Primary Key

A primary key constraint indicates that **a column**, or **group of columns**, can be used as a unique identifier for rows in the table. This requires that the values be **both unique and not null**.

Adding a primary key will automatically create a unique B-tree index on the column or group of columns listed in the primary key, and will force the column(s) to be marked `NOT NULL`.

A table can have **at most one primary key**. (There can be any number of unique and not-null constraints, which are functionally almost the same thing, but only one can be identified as the primary key.) Relational database theory dictates that every table must have a primary key. This rule is not enforced by PostgreSQL, but it is usually best to follow it.

Experiment 1:

One way to define Primary Key constraint

Step1: Create a new table emp, let attribution id be the primary key

> *column_name type primary key*

```
create table emp(
    id int primary key, --Primary Key constraint
    -- same as UNIQUE NOT NULL
    name varchar(30),
    salary numeric(9,2)
);
```

*Step2:*You can insert following data manipulation language (DML)

```
insert into emp values(1,'张三',3000);
insert into emp values(1,'李四',3000);
```

Step3: Insert another DML, watch the result.

```
insert into emp values(1,'王五',3000);
```

Tips: You can create primary key constraint as above format, a new name for this key will also be created at same time automatically by database system.

Experiment 2:

Another way to define Primary Key constraint

> *PRIMARY KEY (column_name)*

or you can name this primary key yourself

> *constraint pk_name PRIMARY KEY (column_name)*

Step1: Create a table emp2, let attribution id be the primary key

```
create table emp2(
    id int,
    name varchar(30),
    salary numeric(9,2),
    constraint pk_emp2 primary key(id)
);
```

Step2: Insert following records

```
insert into emp2 values(1,'张三',3000);
insert into emp2 values(2,'李四',3000);
```

Step3: Insert another record, watch the result

```
insert into emp2 values(1,'李四',3000);
```

Experiment 3:

Define Union Primary Key constraint

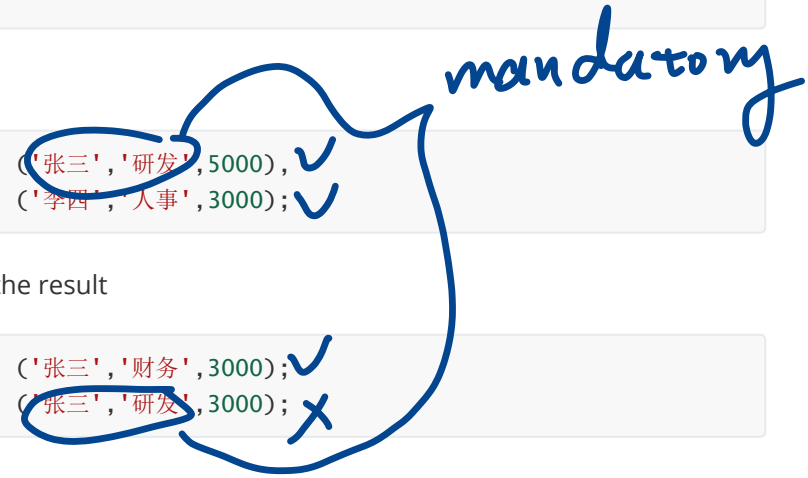
When the primary key is a union, only when every column in the union is the same, will two attributes be regarded as mandatory

> *PRIMARY KEY (column_name1, column_name2, ...)*

Step1: Create a table emp_union, let attribution id be the primary key

```
create table emp_union(
    name varchar(30),
    dep varchar(20),
    salary numeric(9,2),
    primary key(name, dep)
);
```

Step2: Insert following records




```
insert into emp_union values ('张三','研发',5000),
                             ('李四','人事',3000);
```

Step2: Test following DML, watch the result

```
insert into emp_union values ('张三','财务',3000);
insert into emp_union values ('张三','研发',3000);
```

Experiment 4:

Primary Key VS UNIQUE NOT NULL

Step1: Create follow tables, and contrast the results

```
create table emp_pk(
id int primary key ,
name varchar(30) primary key ,
salary numeric(9,2)
);

create table emp_unu(
id int unique not null ,
name varchar(30) unique not null,
salary numeric(9,2)
);

create table emp_pk_unu(
id int primary key ,
name varchar(30) unique not null,
salary numeric(9,2)
);
```

Foreign Key

A foreign key constraint specifies that the values in **a column (or a group of columns)** must match the values appearing in some row of **another table**.

