

B. II only

C. III only

D. III and IV only

Correct Answer: C

I. $\neg \exists t \in r(P(t))$

This expression represents "It is not the case that there exists a tuple in relation r for which P holds."

This is not equivalent to $\forall t \in r(P(t))$, because it negates the existence of any tuple satisfying P, not stating that all tuples satisfy P.

II. $\exists t \notin r(P(t))$

This expression represents "There exists a tuple not in relation r for which P holds."

This is not equivalent to $\forall t \in r(P(t))$, as it introduces the notion of tuples not in relation r, which is not covered by the original expression.

III. $\neg \exists t \in r(\neg P(t))$

This expression represents "It is not the case that there exists a tuple in relation r for which P does not hold."

This is equivalent to $\forall t \in r(P(t))$, because it states that there is no tuple for which P does not hold, which is the same as saying all tuples satisfy P.

IV. $\exists t \notin r(\neg P(t))$

This expression represents "There exists a tuple not in relation r for which P does not hold."

Elviin Thomas Eldho

This is not equivalent to $\forall t \in r(P(t))$, as it introduces the notion of tuples not in relation r and P not holding for those tuples.

Therefore, the correct answer is C. III only.

Elviin Thomas Eldho

GATE CSE 2016

Q3. Which of the following is NOT a superkey in a relational schema with attributes V, W, X, Y, Z and primary key VY?

A. VXYZ
B. VWXZ
C. VWXY
D. VWXYZ

Correct Answer: VWXZ

A. VXYZ - Includes VY, so it's a superkey.

B. VWXZ - Does not include Y, so it's not a superkey.

C. VWXY - Includes VY, so it's a superkey.

D. VWXYZ - Includes VY, so it's a superkey.

Therefore, the option that is NOT a superkey is B. VWXZ.

Elviin Thomas Eldho

GATE CSE 2015

Q4. Consider the following two tables and four queries in SQL.
Book (isbn, bname), Stock (isbn, copies)

Query 1:

```
SELECT B.isbn, S.copies
 FROM Book B INNER JOIN Stock S
 ON B.isbn = S.isbn;
```

Query 2:

```
SELECT B.isbn, S.copies
 FROM Book B LEFT OUTER JOIN Stock S
 ON B.isbn = S.isbn;
```

Query 3:

```
SELECT B.isbn, S.copies
 FROM Book B RIGHT OUTER JOIN Stock S
 ON B.isbn = S.isbn;
```

Query 4:

```
SELECT B.isbn, S.copies
 FROM Book B FULL OUTER JOIN Stock S
 ON B.isbn = S.isbn;
```

Which one of the queries above is certain to have an output that is a superset of the outputs of the other three queries?

A. Query 1

B. Query 2

C. Query 3

D. Query 4

Correct Answer: D

Query 1: INNER JOIN

This query selects records where there is a match in both tables. It will include only the records where the ISBN exists in both the Book and Stock tables.

Query 2: LEFT OUTER JOIN

Elviin Thomas Eldho

This query selects all records from the left table (Book) and the matched records from the right table (Stock). If there is no match, NULL values are returned for the Stock table columns. This will include all records from the Book table and matching records from the Stock table.

Query 3: RIGHT OUTER JOIN
This query selects all records from the right table (Stock) and the matched records from the left table (Book). If there is no match, NULL values are returned for the Book table columns. This will include all records from the Stock table and matching records from the Book table.

Query 4: FULL OUTER JOIN
This query selects all records when there is a match in either table. It includes all records from both tables and NULL values where there is no match.

Since Query 4 uses a FULL OUTER JOIN, it will include all records from both the Book and Stock tables, ensuring that it covers all possibilities. Therefore, the output of Query 4 will be a superset of the outputs of the other three queries.

So, the correct answer is D. Query 4.

Elviin Thomas Eldho

GATE CSE 2014

Q5.

What is the optimized version of the relation algebra expression $\pi_{A1}(\pi_{A2}(\sigma_{F1}(\sigma_{F2}(r))))$, where $A1, A2$ are sets of attributes in r with $A1 \subset A2$ and $F1, F2$ are Boolean expressions based on the attributes in r?

