LAB03: Integrity Constraints

Submission:

- Submit a lab file named "int191_lab03_xxxxxxxxxxx.docx/.pdf" into the LEB2 system. xxxxxxxxxxx = your student id

Due Date & Time:

- Lecturer will inform the LAB03 due date and time in lab class.

Integrity Constraints

- Key Constraint
This defines that certain attributes (keys) can be used to uniquely identify rows in a table. Examples include primary keys, candidate keys, and unique keys. These constraints prevent duplication of data.

- Entity Integrity Constraint
This guarantees that every row in a table is uniquely identifiable. It requires that the primary key must have unique values and cannot contain NULL. This ensures that no two rows are identical.

- Referential Integrity Constraint
This maintains consistency between related tables. A foreign key in one table must correspond to an existing primary key in another table. It prevents invalid references, ensuring that relationships between records are always valid.

- Domain Constraint
This ensures that the values in each column must come from a predefined domain. The domain specifies *the data type, format, or range of valid values*. For example, an age field must only contain positive numbers.

- NOT NULL Constraint
This specifies whether a column cannot be NULL values. It ensures that certain critical attributes (e.g., IDs, names) must always have a value.

The SQL CREATE TABLE Statement

SQL provides the CREATE TABLE statement to create a new table in a given database. An SQL query to create a table must define the structure of a table. The structure consists of the name of a table and names of columns in the table with each column's data type. Note that each table must be uniquely named in a database.

Syntax for creating a table

```
CREATE TABLE table_name(
   column1 datatype [PRIMARY KEY| UNIQUE| NOT NULL],
   column2 datatype,
   column3 datatype,
   .....
   columnN datatype,
   [PRIMARY KEY( one or more columns ),
    UNIQUE (column),
    CHECK (condition),
    FOREIGN KEY(column) REFERENCES parent_table_name (pk_column)
     [ON DELETE reference_option]
     [ON UPDATE reference_option]]
);

reference_option:
RESTRICT | CASCADE | SET NULL
```

Creating a Table from an Existing Table

Instead of creating a new table every time, one can also copy an existing table and its contents including its structure, into a new table. This can be done using a combination of the CREATE TABLE statement and the SELECT statement. Since its structure is copied, the new table will have the same column definitions as the original table. Furthermore, the new table would be populated using the existing values from the old table.

Syntax

The basic syntax for creating a table from another table is as follows –

```
CREATE TABLE NEW_TABLE_NAME
AS
SELECT [column1, column2...columnN]
FROM  EXISTING_TABLE_NAME
WHERE Condition;
```

Here, column1, column2... are the fields of the existing table and the same would be used to create fields of the new table.

SQL – ALTER TABLE Statement

The SQL ALTER TABLE command is a part of Data Definition Language (DDL) and modifies the structure of a table. The ALTER TABLE command can add or delete columns, create or destroy indexes, change the type of existing columns, or rename columns or the table itself.

Syntax:

ADD COLUMN:

ALTER TABLE table_name ADD column_name datatype;

DROP COLUMN:

ALTER TABLE table_name DROP COLUMN column_name;

ADD PRIMARY KEY
ALTER TABLE table_name
ADD [CONSTRAINT constraint_name] PRIMARY KEY (column1, column2...);

DROP PRIMARY KEY
ALTER TABLE table_name DROP PRIMARY KEY;

ADD CONSTRAINT
ALTER TABLE table_name
ADD [CONSTRAINT constraint_name] CONSTRAINT_TYPE(column1, column2...);
Hint: CONSRAINT_TYPE: UNIQUE, CHECK, FOREIGN KEY

DROP CONSTRAINT
ALTER TABLE table_name DROP CONSTRAINT constraint_name;

Reference: https://dev.mysql.com/doc/refman/8.4/en/create-table-foreign-keys.html#foreign-key-examples

-- DML Syntax --

```
INSERT INTO table_name|view_name [(column_list)]
VALUES (value1, value2,…, value3);

INSERT INTO table_name|view_name [(column_list)]
  SELECT column(s)
  FROM table_name| view_name
  [WHERE condition(s)];

UPDATE table_name|view_name
SET  column = value [,column2 = value2,...]
[WHERE condition(s)];

DELETE table_name|view_name
[WHERE condition(s)];
```

Task 1: Using the "stdXXX" database and write SQL statements to answer the following questions.