Experiment 5:

One way to define Foreign Key constraint

> *column_name type REFERENCES another_table(column_name2)*

Step1: Create the "another" table, and add some records

```
create table dept(
    id int primary key,
    name varchar(40)
);

insert into dept values(1, '开发部');
insert into dept values(2, '测试部');
```

Step2: Create a table with a foreign key

```
create table emp5(
    id int primary key,
    name varchar(30),
    salary numeric(9,2),
    deptId int REFERENCES dept(id)
);
```

Step3: Insert some records, watch how foreign key works

```
insert into emp5 values(1,'张三',3000,1);
insert into emp5 values(2,'李四',3000,3);
```

Tips: You can create foreign key constraint as above format, a new name for this key will also be created at same time automatically by database system.

Experiment 6:

Another way to define Foreign Key constraint

> *constraint fk_name foreign key(column_name1) REFERENCES another_table(column_name2)*

Step1： Create a table with foreign key also reference to dept table column id

```
create table emp6(
    id int primary key,
    name varchar(30),
    salary numeric(9,2),
    deptId int,
    constraint fk_dept FOREIGN KEY(deptId) references dept(id)
);
```

Step2: Add following records, and watch the result

```
insert into emp6 values(1,'张三',3000,1);
insert into emp6 values(2,'李四',3000,3);
```

Tips: You can name foreign key yourself in this create method.

Tips: A foreign key can also constrain and reference a group of columns. As usual, it then needs to be written in table constraint form. Here is a contrived syntax example

```
CREATE TABLE t1 (
  a integer PRIMARY KEY,
  b integer,
  c integer,
  FOREIGN KEY (b, c) REFERENCES other_table (c1, c2)
);
```

Tips: Primary key/foreign key is a kind of index, could improve efficiency of query

---

NOT NULL, UNIQUE, DEFAULT, CHECK

A not-null constraint simply specifies that a column must not assume the null value.

Unique constraints ensure that the data contained in **a column**, or **a group of columns**, is unique among all the rows in the table.

A check constraint is the most generic constraint type. It allows you to specify that the value in a certain column must satisfy a **Boolean (truth-value) expression**.

Experiment 7:

NOT NULL constraint

*Step*1: Create a new table with NOT NULL constraint

```
create table emp7(
id int primary key,
name varchar(30) not null,
salary numeric(9,2)
);
```

Step2: Add some records, and watch the result with "select * from ..."

```
insert into emp7 values(1,'张三',3000);
insert into emp7 values(2,null,3000);
select * from emp7;
```

Experiment 8:

UNIQUE constraint

Step1: Create a table with UNIQUE constraint and NOT NULL constraint.

```
create table emp8(
    id     int primary key,
    name   varchar(30) not null,
    phone  varchar(30) unique,
    salary numeric(9, 2)
);
```

Step2: Add some records, watch the contrast of result

```
insert into emp8 values(1, '张三','13611111111',3000);
insert into emp8 values(2, '李四','13611111111',3000);
insert into emp8 values(3, '王五',null,3000);
insert into emp8 values(4, '罗六',null,3000);
insert into emp8 values(null, '庄七','13622222222',3000);
select * from emp8;
```

Tips: For UNIQUE constraint, you can insert NULL value, what's more, many NULL values; but for primary key, NULL value is illegal; here can be many UNIQUE constraints, but only one Primary key.

