Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques



Learning package

SQL Databases Fundamentals

For

Second Year Students

Department of Computer Networks and Software Techniques

By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

Course Description

1. Course Name:
SQL Databases Fundamentals
2. Course Code:
3. Semester / Year: Semester
First Semester/ First Year
4. Description Preparation Date:
20/09/2026
5. Available Attendance Forms:
Attendance Only
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hours during the semester (theoretical + practical), 4 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: Zainab Mohammed Jiwar Email: zainab.m.jiwar@stu.edu.iq
8. Course Objectives

Cognitive objectives	Program Skill Objectives
1) The student will understand databases and their importance in storing and organizing data effectively 2) The student will be able to learn the SQL language and use it to create and manage databases, including creating, modifying, and querying data, and understanding	1) The student will be able to write SQL queries to retrieve data from databases effectively and accurately 2) The student will apply exercises in designing databases using appropriate data models and defining tables and relationships between them. 3) The student will acquire skills in managing and maintaining databases, including adding, modifying, and deleting data

different types of data, such as text, numeric, etc., and how to deal with them using SQL 3) The student will master how to design databases effectively, including defining tables and relationships between them, setting constraints, and writing SQL queries to retrieve data from databases.	

9. Teaching and Learning Strategies

Strategy	1) Teaching Strategy Collaborative Concept Planning. 2) Teaching Strategy Brainstorming. 3) Teaching Strategy Notes Series

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the basic concepts of what databases are, their importance in organizing and managing data, learn the basics of the SQL language and how to install it on the computer, understand the concepts of data normalization, and the practical importance of applying them in database design	Introduction and installation of SQL, Data normalization	Lecture and Lab	Daily Exams and Assignments

2	4	Understand what SQL Wizards are and their role in facilitating the processes of writing SQL queries and creating databases more effectively and easily, and learn about the types of assistance available in database development environments	Using wizards, and HELP types	Lecture and Lab	Daily Exams and Assignments
3-4	8	Understand the types of data definition in SQL, create data tables, save and edit data, use different data types, and use commands and tool keys in the SQL environment in a skillful manner	Data definition types, creating data tables, saving, and editing. Input various data types using commands and keys	Lecture and Lab	Daily Exams and Assignments
5-7	12	Understand how to use the ALTER TABLE command in SQL to modify the structure of tables, including adding, modifying, and deleting columns and changing data types, browsing and displaying table data in an organized and understandable manner, which enables understanding the structure of the data and existing information, and editing data in tables	More on Alter table, Browse, Edit data	Lecture and Lab	Daily Exams and Assignments
8-11	16	Understand the concept of Manipulation Language (DML) and its role in modifying and managing data in databases using commands such as REPLACE, DELETE,	Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data	Lecture and Lab	Daily Exams and Assignments

		PACK, RECALL, and ZAP.			
12-15	16	Understand what indexing is in SQL and its role in improving the performance of data queries by accelerating search and filtering operations, and understand the process of data arrangement in SQL and its role in organizing data appropriately to improve query performance and enhance user experience.	Indexing & Sorting data	Lecture and Lab	Daily Exams and Assignments

11. Course Evaluation

50 marks for mid-term exams (20 practical + 20 theoretical + 10 activity). 50 marks for final exams (10 practical + 40 theoretical)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures of the course material prepared by the lecturer
Main references (sources)	SQL: the complete reference. McGraw-Hill/Osborne, 2002
Recommended books and references (scientific journals, reports...)	– Practical SQL: A Beginner's Guide to Storytelling with Data – SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights 1st Edition
Electronic References, Websites	– https://www.w3schools.com/sql/default.asp – https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16

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Learning package

In

Introduction and Installation of SQL, Data Normalization

For

Students of the Second Year



By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

1/ Overview

1 / A –Target population:-

For students of the Second year
Technological Institute of Basra
Dep. Of Computer Networks and Software Techniques

1 / B –Rationale:-

The installation and setup of SQL database management systems (such as SQL Server) is a critical first step that introduces students to real-world tools and environments. Understanding the environment in which SQL operates helps students grasp how data is processed and accessed in real applications, preparing them for more advanced database topics and practical project development. Normalization enhances students' problem-solving skills in designing databases that are both scalable and efficient, laying the groundwork for advanced topics.

1 / C –Central Idea:-

1- Database, its key components, and types.
2- DBMS and RDBMS,
3- Normalization, its techniques.

1 / D – Performance Objectives

After studying the first unit, the student will be able to:-

1- Chooses the appropriate database model based on application needs.

2- Understanding of how data is efficiently stored, accessed, and managed in digital systems.
3- Designing scalable, consistent, and high-performance databases.

2/ Pretest :-



If you were designing a system to store student information (name, ID, grades, contact info), what would you need, kind of information (data) would need to be stored? How will you organize this information, and how will you make sure it's accurate and not repeated?

3/ Introduction and installation of SQL, Data normalization :-

1. What is a Database?

A database is like a digital warehouse where data is stored, organized, and managed efficiently. It acts as a central hub for information, making it easier to access and analyze data.

A. Key Components of a Database:

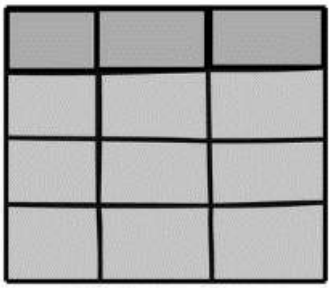
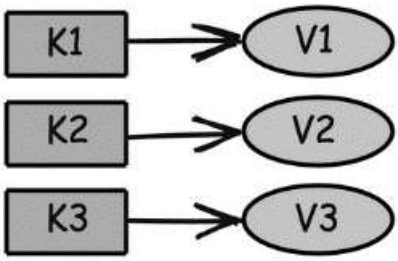
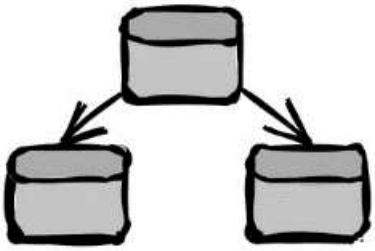
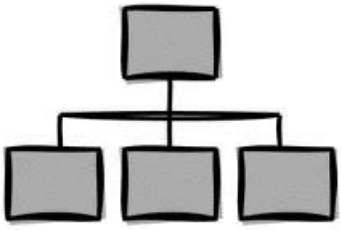
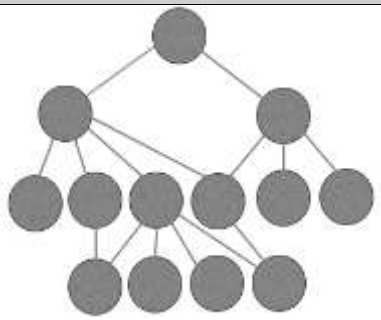
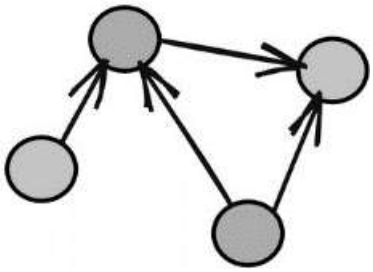
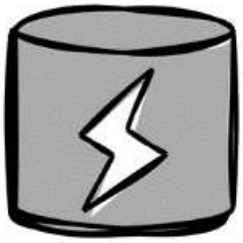
- **Data:** Data is the facts or raw material (raw information) stored in a database, such as customer details, product information, or financial records. It can be in different formats like text, numbers, dates, or images.

To understand these data, they must be translated or interpreted to become information. Information is the meaning that is given to the data through appropriate interpretation.

- **Tables:** Tables are like virtual spreadsheets within a database. They have rows and columns, where each row represents a specific record or instance, and each column represents a particular piece of data. For example, a customer table may have columns like ID, Name, Address, and Contact.
- **Relationships:** Relationships define how tables are connected within a database. They establish associations based on shared data elements. For instance, a customer's ID in one table can be linked to their orders in another. This helps maintain data consistency and enables efficient data retrieval.
- **Queries:** Queries are like search commands that allow users to extract specific data from the database. Users can search, filter, and sort data based on the specified criteria. For example, a query can be used to find all customers who purchased in the last month.

B. Types of Databases:

Here are some common types of databases:

Relational Databases (RDBMS)	NoSQL Databases
	
Object-Oriented Databases	**Hierarchical Databases**
	
Network Databases	**Graph Databases**
	
In-Memory Databases	**Time-Series Databases**
	

2. DBMS and RDBMS:

DBMS (Database Management System) and RDBMS (Relational Database Management System) are software systems used to manage databases; they have different qualities.

A. Why is a DBMS required?

A DBMS is required to manage an organization's data flow efficiently. It handles tasks such as inserting data into the database and retrieving data from it. The DBMS ensures the consistency and integrity of the data, as well as the speed at which data can be accessed.
Examples: XML Window Registry, Forxpro, dbaseIIIplus etc.

B. Why is an RDMS required?

Similarly, an RDBMS is required when we want to manage data relationally, using tables and relationships. It helps reduce data duplication and maintain the integrity of the database. RDBMS ensures that data is stored in a structured manner, allowing for efficient querying and retrieval.
Examples: PostgreSQL, MySQL, Oracle, Microsoft Access, SQL Server, etc.

3. Data normalization

A. What is the Key?

In RDBMS systems, keys are fields that take part in the following operations on tables:

- To establish connections between two tables.
- To keep a table's individuality.
- To maintain accurate and consistent data in the database.
- Possibly speed up data retrieval by enabling indexes on column (s).

The following list includes the many key types that SQL Server supports:

1. Candidate Key
2. Primary Key
3. Unique Key
4. Alternate Key
5. Composite Key
6. Super Key
7. Foreign Key

B. What is a Primary Key?

A primary key is a single column value used to identify a database record uniquely. It has the following attributes:



- A primary key cannot be NULL
- A primary key value must be unique
- The primary key values should rarely be changed
- The primary key must be given a value when a new record is inserted.

