

SQL FOR DB2

Chapter 9

Database Constraints



CHAPTER OBJECTIVES

- ① Explain the purpose of constraints
- ① Explain the purpose of primary key constraint and demonstrate its use
- ① Explain the purpose of unique constraint and demonstrate its use
- ① Explain the purpose of foreign key constraint and demonstrate its use
- ① Explain the purpose of a check constraint and demonstrate its use
- ① Demonstrate how to define constraints using the `CREATE TABLE` command
- ① Demonstrate how to define constraints using the `ALTER TABLE` command to add and drop constraints for an existing table

INTRODUCTION TO DATABASE CONSTRAINTS

- ⦿ Database constraints are restrictions on the contents of the database or database operations
- ⦿ Constraints, or integrity rules, reflect an organization's requirements for valid data and valid operations
- ⦿ The four database constraints are:
 - ⦿ Primary key constraints (key integrity)
 - ⦿ Unique constraints
 - ⦿ Foreign key constraints (referential integrity)
 - ⦿ Check constraint (domain integrity)



DATABASE CONSTRAINTS

- ① Usually, one or more constraints are specified when the `CREATE TABLE` command is used to create a table
- ① The `ALTER TABLE` command can also be used to add or drop constraints
- ① None of the constraints are required, although most tables contain a primary key
- ① Once a constraint has been defined for a table, the constraint is enforced for all database updates

PRIMARY KEY CONSTRAINT

- ① A primary key serves as the unique identifier for rows in the table
- ① The primary key constraint can be included in the create table without the keyword `CONSTRAINT` or constraint name
- ① Each primary key column's definition must include `NOT NULL`
- ① For a table with a primary key constraint, the DBMS blocks any attempt to insert or update a row that would cause two rows in the same table to have identical values for their primary key columns

CREATE TABLE WITH PRIMARY KEY CONSTRAINT

```
Create Table SaleTBL
( OrderID      Integer Not Null,
  SaleDate    Date      Not Null,
  ShipDate    Date      Default Null,
  SaleTotal   Dec( 7, 2 ) Not Null,
  CrdAutNbr   Integer Default Null,
  CustID      Integer Not Null,
  Primary Key( OrderID ) ;
```

UNIQUE CONSTRAINTS

- ③ A unique constraint is similar to a primary key constraint; however, a column listed in a unique constraint need not be defined with `NOT NULL`
- ③ It is recommended that a constraint name be specified for a unique constraint

CREATE TABLE WITH UNIQUE CONSTRAINT

```
Create Table SaleTBL
( OrderID      Integer Not Null,
  SaleDate     Date      Not Null,
  ShipDate     Date      Default Null,
  SaleTotal    Dec( 7, 2 ) Not Null,
  CrdAutNbr    Integer Default Null,
  CustID       Integer Not Null,
  Primary Key( OrderID ),
  Constraint SaleCrdAutNbrUK
  Unique ( CrdAutNbr ) );
```

FOREIGN KEY CONSTRAINTS

- ⊙ A foreign key is one or more column in one table (child) that contain values that match the primary key of a second table (parent)
- ⊙ When a logical model is translated to a physical database, the relationships between database tables are implemented as foreign key constraints, sometimes referred to as referential integrity
- ⊙ A foreign key constraint specifies how records in different tables are related and how the DBMS should handle row insert, delete and update operations that might violate the relationship

DEFINING FOREIGN KEY CONSTRAINTS

- ③ To define a foreign key constraint, a primary key is defined in the parent table and a foreign key in the child table
- ③ The parent primary key constraint should be defined before the child foreign key constraint
- ③ The foreign key constraint must have identical data type and length of precision as the primary key
- ③ Foreign key constraints are defined using the `FOREIGN KEY` clause, which consist of: constraint name, columns and reference



RULES FOR FOREIGN KEYS

- ① When inserting a row with a foreign key, the values of the foreign key columns are checked against the values of the primary key columns in the parent table. If no matching primary key columns are found, the insert is disallowed.
- ① A new primary key row can be inserted into the parent table as long as the primary key is unique for the table.
- ① When updating foreign key values, the same checks are performed as inserting a row with a foreign key.

RULES FOR FOREIGN KEYS

- ⦿ If a primary key value is changed in the parent table, the DBMS does not allow existing foreign keys in the dependent table that refer back to the primary key that is changing. All foreign key rows first must be either deleted or be set to NULL before the value of the primary key can be changed.
- ⦿ Deleting a row in the dependent table with a foreign key is always permitted.
- ⦿ When deleting a row with a primary key, the DBMS takes action as indicated in the command; it restricts deletion, cascades deletes to foreign key rows, or sets all referenced foreign keys to null.

