

A decorative graphic on the left side of the slide consisting of white and light blue lines and circles, resembling a circuit board or a stylized tree structure.

WEEK 10

TRANSACTION – MOTIVATION FOR THE NEED FOR TRANSACTIONS

STUDENT OBJECTIVES

- Upon completion of this video, you should be able to:
 - Give 2 scenarios where transactions are required
 - Define the term *transaction*
 - Give the meaning of each of the 4 properties in acronym ACID
 - Give an example of at least 3 types of things that could happen that would cause problems
 - List the 3 SQL commands used to build transactions
 - Explain why logs are necessary in database management systems

IMAGINE:

- **Situation 1:** Homer moving 50 dollars from his savings account to his checking account where:
 - *Get the account balance of the savings account*
 - *If the Homers&Marge's savings account has more than 50 dollars in the savings account, subtract the 50 bucks from the savings.*
 - *Add the 50 bucks to the checking balance.*
- **Situation 2:** Marge is going to deduct 75 dollars from the SAME savings account as Homer
 - *Get the account balance of the savings account*
 - *If the Homers&Marge's savings account has more than 75 dollars in the savings account subtract the 75 bucks from the savings.*

2 POSSIBLE PROBLEMS:

QUESTION: Just consider problem 1 on it's own. What could go wrong with just problem 1?

UPDATE jointaccount SET balance = balance - 50 WHERE cusID = "homer123" AND type="saving";

UPDATE jointaccount SET balance = balance + 50 WHERE cusID="homer123" AND type="chequing";

QUESTION: Now consider problem 2 with 2 different things happening at the same time. What could go wrong?

Assume account has 100 dollars.

Homer does:

SELECT balance FROM jointaccount WHERE cusID = "homer123";

UPDATE jointaccount SET balance = balance - 50 WHERE cusID="homer123";

Marge does:

SELECT balance FROM jointaccount WHERE cusID = "marg123";

UPDATE jointaccount SET balance = balance - 75 WHERE cusID = "marg123";

WHAT IS A TRANSACTION?

- A transaction is a sequence of database operations, where the execution of the operations preserves the consistency of the database (a Logical Unit of Work)

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SOLUTION: TRANSACTIONS:

- **TRANSACTION 1:** A Transaction for Homer moving 50 dollars from his savings account to his checking account where:

- **Begin Transaction**

- Get the account balance of the savings account
- If the Homers&Marge's savings account has more than 50 dollars in the savings account, subtract the 50 bucks from the savings.
- Add the 50 bucks to the checking balance.

- **Commit**

- **TRANSACTION 2:** Another transaction for Marge, she is going to deduct 75 dollars from the SAME savings account as Homer

- **Begin Transaction**

- Get the account balance of the savings account
- If the Homers&Marge's savings account has more than 75 dollars in the savings account subtract the 75 bucks from the savings.

- **Commit**

PROBLEMS THAT CAN OCCUR DURING THE MIDDLE OF A TRANSACTION:

1. **System Crash:** Example --> Main Memory Failure
2. **Transaction or System Error:** Example → Division by zero
3. **Local/Exception Errors:** Example → Not being able to access or find data
4. **Concurrency control enforcement:** Example → Concurrency may abort a transaction and restart it later
5. **Disk Failure:** Example → Read/Write Head Crash
6. **Catastrophes:** Example → air conditioning failure, fire, theft, overwriting disks by mistake

THE ACID TEST

- The transaction must take the database from a **consistent state** to another **consistent state**, thus the initial state before the *Begin Transaction* of transaction 1 is a **consistent state**, and after the *Commit* it is a consistent state but in-between that the database is in an **inconsistent state** because it violates integrity and semantic rules.
- The DBMS must be able to recover the database to a previous consistent state if for some reason some happens in the middle of the transaction.

• EVERY TRANSACTION MUST PASS THE **ACID** TEST:

- **A**tomtic: All or nothing: All parts of the transaction **MUST** be executed, thus in the above example, all steps are thought of as 1 atomic transaction where either all are completed or none are completed
- **C**onsistency: A transaction must transform the database from one consistent state to another consistent state.
- **I**solation: Data used during the execution of the a transaction cannot be used by a second transaction until the first one is completed (runs as if in isolation)
- **D**urability: When a transaction is completed, the database has reached a consistent state and that state cannot be lost, even if there is a system failure. The changes made by the transaction are durable, i.e. will survive certain types of systems crashes.

- Transactions are supported in SQL with the use of 3 commands:
 - **Begin Transaction**
 - **Commit**
 - **Rollback (also called Abort)**

```
DECLARE '_rollback' BOOL DEFAULT 0;
DECLARE CONTINUE HANDLER FOR SQLEXCEPTION SET '_rollback' = 1;
START TRANSACTION;
INSERT INTO SAIDAS(data, hora) VALUES(CURDATE("yyyy-MM-dd"),CURTIME("hh:mm:ss"));
UPDATE INTO ENTRADAS(sai) VALUES(@sai);

IF '_rollback' THEN
    SET retcode = 0;
    ROLLBACK;
ELSE
    SET retcode = 1;
    COMMIT;
END IF;
END$$
```

TRANSACTION LOGS

- DBMS use transaction logs to keep track of all updates on the system. The log file is used for recovery of a consistent state if there is an abnormal termination or crash
- *Example Log File:*

TID	Table	TupleID	Attribute	Before Value	After Value
101	*** Begin Transaction ***				
101	Inventory	645	On_Hand	243	109
101	AccRec	4324542	Balance	1200	4500
101	*** End Transaction: Committed				
102	*** Begin Transaction ***				
102	Inventory	645	On_Hand	109	43
102	AccRec	323453	Balance	4000	5600

- **QUESTION:** Why would you want to have your log file on a different disk than your data file?

ANSWER: Need the log to recreate the data, if the disk is gone and both the log and data are on the same disk, then you lose both!

- **QUESTION:** Why would you want to have your log file repeated on more than 1 disk?

ANSWER: Need to have a backup of your log file.