C. What is a Composite Key?

– A composite key is a primary key composed of multiple columns used to identify a record uniquely

D. What is a Foreign Key in SQL?

Foreign Key references the primary key of another Table! It helps connect database Tables. It has the following attributes:



- A foreign key can have a different name from its primary key
- It ensures rows in one table have corresponding rows in another
- Unlike the Primary key, they do not have to be unique. Most often, they aren't
- Foreign keys can be null even though primary keys can not

E. What are transitive functional dependencies?

A transitive functional dependency is when changing a non-key column might cause any of the other non-key columns to change.

Consider Table 1. Changing the non-key column Full Name may change the Salutation.

MEMBERSHIP ID	FULL NAMES	PHYSICAL ADDRESS	SALUTATION
1	Janet Jones	First Street Plot No 4	Ms.
2	Robert Phil	3rd Street 34	Mr.
3	Robert Phil	5th Avenue	Mr.

Change in Name

May Change Salutation

F. What is SQL Normalization?

- Normalization is a database design technique that reduces data redundancy and eliminates undesirable characteristics like Insertion, Update, and Deletion Anomalies.
- Normalization rules divide larger tables into smaller tables and link them using relationships.
- The purpose of Normalization in SQL is to eliminate redundant (repetitive) data and ensure that data is stored logically.
- Normalization in SQL databases offers several advantages, such as data integrity, reduction of data redundancy, efficient data storage, improved query performance (in many cases), easier data maintenance, scalability, enhanced data modeling, consistency, reduction of anomalies, and simplified schema changes.
- Different levels of normalization exist, such as 1NF (First Normal Form), 2NF (Second Normal Form), 3NF (Third Normal Form), and BCNF (Boyce-Codd Normal Form)

Note: In most practical applications, normalization achieves its best in the 3rd Normal Form.

F.1. First Normal Form (1NF):

In 1NF, each column in a table contains only atomic values, meaning it cannot be further divided. There should be no repeating groups or arrays of values within a single column. Each row in the table should be uniquely identifiable.

Example:

Original Table:

CustomerID	Name	Phone no.
1	Huda	8978847383
2	Ahmed	7899748899, 8899278299
3	Mohammed	9877382892

1NF Table:

CustomerID	Name	Phone no.
1	Huda	8978847383
2	Ahmed	7899748899
3	Mohammed	9877382892
2	Ahmed	8899278299

F.2. Second Normal Form (2NF):

In 2NF, the table is already in 1NF, and each non-key column is dependent on the entire primary key. If there are partial dependencies, those columns should be moved to a separate table.

Example:

Original Table:

OrderID	ProductID	ProductName	Category	Price
1	1	Laptop	Electronics	1000
2	2	Smartphone	Electronics	800
3	3	Laptop	Electronics	900

2NF Table:

Table 1: Products

ProductID	ProductName	Category
1	Laptop	Electronics
2	Smartphone	Electronics

Table 2: Orders

OrderID	ProductID	Price
1	1	1000
2	2	800
3	1	900

F.3. Third Normal Form (3NF):

In 3NF, the table is already in 2NF, and there are no transitive dependencies. Non-key columns should not depend on other non-key columns. If there are such dependencies, those columns should be moved to a separate table.

Example:

Original Table:

CustomerID	OrderID	ProductID	ProductName	Price	CustomerName	CustomerEmail
1	1	1	Laptop	1000	Huda	Huda@example.com
2	2	2	Smartphone	800	Ahmed	Ahmed@example.com
3	3	1		900	Ali	Ali@example.com

3NF Table:

Table 1: Customers

CustomerID	CustomerName	CustomerEmail
1	Huda	Huda@example.com
2	Ahmed	Ahmed@example.com
3	Ali	Ali@example.com

Table 2: Products

ProductID	ProductName
1	Laptop
2	Smartphone

Table 3: Orders

OrderID	CustomerID	ProductID	Price
1	1	1	1000
2	2	2	800
3	3	1	900

F.4. Boyce-Codd Normal Form (BCNF):

BCNF is an advanced form of normalization that addresses certain anomalies that can occur in 3NF. It ensures that there are no non-trivial functional dependencies of non-key attributes on a candidate key. Achieving BCNF involves decomposing tables further if necessary.

4/ Posttest :-

1. What is the main purpose of a database?
   a) To display web pages b) To store and organize data
   c) To draw charts d) To write code
2. Which of the following is NOT a component of a relational database?
   a) Table b) Record c) Formula d) Field

3. A **record** in a database refers to:
   a) A single column b) A database software
   c) A complete row of data d) A type of database
4. Which is an example of a **primary key**?
   a) Student name b) Student grade c) Student email d) Student ID
5. Which database system is widely used?
   a) Microsoft Word b) SQL c) Google Docs d) Adobe Photoshop

key answer:-

1. b) 2. c) 3. c) 4.d) 5. b)

5/ HomeWorks: -

Task// Prepare a report on the importance of normalization in databases, mentioning the differences between its types.

Note: The answer must be uploaded in PDF format to the course's classroom. The assignment will be active from today until the next lecture.

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Name: Zainab Mohammed Jiwar Email: zainab.m.jiwar@stu.edu.iq
8. Course Objectives

Cognitive objectives	Program Skill Objectives
1) The student will understand databases and their importance in storing and organizing data effectively 2) The student will be able to learn the SQL language and use it to create and manage databases, including creating, modifying, and querying data, and understanding	1) The student will be able to write SQL queries to retrieve data from databases effectively and accurately 2) The student will apply exercises in designing databases using appropriate data models and defining tables and relationships between them. 3) The student will acquire skills in managing and maintaining databases, including adding, modifying, and deleting data

different types of data, such as text, numeric, etc., and how to deal with them using SQL 3) The student will master how to design databases effectively, including defining tables and relationships between them, setting constraints, and writing SQL queries to retrieve data from databases.	

9. Teaching and Learning Strategies

Strategy	1) Teaching Strategy Collaborative Concept Planning. 2) Teaching Strategy Brainstorming. 3) Teaching Strategy Notes Series

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the basic concepts of what databases are, their importance in organizing and managing data, learn the basics of the SQL language and how to install it on the computer, understand the concepts of data normalization, and the practical importance of applying them in database design	Introduction and installation of SQL, Data normalization	Lecture and Lab	Daily Exams and Assignments

2	4	Understand what SQL Wizards are and their role in facilitating the processes of writing SQL queries and creating databases more effectively and easily, and learn about the types of assistance available in database development environments	Using wizards, and HELP types	Lecture and Lab	Daily Exams and Assignments
3-4	8	Understand the types of data definition in SQL, create data tables, save and edit data, use different data types, and use commands and tool keys in the SQL environment in a skillful manner	Data definition types, creating data tables, saving, and editing. Input various data types using commands and keys	Lecture and Lab	Daily Exams and Assignments
5-7	12	Understand how to use the ALTER TABLE command in SQL to modify the structure of tables, including adding, modifying, and deleting columns and changing data types, browsing and displaying table data in an organized and understandable manner, which enables understanding the structure of the data and existing information, and editing data in tables	More on Alter table, Browse, Edit data	Lecture and Lab	Daily Exams and Assignments
8-11	16	Understand the concept of Manipulation Language (DML) and its role in modifying and managing data in databases using commands such as REPLACE, DELETE,	Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data	Lecture and Lab	Daily Exams and Assignments

		PACK, RECALL, and ZAP.			
12-15	16	Understand what indexing is in SQL and its role in improving the performance of data queries by accelerating search and filtering operations, and understand the process of data arrangement in SQL and its role in organizing data appropriately to improve query performance and enhance user experience.	Indexing & Sorting data	Lecture and Lab	Daily Exams and Assignments

11. Course Evaluation

50 marks for mid-term exams (20 practical + 20 theoretical + 10 activity). 50 marks for final exams (10 practical + 40 theoretical)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures of the course material prepared by the lecturer
Main references (sources)	SQL: the complete reference. McGraw-Hill/Osborne, 2002
Recommended books and references (scientific journals, reports...)	– Practical SQL: A Beginner's Guide to Storytelling with Data – SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights 1st Edition
Electronic References, Websites	– https://www.w3schools.com/sql/default.asp – https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16

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Learning package

In

Using The Wizard, HELP Types

For

Students of the Second Year



By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
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2026

1/ Overview

1 / A –Target population:-

For students of the Second year
Technological Institute of Basra
Dep. Of Computer Networks and Software Techniques

1 / B –Rationale:-

Gaining proficiency with Wizards and HELP tools advances one's technical proficiency and digital independence. In a constantly evolving technology environment, these abilities are essential for success in academic assignments, workplace efficiency, and lifetime learning.

1 / C –Central Idea:-

1- SQL.
2- SQL Server.
3- Some simple SQL queries using the wizard and Help types.

1 / D – Performance Objectives

After studying the second unit, the student will be able to:-

1- Know SQL and SQL Server.
2- Implement some simple SQL queries using the wizard.

2/ Pretest :-



If you were designing a system to store information for a specific domain in a database as quickly as possible, what do you think would be the most effective methods for doing so?

3/ Using the wizard, HELP types:-

1. Introduction to SQL

A. SQL:

SQL (**S**tructured **Q**uery **L**anguage) is a computer programming language designed specifically for maintaining and modifying databases in **R**elational **D**atabase **M**anagement **S**ystems (**RDBMS**). It offers statements and commands for creating database structures. Users can interact with databases to access, modify, and manage structured data by creating queries. Regardless of the underlying database management system, SQL offers a consistent and effective way to work with databases.