A $\pi_{A1}(\sigma_{(F1 \wedge F2)}(r))$

B $\pi_{A1}(\sigma_{(F1 \vee F2)}(r))$

C $\pi_{A2}(\sigma_{(F1 \wedge F2)}(r))$

D $\pi_{A2}(\sigma_{(F1 \vee F2)}(r))$

Correct Answer: A

Eshaan

Which of the following statements are TRUE about an SQL query?

P: An SQL query can contain a HAVING clause even if it does not a GROUP BY clause
Q: An SQL query can contain a HAVING clause only if it has a GROUP BY clause
R: All attributes used in the GROUP BY clause must appear in the SELECT clause
S: Not all attributes used in the GROUP BY clause need to appear in the SELECT clause

(A) P and R

(B) P and S

(C) Q and R

(D) Q and S

Answer C

If we talk about different SQL implementations like MySQL, then option (B) is also right. But in question they seem to be talking about standard SQL not about implementation. For example below is a P is correct in most of the implementations. HAVING clause can also be used with aggregate function. If we use a HAVING clause without a GROUP BY clause, the HAVING condition applies to all rows that satisfy the search condition. In other words, all rows that satisfy the search condition make up a single group. See this for more de**tails.**

Eshaan

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)
```

Consider the following relational query on the above database:

```
SELECT S.sname
    FROM Suppliers S
        WHERE S.sid NOT IN (SELECT C.sid
                            FROM Catalog C
                            WHERE C.pid NOT IN (SELECT P.pid
                                                FROM Parts P
                                                WHERE P.color<> 'blue'))
```

Assume that relations corresponding to the above schema are not empty. Which one of the following is the correct interpretation of the above query?

(A) Find the names of all suppliers who have supplied a non-blue part.

(B) Find the names of all suppliers who have not supplied a non-blue part.

(C) Find the names of all suppliers who have supplied only blue parts.

(D) Find the names of all suppliers who have not supplied only blue parts.

Answer (A)

gives pids of parts which are not blue.

The bigger subquery “” gives sids of all those suppliers who have supplied blue parts.

The complete query gives the names of all suppliers who have supplied a non-blue part

Eshaan

2008

Let R and S be two relations with the following schema R (P,Q,R1,R2,R3) S (P,Q,S1,S2) Where {P, Q} is the key for both schemas. Which of the following queries are equivalent?

I. $\Pi_p (R \bowtie S)$

II. $\Pi_p (R) \bowtie \Pi_p (S)$

III. $\Pi_p (\Pi_{P,Q} (R) \cap \Pi_{P,Q} (S))$

IV. $\Pi_p (\Pi_{P,Q} (R) - (\Pi_{P,Q} (R) - \Pi_{P,Q} (S)))$

(A) Only I and II

(B) Only I and III

(C) Only I, II and III

(D) Only I, III and IV

Answer (D)

explanation:

In I, Ps from natural join of R and S are selected. In III, all Ps from intersection of (P, Q) pairs present in R and S. IV is also equivalent to III because (R – (R – S)) = R ∩ S. II is not equivalent as it may also include Ps where Qs are not same in R and S.

Eshaan

2021

```
Table A
Id   Name    Age
---------------
12   Arun    60
15   Shreya  24
99   Rohit   11


Table B
Id   Name   Age
---------------
15   Shreya  24
25   Hari    40
98   Rohit   20
99   Rohit   11


Table C
Id   Phone  Area
----------------
10   2200   02
99   2100   01
```

4) consider the above table a,b and c.how many tuples does the result of the following sql query contains?