Tips: The following syntax is also legal.

```
CREATE TABLE products (
    product_no integer,
    name text,
    price numeric,
    UNIQUE (product_no)
);
```

```
CREATE TABLE example (
    a integer,
    b integer,
    c integer,
    UNIQUE (a, c)
);
```

Experiment 9:

CHECK constraint

Step1: Create a table with check constraint

```
create table emp9(
    id int primary key,
    name varchar(30) ,
    phone varchar(30) ,
    salary numeric(9,2) CHECK ( salary>0 )
);
```

Step2: Add some records, and watch the result.

```
insert into emp9 values(1, '张三','13611111111',3000);
insert into emp9 values(2, '李四','13611111111',-3000);
```

Tips: You can also name a check constraint a separate name using following syntax

```
CREATE TABLE products (
    product_no integer,
    name text,
    price numeric CONSTRAINT positive_price CHECK (price > 0 and price<=100000)
);
```

Tips: A check constraint can also refer to several columns.

```
CREATE TABLE products (
    product_no integer,
    name text,
    price numeric CHECK (price > 0),
    discounted_price numeric CHECK (discounted_price > 0),
    CHECK (price > discounted_price)
);
```

Experiment 10:

DEFAULT constraint

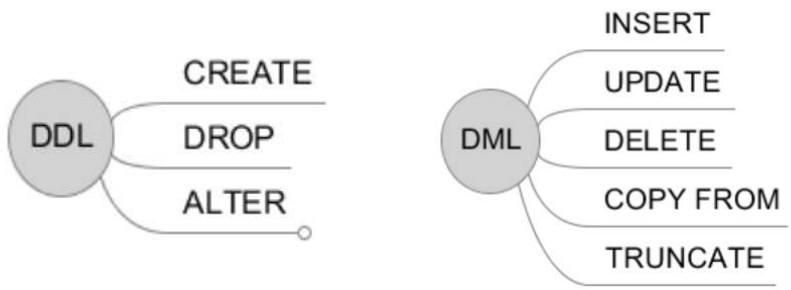
Step1: Create a table with check constraint

```
create table emp10(
    id int primary key,
    name varchar(30) not null,
    salary numeric(9,2) default 0.0
);
```

Step2: Add some records, and watch the result.

```
insert into emp10(id, name) values(1,'张三');
insert into emp10(id, name, salary) values(2,'李四',3000);
select * from emp10;
```

DDL vs DML



DML

Data manipulation language: **insert, update, delete, truncate**

Using the following table

```
create table emp10(

id int primary key,

name varchar(30) not null,

salary numeric(9,2) default 0.0

);

insert into emp10(id, name) values(1,'张三');

insert into emp10(id, name, salary) values(2,'李四',3000);

select * from emp10;
```

```
drop table emp;

drop table dept;

create table dept(

id int primary key,

name varchar(40)

);

create table emp(

id int primary key,

name varchar(30),

salary numeric(9,2),

deptId int references dept(id)
```

Experiment 11:

Insert— create new rows in a table

> *INSERT INTO table(...) VALUES(..);*

https://www.postgresql.org/docs/current/sql-insert.html

Tips: When inserting a lot of data at the same time, consider using the COPY command. It is not as flexible as the INSERT command, but is more efficient.

Experiment 12:

Update— update rows of a table

> *UPDATE table SET ...;*

https://www.postgresql.org/docs/current/sql-update.html

```
UPDATE dept SET name='市场部' where id=4;
```

Tips: To update existing rows, use the UPDATE command. This requires three pieces of information:

1. The name of the table and column to update
2. The new value of the column
3. Which row(s) to update

Experiment 13:

Delete— delete rows of a table

DELETE FROM table WHERE ...;