B. What Can SQL do?

SQL can execute queries against a database

SQL can retrieve data from a database

SQL can insert records in a database

SQL can update records in a database

SQL can delete records from a database

SQL can create new databases

SQL can create new tables in a database

SQL can create stored procedures in a database

SQL can create views in a database

SQL can set permissions on tables, procedures, and views

C. SQL constraints

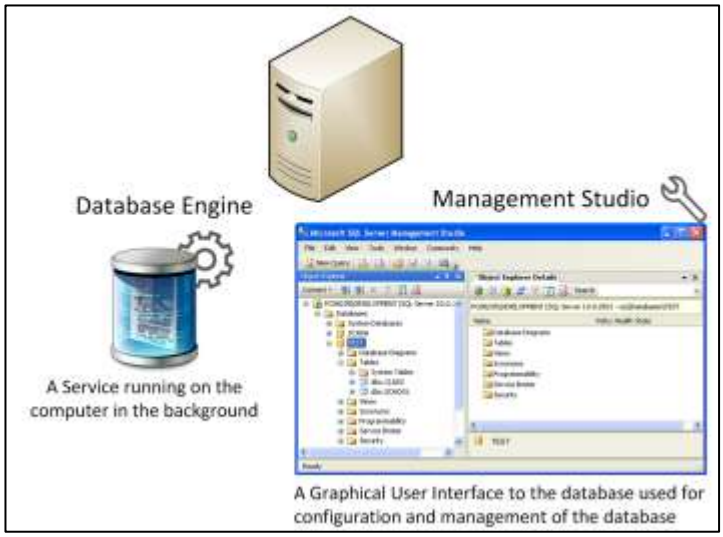
- Rules for the data in a table can be specified using SQL constraints.
- The kinds of data that can be entered into a table are restricted by constraints. This guarantees the reliability and accuracy of the data in the table. The action is stopped if there is a violation between the constraint and the data action.
- Column-level or table-level constraints are both possible. Table-level restrictions apply to the entire table, while column-level constraints just affect the specified column.

In SQL, the following restrictions are frequently applied:

- **NOT NULL:** A column cannot have a NULL value by using the NOT NULL flag.
- **UNIQUE:** A unique value makes sure that each value in a column is distinct.
- **PRIMARY KEY:** A NOT NULL and UNIQUE combination. Uniquely identifies each table row.
- **FOREIGN KEY:** Prevents acts that would break linkages between tables.
- **CHECK-** Verifies if the values in a column meet a certain requirement.
- **DEFAULT:** If no value is specified, DEFAULT sets a default value for the column.
- **CREATE INDEX -** Used to easily create and access data from the database.

2. Introduction to SQL Server

- Microsoft is the vendor of SQL Server. We have different editions of SQL Server, where SQL Server Express is free to download and use.
- SQL Server consists of a Database Engine and a Management Studio (and lots of other stuff that we will not mention here). The Database engine has no graphical interface - it is just a service running in the background of your computer (preferably on the server). The Management Studio is a graphical tool for configuring and viewing the information in the database. It can be installed on the server or on the client (or both).

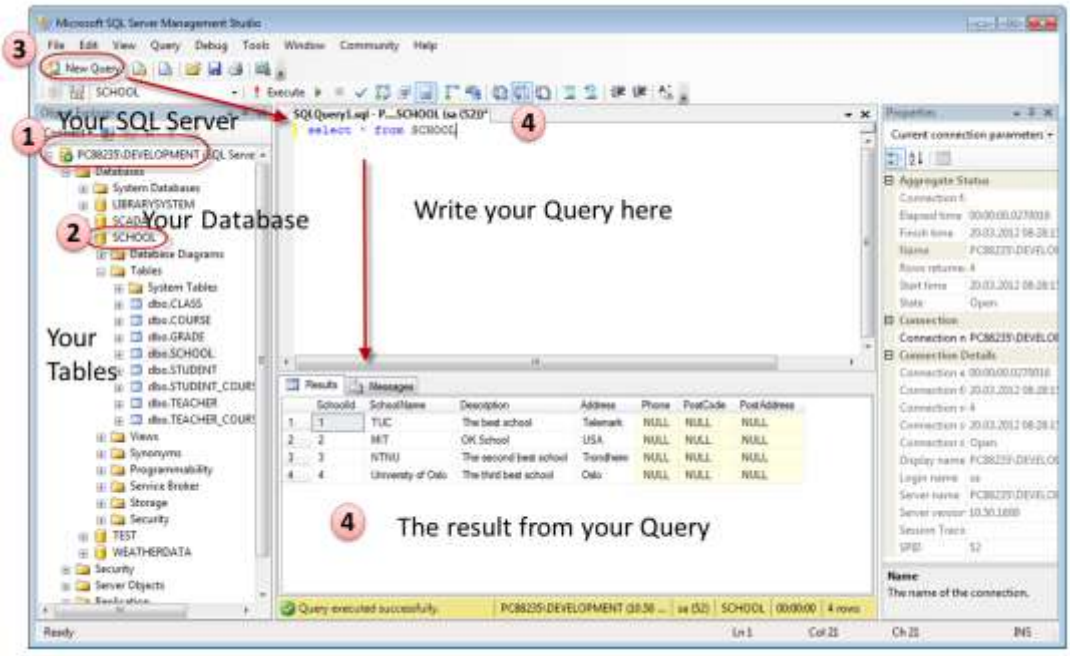


SQL Server

A.SQL Server Management Studio

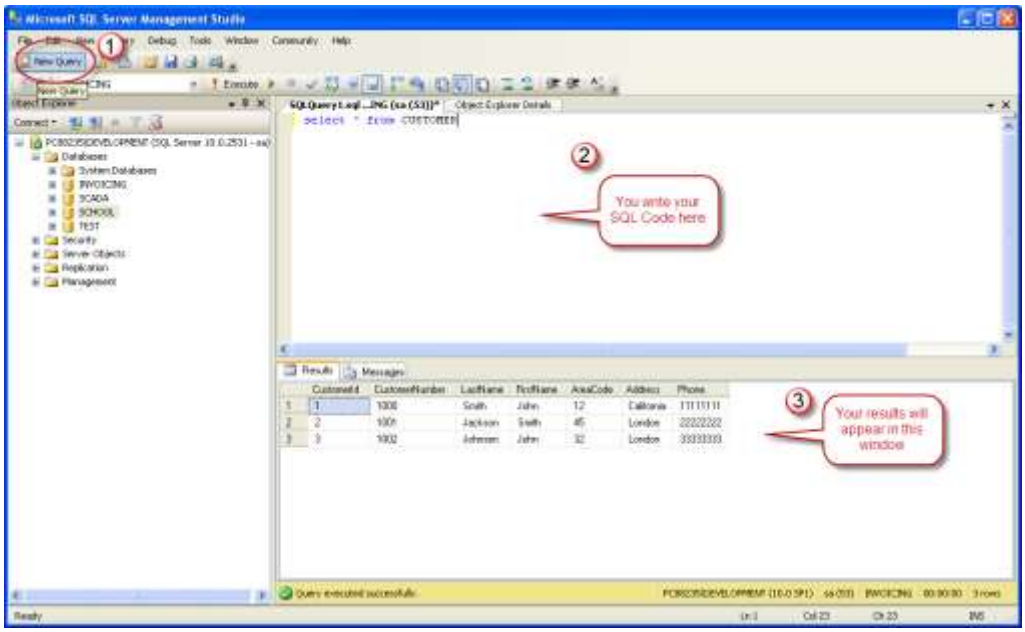
- SQL Server Management Studio is a GUI tool included with SQL Server for configuring, managing, and administering all components within Microsoft SQL Server.
- The tool includes both script editors and graphical tools that work with objects and features of the server.
- A central feature of SQL Server Management Studio is the Object Explorer, which allows the user to browse, select, and act upon any of the objects within the server. It can be used to visually observe and analyze query plans

and optimize the database performance, among others. SQL Server Management Studio can also be used to create a new database, alter any existing database schema by adding or modifying tables and indexes, or analyze performance. It includes the query windows which provide a GUI based interface to write and execute queries.



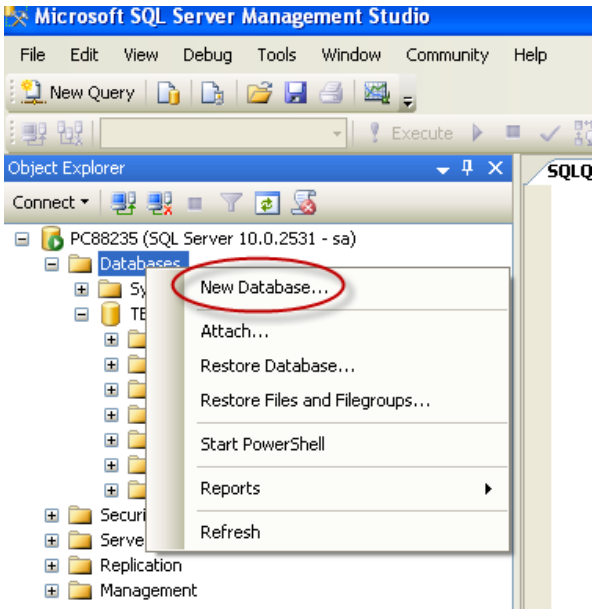
SQL Server Management Studio

- When creating SQL commands and queries, the "Query Editor" (select "New Query" from the Toolbar) is used (shown in the figure above).
- With SQL and the "Query Editor" we can do almost everything with code, but sometimes it is also a good idea to use the different Designer tools in SQL to help us do the work without coding (so much).

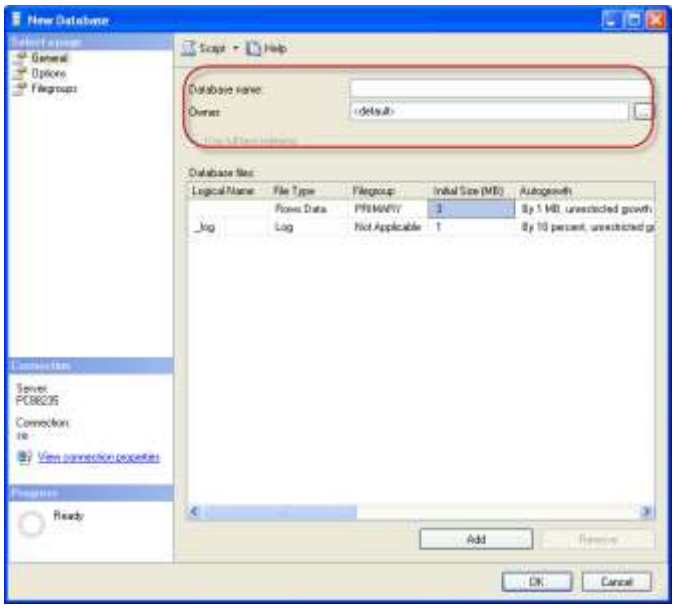


B. Create a new database using the wizard

It is quite simple to create a new database in Microsoft SQL Server. Just right-click on the "Databases" node and select "New Database…"