1. Write SQL statements to create tables based on the table structure below, stored in the "stdXXX" database.
   STUDENTS

Column Name	Data Type	Constraint	Referenced Table
StudentID	INT	Primary Key	
Fname	VARCHAR(50)	NOT NULL	
Lname	VARCHAR(100)	NOT NULL	
DOB	DATE	Check (DOB < '2014-01-01')	
EMAIL	VARCHAR(100)	Check (EMAIL like '%@%')	
AdmissionDate	DATE	NOT NULL	
ProgramID	INT	Foreign Key	Program

PROGRAMS

Column Name	Data Type	Constraint	Referenced Table
ProgramID	INT	Primary Key	
ProgramCode	VARCHAR(10)	Unique, NOT NULL	
ProgramName	VARCHAR(100)	NOT NULL	
Faculty	VARCHAR(100)	NOT NULL	

2. Insert in the following data into the tables and save the data:

STUDENTS

StudentID	Fname	Lname	DOB	EMAIL	AdmissionDate	ProgramID
6691	Emi	McKinsey	2006-09-01	<NULL>	2024-07-31	1
6692	Bob	Loy	2006-12-10	<NULL>	2024-07-31	2
6693	Scott	Tiger	2006-04-25	scott@sit.com	2024-07-31	1

PROGRAMS

ProgramID	ProgramCode	ProgramName	Faculty
1	B.Sc.IT	Information Technology	School of Information Technology
2	B.Sc.CS	Computer Science	School of Information Technology
3	BA.DSI	Digital Service Innovation	School of Information Technology

3. Try to insert the given data:

StudentID	Fname	Lname	DOB	EMAIL	AdmissionDate	ProgramID
6694	Lisa	Mac	2014-03-11	<NULL>	2024-07-31	4

Can the row be inserted?
If yes, please show all rows of the STUDENTS table.
If no, please show error code and error message and explain.

No
Error Code: 3819. Check constraint 'students_chk_1' is violated.
Because ตาราง students เป็น fk ซึ่ง primary มี Program id แค่ 4 DOB ก็เกินอีกด้วย ทำให้ไม่ผ่าน Check

4. Try to insert the given data:

StudentID	Fname	Lname	DOB	EMAIL	AdmissionDate	ProgramID
6695	Mary	MacKinsey	2009-06-07	mary.sit.kmutt	2024-07-31	<NULL>

Can the row be inserted?
If yes, please show all rows of the STUDENTS table.
If no, please show error code and error message and explain.

NO
Error Code: 3819. Check constraint 'students_chk_1' is violated.
Because เพราะ Email ไม่มี @ เพราะไม่ตรงตามที่เช็ค

5. Try to insert the given data:

StudentID	Fname	Lname	DOB	EMAIL	AdmissionDate	ProgramID
6696	Mac	Donald	2010-02-11	mac@sit.kmutt	2024-07-31	<NULL>

Can the row be inserted?
If yes, please show all rows of the STUDENTS table.
If no, please show error code and error message and explain.

StudentID	FName	LName	DOB	EMAIL	AdmissionDate	ProgramID
6691	Emi	McKinsey	2006-09-01	NULL	2024-07-31	1
6692	Bob	Loy	2006-12-10	NULL	2024-07-31	2
6693	Scott	Tiger	2006-04-25	scott@sit.com	2024-07-31	1
6695	Mac	Donald	2010-02-11	mac@sit.kmutt	2024-07-31	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL

6. Try to change the program ID of student ID 6693 from 1 to 2.
   Can the row be modified?
   If no, please show error code and error message and explain.
   If yes, please show all data of student ID 6693.

