


SQL language: other definitions

Transactions

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Transactions

- Introduction
- Transactions in SQL
- Properties of transactions

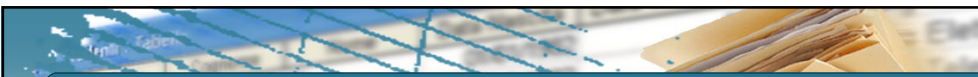
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Transactions


Introduction



Example of application




- Banking operations
 - cash withdrawal from a current account using a cash card
 - depositing cash on a current account



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Cash withdrawal



- Operations
 - specify the amount required
 - check availability
 - memorize transaction
 - update balance
 - enable withdrawal of the amount required

➤ All the operations have to be carried out correctly, otherwise the cash cannot be withdrawn

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Cash withdrawal

- *What happens if a co-signatory of a joint account makes another cash withdrawal?*
- *What happens if there is a malfunction?*

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Cash deposit



- Operations
 - check the amount paid in
 - memorize the transaction
 - update the balance

➤ All the operations have to be carried out correctly, otherwise the cash cannot be deposited

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Cash deposit

- *What happens if another person pays cash into the same account?*
- *What happens if there is a malfunction?*

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Example: banking operations

- The bank database is a multi-user environment
 - various operators can work simultaneously on the same portion of data
- The correct management of the information requires
 - mechanisms for the management of *simultaneous access* to the database
 - Mechanisms for the *recovery* of the correct state of the database in the case of malfunction

Transactions

- It is necessary when several users can simultaneously access the data
- It provides efficient mechanisms for
 - managing competing access to data
 - recovery after a malfunction

Transactions

- A transaction is a sequence of operations that
 - represents an elementary unit of work
 - can end in success or failure
 - in the case of success, the result of the operations has to be permanent in the database
 - in the case of failure, the database has to return to the original state before the transaction was initiated


Transactional system

- A system that makes a mechanism available for the definition and execution of transactions is called a *transactional system*
- The DBMS contain architecture blocks that offer transaction management services



Transactions


Transactions in SQL



Transaction

⇒ A transaction is

- a logical unit of work, which cannot be broken down any further
- a sequence of operations (SQL instructions) to change data, which takes the database from a consistent state to another consistent state
 - it is not necessary to conserve the consistency of the intermediate states



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Beginning a transaction

- To define the beginning of a transaction, the SQL language uses the instruction
 - `START TRANSACTION`
- Usually the instruction to begin a transaction is omitted
 - the beginning is implicit for
 - the first SQL instruction of the programme that accesses the database
 - the first SQL instruction following the instruction ending the previous transaction

Ending a transaction

- The SQL language has instructions for defining the end of a transaction
 - Transaction **successful**
 - `COMMIT [WORK]`
 - the action associated with the instruction is called *commit*
 - Transaction **failed**
 - `ROLLBACK [WORK]`
 - the action associated with the instruction is called *abort*

Commit

- Action executed when a transaction ends with success
- The database is in a new (final) correct state
- The changes to the data executed by the transaction become
 - permanent
 - visible to other users

Rollback

- Action executed when a transaction ends because of an error
 - for example, an error in application
- All the operations modifying the data executed during the transaction are “annulled”
- The database returns to the state prior to the beginning of the transaction
 - the data is once more visible to the other users



Example

➤ Transfer the sum of 100

- from current account number
IT92X0108201004300000322229
- to current account number
IT32L0201601002410000278976

```
START TRANSACTION;  
UPDATE Account  
  SET Balance= Balance + 100  
  WHERE IBAN='IT92X0108201004300000322229';  
UPDATE Account  
  SET Balance = Balance - 100  
  WHERE IBAN= 'IT32L0201601002410000278976';  
COMMIT;
```



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Transactions

Transaction properties



Transaction properties

- The principal properties of transactions are
 - Atomicity
 - Consistency
 - Isolation
 - Durability
- They are summarized by the English acronym *ACID*

Atomicity

- A transaction is an indivisible unit (atom) of work
 - all the operations contained in the transaction have to be executed
 - or none of the operations contained in the transaction have to be executed
 - the transaction has no effect on the database
- The database cannot remain in an intermediate state arrived at during the processing of a transaction

Consistency

- The execution of a transaction has to take the database
 - from an initial state of consistency (correct)
 - to a final state of consistency
- Correctness is verified by integrity constraints defined on the database
- When there is a violation of the integrity constraint the system intervenes
 - to **annul** the transaction
 - or to modify the state of the database by eliminating the violation of the constraint

Isolation

- The execution of a transaction is independent from the simultaneous execution of other transactions
- The effects of a transaction are not visible by other transactions until the transaction is terminated
 - the visibility of unstable intermediate states is avoided
 - an intermediate state can be **annulled** by a subsequent rollback
 - in the case of rollback, it is necessary to rollback the other transactions that have observed the intermediate state (domino effect)

Durability

- The effect of a transaction that has executed a commit is memorized permanently
 - the changes to the data carried out by a transaction ending successfully are permanent after a commit
- It guarantees the reliability of the operations of data modification
 - the DBMS provides mechanisms for recovery to the correct state of the database after a malfunction has occurred