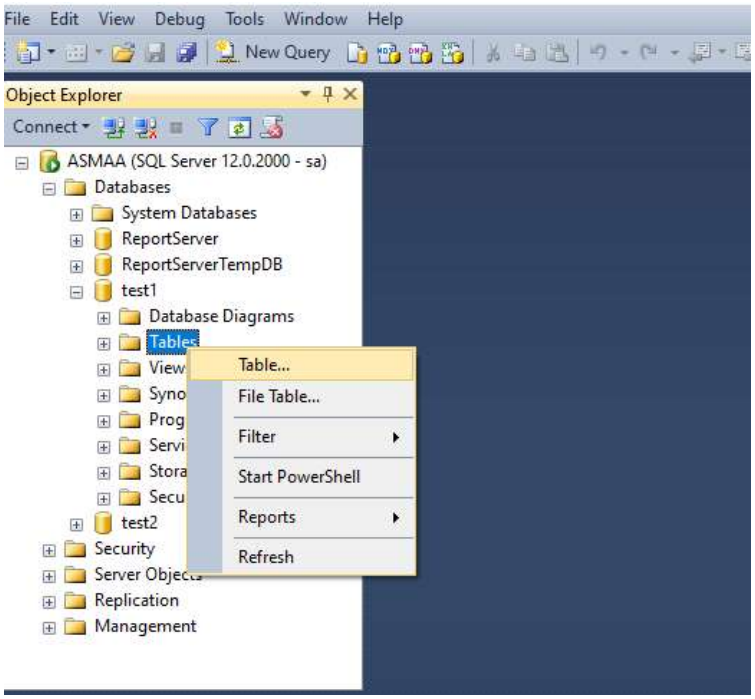
There are lots of settings you may set regarding your database, but the only information you must fill in is the name of your database:



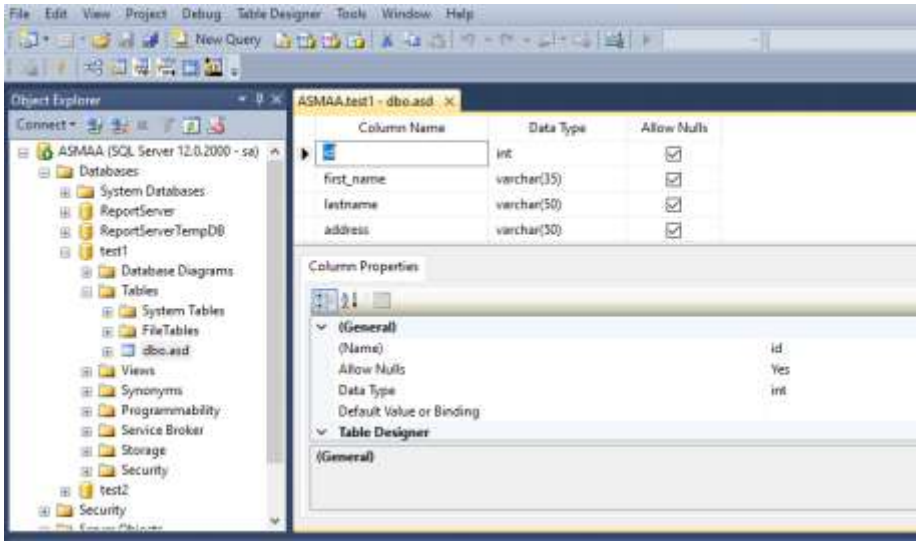
You may also use the SQL language to create a new database, but sometimes it is easier to just use the built-in features in the Management Studio.

C.Create a table using the wizard

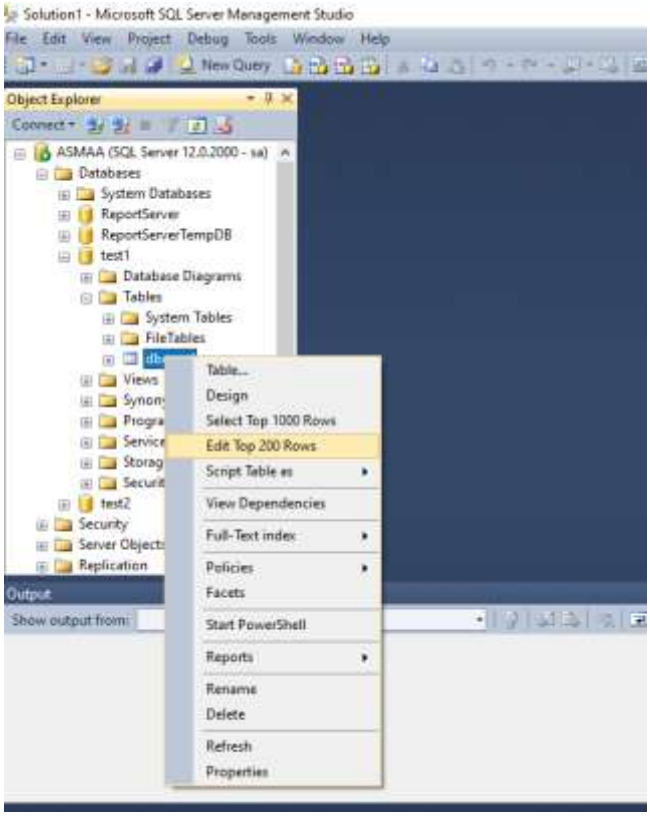
Open the database that you created, right-click on the selection Tables, a menu appears, choose a "Table…." from it.



After that, the table design interface appears, which contains the column name and the graph type, add columns, and select the graphic type for each column.



To add data to the table, right-click on the table name, after saving it, a menu appears, choose from it “Edit Top 200 Rows”.



4/ Posttest:-

True or False

1. Wizards help beginners execute SQL operations without writing code manually.
2. You can only use wizards to run SELECT queries.
3. Using a wizard, you can filter data by specifying criteria.
4. Wizards are only available in Microsoft Access.
5. A query wizard can generate SQL code behind the scenes.

key answer :-

1. True 2. False 3. True 4. False 5. True

5/ HomeWorks: -

Task// What is one advantage of using a wizard instead of manually writing SQL code?

Note: The answer must be uploaded in PDF format to the course's classroom. The assignment will be active from today until the next lecture.

Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques



Learning package

SQL Databases Fundamentals

For

Second Year Students

Department of Computer Networks and Software Techniques

By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

Course Description

1. Course Name:
SQL Databases Fundamentals
2. Course Code:
3. Semester / Year: Semester
First Semester/ First Year
4. Description Preparation Date:
20/09/2026
5. Available Attendance Forms:
Attendance Only
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hours during the semester (theoretical + practical), 4 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: Zainab Mohammed Jiwar Email: zainab.m.jiwar@stu.edu.iq
8. Course Objectives

Cognitive objectives	Program Skill Objectives
1) The student will understand databases and their importance in storing and organizing data effectively 2) The student will be able to learn the SQL language and use it to create and manage databases, including creating, modifying, and querying data, and understanding	1) The student will be able to write SQL queries to retrieve data from databases effectively and accurately 2) The student will apply exercises in designing databases using appropriate data models and defining tables and relationships between them. 3) The student will acquire skills in managing and maintaining databases, including adding, modifying, and deleting data

different types of data, such as text, numeric, etc., and how to deal with them using SQL 3) The student will master how to design databases effectively, including defining tables and relationships between them, setting constraints, and writing SQL queries to retrieve data from databases.	

9. Teaching and Learning Strategies

Strategy	1) Teaching Strategy Collaborative Concept Planning. 2) Teaching Strategy Brainstorming. 3) Teaching Strategy Notes Series

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the basic concepts of what databases are, their importance in organizing and managing data, learn the basics of the SQL language and how to install it on the computer, understand the concepts of data normalization, and the practical importance of applying them in database design	Introduction and installation of SQL, Data normalization	Lecture and Lab	Daily Exams and Assignments

2	4	Understand what SQL Wizards are and their role in facilitating the processes of writing SQL queries and creating databases more effectively and easily, and learn about the types of assistance available in database development environments	Using wizards, and HELP types	Lecture and Lab	Daily Exams and Assignments
3-4	8	Understand the types of data definition in SQL, create data tables, save and edit data, use different data types, and use commands and tool keys in the SQL environment in a skillful manner	Data definition types, creating data tables, saving, and editing. Input various data types using commands and keys	Lecture and Lab	Daily Exams and Assignments
5-7	12	Understand how to use the ALTER TABLE command in SQL to modify the structure of tables, including adding, modifying, and deleting columns and changing data types, browsing and displaying table data in an organized and understandable manner, which enables understanding the structure of the data and existing information, and editing data in tables	More on Alter table, Browse, Edit data	Lecture and Lab	Daily Exams and Assignments
8-11	16	Understand the concept of Manipulation Language (DML) and its role in modifying and managing data in databases using commands such as REPLACE, DELETE,	Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data	Lecture and Lab	Daily Exams and Assignments

		PACK, RECALL, and ZAP.			
12-15	16	Understand what indexing is in SQL and its role in improving the performance of data queries by accelerating search and filtering operations, and understand the process of data arrangement in SQL and its role in organizing data appropriately to improve query performance and enhance user experience.	Indexing & Sorting data	Lecture and Lab	Daily Exams and Assignments

11. Course Evaluation

50 marks for mid-term exams (20 practical + 20 theoretical + 10 activity). 50 marks for final exams (10 practical + 40 theoretical)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures of the course material prepared by the lecturer
Main references (sources)	SQL: the complete reference. McGraw-Hill/Osborne, 2002
Recommended books and references (scientific journals, reports...)	– Practical SQL: A Beginner's Guide to Storytelling with Data – SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights 1st Edition
Electronic References, Websites	– https://www.w3schools.com/sql/default.asp – https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16

Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques

Learning package

In

Data definition types

For

Students of the Second Year



By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

1/ Overview

1 / A –Target population:-

For students of the Second year
Technological Institute of Basra
Dep. Of Computer Networks and Software Techniques

1 / B –Rationale:-

Students obtain useful abilities that they can use immediately in positions involving data administration, system analysis, and software development. They also develop the critical thinking and problem-solving skills required for more complex subjects like database security, application integration, and query optimization.

1 / C –Central Idea:-

1- Data definition types
2- Create data tables
3- Input various data types using commands and keys

1 / D – Performance Objectives

After studying the third unit, the student will be able to:-

1- Identify and apply appropriate data definition types.
2- Create and structure relational data tables.
3- Input various data types using SQL commands.

2/ Pretest:-



Have you ever used a system (like MS Access or Excel) to enter or edit data? What did you notice about how data is entered, saved, or changed?

3/ Data definition types, Create data tables, Saving and editing, Input various data types using commands and keys:-

1. SQL command types

1. **Data Definition Language (DDL):** The commands that fall under this group provide the ability to define data, its form, and the way it is linked to other data by using commands to create tables and a database. Common DDL commands include **CREATE**, **ALTER**, and **DROP**.
2. **Data Manipulation Language (DML):** This group contains sentences whose purpose is to give the ability to deal with data without affecting its structure and general form so that you can query data, add records, and delete or modify them. Common DML commands include **SELECT**, **INSERT**, **UPDATE**, and **DELETE**.
3. **Data Control Language (DCL):** This set of commands helps in defining the permissions that can be granted or taken away from users in the database. Common DCL commands include **GRANT** and **REVOKE**, which are used to assign or remove permissions to users or roles.

2. The SQL CREATE DATABASE Statement

The CREATE DATABASE statement is used to create a new SQL database.

Syntax

```
CREATE DATABASE databasename;
```

SQL CREATE DATABASE Example

The following SQL statement creates a database called "testDB":

Example

```
CREATE DATABASE testDB;
```

3. The SQL DROP DATABASE Statement

The DROP DATABASE statement is used to drop an existing SQL database.

Syntax

```
DROP DATABASE databasename;
```

SQL DROP DATABASE Example

The following SQL statement drops the existing database "testDB":

Example

```
DROP DATABASE testDB;
```

4. The SQL CREATE TABLE Statement

The CREATE TABLE statement is used to create a new table in a database.

Syntax

```
CREATE TABLE table_name (
    column1datatype,
    column2 datatype,
    column3 datatype,
    ....
    );
```

The column parameters specify the names of the columns of the table.

The datatype parameter specifies the type of data the column can hold.
The data type can be one of the following categories:

- **Numeric** such as INT, TINYINT, BIGINT, FLOAT, REAL, etc.
- **Date and Time** such as DATE, TIME, DATETIME, etc.
- **Character and String** data types such as CHAR, VARCHAR, TEXT, etc.
- **Unicode character string** such as NCHAR, NVARCHAR, NTEXT, etc.
- **Binary** such as BINARY, VARBINARY, etc.
- **Other types** such as CLOB, BLOB, XML, CURSOR, TABLE, etc.

SQL CREATE TABLE Examples

Example-1

The following example creates a table called "Persons" that contains five columns: PersonID, LastName, FirstName, Address, and City:

```
CREATE TABLE Persons (
    PersonID int,
    LastName varchar(255),
    FirstName varchar(255),
    Address varchar(255),
    City varchar(255)
);
```

The PersonID column is of type int and will hold an integer. The LastName, FirstName, Address, and City columns are of type varchar and will hold characters, and the maximum length for these fields is 255 characters.
The empty "Persons" table will now look like this:

PersonID	LastName	FirstName	Address	City

Example-2

The following example creates a table called " Employee" that contains five columns: EmpId, LastName, FirstName, Address, and City:

```
CREATE TABLE Employee (
    EmpId int,
    LastName varchar(25),
```

```
    FirstName varchar(25),
    Address varchar(100),
    City varchar(20)
);
```

The EmpId column is of type int and will hold an integer. The LastName, FirstName, Address, and City columns are of type varchar and will hold characters, and the maximum length for these fields is 255 characters.
The empty " Employee" table will now look like this:

EmpId	LastName	FirstName	Address	City

5. The SQL INSERT INTO Statement

The INSERT INTO statement is used to insert new records in a table.
It is possible to write the INSERT INTO statement in two ways.

Syntax

The first way specifies both the column names and the values to be inserted.

If you are adding values for all the columns of the table, then no need to specify the column names in the SQL query. However, make sure that the order of the values is in the same order as the columns in the table.

First way:

```
INSERT INTO table_name (column1, column2, column3, ...)
VALUES (value1, value2, value3, ...);
```

Second way:

```
INSERT INTO table_name
VALUES (value1, value2, value3, ...);
```

SQL INSERT INTO Example

Insert value in the first way. The column names are used here

```
INSERT INTO Employee    (EmpId,LastName,FirstName,ADDRES
S,City)
```

```
VALUES (1, 'Ali', 'Wael', 'Iraq', 'Basra' );
 INSERT INTO Employee (EmpId,LastName,FirstName,ADDRESS
,City)
VALUES (2, 'Mohammed', 'Saad', 'Iraq', 'Baghdad' );
```

Insert value in the second way.

```
INSERT INTO Employee
VALUES (3, 'Huda', 'Salim', 'Iraq', 'Basra' );
```

6. The SQL SELECT Statement

The SELECT statement is used to select data from a database.
The data returned is stored in a result table, called the result-set.

Syntax

```
SELECT column1, column2, ...
FROM table_name;
```

Here, column1, column2, ... are the field names of the table you want to select from the data. If you want to select all the fields available in the table, use the following syntax:

```
SELECT * FROM table_name;
```

If the above query is executed, then all record is displayed.

Example

```
SELECT EmpId, LastName FROM Employee;


SELECT * FROM Employee;
```

7. The SQL DROP TABLE Statement

The DROP TABLE statement is used to drop an existing table in a database.

Syntax

```
DROP TABLE table_name;
```

SQL DROP TABLE Example

The following SQL statement drops the existing table "Persons":

Example

```
DROP TABLE Persons;
```

8. SQL TRUNCATE TABLE

The TRUNCATE TABLE statement is used to delete the data inside a table, but not the table itself.

Syntax

```
TRUNCATE TABLE table_name;
```

9. The SQL ALTER TABLE Statement

The ALTER TABLE statement is used to add, delete, or modify columns in an existing table.
The ALTER TABLE statement is also used to add and drop various constraints on an existing table.

9. 1. ALTER TABLE - ADD Column

To add a column in a table, use the following syntax:
Syntax

```
ALTER TABLE table_name
ADD column_name datatype;
```

ALTER TABLE - ADD Column Example

The following SQL statement adds an "Email" column to the "Employee" table:

Example

```
ALTER TABLE Employee
ADD Email varchar(255);
```

9.2 ALTER TABLE - DROP COLUMN

To delete a column in a table, use the following syntax (notice that some database systems don't allow deleting a column):

Syntax

```
ALTER TABLE table_name
DROP COLUMN column_name;
```

ALTER TABLE - DROP COLUMN Example

The following SQL query deletes the "Email" column from the "Employee" table:

Example

```
ALTER TABLE Employee
DROP COLUMN Email;
```

4/ Posttest :-

True or false

1. INT is a data type used to store decimal numbers.
2. VARCHAR(50) allows up to 50 characters in a text field.
3. After editing a table, you must save the changes to apply them.
4. You can store letters in a field defined as BOOLEAN.
5. Drop Table is used to drop an existing table in a database.

key answer :-

1. False 2. True 3. True 4. False 5. True

5/ HomeWorks: -

Task// Write a simple SQL statement to create a table named Employees with the following columns:

- **ID (Integer)**
- **Name (Text)**
- **HireDate (Date)**

Note: The answer must be uploaded in PDF format to the course's classroom. The assignment will be active from today until the next lecture.

Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques



Learning package

SQL Databases Fundamentals

For

Second Year Students

Department of Computer Networks and Software Techniques

By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

Course Description

1. Course Name:
SQL Databases Fundamentals
2. Course Code:
3. Semester / Year: Semester
First Semester/ First Year
4. Description Preparation Date:
20/09/2026
5. Available Attendance Forms:
Attendance Only
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hours during the semester (theoretical + practical), 4 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: Zainab Mohammed Jiwar Email: zainab.m.jiwar@stu.edu.iq
8. Course Objectives

Cognitive objectives	Program Skill Objectives
1) The student will understand databases and their importance in storing and organizing data effectively 2) The student will be able to learn the SQL language and use it to create and manage databases, including creating, modifying, and querying data, and understanding	1) The student will be able to write SQL queries to retrieve data from databases effectively and accurately 2) The student will apply exercises in designing databases using appropriate data models and defining tables and relationships between them. 3) The student will acquire skills in managing and maintaining databases, including adding, modifying, and deleting data

different types of data, such as text, numeric, etc., and how to deal with them using SQL 3) The student will master how to design databases effectively, including defining tables and relationships between them, setting constraints, and writing SQL queries to retrieve data from databases.	

9. Teaching and Learning Strategies

Strategy	1) Teaching Strategy Collaborative Concept Planning. 2) Teaching Strategy Brainstorming. 3) Teaching Strategy Notes Series

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the basic concepts of what databases are, their importance in organizing and managing data, learn the basics of the SQL language and how to install it on the computer, understand the concepts of data normalization, and the practical importance of applying them in database design	Introduction and installation of SQL, Data normalization	Lecture and Lab	Daily Exams and Assignments

2	4	Understand what SQL Wizards are and their role in facilitating the processes of writing SQL queries and creating databases more effectively and easily, and learn about the types of assistance available in database development environments	Using wizards, and HELP types	Lecture and Lab	Daily Exams and Assignments
3-4	8	Understand the types of data definition in SQL, create data tables, save and edit data, use different data types, and use commands and tool keys in the SQL environment in a skillful manner	Data definition types, creating data tables, saving, and editing. Input various data types using commands and keys	Lecture and Lab	Daily Exams and Assignments
5-7	12	Understand how to use the ALTER TABLE command in SQL to modify the structure of tables, including adding, modifying, and deleting columns and changing data types, browsing and displaying table data in an organized and understandable manner, which enables understanding the structure of the data and existing information, and editing data in tables	More on Alter table, Browse, Edit data	Lecture and Lab	Daily Exams and Assignments
8-11	16	Understand the concept of Manipulation Language (DML) and its role in modifying and managing data in databases using commands such as REPLACE, DELETE,	Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data	Lecture and Lab	Daily Exams and Assignments

		PACK, RECALL, and ZAP.			
12-15	16	Understand what indexing is in SQL and its role in improving the performance of data queries by accelerating search and filtering operations, and understand the process of data arrangement in SQL and its role in organizing data appropriately to improve query performance and enhance user experience.	Indexing & Sorting data	Lecture and Lab	Daily Exams and Assignments

11. Course Evaluation

50 marks for mid-term exams (20 practical + 20 theoretical + 10 activity). 50 marks for final exams (10 practical + 40 theoretical)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures of the course material prepared by the lecturer
Main references (sources)	SQL: the complete reference. McGraw-Hill/Osborne, 2002
Recommended books and references (scientific journals, reports...)	– Practical SQL: A Beginner's Guide to Storytelling with Data – SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights 1st Edition
Electronic References, Websites	– https://www.w3schools.com/sql/default.asp – https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16

Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques

Learning package

In

More on Alter Table, Browse, Edit Data

For

Students of the Second Year



By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

1/ Overview

1 / A –Target population:-

For students of the Second year
Technological Institute of Basra
Dep. Of Computer Networks and Software Techniques

1 / B –Rationale:-

In practical database settings, maintaining and altering pre-existing data structures is equally as crucial as developing them. Databases must be adaptable enough to handle changes as business requirements change without compromising operations or data integrity. Therefore, a fundamental skill for database administrators and users is the capacity to examine, edit, and modify data.