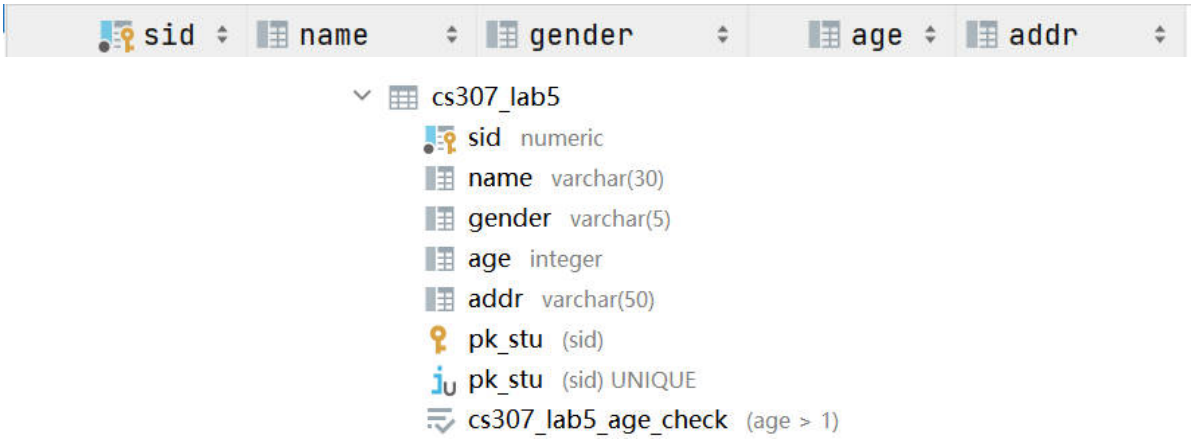
https://www.postgresql.org/docs/current/sql-delete.html

```
DELETE FROM dept WHERE name='市场部';

DELETE FROM dept;
```

Tips: You can also remove groups of rows matching a condition, or you can remove all rows in the table at once.

Experiment 14

Step1:**Create** a table with table head and suitable constraint as follow



Step2:**INSERT** some records into the table created in step1, ;