FOREIGN KEY ACTIONS

- ⦿ **RESTRICT**: disallows the deletion/update of the primary key row if any foreign keys relate to the row.
- ⦿ **CASCADE**: allows the deletion of the primary key row and also deletes the foreign key rows that relate to it.
- ⦿ **SET NULL**: allows the deletion of the primary key row and, instead of deleting all related foreign key rows, sets the foreign key columns to NULL.
- ⦿ **SET DEFAULT**: allows the deletion of the primary key row and, instead of deleting all related foreign key rows, sets the foreign key columns to their respective default values. The parent table must contain a row that has the same value as the foreign key column default.

CREATE TABLE WITH FOREIGN KEY CONSTRAINT

```
Create Table SaleTBL
( OrderID      Integer Not Null
  SaleDate     Date      Not Null,
  ShipDate     Date      Default Null,
  SaleTotal    Dec( 9, 2 ) Not Null,
  CrdAutNbr    Integer Default Null,
  CustID       Integer Not Null,
Primary Key( OrderID ),
Constraint SaleCrdAutNbrUK Unique(CrdAutNbr),
Constraint SaleCustomerFK Foreign Key (CustID)
References Customer (CustID)
On Delete Cascade
On Update Restrict);
```



CHECK CONSTRAINTS

- ⦿ Check constraints are used to enforce business rules by placing restrictions on the data that can be entered into a column
- ⦿ Any attempt to modify the column (`UPDATE` or `INSERT` commands) will cause the check constraint to be evaluated
- ⦿ If the modification conforms to the check constraint, the modification is permitted to continue; if not, the command will fail with a constraint violation

CHECK CONSTRAINT GUIDELINES

- ① The same constraint name cannot be specified more than once for the same table.
- ① The constraint can only refer to columns in the table
- ① The first operand specified in the check condition *must be* the name of a column contained in the table. The second operand must be either another column name or a constant.
- ① If the second operand is a constant, it must be compatible with the data type of the first operand. If the second operand is a column, it must be the same data type as the first column specified.
- ① The check condition defines the actual constraint logic. The check condition can be defined using $>$, $<$, $=$, $<>$, $<=$, $>=$ as well as BETWEEN, IN, LIKE, and NULL. Furthermore, AND and OR can be used to string conditions together. NOT cannot be used

CHECK CONSTRAINT EXAMPLES

Constraint EmpSocSecNo

Check (SocSecNo > 0 AND SocSecNo < 999999999),

Constraint EmpBirthHireDates Check (HireDate > BirthDate),

Constraint EmpJobLevel Check (JobLevel > 0 AND JobLevel < 10),

Constraint EmpSex Check (Sex = 'F' OR Sex = 'M'),

Constraint EmpCheckSalary Check (Salary < 92000.00),

Constraint EmpCommSalary Check (Salary > Commission),

BENEFITS OF CHECK CONSTRAINTS

- ③ Check constraints provide better data integrity because a check constraint is always executed whenever the data is modified. Without a check constraint critical business rules could be bypassed during ad hoc data modification.
- ③ Check constraints promote consistency. Because they are implemented once, in the table command, each constraint is always enforced.

CODING SUGGESTIONS

- ◎ Beware of semantics with check constraints. The DBMS performs no semantic checking on constraints and defaults. Check constraints could contradict one another
- ◎ Define constraints at the table level, maintenance is easier and clarity is improved
- ◎ It is recommended that names be specified for unique, foreign key and check constraints

ALTER TABLE COMMAND

- ① After a table is created, the `ALTER TABLE` command can be used to add or remove a primary key, unique, foreign key or check constraint
- ① To drop a primary key constraint, just specify `DROP PRIMARY KEY`
- ① To drop a unique, foreign key, or check constraint, just specify `DROP CONSTRAINT` constraint name.
- ① To add a constraint just specify `ADD CONSTRAINT` constraint name

CHAPTER SUMMARY

- ⦿ Database constraints consist of
 - ⦿ Primary key constraint
 - ⦿ Unique constraint
 - ⦿ Foreign Key constraint (Referential integrity)
 - ⦿ Check Constraint

CHAPTER SUMMARY

- ◎ Primary key constraint
 - ◎ Serves as the unique identifier for rows in a table.
 - ◎ Used as the target identifier to a foreign key in another database table.
- ◎ A unique constraint
 - ◎ Is similar to a primary key constraint.
 - ◎ Does not have to be defined with Not Null.
- ◎ Foreign Key constraint
 - ◎ Is a method of ensuring data integrity between tables related by primary and foreign keys.

CHAPTER SUMMARY

- ◎ Check constraints
 - ◎ Are used to enforce business rules by placing restrictions on the data that can be entered into a column
- ◎ After a table is created, the `ALTER TABLE` command can be used to add or remove a primary key, unique, foreign key or check constraint