1 / C –Central Idea:-

1- Correct design issues without recreating tables
2- learn to use SELECT statements, and filters to efficiently navigate through large datasets.

1 / D – Performance Objectives

After studying the fourth unit, the student will be able to:-

1- Modifying data types without recreating tables.
2- Writing accurate queries based on real values.
3- Filters records based on a condition

2/ Pretest:-



What are some reasons why a database table might need to be altered after it's created?

3/ More on Alter table, Browse, Edit data:-

1. ALTER TABLE - ALTER/MODIFY DATATYPE

To change the datatype of a column in a table, use the following syntax:

Syntax

```
ALTER TABLE table_name
ALTER COLUMN column_name datatype;
```

ALTER TABLE - ALTER/MODIFY DATATYPE Example

The following SQL query changes the datatype of a column "*LastName*" of the datatype "varchar(25)" in a table "Employee" to be in a new datatype of "*nchar(10)*":

Example

```
ALTER TABLE Employee
ALTER COLUMN LastName nchar(10);
```

Note: To change the datatype of any column in a table, the new datatype must be compatible with the entered data.

2. The SQL SELECT DISTINCT Statement

The SELECT DISTINCT statement is used to return only distinct (different) values.

Inside a table, a column often contains many duplicate values, and sometimes you only want to list the different (distinct) values.

Syntax

```
SELECT DISTINCT column1, column2, ...
FROM table_name;
```

Example

Customers table:

CustomerID	CustomerName	Address	City
1	Ahmed Mohammed	Iraq	Basra
2	Hana Saad	Syria	Damascus
3	Amer Sultan	Iraq	Baghdad
4	Abdulrahman Saleh	Saudi Arabia	Makkah
5	Zainab Mohammed	Iraq	Basra
6	Noof Saud	Saudi Arabia	Jeddah

Select all the different addresses from the "Customers" table:

```
SELECT DISTINCT Address FROM Customers;
```

Result

Address
Iraq
Syria
Saudi Arabia

If you omit the DISTINCT keyword, the SQL statement returns the "Address" value from all the records of the "Customers" table:

```
SELECT Address FROM Customers;
```

Result

Address
Iraq
Syria
Iraq
Saudi Arabia
Iraq
Saudi Arabia

3. The SQL WHERE Clause

The WHERE clause is used to filter records.
It is used to extract only those records that fulfill a specified condition.

Syntax

```
SELECT column1, column2, ...
FROM table_name;
WHERE condition;
```

Example

Select all customers from Iraq:

```
SELECT * FROM Customers
WHERE Address='Iraq';
```

Result

CustomerID	CustomerName	Address	City
1	Ahmed Mohammed	Iraq	Basra
3	Amer Sultan	Iraq	Baghdad
5	Zainab Mohammed	Iraq	Basra

Text Fields vs. Numeric Fields

SQL requires **single** quotes around **text** values (most database systems will also allow **double** quotes).
However, **numeric** fields should **not** be enclosed in quotes:

Example

```
SELECT * FROM Customers
WHERE CustomerID =1;
```

3.1. Operators in The WHERE Clause

The following operators can be used in the **WHERE** clause:

Operator المعامل	Description الوصف	Example مثال
=	Equal متساوي	SELECT * FROM Customers WHERE CustomerID = 3;
>	Greater than أكبر من	SELECT * FROM Customers WHERE CustomerID > 3;
<	Less than	SELECT * FROM Customers

	أصغر من	WHERE CustomerID < 3;
>=	Greater than or equal أكبر من او يساوي	SELECT * FROM Customers WHERE CustomerID >= 3;
<=	Less than or equal أصغر من او يساوي	SELECT * FROM Customers WHERE CustomerID <= 3;
<>	Not equal. Note: In some versions of SQL this operator may be written as != غير متساوي. ملاحظة: في بعض إصدارات SQL قد تتم كتابة هذا العامل كـ=!	SELECT * FROM Customers WHERE CustomerID <> 3;
BETWEEN	Between a certain range بين نطاق معين	SELECT * FROM Customers WHERE CustomerID BETWEEN 3 AND 6;
IN	To specify multiple possible values for a column لتحديد قيم متعددة محتملة لعمود	SELECT * FROM Customers WHERE City IN ('Basra', 'Baghdad');
LIKE	Search for a pattern (The percent sign (%) represents zero, one, or multiple characters, and the underscore sign (_) represents one, single character) ابحث عن نمط (علامة النسبة المئوية (%) تمثل صفرًا أو حرفًا واحدًا أو عدة أحرف، وعلامة الشرطة السفلية (_) تمثل حرفًا واحدًا)	Ex: Find any address that starts with "S"? SELECT * FROM Customers WHERE Address LIKE 'S%';
		Ex: Find any address that ends with "a"? SELECT * FROM Customers WHERE Address LIKE '%a';
		Ex: Find any address that have "ra" in any position ? SELECT * FROM Customers WHERE Address LIKE '%ra%';
		Ex: Find any address that have "r" in the second position ? SELECT * FROM Customers WHERE Address LIKE '_r%';
		Ex: Find any address that starts with "I" and is at least 2 characters in length? SELECT * FROM Customers WHERE Address LIKE 'I_%';
		Ex: Find any address that starts with "I" and is at least 3 characters in length? SELECT * FROM Customers WHERE Address LIKE 'I__%';
		Ex: Find any address that starts with "I" and ends with "q"? SELECT * FROM Customers WHERE Address LIKE 'I%q';

Note: The WHERE clause is not only used in SELECT statements, it is also used in UPDATE, DELETE, etc.!

4. Important points

- When creating a new database successfully, you can view the newly created database in the Object Explorer. If the new database does not appear, you can click the **Refresh** button or press **F5** keyboard to update the object list.
- Be Careful before dropping a database. Deleting a database will result in the loss of complete information stored in the database.
- Tables are database objects that contain all the data in a database (**unit of storage**).
- In tables, data is logically organized in a **row-and-column** format similar to a spreadsheet. Each row represents a **unique record**, and each column represents a **field in the record**.
- The **INSERT INTO** statement is used to insert **new records** in a table, whereas the **ALTER TABLE - ADD** statement is used to add a **new column** in a table.
- SQL keywords are **not** case sensitive: **select** is the same as **SELECT**.
- Semicolon after SQL Statements: This is the standard way to separate each SQL statement in database systems that allow more than one SQL statement to be executed in the same call to the server.

4/ Posttest :-

True or false

1. The SELECT command is used to retrieve data from one or more tables.
2. The ALTER TABLE command can delete records from a table.
3. The WHERE clause can be used with SELECT, UPDATE, and DELETE.
4. SELECT * displays all columns in the table.
5. You can change a column name using the ALTER TABLE command.

key answer :-

1. True 2. False 3. True 4. True 5. True

5/ HomeWorks: -

Task// Imagine you have a table named Products with columns: ProductID, ProductName, and Price.
Write the SQL command to:
a) Add a new column called Stock of type INT
b) Select only the products that cost less than 50

Note: The answer must be uploaded in PDF format to the course's classroom. The assignment will be active from today until the next lecture.

Ministry of Higher Education and Scientific Research
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SQL Databases Fundamentals

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Department of Computer Networks and Software Techniques

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60 hours during the semester (theoretical + practical), 4 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: Zainab Mohammed Jiwar Email: zainab.m.jiwar@stu.edu.iq
8. Course Objectives

Cognitive objectives	Program Skill Objectives
1) The student will understand databases and their importance in storing and organizing data effectively 2) The student will be able to learn the SQL language and use it to create and manage databases, including creating, modifying, and querying data, and understanding	1) The student will be able to write SQL queries to retrieve data from databases effectively and accurately 2) The student will apply exercises in designing databases using appropriate data models and defining tables and relationships between them. 3) The student will acquire skills in managing and maintaining databases, including adding, modifying, and deleting data

different types of data, such as text, numeric, etc., and how to deal with them using SQL 3) The student will master how to design databases effectively, including defining tables and relationships between them, setting constraints, and writing SQL queries to retrieve data from databases.	