```
SELECT A.id
FROM   A
WHERE  A.age > ALL (SELECT B.age
                    FROM   B
                    WHERE  B. name = "arun")
```

(A) 4

(B) 3

(C) 0

(D) 1

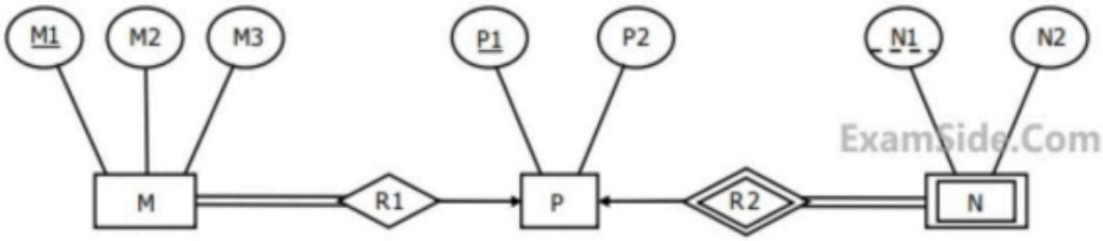
Answer (B)

The meaning of “ALL” is the A.Age should be greater than all the values returned by the subquery. There is no entry with name “arun” in table B. So the subquery will return NULL. If a subquery returns NULL, then the condition becomes true for all rows of A

Eshaan

2008

Consider the following ER diagram



The minimum number of table needed to represent $M, N, P, R1, R2$ is

A 2

B 3

C 4

D 5

Answer (B)

Eswanth Sunil Dutt

GATE 2020

Q1.

Consider a relational database containing the following schemas.

Catalogue

sno	pno	cost
S1	P1	150
S1	P2	50
S1	P3	100
S2	P4	200
S2	P5	250
S3	P1	250
S3	P2	150
S3	P5	300
S3	P4	250

Suppliers

sno	sname	location
S1	M/s Royal furniture	Delhi
S2	M/s Balaji furniture	Bangalore
S3	M/s Premium furniture	Chennai

Parts

pno	pname	part_spec
P1	Table	Wood
P2	Chair	Wood
P3	Table	Steel
P4	Almirah	Steel
P5	Almirah	Wood

The primary key of each table is indicated by underlining the constituent fields.

```
SELECT s.sno, s.sname
   FROM Suppliers s, Catalogue c
   WHERE s.sno=c.sno AND
       cost > (SELECT AVG (cost)
               FROM Catalogue
               WHERE pno = 'P4'
               GROUP BY pno) ;
```

The number of rows returned by the above SQL query is

A 4

B 5

C 0

D 2

Answer :- A

Eswanth Sunil Dutt

GATE 2014

Q2.

Consider the following relational schema:
Employee (empId, empName, empDept)
Customer (custId,custName, salesRepId, rating)
SalesRepId is a foreign key referring to empId of the employee relation. Assume that each employee makes a sale to at least one customer. What does the following query return?

```
SELECT empName
FROM employee E
 WHERE NOT EXISTS (SELECT custId
FROM customer C
WHERE C. salesRepId = E. empId
AND C. rating < > 'GOOD')
```

A Names of all the employees with at least one of their customers having a 'GOOD' rating

B Names of all the employees with at most one of their customers having a 'GOOD' rating.

C Names of all the employees with none of their customers having a 'GOOD' rating.

D Names of all the employees with all their customers having a 'GOOD' rating.

Answer :- D

GATE 2014 SET-I

Eswanth Sunil Dutt

Q3

Given the following statements:
S1: A foreign key declaration can always be replaced by an equivalent check assertion in SQL
S2: Given the table R(a,b,c) where a and b together form the primary key, the following is a valid table definition.

```
CREATE TABLE S (
a INTEGER,
d INTEGER,
e INTEGER,
PRIMARY KEY (d),
FOREIGN KEY (a) references R)
```

Which one of the following statements is CORRECT?

A. S1 is TRUE and S2 is a FALSE

B. Both S1 and S2 are TRUE

C. S1 is FALSE and S2 is a TRUE

D. Both S1 and S2 are FALSE

Answer:- D

GATE 2012

Eswanth Sunil Dutt

Q4

There are three table above tables A, B and C as given below

Table A

Id	Name	Age
12	Arun	60
15	Shreya	24
99	Rohit	11

Table B

Id	Name	Age
15	Shreya	24
25	Hari	40
98	Rohit	20
99	Rohit	1

Table C

Id	Phone	Area
10	2200	02
99	2100	01

Then determine the number of tuples return in the result of the following SQL query.

```
SELECT A.id
FROM   A
WHERE  A.age > ALL (SELECT B.age   FROM   B
                    WHERE  B. name = "arun");
```

a. 4
b. 3
c. 0
d. 1

Answer :- b

Eswanth Sunil Dutt

Q5.

If a certain block is capable of holding either 10 key pointers or 3 records or and a database consists of "n" number of records, how many blocks are needed to hold the data file as well as the dense index?

(A)13n/30

(B) N/10

(C) N/30

(D) N/3

Ans: (a)13n/30

Q1. Let R = (A, B, C, D, E, F) be a relation schema with the following dependencies:

C→F, E→A, EC→D, A→B.

Which of the following is a key of R?

(a) CD (b) EC (c) AE (d) AC

Answer:EC

Solution by

closure

Q2. Consider the relation R (ABCDE):

$FD = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow E\}$

Find out the highest normal form.

(a) 1NF (b) 2NF (c) 3NF (d) BCNF

Answer:2NF

Not BCNF(lhs not candidate key)

Not 3NF(transitive dependence)

Q6. Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values. $F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$ is a set of functional dependencies so that F+ is exactly the set of FDs that hold for R.

How many candidate keys does the relation R have?

(a) 3 (b) 4 (c) 5 (d) 6

Answer:4

BD is candidate key,A gives B so AD,E gives A so ED,F gives E so FD

Q7. Let the set of functional dependencies F= {QR→S, R→P, S→Q} hold on a relation schema X= (PQRS). X is not in BCNF. Suppose X is decomposed into two schemas Y and Z, where Y= (PR) and Z= (QRS).

Consider the two statements given below.

I: Both Y and Z are in BCNF

II: Decomposition of X into Y and Z is dependency preserving and lossless.

Which of the above statements is/are correct?

(a) Both I and II

(b) I only

(c) II only

d)neither I or II

answer II only,

Y in BCNF

Z not in BCNF

Lossless because common attribute R is candidate key in Y

Q9. Consider a relational table R that is in 3NF, but not in BCNF. Which one of the following statements is TRUE?

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

(b) 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

(c) 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

(d) A cell in R holds a set instead of an atomic value

Answer : a)

Milin C A

1) Relations produced from E-R model will always be in what normal form?
   a)1NF
   b)2NF
   c)3NF
   d)4NF

ANS a)1NF

In the Entity-Relationship (E-R) model, relations (tables) produced will typically be in at least the First Normal Form (1NF).

Conditions:

It should only have single(atomic) valued attributes/columns.
Values stored in a column should be of the same domain
All the columns in a table should have unique names.
And the order in which data is stored, does not matter.

2) 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 to c
   b to d
   the relation is in which normal form

   a)1NF
   b)2NF
   c)3NF
   d)BCNF

   ANS d) BCNF

In BCNF, every determinant (attribute or set of attributes whose values determine the values of other attributes) is a candidate key. In this case, both a and b are candidate keys, and each determinant uniquely determines the value of its dependent attributes. Therefore, the relation satisfies the requirements of BCNF.

3) Given the following relation
   instances X Y Z
   1 4 2
   1 5 3
   1 6 3
   3 2 2

Which of the following FDs are satisfied by the instance

a)XY->Z, Z->Y
b)YZ->X, Y->Z
c)YZ->X, X->Z
d)XZ->Y, Y->X

ANS b)YZ->X, Y->Z
d)XZ->Y,Y->X

4) Relation R has 8 attributes ABCDEFGH. Fields of R contain only atomic values. F={CH->G, A->BC, B->CFH, E->A, F->EG} is a set of FDs so that F+ is exactly the set of FDs that hold for R

How many candidate keys does R have?
a)3
b)4
c)5
d)6

ANS b) 4

5) The above relation R is
a)1NF but not 2NF
b)2NF but not 3NF
c)3NF but not
BCNF d)BCNF

Ans d) BCNF

A relation is in BCNF if, for every one of its non-trivial functional dependencies X -> Y, X is a superkey.

Given FDs:

CH->G

A->BC

B->CFH

E->A

F->EG

Candidate keys: ACEB and ACEH

All functional dependencies in R already have the left-hand side as a superkey.

Thus, the relation is in BCNF.

Mohammed basil

1)Which one of the following is **NOT** a part of the properties of database transactions?

A) Atomicity
B) Consistency
C) Isolation
D) Deadlock-freedom

Correct answer – D)

Atomicity: Atomicity ensures that a transaction is treated as a single unit of work, which means that either all of its operations are successfully completed, or none of them are.

Consistency: Consistency ensures that a transaction brings the database from one valid state to another valid state. It ensures that all integrity constraints, such as primary key constraints or foreign key constraints, are maintained during the transaction.

Isolation: Isolation ensures that the execution of multiple transactions concurrently does not result in interference between transactions. Each transaction should be executed as if it is the only transaction executing on the database.

Durability: Durability ensures that once a transaction has been committed, the changes it made to the database persist even in the event of system failures such as power outages or crashes.

2) Which level of locking provides the highest degree of concurrency in a relational database?

A) Page.
B) Table.
C) Row.
D) Page, table and row level locking allow the same degree of concurrency.

Correct answer : - C)

Row has lower level of granularity(granularity of locks in a database refers to how much of the data is locked at one time) among page, table and row. As in case of Row the amount of data which is locked very less so it takes less amount of memory then many processes can run at the same time. So concurrency is high for Row level locking.

Row-level locking is a concurrency control mechanism in database management systems where locks are applied at the level of individual rows

within a table.

3) Which of the following scenarios may lead to an irrecoverable error in a database system?
A) transaction writes a data item after it is read by an uncommitted transaction
B) transaction reads a data item after it is read by an uncommitted transaction
C) transaction reads a data item after it is written by a committed transaction
D) transaction reads a data item after it is written by a uncommitted transaction

Correct answer : - D)

Reading uncommitted data is called as dirty read. If a transaction reads uncommitted data and commits before the transaction that writes data item leads to non-recoverable schedule if transaction that writes data item rolled back.

4) B plus trees are considered BALANCED because
A) the lengths of the paths from the root to all leaf nodes are all equal.
B) the lengths of the paths from the root to all leaf nodes differ from eachother by at most 1.
C) the number of children of any two non-leaf sibling nodes differ by at most
D) the number of records in any two leaf nodes differ by at most 1.

Correct answer : - A)

They are mainly considered as balanced because of the factors like :

1. Uniform Height: All leaf nodes are at the same level, maintaining balance.

2. Minimum Occupancy: Non-root nodes have at least half-full occupancy, preventing underflow.

3. Splitting and Merging: Nodes split when full and merge when below minimum occupancy, ensuring balance.

4. Ordered Structure: Keys are stored in sorted order within each level, aiding in balance and efficient operations.

5) a file of 16384 records. Each record is 32 bytes long and its key field is of size 6 bytes. The file is ordered on a non-key field, and the file organization is unspanned. The file is stored in a file system with block size 1024 bytes, and the size of a block pointer is 10 bytes. If the secondary index is built on the key field of the file, and a multi-level index scheme is used to store the secondary index, the number of first-level and second-level blocks in the multi-level index are respectively

A) 8 and 0
B) 128 and 6
C) 256 and 4
D) 512 and 5

Correct answer : - C)

MOHAMMED KAIF

1)

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

- $a \rightarrow c$
- $b \rightarrow d$

This relation is

A. in first normal form but not in second normal form
B. in second normal form but not in first normal form
C. in third normal form
D. none of the above

Ans:A

2

Which normal form is considered adequate for normal relational database design?

A. $2NF$ B. $5NF$ C. $4NF$ D. $3NF$

Ans:D

3

Consider a schema $R(A, B, C, D)$ and functional dependencies $A \rightarrow B$ and $C \rightarrow D$. Then the decomposition of R into $R_1(A, B)$ and $R_2(C, D)$ 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

Ans:c

4

Which statement accurately describes Cassandra's features?
A) Cassandra does not support horizontal scalability and cannot accommodate larger datasets.
B) Cassandra employs a master-slave replication model and has a single point of failure.
C) Cassandra supports elastic scalability, always-on architecture, and fast linear-scale performance.
D) Cassandra does not provide transaction support and lacks data consistency.

Correct Answer: C) Cassandra supports elastic scalability, always-on architecture, and fast linear-scale performance.

5

Consider the schema $R = (S, T, U, V)$ and the dependencies $S \rightarrow T, T \rightarrow U, U \rightarrow V$ and $V \rightarrow S$. Let $R = (R1 \text{ and } R2)$ be a decomposition such that $R1 \cap R2 \neq \phi$. The decomposition is

A. not in $2NF$
B. in $2NF$ but not $3NF$
C. in $3NF$ but not in $2NF$
D. in both $2NF$ and $3NF$

Ans:d

Namdid

1]

Consider a relation R(A,B,C,D,E) with the following functional dependencies:

AB→C

C→D

D→E

Which of the following is a superkey for R ?

A) {A, B}

B) {A, B, C}

C) {A, B, C, D}

D) {A, B, C, D, E}

Answer: D) {A, B, C, D, E}

Explanation: The closure of {A, B, C, D, E} includes all attributes.

2]

Which of the following is a benefit of using NoSQL databases over traditional relational databases?

A) Strong consistency guarantees

B) Schema flexibility

C) ACID transactions

D) Well-defined joins

Answer: B) Schema flexibility

Explanation: NoSQL databases allow dynamic schema changes.

3]

Which of the following is a property of a serializable schedule?

A) It is conflict-serializable.

B) It is recoverable.

C) It is cascadeless.

D) It is view-serializable.

Answer: A) It is conflict-serializable.

Explanation: Serializable schedules are conflict-serializable.

4]

Consider a relation R (A, B, C, D, E) with the following three functional dependencies:

AB → C

BC → D

C → E The number of superkeys for this relation is:

A) 8

B) 10

C) 12

D) 16

Answer: B) 10

Explanation: The superkeys are {AB}, {BC}, {C}, {ABD}, {BCD}, {AC}, {ABC}, {CDE}, {ABCDE}, {ABCE}.

5]

Consider a set of attributes {A, B, C, D, E} and the following set of functional dependencies:

A → B

B → C

CD → E

E → A

Compute the closure of the attribute set {A, C} with respect to these functional dependencies.

Solution:

Initial Closure: {A, C}

Applying A → B: {A, C, B}

Applying B → C: {A, C, B}

Applying CD → E: {A, C, B, D, E}

Applying E → A: {A, C, B, D, E}

The closure of {A, C} with respect to the given functional dependencies is {A, C, B, D, E}.

MUHAMMED ASHIR K A

1] Suppose the following functional dependencies hold on a relation U with attributes P,Q,R,S and T:

P->QR
RS->T

Which of the following functional dependencies can be inferred from the above functional dependencies?

A) PS->T
B) R->T
C) P->R
D) PS->Q

Solution:

A) PS->T
C) P->R
D) PS->Q

Explanation:

A) PS->T
$(PS)^+$ = P,Q,R,S,T. So, PS->T holds

B) R->T
$(R)^+$ = R. So R->T does not

C) P->R
$(P)^+$ = P,Q,R. So, P->R holds

D) PS->Q
$(PS)^+$ = P,Q,R,S,T. So, PS->Q holds

2] Consider a relational table R that is in 3NF but not in BCNF which one of the following statements is true?

A) R has a nontrivial functional dependency X->A where X is not a super key and A is a prime attribute

B) R has a nontrivial functional dependency X->A where X is not a super key and A is a non prime attribute and X is not a proper subset of any key

C) R has a nontrivial functional dependency X->A where X is not a super key and A is a non-prime attribute and X is a proper subset of some key

D) A cell in R holds a set instead of an atomic value

Solution:

In 3NF where functional dependency is of type X → Y

X can be the super key or Y can be the prime attribute

Whereas in BCNF where functional dependency is of type X → Y

X should be super key (BCNF is more strict compared to 3NF)

Option (C) says it has a partial dependency (not even 2NF).

Option (D) multiple values in a cell. i.e not atomice (not even 1NF).

Option (B) says X is not a super key and Y is not a prime attribute. Therefore not 3NF.

Ans (A): Says X is not a super key but Y is a prime attribute. Satisfies one of the conditions of the 3NF formal definition. As X is not a Super Key it is not in BCNF

3]

The following functional dependencies hold true for the relational schema R{V,W,X,Y,Z}: V→W

VW →X

Y→ VX

Y→Z

Which of the following is irreducible equivalent for this set of functional dependencies ?

A)

V→W

V→X

Y →V

Y→Z

B)

V→W

W→X

Y→ V

Y→ Z

C)

V →W

V→X

CY→V

Y→X

Y→Z

D)

V→W

W→ X

D Y→V

Y →X

Y→Z

Solution:

In option B and option D there is a dependency W→ X which is not implied by the question and hence they are definitely wrong.

Now in option C) Y → X can be removed as it can be implied as Y → V and V → X.

Hence, option (A) is correct.

4] Once the DBMS informs the user that a transaction has been successfully completed, its effect should persist even if the system crashes before all its changes are reflected on disk. This property is called

A) Durability

B) Atomicity

C) Consistency

D) Isolation

Solution: A) Durability

5] From the statements mentioned below, which of them may result in an

irrevocable error in a database system?

(A) Transaction writes a data item after it is read by an uncommitted transaction

(B) Transaction reads a data item after it is read by an uncommitted transaction

(C) Transaction reads a data item after it is written by a committed transaction

(D) Transaction reads a data item after it is written by a uncommitted transaction

Solution:

A) It will not lead to an irrecoverable error in a database system.

If transaction writing data commits, then transaction which read the data might get phantom tuple/ Unrepeatable error. Though there is no irrecoverable error possible even in this option.

B) It will not lead to an irrecoverable error in a database system.

It is not an issue since both the transaction reading data.

C) It will not lead to an irrecoverable error in a database system.

It is non issue. Since data is written by a committed .

This is a dirty read. In case, if transaction reading uncommitted data commits, an irrecoverable error occurs of the uncommitted transaction fails.

Therefore D is correct.

NADHA SHIRIN K N

1) Consider the following log sequence of two transactions on a bank account, with initial balance 12000, that transfer 2000 to a mortgage payment and then apply a 5% interest.

1. T1 start
2. T1 B old=12000 new=10000
3. T1 M old=0 new=2000
4. T1 commit
5. T2 start
6. T2 B old=10000 new=10500
7. T2 commit

Suppose the database system crashes just before log record 7 is written. When the system is restarted, which one statement is true of the recovery procedure?

(A) We must redo log record 6 to set B to 10500

(B) We must undo log record 6 to set B to 10000 and then redo log records 2 and 3

(C) We need not redo log records 2 and 3 because transaction T1 has committed

(D) We can apply redo and undo operations in arbitrary order because they are idempotent.

Answer (B)

Explanation :

(A) Redo log record 6 to set B to 10500: This would be incorrect because T2 has already committed, and the change to B is already reflected in the database.

(B) Undo log record 6 to set B to 10000 and then redo log records 2 and 3: This is the correct approach. We need to undo the change made by T2 (log record 6) and then redo the changes made by T1 (log records 2 and 3) to restore the database to a consistent state.

© We need not redo log records 2 and 3 because transaction T1 has committed: This is incorrect because T1's changes need to be reapplied after undoing T2's changes.

(D) We can apply redo and undo operations in arbitrary order because they are idempotent: This is not true; the order matters for correct recovery.

2) The following functional dependencies are given:

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}

Answer:

(C) Closure of AF or AF+ = {ADEF}, closure of AF doesn't contain C and G.

3) 20. Which of the following is not part of the ACID properties?

