



Assignment Project Exam Help

SQL – Part 1

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What is SQL?

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- stands for structured query language
- SQL was initially developed at IBM (SEQUEL → SQL), as one of the first co

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- 1992 – SQL was strengthened and much ex
- 1999 – SQL was expanded and divided into a optional specialised packages (↪ S
- 2003 – SQL was further expanded, e.g., XML support (↪ SQL:2003).
- 2011 — SQL was further expanded, e.g., improved support for temporal databases (↪ SQL:2011).

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What is SQL?

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- SQL provides an interface to relational database systems, including:

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- Data Manipulation Language (DML);

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- Transaction Control Language (TCL).



Relational Data Model and SQL

- Unlike the relational data model that is based on **sets**, SQL is based on **multisets**. It means that SQL allows a relation to have duplicate tuples.

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Data Definition Language

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Data Definition Language – Create Table

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- The **CREATE TABLE** statement is used to create a new relation schema by specifying its name, its attributes and, *optionally*, its constraints.

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```
attribute_name data_type [attribute constraints],  
[table constraints]);
```

- For each attribute in a relation, we specify its name, its *data type*, *optionally*, a constraint specific to the attribute (i.e., attribute constraint).

```
attribute_name data_type [attribute_constraint]
```



Create Table – Example

```
CREATE TABLE STUDENT  
(StudentID INT,  
Name VARCHAR(50),  
DoB Date,
```

StudentID	Name	DoB	Email
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```
CRE
```

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```
Cname VARCHAR(50),  
Unit SMALLINT);
```

```
CREATE TABLE ENROL
```

```
(StudentID INT,  
CourseNo VARCHAR(20),  
Semester VARCHAR(50),  
Status VARCHAR(50)),
```

StudentID	CourseNo	Semester	Status
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Attribute Data Types

- **Numeric types:**

- **TINYINT** and **SMALLINT** provide domains of integer numbers of various sizes.

- **MEDIUMINT** provides a domain of integer numbers

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- **INT** provides a domain of integer numbers
- **scale** for the number of digits following the decimal point

- **String types:**

- **CHAR(n)** allows character strings of fixed length, where n is the number of characters.
- **VARCHAR(n)** allows character strings of varying length, where n is the maximum number of characters.
- **BIT(n)** allows bit strings of fixed length, where n is the number of bits.
- **BIT VARYING(n)** allows bit strings of varying length, where n is the maximum number of bits.



Attribute Data Types

- **Date and time types:**

- **DATE** provides date values (year, month, day).
- **TIME** provides time values (hour, minute, second).



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- **Boolean type:** has the values of TRUE or FALSE.
- The **CREATE DOMAIN** statement is used to create a specific data type.

```
CREATE DOMAIN domain_name AS data_type  
[default expression] [constraint,...,constraint];
```

Example: CREATE DOMAIN ssn_type AS CHAR(9);



Attribute Data Types – Example

```
CREATE TABLE STUDENT  
(StudentID INT,  
Name VARCHAR(50),  
DoB Date,
```

StudentID	Name	DoB	Email
-----------	------	-----	-------

```
CRE
```

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--	--	--	--

```
Cname VARCHAR(50),  
Unit SMALLINT);
```

```
CREATE TABLE ENROL  
(StudentID INT,  
CourseNo VARCHAR(20),  
Semester VARCHAR(50),  
Status VARCHAR(50));
```

Studen			Status
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Attribute Constraints

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The following constraints can be specified in SQL.

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UNIQUE: ensure that uniqueness of the value of attribute in a table.

PRIMARY KEY: uniquely identify each tuple in a table.

FOREIGN KEY: enforce referential integrity between two tables.

INDEX: provides accelerated access to the rows of table.

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Attribute Constraints – Not Null, Default and Check

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```
CREATE TABLE COURSE  
(Cname VARCHAR(20) PRIMARY KEY,  
  Cname VARCHAR(50) NOT NULL,
```