9. Teaching and Learning Strategies

Strategy	1) Teaching Strategy Collaborative Concept Planning. 2) Teaching Strategy Brainstorming. 3) Teaching Strategy Notes Series

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the basic concepts of what databases are, their importance in organizing and managing data, learn the basics of the SQL language and how to install it on the computer, understand the concepts of data normalization, and the practical importance of applying them in database design	Introduction and installation of SQL, Data normalization	Lecture and Lab	Daily Exams and Assignments

2	4	Understand what SQL Wizards are and their role in facilitating the processes of writing SQL queries and creating databases more effectively and easily, and learn about the types of assistance available in database development environments	Using wizards, and HELP types	Lecture and Lab	Daily Exams and Assignments
3-4	8	Understand the types of data definition in SQL, create data tables, save and edit data, use different data types, and use commands and tool keys in the SQL environment in a skillful manner	Data definition types, creating data tables, saving, and editing. Input various data types using commands and keys	Lecture and Lab	Daily Exams and Assignments
5-7	12	Understand how to use the ALTER TABLE command in SQL to modify the structure of tables, including adding, modifying, and deleting columns and changing data types, browsing and displaying table data in an organized and understandable manner, which enables understanding the structure of the data and existing information, and editing data in tables	More on Alter table, Browse, Edit data	Lecture and Lab	Daily Exams and Assignments
8-11	16	Understand the concept of Manipulation Language (DML) and its role in modifying and managing data in databases using commands such as REPLACE, DELETE,	Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data	Lecture and Lab	Daily Exams and Assignments

		PACK, RECALL, and ZAP.			
12-15	16	Understand what indexing is in SQL and its role in improving the performance of data queries by accelerating search and filtering operations, and understand the process of data arrangement in SQL and its role in organizing data appropriately to improve query performance and enhance user experience.	Indexing & Sorting data	Lecture and Lab	Daily Exams and Assignments

11. Course Evaluation

50 marks for mid-term exams (20 practical + 20 theoretical + 10 activity). 50 marks for final exams (10 practical + 40 theoretical)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Lectures of the course material prepared by the lecturer
Main references (sources)	SQL: the complete reference. McGraw-Hill/Osborne, 2002
Recommended books and references (scientific journals, reports...)	– Practical SQL: A Beginner's Guide to Storytelling with Data – SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights 1st Edition
Electronic References, Websites	– https://www.w3schools.com/sql/default.asp – https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16

Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques

Learning package

In

Data Manipulation Language

For

Students of the Second Year



By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

1/ Overview

1 / A –Target population:-

For students of the Second year
Technological Institute of Basra
Dep. Of Computer Networks and Software Techniques

1 / B –Rationale:-

Maintaining accurate, current, and secure information systems in database administration requires the ability to manipulate and control data. The SQL commands SELECT INTO, UPDATE, and DELETE give students the fundamental knowledge and abilities they need to handle data efficiently at every stage of its lifetime, from copying to editing to deleting as needed.

1 / C –Central Idea:-

1- Copying Data Efficiently
2- Modifying Existing Data
3- Removing Data Safely

1 / D – Performance Objectives

After studying the fifth unit, the student will be able to:-

1-Creating backup or temporary tables.
2-Correcting errors.
3-Understand the implications of removing data in relational databases

2/ Pretest:-



Imagine you have a table of customer data and you want to copy part of it into a new table.
What kind of command or method do you **think** you would use?

3/ Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data:-

1. The SQL SELECT INTO Statement

The SELECT INTO statement copies data from one table into a new table.
Syntax1 (Copy all columns into a new table**)**

```
SELECT *
INTO new_table
FROM old_table
WHERE condition ;
```

Syntax2 (Copy only some columns into a new table**)**

```
SELECT column1, column2, ...
INTO new_table
FROM old_table
WHERE condition ;
```

Note: The new table will be created with the column-names and types as defined in the old table. You can create new column names using the AS clause.
Example
If we have the **Customers** table in the database **testDB:**

CustomerID	CustomerName	Country	City
1	Ahmed Mohammed	Iraq	Basra
2	Hana Saad	Syria	Damascus
3	Amer Sultan	Iraq	Baghdad
4	Abdulrahman Saleh	Saudi Arabia	Makkah
5	Zainab Mohammed	Iraq	Basra
6	Noof Saud	Saudi Arabia	Jeddah

A) The following SQL statement creates a backup copy of table "Customers":

```
SELECT * INTO CustomersBackup2023
FROM Customers;
```

B) The following SQL is used to copy the table "Customers" into a new table "CustomersBackup2023" in another database " test2db":

```
SELECT * INTO test2db.dbo.CustomersBackup2023
FROM testDB.dbo.Customers;
```

C) The following SQL copies only a few columns into a new table:

```
SELECT CustomerName, Country INTO CustomersBackup2023
FROM Customers;
```

D) The following SQL copies only the Iraqi customers into a new table:

```
SELECT * INTO CustomersBackup2023
FROM Customers
WHERE Country ='Iraq' ;
```

Note: SELECT INTO can also be used to create a new, empty table using the schema of another. Just add a WHERE clause that causes the query to return no data.

```
SELECT * INTO new_table
FROM old_table
WHERE 1 = 0 ;
```

2. The SQL UPDATE Statement

The UPDATE statement is used to modify the existing records in a table.

Syntax

```
UPDATE table_name
SET column1 = value1, column2 = value2, ...
WHERE condition;
```

Note: Be careful when updating records in a table! Notice the WHERE clause in the UPDATE statement. The WHERE clause specifies which record(s) that should be updated. If you omit the WHERE clause, all records in the table will be updated!

Examples

A) The following SQL statement updates the first customer (CustomerID = 1) with a new person name and a new city:

```
UPDATE Customers
SET CustomerName  = 'Hussein Ali', City = 'karbala'
WHERE CustomerID = 1;
```

Result

The following message appears:

```
(1 rows affected)
Completion time: 2023-10-13T21:44:13.6738293+03:00
```

To view the table records after modification, we execute the following SQL statement:

```
SELECT * FROM Customers;
```

CustomerID	CustomerName	Country	City
1	Hussein Ali	Iraq	karbala
2	Hana Saad	Syria	Damascus
3	Amer Sultan	Iraq	Baghdad
4	Abdulrahman Saleh	Saudi Arabia	Makkah
5	Zainab Mohammed	Iraq	Basra
6	Noof Saud	Saudi Arabia	Jeddah

B) The following SQL statement will update the customer's name to "Abdul Aziz Fahd" for all records where the country is "Saudi Arabia":

```
UPDATE Customers
SET CustomerName  = 'Abdul Aziz Fahd'
WHERE Country = 'Saudi Arabia' ;
```

Result

The following message appears:

```
(2 rows affected)
Completion time: 2023-10-13T22:33:27.6202344+03:00
```

To view the table records after modification, we execute the following SQL statement:

```
SELECT * FROM Customers;
```

CustomerID	CustomerName	Country	City
1	Hussein Ali	Iraq	karbala
2	Hana Saad	Syria	Damascus
3	Amer Sultan	Iraq	Baghdad
4	Abdul Aziz Fahd	Saudi Arabia	Makkah
5	Zainab Mohammed	Iraq	Basra
6	Abdul Aziz Fahd	Saudi Arabia	Jeddah

C) If you omit the WHERE clause, ALL records will be updated, So the following SQL statement will update the customer's name to "Abdul Aziz Fahd" for all records:

```
UPDATE Customers
SET CustomerName  = 'Abdul Aziz Fahd'
```

Result

The following message appears:

```
(6 rows affected)
Completion time: 2023-10-13T23:10:12.9263944+03:00
```

To view the table records after modification, we execute the following SQL statement:

```
SELECT * FROM Customers;
```

CustomerID	CustomerName	Country	City
1	Abdul Aziz Fahd	Iraq	karbala
2	Abdul Aziz Fahd	Syria	Damascus
3	Abdul Aziz Fahd	Iraq	Baghdad
4	Abdul Aziz Fahd	Saudi Arabia	Makkah
5	Abdul Aziz Fahd	Iraq	Basra
6	Abdul Aziz Fahd	Saudi Arabia	Jeddah

3. The SQL DELETE Statement

The DELETE statement is used to delete existing records in a table.

Syntax

```
DELETE FROM table_name;
WHERE condition;
```

Note: Be careful when deleting records in a table! Notice the WHERE clause in the DELETE statement. The WHERE clause specifies which record(s) should be deleted. If you omit the WHERE clause, all records in the table will be deleted!

Example

The following SQL statement deletes the customer "Zainab Mohammed" from the "Customers" table:

```
DELETE FROM Customers
WHERE CustomerName= 'Zainab Mohammed';
```

Result

The following message appears:

```
(1 rows affected)
Completion time: 2023-10-14T00:25:44.7946797+03:00
```

To view the table records after deletion, we execute the following SQL statement:

```
SELECT * FROM Customers;
```

CustomerID	CustomerName	Country	City
1	Ahmed Mohammed	Iraq	Basra
2	Hana Saad	Syria	Damascus
3	Amer Sultan	Iraq	Baghdad
4	Abdulrahman Saleh	Saudi Arabia	Makkah
6	Noof Saud	Saudi Arabia	Jeddah

DELETE All Records

Deleting all rows in a table is possible without deleting the table. This means that the table structure, attributes, and indexes will be intact:

Syntax 1

```
DELETE FROM table_name;
```

Or Syntax 2

```
DELETE * FROM table_name;
```

Example

```
DELETE FROM Customers;
DELETE * FROM Customers;
```

Result

The following message appears:

```
(6 rows affected)
Completion time: 2023-10-14T00:25:44.7946797+03:00
```

To view the table after deletion, we execute the following SQL statement:

```
SELECT * FROM Customers;
```

CustomerID	CustomerName	Country	City

4/ Posttest :-

True or false

1. The SELECT INTO command creates a new table and copies data into it.

2. The UPDATE command must include the SET keyword.
3. The DELETE command can remove both structure and data of a table.
4. It is safe to run DELETE FROM TableName; without a WHERE clause if you only want to delete one record.
5. SELECT INTO can be used to back up part of a table.

key answer :-

1. True 2. True 3. False 4. False 5. True

5/ HomeWorks: -

Task// You are asked to create a backup of student records where Grade >= 90 from the Students table into a new table called TopStudents. Then, update all students in the original Students table who scored below 50 by setting their Status to 'Fail'.

Note: The answer must be uploaded in PDF format to the course's classroom. The assignment will be active from today until the next lecture.

Ministry of Higher Education and Scientific Research
Southern Technical University
Basra Engineering Polytechnic College
Department of Computer and AI
Engineering Techniques



Learning package

SQL Databases Fundamentals

For

Second Year Students

Department of Computer Networks and Software Techniques

By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

Course Description

1. Course Name:
SQL Databases Fundamentals
2. Course Code:
3. Semester / Year: Semester
First Semester/ First Year
4. Description Preparation Date:
20/09/2026
5. Available Attendance Forms:
Attendance Only
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hours during the semester (theoretical + practical), 4 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: Zainab Mohammed Jiwar Email: zainab.m.jiwar@stu.edu.iq
8. Course Objectives

Cognitive objectives	Program Skill Objectives
1) The student will understand databases and their importance in storing and organizing data effectively 2) The student will be able to learn the SQL language and use it to create and manage databases, including creating, modifying, and querying data, and understanding	1) The student will be able to write SQL queries to retrieve data from databases effectively and accurately 2) The student will apply exercises in designing databases using appropriate data models and defining tables and relationships between them. 3) The student will acquire skills in managing and maintaining databases, including adding, modifying, and deleting data

different types of data, such as text, numeric, etc., and how to deal with them using SQL 3) The student will master how to design databases effectively, including defining tables and relationships between them, setting constraints, and writing SQL queries to retrieve data from databases.	

9. Teaching and Learning Strategies

Strategy	1) Teaching Strategy Collaborative Concept Planning. 2) Teaching Strategy Brainstorming. 3) Teaching Strategy Notes Series

10. Course Structure

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2	4	Understand what SQL Wizards are and their role in facilitating the processes of writing SQL queries and creating databases more effectively and easily, and learn about the types of assistance available in database development environments	Using wizards, and HELP types	Lecture and Lab	Daily Exams and Assignments
3-4	8	Understand the types of data definition in SQL, create data tables, save and edit data, use different data types, and use commands and tool keys in the SQL environment in a skillful manner	Data definition types, creating data tables, saving, and editing. Input various data types using commands and keys	Lecture and Lab	Daily Exams and Assignments
5-7	12	Understand how to use the ALTER TABLE command in SQL to modify the structure of tables, including adding, modifying, and deleting columns and changing data types, browsing and displaying table data in an organized and understandable manner, which enables understanding the structure of the data and existing information, and editing data in tables	More on Alter table, Browse, Edit data	Lecture and Lab	Daily Exams and Assignments
8-11	16	Understand the concept of Manipulation Language (DML) and its role in modifying and managing data in databases using commands such as REPLACE, DELETE,	Data Manipulation Language, Replace, Delete, Pack, Recall, Zap data	Lecture and Lab	Daily Exams and Assignments

		PACK, RECALL, and ZAP.			
12-15	16	Understand what indexing is in SQL and its role in improving the performance of data queries by accelerating search and filtering operations, and understand the process of data arrangement in SQL and its role in organizing data appropriately to improve query performance and enhance user experience.	Indexing & Sorting data	Lecture and Lab	Daily Exams and Assignments

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Electronic References, Websites	– https://www.w3schools.com/sql/default.asp – https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16

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Engineering Techniques

Learning package

In

Indexing, Sorting data

For

Students of the Second Year



By

Zainab Mohammed Jiwar
Assistant Lecturer
Department of Computer and AI
Engineering Techniques
2026

1/ Overview

1 / A –Target population:-

For students of the Second year
Technological Institute of Basra
Dep. Of Computer Networks and Software Techniques

1 / B –Rationale:-

As databases get bigger and more complex, effective data management and retrieval become essential to system functionality and user happiness. Learning how to index and sort data in SQL gives students the skills they need to create database systems that are scalable, user-friendly, and optimized.

1 / C –Central Idea:-

1. Indexing improves search speed and query performance
2. Sorting makes data readable, ordered, and ready for reporting

1 / D – Performance Objectives

After studying the sixth unit, the student will be able to:-

1-Define the concept of indexing and sorting in relational databases

2-Design and apply indexes on one or more columns in a table using the CREATE INDEX command.

3-Create SQL queries that use the ORDER BY clause to sort data in ascending or descending order based on one or more columns

2/ Pretest:-



If a database has millions of records, what challenges might you face when trying to search or retrieve specific data?

3/ Indexing, Sorting data:-

1. SQL INDEX

- The Index in SQL is a special table used to speed up the data search in the database tables. It also retrieves a vast amount of data from the tables frequently. The INDEX requires its own space on the hard disk.
- The index concept in SQL is the same as the index concept in a novel or a book.
- It is the best SQL technique for improving the performance of queries. The drawback of using indexes is that they slow down the execution time of UPDATE and INSERT statements. But they have one advantage also, as they speed up the execution time of SELECT and WHERE statements.
- In SQL, an Index is created on the fields of the tables. We can easily build one or more indexes on a table. The creation and deletion of the Index do not affect the database's data.

1.1. Why SQL Index?

The following reasons tell why an Index is necessary in SQL:

1. SQL Indexes can search the information of a large database quickly.
2. This concept is a quick process for those columns, including different values.
3. This data structure sorts the data values of columns (fields) either in ascending or descending order. Then, it assigns the entry for each value.

4. Each Index table contains only two columns. The first column is row_id, and the other is indexed-column.
5. When indexes are used with smaller tables, the performance of the index may not be recognized.

1.2. The SQL CREATE INDEX statement

The CREATE INDEX statement is used to create indexes in tables. Indexes are used to retrieve data from the database very fast. The users cannot see the indexes, they are just used to speed up searches/queries.

Note: Updating a table with indexes takes longer than updating a table without (because the indexes also need an update). So, only create indexes on columns that will be frequently searched against.

1.3. When should INDEXES not be used in SQL?

The Indexes should not be used in SQL in the following cases or situations:

- SQL Indexes can be avoided when the size of the table is small.
- When the table needs to be updated frequently.
- Indexed should not be used in those cases when the column of a table contains a large number of NULL values.

1.4. CREATE INDEX Syntax

Creates an index on a table. Duplicate values are allowed:

```
CREATE INDEX index_name
ON table_name (column1, column2, ...);
```

1.5. CREATE UNIQUE INDEX Syntax

Creates a unique index on a table. Duplicate values are not allowed:

```
CREATE UNIQUE INDEX index_name
ON table_name (column1, column2, ...);
```

Note: The syntax for creating indexes varies among different databases. Therefore: Check the syntax for creating indexes in your database.

1.6. CREATE INDEX Example

If we have the **Persons** table in the database **testDB:**

ID	LastName	FirstName	Country	City
1	Mohammed	Ahmed	Iraq	Basra
2	Saad	Hana	Syria	Damascus
3	Sultan	Amer	Iraq	Baghdad

A- The SQL statement below creates an index named "idx_lastname" on the "LastName" column in the "Persons" table:

```
CREATE INDEX idx_lastname
ON Persons (LastName);
```

Result

```
Commands completed successfully.
Completion time: 2023-11-08T22:43:47.3381535+03:00
```

B- If you want to create an index on a combination of columns, you can list the column names within the parentheses, separated by commas:

```
CREATE INDEX idx_pname
ON Persons (LastName, FirstName);
```

1.7. The SQL DROP INDEX statement

The DROP INDEX statement is used to delete an index in a table.

Syntax

```
DROP INDEX table_name.index_name;
```

2. The SQL ORDER BY Statement

The ORDER BY statement is used to sort the result-set in ascending or descending order.

The ORDER BY statement sorts the records in ascending order by default or using the **ASC** keyword. To sort the records in descending order, we use the **DESC** keyword.

Syntax

```
SELECT column1, column2, ...
FROM table_name
ORDER BY column1, column2, ... ASC|DESC;
```

Examples

A) The following SQL statement selects all customers from the "Customers" table, sorted by the "Country" column (in ascending order by default because we did not specify the order type)

```
SELECT * FROM Customers
ORDER BY Country;
```

Result

CustomerID	CustomerName	Country	City
1	Ahmed Mohammed	Iraq	Basra
3	Amer Sultan	Iraq	Baghdad
5	Zainab Mohammed	Iraq	Basra
6	Noof Saud	Saudi Arabia	Jeddah
4	Abdulrahman Saleh	Saudi Arabia	Makkah
2	Hana Saad	Syria	Damascus

B) The following SQL statement selects all customers from the "Customers" table, sorted DESCENDING by the "Country" column:

```
SELECT * FROM Customers
ORDER BY Country DESC;
```

Result

CustomerID	CustomerName	Country	City
2	Hana Saad	Syria	Damascus
4	Abdulrahman Saleh	Saudi Arabia	Makkah
6	Noof Saud	Saudi Arabia	Jeddah
1	Ahmed Mohammed	Iraq	Basra
5	Zainab Mohammed	Iraq	Basra
3	Amer Sultan	Iraq	Baghdad

C) The following SQL statement selects all customers from the "Customers" table, sorted (in ascending by default) by the "Country" and the "CustomerName" columns:

```
SELECT * FROM Customers
ORDER BY Country, CustomerName;
```

Result

CustomerID	CustomerName	Country	City
1	Ahmed Mohammed	Iraq	Basra
3	Amer Sultan	Iraq	Baghdad
5	Zainab Mohammed	Iraq	Basra
4	Abdulrahman Saleh	Saudi Arabia	Makkah
6	Noof Saud	Saudi Arabia	Jeddah
2	Hana Saad	Syria	Damascus

D) The following SQL statement selects all customers from the "Customers" table, sorted ascending by the "Country" and descending by the "CustomerName" column:

```
SELECT * FROM Customers
ORDER BY Country ASC, CustomerName DESC;
```

Result

CustomerID	CustomerName	Country	City
5	Zainab Mohammed	Iraq	Basra
3	Amer Sultan	Iraq	Baghdad
1	Ahmed Mohammed	Iraq	Basra
6	Noof Saud	Saudi Arabia	Jeddah
4	Abdulrahman Saleh	Saudi Arabia	Makkah
2	Hana Saad	Syria	Damascus

4/ Posttest:-

True or false

1. You can sort query results by more than one column using ORDER BY.

2. Creating too many indexes can slow down insert and update operations.
3. The ORDER BY clause changes the physical order of data in the table.
4. Indexes can be created on multiple columns.
5. Sorting always improves performance.

kev answer :-

1. True 2. True 3. False 4. True 5. False

5/ HomeWorks: -

Task// You have a table called Sales with columns: SaleID, Date, and TotalAmount.
Write two SQL queries:
a) Create an index on the Date column
b) Retrieve all sales data sorted by TotalAmount from highest to lowest

Note: The answer must be uploaded in PDF format to the course's classroom. The assignment will be active from today until the next lecture.

References

- SQL: the complete reference. McGraw-Hill/Osborne, 2002.
- Practical SQL: A Beginner's Guide to Storytelling with Data.
- SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights 1st Edition.
- https://www.w3schools.com/sql/default.asp
- https://learn.microsoft.com/en-us/sql/samples/sql-samples-where-are?view=sql-server-ver16