Step3: **UPDATE** some data in the table

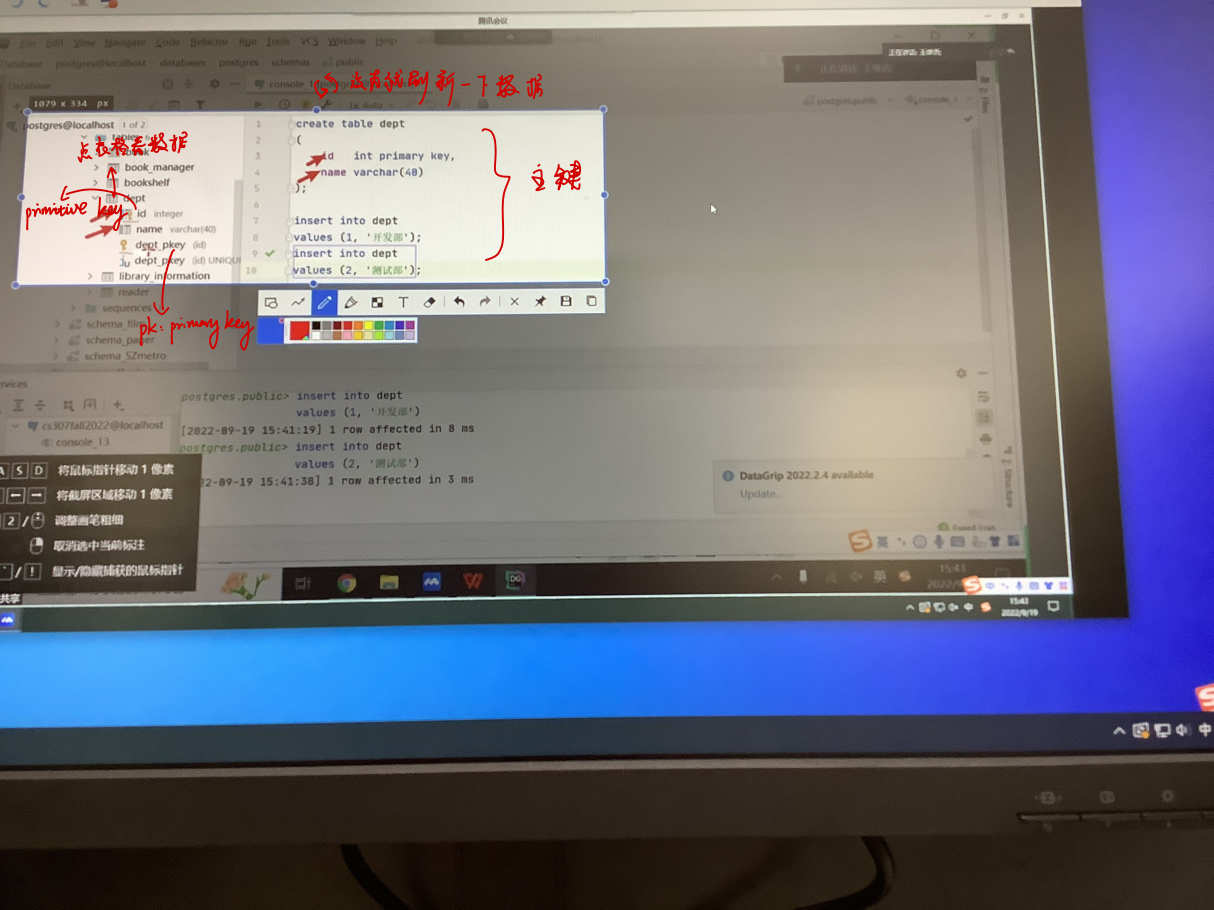
Step4:**DELETE** one record

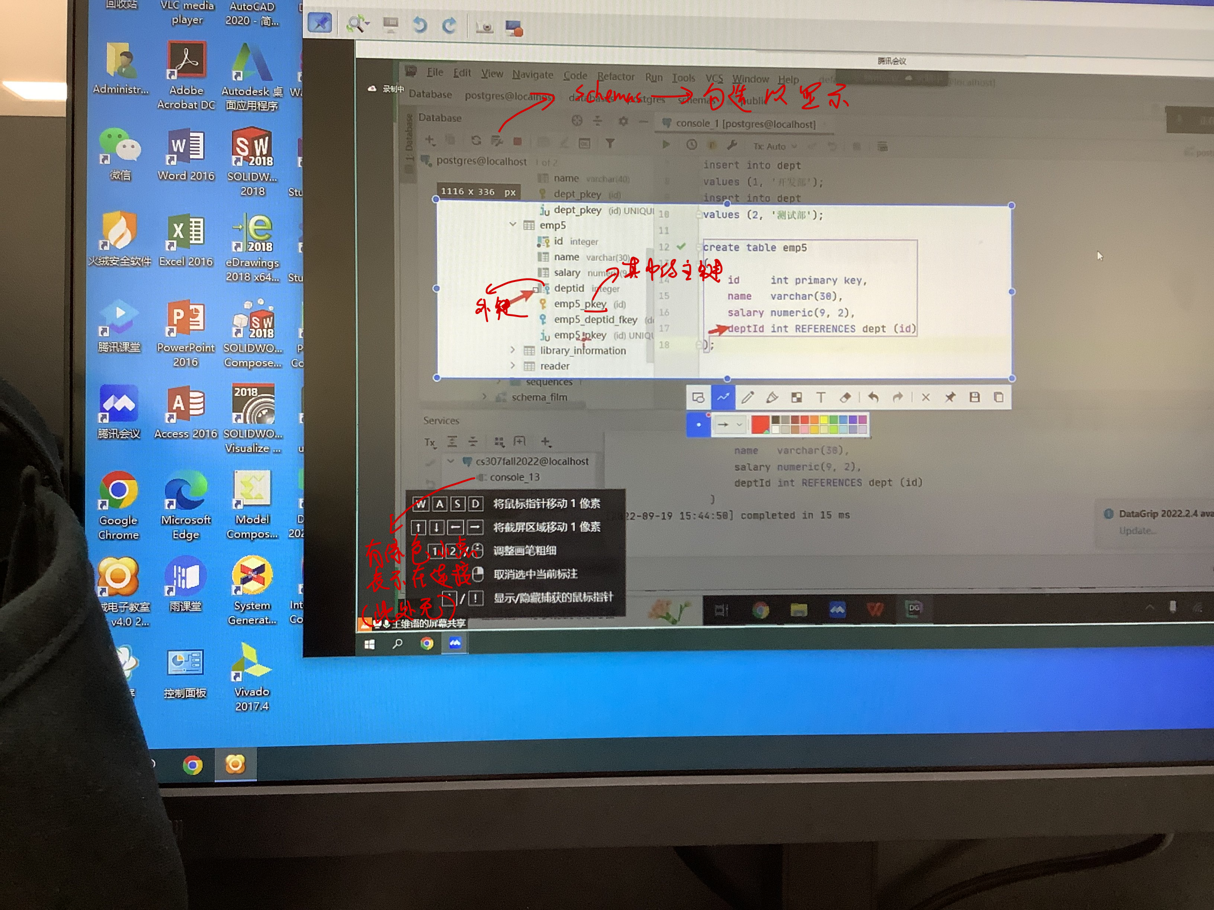
Step5:**TRUNCATE** the whole table

example:

```
CREATE table cs307_lab5
(
    sid    numeric,
    name   varchar(30),
    gender varchar(5),
    age    int check ( age > 1 ),
    addr   varchar(50),
    constraint pk_stu primary key (sid)
);

insert into cs307_lab5
values (1, 'zhangsan', 'M', 19, 'department 9'),
       (3, 'lisi', 'F', 18, 'joy land');
```

```
UPDATE cs307_lab5 set age=19 where name='lisi';

DELETE from cs307_lab5 where name='lisi';

TRUNCATE cs307_lab5;
```


postgres@localhost
book_manager
bookshelf
dept
id integer
name varchar(40)
dept_pkey (id)
dept_pkey (id) UNIQUE
library_information
reader
sequences
schema_film
schema_park
schema_SZmetro
create table dept
(
id int primary key,
name varchar(40)
);
insert into dept
values (1, '开发部');
insert into dept
values (2, '测试部');
主键
primitive key
pk: primary key
postgres.public> insert into dept
values (1, '开发部')
[2022-09-19 15:41:19] 1 row affected in 8 ms
postgres.public> insert into dept
values (2, '测试部')
[2022-09-19 15:41:38] 1 row affected in 3 ms
DataGrip 2022.2.4 available
Update...
将鼠标指针移动 1 像素
将截屏区域移动 1 像素
调整画笔粗细
取消选中当前标注
显示/隐藏捕获的鼠标指针



File Edit View Navigate Code Refactor Run Tools VCS Window Help
Database postgres@localhost
schemas → 勾选以显示
console_1 [postgres@localhost]
postgres@localhost
1116 x 336 px
name varchar(40)
dept_pkey (id)
dept_pkey (id) UNIQU
emp5
id integer
name varchar(30)
salary
deptid integer
emp5_pkey (id)
emp5_deptid_fkey
emp5_pkey (id) UNIQ
library_information
reader
sequences
schema_film
其中的主键
外键
insert into dept
values (1, '开发部');
insert into dept
values (2, '测试部');
create table emp5
id int primary key,
name varchar(30),
salary numeric(9, 2),
deptId int REFERENCES dept (id)
);
Services
cs307fall2022@localhost
console_13
将鼠标指针移动 1 像素
将截屏区域移动 1 像素
调整画笔粗细
取消选中当前标注
显示/隐藏捕获的鼠标指针
2022-09-19 15:44:50] completed in 15 ms
DataGrip 2022.2.4 ava
Update...