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```
  CourseNo VARCHAR(20) NOT NULL  
  Semester VARCHAR(50) NOT NULL  
  Status VARCHAR(50),  
  ...);
```

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- If we don't want to have missing and unknown data, we can specify **NOT NULL** for attributes to forbid NULL values.
- Unit of any new tuple in COURSE is set to 6 if no explicit value is provided.
- **CHECK()** for StudentID excludes the student IDs such as 0 and -37.

Attribute Constraints – Unique and Primary Key

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```
CREATE TABLE Course  
(No VARCHAR(20) PRIMARY KEY,  
Cname VARCHAR(50) UNIQUE,
```

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```
CourseNo VARCHAR(20) NOT NULL,  
Semester VARCHAR(50) NOT NULL  
Status VARCHAR(50),  
PRIMARY KEY (StudentID, CourseNo, S  
...);
```

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- If a primary key contains only one attribute, **PRIMARY KEY** can be defined as an attribute constraint (e.g., in COURSE); otherwise it is defined as a table constraint (e.g., in ENROL).
- **PRIMARY KEY** specifies a key while **UNIQUE** specifies additional keys.



Attribute Constraints – Foreign Key

```
CREATE TABLE STUDENT
```

```
( StudentID INT PRIMARY KEY,  
  Name VARCHAR(50),  
  DoB Date,
```

```
CRE
```

```
  Cname VARCHAR(50),  
  Unit SMALLINT);
```

exist in STUDENT.

```
CREATE TABLE ENROL
```

```
( StudentID INT,  
  CourseNo VARCHAR(20),  
  Semester VARCHAR(50),  
  Status VARCHAR(50));
```

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Attribute Constraints – Foreign Key

```
CREATE TABLE STUDENT
```

```
(StudentID INT PRIMARY KEY,  
Name VARCHAR(50),  
DoB Date,
```

```
CRE
```

```
Cname VARCHAR(50),  
Unit SMALLINT);
```

```
CREATE TABLE ENROL
```

```
(StudentID INT,  
CourseNo VARCHAR(20),  
Semester VARCHAR(50),  
Status VARCHAR(50),  
FOREIGN KEY(StudentID) REFERENCES STUDENT(StudentID),  
FOREIGN KEY(CourseNo) REFERENCES COURSE(No));
```

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Attribute Constraints – Foreign Key

```
CREATE TABLE ENROL
```

```
(StudentID INT,  
CourseNo VARCHAR(20),  
Semester VARCHAR(50),
```

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```
CREATE TABLE STUDENT
```

```
(StudentID INT PRIMARY KEY,  
Name VARCHAR(50),  
DOB Date,  
Email VARCHAR(100));
```

```
CREATE TABLE COURSE
```

```
(No VARCHAR(20) PRIMARY KEY,  
Cname VARCHAR(50),  
Unit SMALLINT);
```

reference STUDENT and
COURSE.

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Attribute Constraints – Index

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- Indexes are used for fast retrieval based on columns other than the primary key.

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```
Address VARCHAR(80),  
Phone INT CHECK (Phone>0),  
PRIMARY KEY (CustomerID))
```

```
CREATE INDEX index1 ON CUSTOMER (Name, DOB);
```

```
CREATE UNIQUE INDEX index2 ON CUSTOMER (Phone);
```

Data Definition Language – Alter and Drop Table

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- The **ALTER TABLE** statement is used to modify an existing relation schema, including:

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- adding or dropping table constraints.

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- The **DROP TABLE** statement is used to remove a from a database schema.

Data Definition Language – Alter and Drop Table

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- Add a NOT NULL constraint:

```
ALTER TABLE CUSTOMER ALTER COLUMN Address SET NOT NULL;
```

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- Add a check() constraint:

```
ALTER TABLE CUSTOMER  
ADD CONSTRAINT positive_id CHECK (customer
```

- Add a Foreign Key constraint:

```
ALTER TABLE ENROL  
ADD FOREIGN KEY(StudentID) REFERENCES Student(StudentID);
```

Data Definition Language – Alter and Drop Table

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- Add an attribute EMAIL into the table CUSTOMER:

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- Drop the table ENROL:

`DROP TABLE ENROL;`

- Drop the table CUSTOMER (if exists):

`DROP TABLE IF EXISTS CUSTOMER;`

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