Farees Siddiqui

100-780-513

1 A).What is the difference between CASCADE and RESTRICT grant options? (1 Point)

If user A revokes privilege P from user B with the CASCADE option, delete the edge from AP to BP. But if A uses RESTRICT instead, and there is an edge from BP to anywhere, then reject the revocation and make no change to the graph. Meaning, if the CASCADE option used, all subsequent users will lose the privilege P

1 B). Assume user A executes REVOKE P FROM B RESTRICT. Describe how is it going to affect the grant diagram presented above? (1 Point)

If A executes REVOKE P FROM B RESTRICT, then the revocation would be rejected and no change would be made to the graph.

1 C). Which revoke operations have to be executed from user A, so user C loses all privileges? (1 Point)

For user C to lose all privileges, you would need to run the revoke command with the CASCADE option. So the query would become REVOKE P FROM C CASCADE

2 A). What does normalization mean? (1 Point)

Normalization is the process of breaking down relations into 2 more schemas which are not in normal form so we can create a better design for the database and remove redundancies and/or anomalies.

2 B). What does anomaly mean? (Provide an example) (1 Point)

A relation can have 2 types of anomalies. Update and Deletion

| Employee\_ID | Name | Department | Student\_Group |
| --- | --- | --- | --- |
| 123 | J.Longfellow | Accounting | Alpha Beta Psi |
| 234 | B.Rech | Marketing | Marketing Club |
| 234 | B.Rech | Marketing | Management Club |
| 456 | A.Bruchs | CIS | Technology Org |
| 456 | A.Bruchs | CIS | Alpha Beta Psi |

Update Anomaly : One occurance of a fact is changed, but not all. In other words an update anomaly is a data inconsistency that results from data redundancy and a partial update. For example, each employee in a company has a department associated with them as well as the student group they participate in.

Deletion Anomaly : valid fact is lost when a tuple (row) is deleted

Looking at the above table we can see the following examples

If A.Bruch's department is an error it must be updated at least 2 times or there will be inconsistent/contradictory data in the database. If the user performing the update does not realize the data is stored redundantly, the update will not be done properly. (Update Anomaly)

A deletion anomaly is the unintended loss of data due to deletion of another data. For example, if the student group Beta Alpha Psi disbanded and was deleted from the table above, J.Longfellow and the Accounting department would cease to exist. This results in database inconsistencies and is an example of how combining information that doesn't really belong together into one table can cause problems. (Deletion Anomaly)

2 C). What does it mean that a relation is in BCNF (provide clear definition)? (1 Point)

We say that a relation is in BCNF if whenever X->Y is a nontrivial FD that holds in R, X is a superkey. Nontrivial means that Y is not contained in X and a superkey is any superset of a key

2 D). Assume set of FDs F = {BC -> A, BC -> D, BC -> E, F -> G, F -> H} over the table T. Is the

table T in BCNF? Provide justification. If answer is no, decompose table T into the BCNF

form. (2 Points)

Closure of BC:

Basis: BC^+ = BC

BC+ = BC^+ union A

BC+ = BC^+ union D

BC+ = BC^+ union E

Closure BC^+ = BCADE = {BC, A, D, E}

Therefore T is not in BCNF since BC is not a superkey.

BCNF Decomp:

Original Table: T(BC, A, D, E, F, G, H)

Closure of BC:

Basis: BC^+ = BC

BC+ = BC^+ union A

BC+ = BC^+ union D

BC+ = BC^+ union E

Closure BC^+ = BCADE = {BC, A, D, E}

T1(BC, A, D, E) <- Satisfies BCNF, FD’s are {BC-A, BC->D, BC->E}

T2(BC, F, G, H)

We still need to check whether or not T2 is in BCNF

T2 is not in BCNF since F is not a superkey

Calculate closure of F^+

Basis: F^+ = F

F^+ = F^+ union G since F->G

F^+ = F^+ union H since H->H

Closure of F^+ = FGH = {F, G, H}

T3(F, G, H)

T4(BC, F)

Therefore the decomposed relations would be:

T1(BC, A, D, E)

T3(F, G, H)

T4(BC, F)

3) Closure test. Assume a set of FDs F = {AB-> CD, E -> F, GH -> IJ, F -> GH, I -> K, LM -> N, N -> O}.

a. Compute a closure of ABE+. Describe all intermediate steps. (2 Points)

b. Based on the closure information is true that ABE -> I, ABE -> K, ABE -> L? (1 Point)

A) Closure of ABE:

Basis: ABE^+ = ABE

ABE^+ = ABE^+ union CD since AB->CD (ABECD)

ABE^+ = ABE^+ union F since E->F (ABECDF)

ABE^+ = ABE^+ union GH since F->GH (ABECDFGH)

ABE^+ = ABE^+ union IJ since GH->IJ (ABECDFGHIJ)

ABE^+ = ABE^+ union K since I->K (ABECDFGHIJK)

Therefore the closure of ABE^+ = ABECDFGHIJK

B) Based of the closure information

ABE->I Holds true (True)

ABE->K Holds True (True)

ABE->L Does not hold true (False)

Consider a database for a bank, including information about customers and their accounts. Information about a customer includes their name, address, phone, and Social Security number. Accounts have numbers, types (e.g., savings, checking) and balances.

a. How a typical data about banks and customers could be represented as a DTD. (2 Points)

b. Provide a sample XML document for the provided DTD. In your XML document include information about 2 customers and for each customer provide sample 1 account (2 Points)

<!DOCTYPE BANK[

<!ELEMENT BANK (CUSTOMER+)>

<!ELEMENT CUSTOMER (NAME, ADDRESS, PHONE, SSN, ACCOUNT+)>

<!ELEMENT NAME (#PCDATA)>

<!ELEMENT ADDRESS (#PCDATA)>

<!ELEMENT PHONE (#PCDATA)>

<!ELEMENT SSN (#PCDATA)>

<!ELEMENT ACCOUNT (ACCOUNT\_NUMBER, ACCOUNT\_TYPE, BALANCE)>

<!ELEMENT ACCOUNT\_NUMBER (#PCDATA)>

<!ELEMENT ACCOUNT\_TYPE (#PCDATA)>

<!ELEMENT BALANCE (#PCDATA)>

<!ATTLIST CUSTOMER ID ID #REQUIRED>

<!ATTLIST ACCOUNT ID ID #REQUIRED>

]>

<BANK>

<CUSTOMER ID="1">

<NAME>John Smith</NAME>

<ADDRESS>123 Main St.</ADDRESS>

<PHONE>123-456-7890</PHONE>

<SSN>123-45-6789</SSN>

<ACCOUNT ID="1">

<ACCOUNT\_NUMBER>123456789</ACCOUNT\_NUMBER>

<ACCOUNT\_TYPE>Savings</ACCOUNT\_TYPE>

<BALANCE>1000</BALANCE>

</ACCOUNT>

</CUSTOMER>

<CUSTOMER ID="2">

<NAME>Jane Doe</NAME>

<ADDRESS>456 Main St.</ADDRESS>

<PHONE>123-456-7890</PHONE>

<SSN>123-45-6789</SSN>

<ACCOUNT ID="2">

<ACCOUNT\_NUMBER>123456789</ACCOUNT\_NUMBER>

<ACCOUNT\_TYPE>Checking</ACCOUNT\_TYPE>

<BALANCE>1000</BALANCE>

</ACCOUNT>

</CUSTOMER>