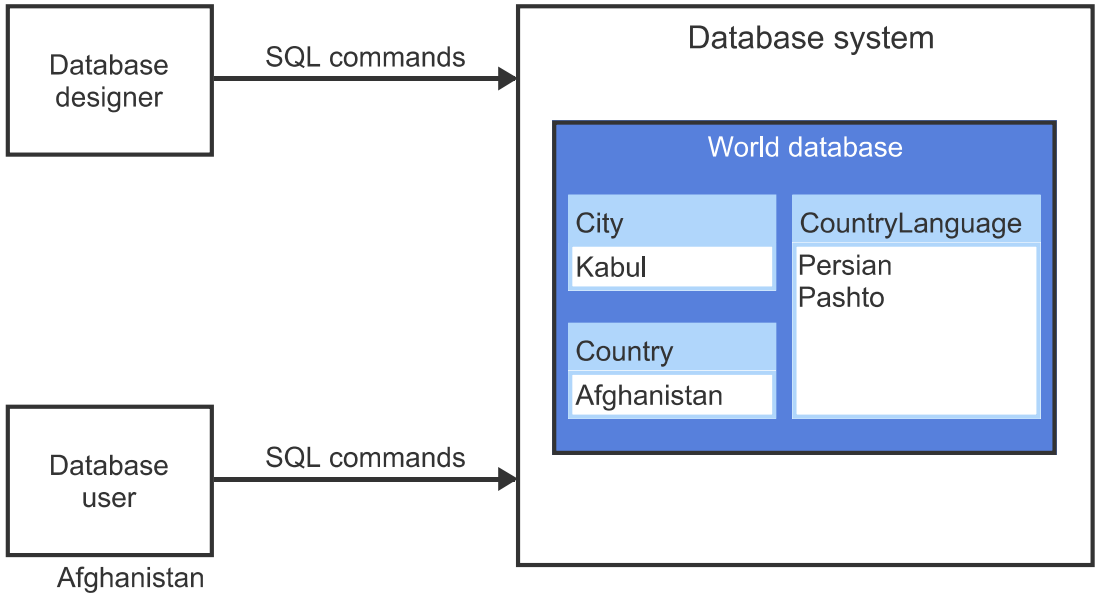
4.2 Introduction to SQL

Structured Query Language

Structured Query Language (***SQL***) is a high-level computer language for storing, manipulating, and retrieving data in a relational database. SQL, pronounced "ess-que-el" or "see-qual", is the language used by database designers and database users to interact with relational database systems. Though the SQL language has been standardized, a database system may implement variations of SQL statements.

PARTICIPATION ACTIVITY 4.2.1: SQL interaction with a database system.

1 2 2x speed



A database user uses SQL to insert, retrieve, update, and delete data from the tables.

Captions

1. A database designer uses SQL to create a database and the database tables.
2. A database user uses SQL to insert, retrieve, update, and delete data from the tables.

Feedback?

PARTICIPATION ACTIVITY 4.2.2: SQL.

1) SQL commands can create databases and tables.
   - (•) True
   - ( ) False

   Correct
   In the animation above, SQL commands create a database called World and then create three tables for the World database.

2) A database designer and database user both use SQL.
   - (•) True
   - ( ) False

   Correct
   The database designer uses SQL to create the database and tables, and the database user uses SQL to insert, retrieve, update, and delete data from the tables.

3) All database systems use identical SQL statements.
   - ( ) True
   - (•) False

   Correct
   The SQL language has been standardized, but SQL implementations can vary between database systems in small ways.

Feedback?

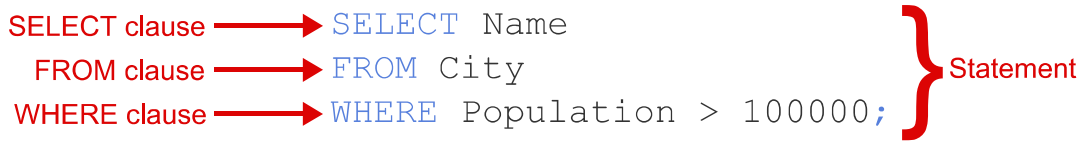
SQL syntax

An SQL ***statement*** is a complete command composed of one or more clauses. A ***clause*** groups SQL keywords like SELECT, FROM, and WHERE with table names like City, column names like Name, and conditions like Population >

100000. An SQL statement may be written on a single line, but good practice is to write each clause on a separate line.

PARTICIPATION ACTIVITY 4.2.3: Three clauses in a SELECT statement.

1 2 3 4 2x speed



The three clauses ending in a semicolon is a statement. The statement retrieves the names of all cities that have a population greater than 100,000 people.

Captions

1. The SELECT clause starts the statement. Name is a column name.
2. The FROM clause must follow the SELECT clause. City is a table name.
3. The WHERE clause is optional. When included, the WHERE clause must follow the FROM clause. Population > 100000 is a condition.
4. The three clauses ending in a semicolon is a statement. The statement retrieves the names of all cities that have a population greater than 100,000 people.

Feedback?

All SQL statements end with a semicolon. SQL keywords like SELECT, FROM, WHERE, etc. are not case sensitive. Ex: SELECT and select are equivalent. However, identifiers like column names and table names are case sensitive in many database systems. This material uses capital letters for SQL keywords so the keywords stand out from other syntactic parts. The table below summarizes various syntactic features of SQL.

Table 4.2.1: Summary of SQL syntax features.

Type	Description	Examples

Literals	Explicit values that are string, numeric, or binary.
	Strings must be surrounded by single quotes or double quotes.
	Binary values are represented with `x'0'` where the 0 is any hex value.
		`'String'`
		`"String"`
		`123`
		`x'0fa2'`

Keywords	Words with special meaning.	SELECT, FROM, WHERE
Identifiers	Objects from the database like tables, columns, etc.	City, Name, Population
Comments	Statement intended only for humans and ignored by the database when parsing an SQL statement.	`-- single line comment` `/* multi-line Comment */`

Feedback?

All database systems recognize single quotes for string literals, but some also recognize double quotes. This material uses single quotes to ensure the SQL statements are compatible with all database systems.

PARTICIPATION ACTIVITY 4.2.4: SQL syntax.

1) The INSERT statement adds a student to the Student table. How many clauses are in the INSERT statement?

Correct

The INSERT INTO clause is followed by the VALUES clause.

```
INSERT INTO Student
VALUES (888, 'Smith', 'Jim',
3.0);
```

- ○ 1
- ◉ 2
- ○ 3

2) The SQL statement below is used to select students with the last name "Smith". What is wrong with the statement?

```
SELECT FirstName
FROM Student
WHERE LastName = Smith;
```

- ◉ The literal "Smith" must be surrounded by single quotes or double quotes.
- ○ The WHERE clause should be removed.
- ○ The last name "Smith" may not exist in the database.

Correct

'Single' or "double" quotes must surround string literals.

3) What is wrong with the SQL statement below?

```
SELECT FirstName
from Student
```

- ○ The keyword from must be written FROM.
- ○ The WHERE clause is

Correct

The semicolon indicates the end of an SQL statement. All SQL statements require a terminating semicolon.

missing.

- A terminating semicolon is missing.

4) What is wrong with the SQL statement below?

```
SELECT Gpa
--FROM Student;
```

- The FROM clause is a comment.
- The WHERE clause is missing.
- Gpa should be a table name.

Correct

The double dashes preceding the FROM clause cause the database to ignore the FROM clause. The FROM clause is required in a SELECT statement

Feedback?

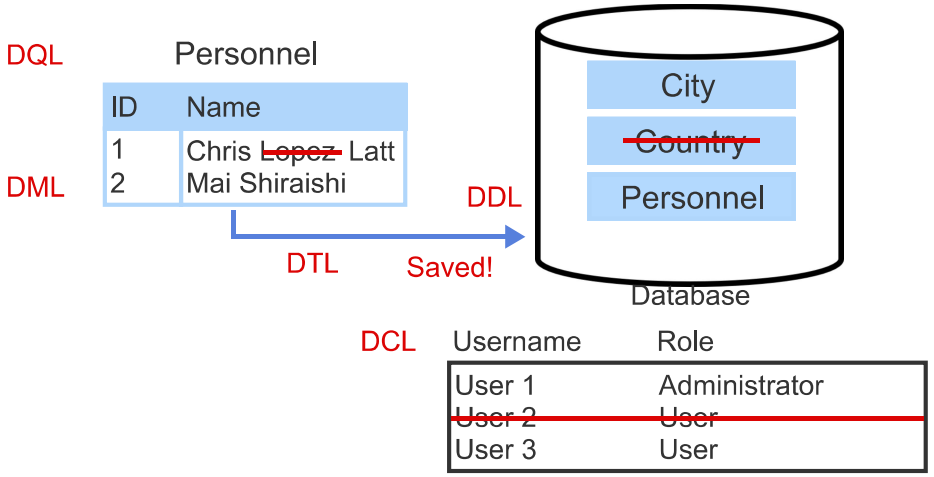
SQL sublanguages

The SQL language is divided into five sublanguages:

- ***Data Definition Language*** (DDL) defines the structure of the database.
- ***Data Query Language*** (DQL) retrieves data from the database.
- ***Data Manipulation Language*** (DML) manipulates data stored in a database.
- ***Data Control Language*** (DCL) controls database user access.
- ***Data Transaction Language*** (DTL) manages database transactions.

PARTICIPATION ACTIVITY 4.2.5: SQL sublanguages.

1 2 3 4 5 2x speed



DTL commits data to a database, rolls back data from a database, and creates savepoints.

Captions

1. DDL creates, alters, and drops tables.
2. DQL selects data from a table.
3. DML inserts, updates, and deletes data in a table.
4. DCL grants and revokes permissions to and from users.
5. DTL commits data to a database, rolls back data from a database, and creates savepoints.

Feedback?

PARTICIPATION ACTIVITY 4.2.6: SQL sublanguages.

Match the SQL sublanguage to the statement behavior.

Insert a data row into table product. Correct

DML	INSERT is a DML statement that inserts data into a table.	
DTL	Rollback database changes. COMMIT is a DTL statement that saves a transaction to the database.	**Correct**
DQL	Select all rows from table Product. SELECT is a DQL statement that retrieves data from a table.	**Correct**
DCL	Grant all permissions to user 'tester'. GRANT is a DCL statement used to give permissions to users.	**Correct**
DDL	Create table Product. CREATE is a DDL statement that creates a table.	**Correct**

Reset

Feedback?

How was this section? **Provide feedback**