Consistency

Atomicity

Inconsistency

Isolation

Answer : c

4) Consider the following transactions with data items P and Q initialized to zero:

T1: read (P) ;

read (Q) ;

if P = 0 then Q : = Q + 1 ;

write (Q) ;

T2: read (Q) ;

read (P) ;

if Q = 0 then P : = P + 1 ;

write (P) ;

Any non-serial interleaving of T1 and T2 for concurrent execution leads to

(A) A serializable schedule

(B) A schedule that is not conflict serializable

(C) A conflict serializable schedule

(D) A schedule for which a precedence graph cannot be drawn

Answer (B)

Two or more actions are said to be in conflict if:

1) The actions belong to different transactions.

2) At least one of the actions is a write operation.

3) The actions access the same object (read or write).

Let's analyze the given transactions T1 and T2:

T1:

Reads P.

Reads Q.

If P = 0, increments Q by 1.

Writes the updated value of Q.

T2:

Reads Q.

Reads P.

If Q = 0, increments P by 1.

Writes the updated value of P.

Now, let's consider a non-serial interleaving of these transactions:

T1 reads P (initial value of P is 0).

T2 reads Q (initial value of Q is 0).

T1 reads Q (still 0).

T1 increments Q by 1 (new value of Q is 1).

T2 reads P (still 0).

T2 increments P by 1 (new value of P is 1).

Both transactions write their updated values.

The resulting values are:

P = 1

Q = 1

This interleaving is not conflict serializable because there is a conflict between the read and write operations on P and Q. Specifically, T1 reads Q before T2 writes to it, and T2 reads P before T1 writes to it.

Therefore, the correct answer is (B): A schedule that is not conflict serializable

5. Which among the given options below is the highest level of isolation in transaction management?

(A) Committed read

(B) Serializable (highest isolation)

(C) Repeated read (most restrictive)

(D) Uncommitted read (lowest)

Ans: (B) Serializable

Muhammed Bais

1)
Which normal form is considered adequate for normal relational database design?
(a) 3 N F
(b) 5 N F
(c) 2 N F
(d) 4 N F

Ans: d

Explaination: It ensures that a database table is free from certain types of anomalies and redundancies, providing a higher level of data integrity and reducing the risk of data inconsistencies.

2)
In a Schema with attributes A, B,C, D and E, following set of functional dependencies given.
A->B
A->C
CD->E
B->D
E->A

Which of the following Functional dependency is NOT implied by the above set.

A) CD->AC
B) BD->CD
C) BC->CD
D) AC->BC

Ans: b

3)
From the statements mentioned below, which of them may result in an irrevocable error in a database system?
(a) Transaction reads a data item after it is written by an uncommitted transaction
(b) Transaction reads a data item after it is written by a committed transaction
(c) Transaction writes a data item after it is read by a committed transaction
(d) Transaction writes a data item after it is read by an uncommitted transaction

Ans: d

Explaination: This situation can lead to a phenomenon known as "dirty write" or "dirty update," where a transaction writes data that has been read by another transaction that has not yet committed its changes. This can cause inconsistent or incorrect data to be persisted in the database and can be difficult to recover from without manual intervention.

4)

Which among the following is a true statement?
(i) Lossless, dependency preserving decomposition into 3NF is always possible
(ii) Any relation with two attributes is in BCNF

. (i)
a. (ii)
b. (i) and (ii)
c. None of the above

Ans: a

Explaination: This statement is true because it is possible to decompose a relation into a set of smaller relations that are in the Third Normal Form (3NF) while preserving all functional dependencies and ensuring that the decomposition is lossless (meaning no information is lost). However, statement (ii) is not necessarily true, as not all relations with two attributes are in Boyce-Codd Normal Form (BCNF).

5)

If a block can hold either 3 records or 10 key pointers and a database contains "n" records, then how many blocks do we need to hold the data file and the dense index?
(a)13n/30
(b) N/10
(c) N/30
(d) N/3

Ans: a