StudentID	FName	LName	DOB	EMAIL	AdmissionDate	ProgramID
6693	Scott	Tiger	2006-04-25	scott@sit.com	2024-07-31	3
NULL	NULL	NULL	NULL	NULL	NULL	NULL

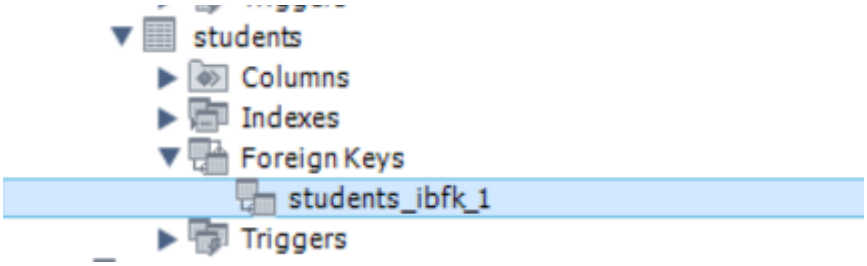
7. Try to remove the row of program ID 1 from the PROGRAMS table.
   Can the row be removed?
   If no, please show error code and error message and explain.
   If yes, what happens about the students of the program ID 1 in the STUDENTS table?

   No
   Error Code: 1451. Cannot delete or update a parent row: a foreign key constraint fails (`std025`.`students`, CONSTRAINT `students_ibfk_1` FOREIGN KEY (`ProgramID`) REFERENCES `programs` (`ProgramID`))
   Because เป็น FR ซึ่งไม่สามาลบที่เป็น PR key ได้

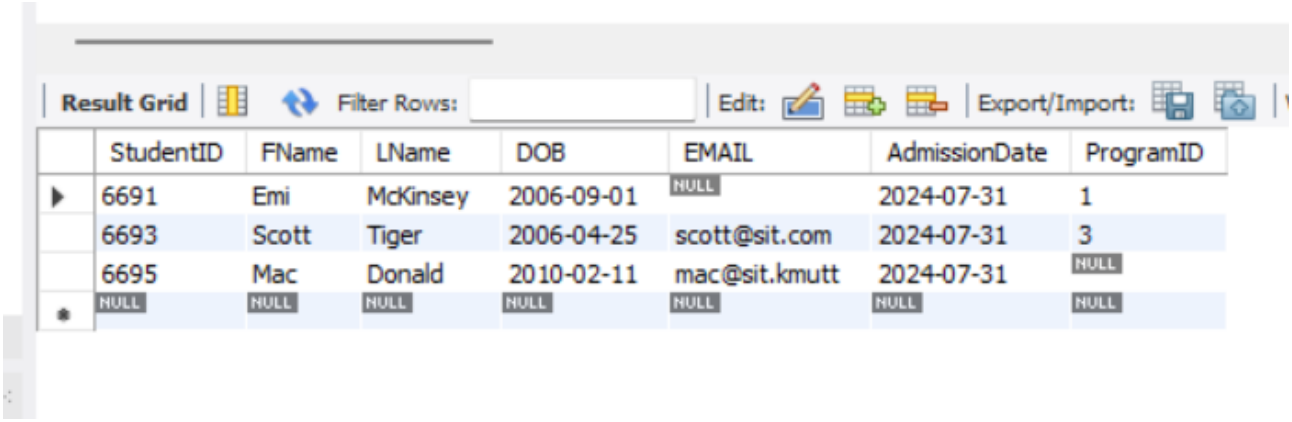
8. Try to remove the row of program ID 3 from the PROGRAMS table.
   Can the row be removed?
   If no, please show error code and error message and explain.
   If yes, what happens about the students of the program ID 3 in the STUDENTS table?

   no
   Error Code: 1451. Cannot delete or update a parent row: a foreign key constraint fails (`std025`.`students`, CONSTRAINT `students_ibfk_1` FOREIGN KEY (`ProgramID`) REFERENCES `programs` (`ProgramID`))
   Because เป็น FR ซึ่งไม่สามารรบที่เป็น PR key ได้

9. Remove the existing foreign key of the STUDENTS table and add the foreign key constraint with ON DELETE CASCADE option into the STUDENTS table. If you not specify the constraint name, what is the constraint name of FK generated by the system?



10. Try to remove the row of program ID 2 from the PROGRAM table.
    Can the row be removed?
    If no, please show error code and error message and explain.
    If yes, what happens about the students of the program ID 2 in the STUDENT table?



StudentID	FName	LName	DOB	EMAIL	AdmissionDate	ProgramID
6691	Emi	McKinsey	2006-09-01	NULL	2024-07-31	1
6693	Scott	Tiger	2006-04-25	scott@sit.com	2024-07-31	3
6695	Mac	Donald	2010-02-11	mac@sit.kmutt	2024-07-31	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL