

CS213

Principles of Database Systems(H)

Chapter 8 Update, Delete, Function, Procedure

Shiqi YU 于仕琪

yusq@sustech.edu.cn

Most contents are from Stéphane Faroult's slides

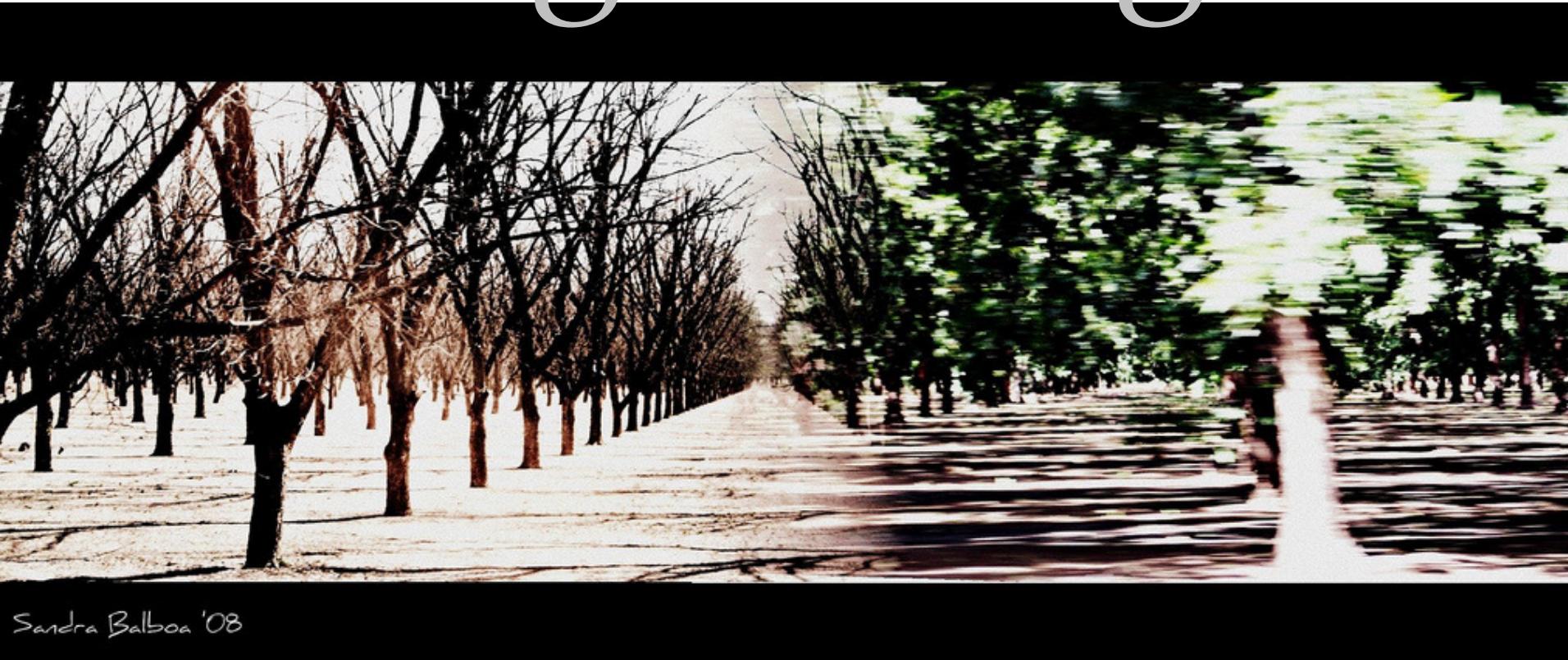
8.1 Update

Shiqi Yu 于仕琪

yusq@sustech.edu.cn

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Things change ...



We have talked about inserting data, lets' now see how we can update what is in the database.

Update is the command than changes column values. You can even set a non-mandatory column to NULL. The change is applied to all rows selected by the WHERE.



```
update table_name  
set column_name = new_value  
      other_col = other_val,  
...  
where ...
```

```
update us_movie_info  
set title = replace(title, "", "")
```

Without a WHERE all rows are affected.

A nobiliary particle is used in a surname or family name in many Western cultures to signal the nobility of a family.

John von Neumann



We may want to modify some names in such a way as they sort as they should.

```
update people
set surname = substr(surname, 4)
    || ' (von)'
where surname like 'von %'
```

This could be used to postfix all surnames starting by 'von' with '(von)' and turn for instance 'von Stroheim' into 'Stroheim (von)'

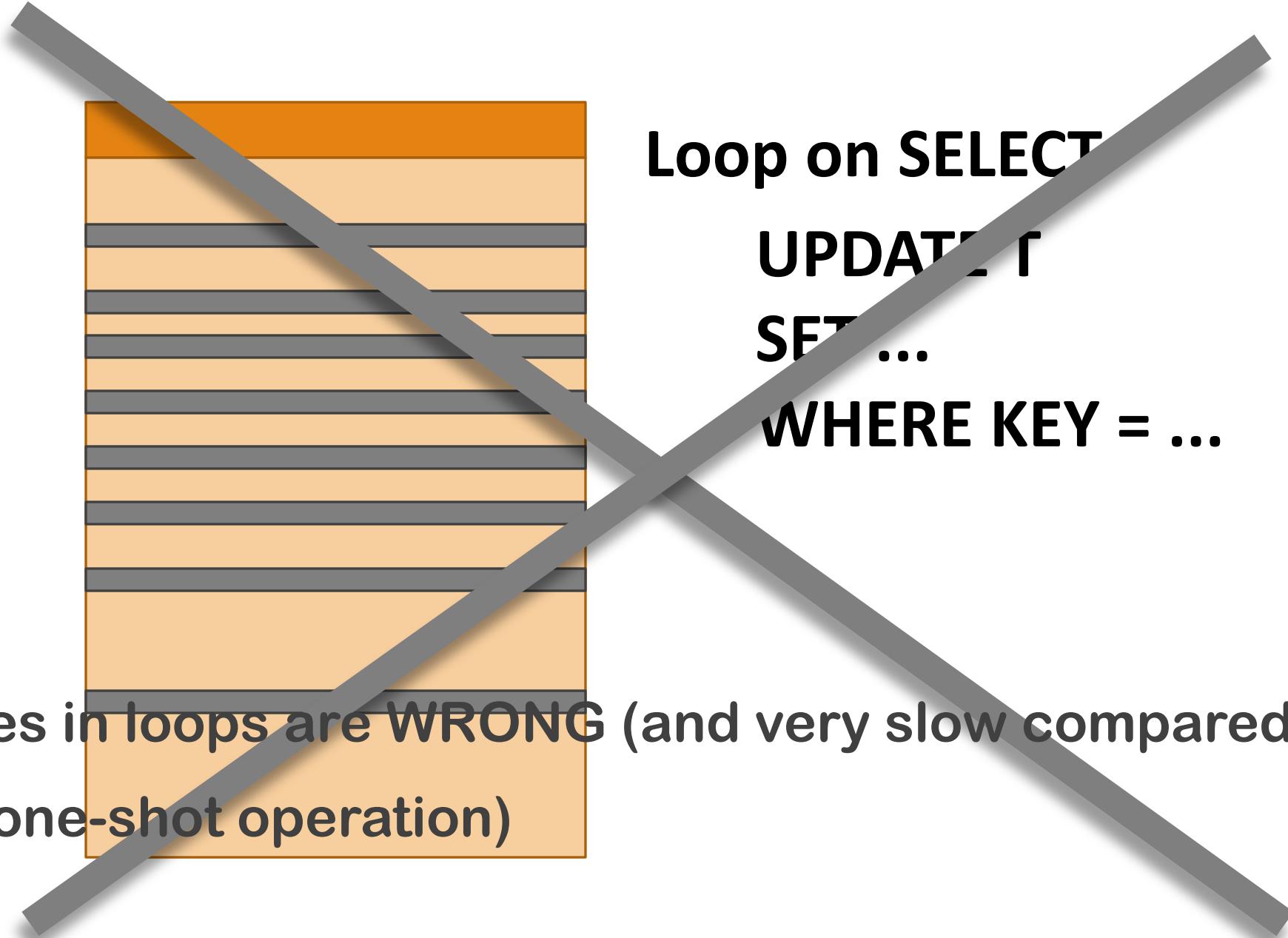


~~row~~

update

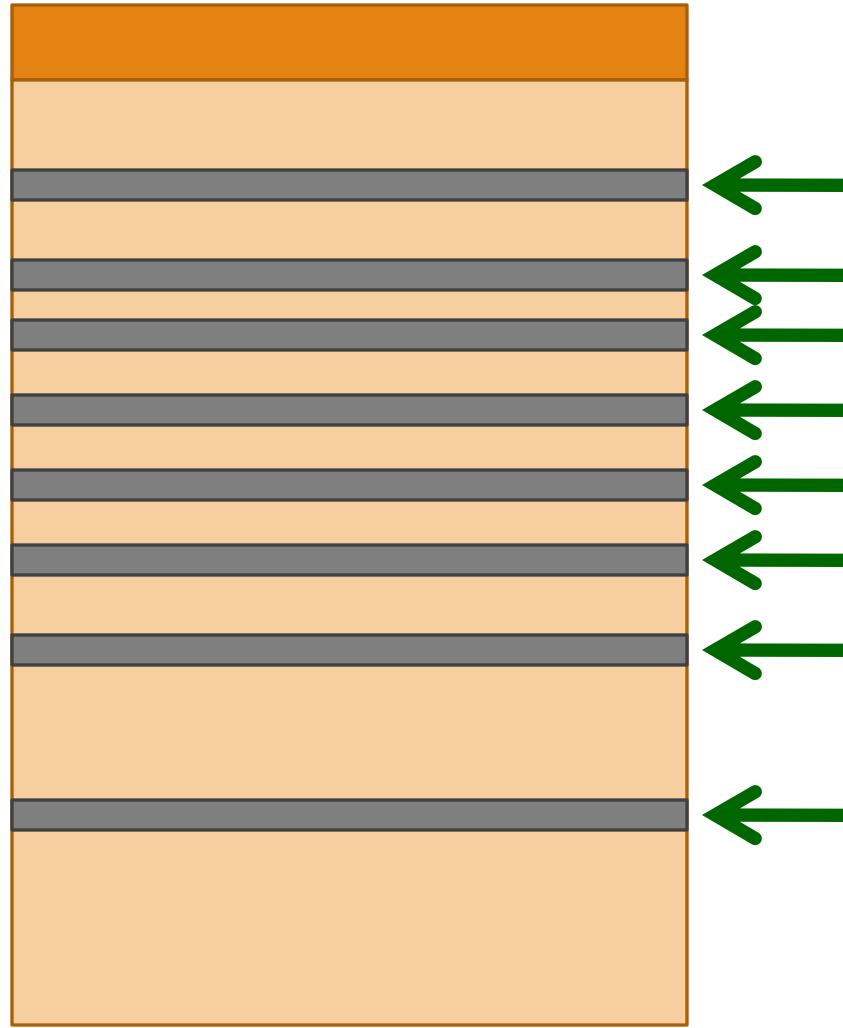
set

A very important point to remember is that UPDATE is a SET operation. The set may contain 1, or 1,000,000 or 0 rows.



**Loop on SELECT
UPDATE T
SET ...
WHERE KEY = ...**

Updates in loops are **WRONG** (and very slow compared to the one-shot operation)



**UPDATE T
SET ...
WHERE ...**

Think massive operations.

movies_2

us movies info

title	year_released	duration	color

Updates can be subtle when you want to update a table with data coming from another table.

Like a join in a select ...
... same issues
with nulls
and duplicates !

movieid	title	country	year_released	duration	color	us_movies_info																				
1234	Wo Shi Li Huanying	cn	2021	120	Y	<table><thead><tr><th>title</th><th>year_released</th><th>duration</th><th>color</th></tr></thead><tbody><tr><td>Wo Shi Li Huanying</td><td>2021</td><td>120</td><td>Y</td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></tbody></table>	title	year_released	duration	color	Wo Shi Li Huanying	2021	120	Y												
title	year_released	duration	color																							
Wo Shi Li Huanying	2021	120	Y																							

Not found ?  SQLite

```
update movies_2
set duration = (select duration
                 from us_movie_info i
                 where i.title = movies_2.title
                   and i.year_released = movies_2.year_released) ,
color = (select case color
            when 'C' then 'Y'
            when 'B' then 'N'
            end color
           from us_movie_info i
           where i.title = movies_2.title
             and i.year_released = movies_2.year_released)
where country = 'us'
  and exists (select null
              from us_movie_info i2
              where i2.title = movies_2.title
                and i2.year_released = movies_2.year_released)
```

NULL

As subqueries can return NULL, you must be certain to only affect rows in your scope.

```
update movies_2
set duration = (select duration
                 from us_movie_info i
                 where i.title = movies_2.title
                   and i.year_released = movies_2.year_released)
color = (select case color
               when 'C' then 'Y'
               when 'B' then 'N'
             end color
            from us_movie_info i
            where i.title = movies_2.title
              and i.year_released = movies_2.year_released)
where country = 'us'
      and exists (select null
                  from us_movie_info i2
                  where i2.title = movies_2.title
                    and i2.year_released = movies_2.year_released)
```

Three Queries
per row
processed

Not madly efficient; all subqueries are correlated (for the third query SQLite now supports the same as Oracle - next slide).

```
update movies_2
set (duration, color) =
  (select duration,
         case color
             when 'C' then 'Y'
             when 'B' then 'N'
         end color
      from us_movie_info i
     where i.title = movies_2.title
       and i.year_released = movies_2.year_released)
  where country = 'us'
    and exists (select null
                 from us_movie_info i2
                where i2.title = movies_2.title
                  and i2.year_released = movies_2.year_released)
```

run for each retrieved row

Oracle and DB2 both support
subqueries returning several columns
(SQLite also now).

```
update movies_2
set (duration, color) =
  (select duration,
         case color
             when 'C' then 'Y'
             when 'B' then 'N'
         end color
    from us_movie_info i
   where i.title = movies_2.title
     and i.year_released = movies_2.year_released)
  where country = 'us'
    and (m.title, m.year_released)
      in (select title, year_released
            from us_movie_info)
```

run for each retrieved row

Once

Oracle and DB2 both support
subqueries returning several columns
(SQLite also now).



```
update movies_2
set duration = i.duration,
color = case i.color
    when 'C' then 'Y'
    when 'B' then 'N'
end
from us_movie_info i
where i.title = movies_2.title
and i.year_released = movies_2.year_released
and movies_2.country = 'us'
```

⌘ Join

SQL Server and PostgreSQL both support the same older-join type of syntax allowing to join the updated table to the one from which we are getting data.



```
update movies_2 m
    inner join us_movie_info i
        on i.title = m.title
        and i.year_released = m.year_released
    set m.duration = i.duration,
        m.color = case i.color
            when 'C' then 'Y'
            when 'B' then 'N'
        end
    where m.country = 'us'
```

MySQL allows a join with the newer syntax.

What can happen when join conditions are

WRONG!

When you have a **SELECT** wrong, it only affects your query. When you have an **UPDATE** wrong, you can corrupt the database and later correct queries on wrong data will return wrong results.

So you really need to be extra careful.

movies_2

us_movie_info

title \longleftrightarrow **title**

year_released \longleftrightarrow **year_released**

country = 'us'

Imagine for instance that we forget the join on the year and that we have remakes. What will happen?

movies_2



us_movie_info



Let's first say that we only have remakes in the table that we update.

Running a SELECT shows what happens.

```
select m.title, m.year_released,  
       i.year_released, i.duration, i.color  
  from movies_2 m  
  inner join us_movie_info i  
    on i.title = m.title  
   where m.title like 'Treasure%'
```

One row from the source table will be associated with both films.

title	year_released	year_released	duration	color
-------	---------------	---------------	----------	-------

Treasure Island	1934	1934	103	B
Treasure Island	1950	1934	103	B



movies_2

us_movie_info

movies_2



us_movie_info



Now let's see what happens if we have remakes in the source table, but not in the one that we update

Once again, a SELECT shows what happens.

```
select m.title, m.year_released,  
       i.year_released, i.duration, i.color  
  from movies_2 m  
  inner join us_movie_info i  
    on i.title = m.title  
   where m.title = 'King Kong'
```

The same row will be updated twice. What will remain is the last update. Heads or tails?

title	year_released	year_released	duration	color
King Kong	1976	1933	100	B
King Kong	1976	1976	134	C



movies_2

us_movie_info

Subquery

```
update movies_2  
set duration =  
(select duration  
from us_movie_info i  
where i.title = movies_2.title)
```

...

Join

2 rows

↑
FAILURE

Note that a subquery returning more than one row would generate an error.

title	year_released	year_released	duration	color
King Kong	1976	1933	100	B
King Kong	1976	1976	134	C



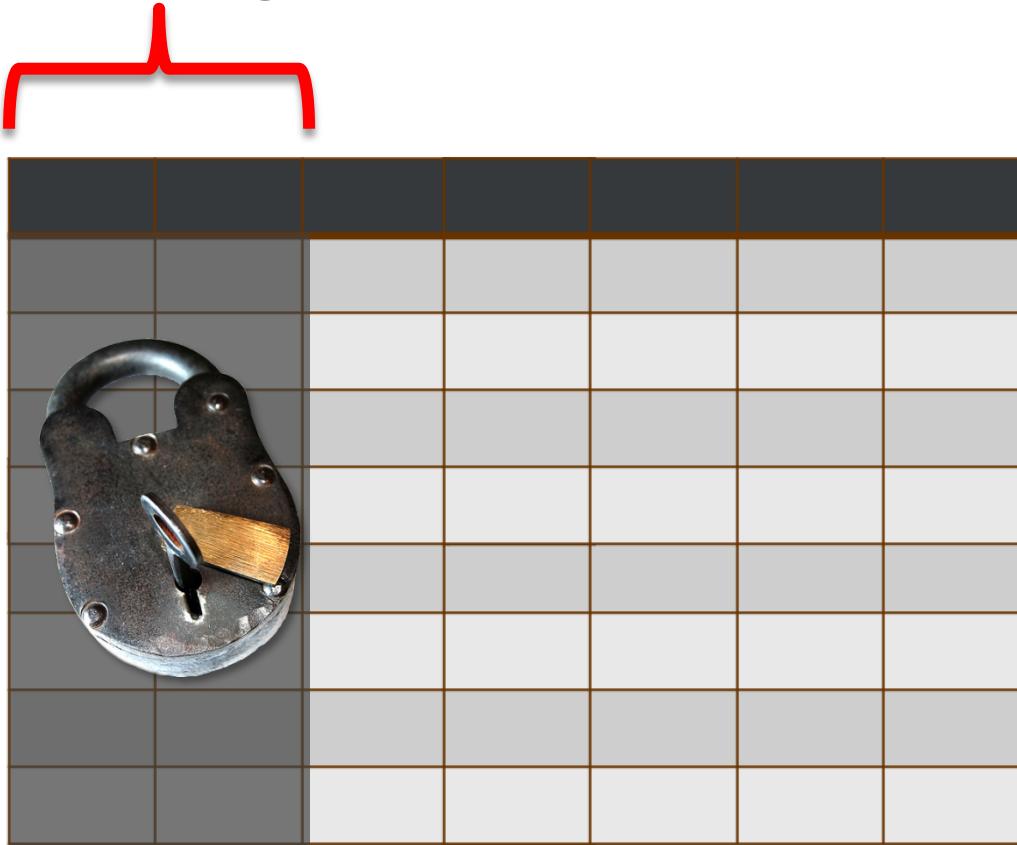
A join won't fail, and just update randomly.

Primary Key

Surname	Firstname	Birthdate	Picture
Hepburn	A STOP	4-May-1929	
Katharine			

You are reminded that if a regular attribute can be updated, it's usually forbidden to update a key - it's the identifier. You cannot change an identifier. You can only delete the row and insert another.

Primary Key



Update-wise, a primary key is locked.

Off-limits.



```
merge into movies_2 m
using (select 'us' as country,
            title,
            year_released,
            duration,
            case color
                when 'C' then 'Y'
                when 'B' then 'N'
            end as color
        from us_movie_info) i
    on (i.country = m.country
    and i.title = m.title
    and i.year_released = m.year_released)
when matched then
    update
        set m.duration = i.duration,
            m.color = i.color
when not matched then
    insert(title, year_released, country, duration, color)
        values(i.title, i.year_released, i.country, i.duration, i.color)
```

Update or Insert

An interesting operation would be to update a film we know, and insert it if we don't. That's the purpose of MERGE.

Update or Insert

```
insert into movies_2(title, year_released,  
                     country, duration, color)  
select title, year_released, country, duration, color  
from (select title,  
          year_released,  
          'us' as country,  
          duration,  
          case color  
              when 'C' then 'Y'  
              when 'B' then 'N'  
          end color  
       from us_movie_info) i  
on duplicate key update  
movies_2.duration = i.duration,  
movies_2.color = i.color
```

MySQL can catch an insert that fails because the row is already here, and turn on the fly the insert into an update.



Update or Insert

```
insert or replace into movies_2(title, year_released,  
                                country, duration, color)  
select title, year_released, country, duration, color  
from (select title,  
          year_released,  
          'us' as country,  
          duration,  
          case color  
            when 'C' then 'Y'  
            when 'B' then 'N'  
          end color  
       from us_movie_info) i
```

SQLite allows something similar with a simpler (but less flexible) syntax.
Beware, because it deletes a row and creates a new one, foreign keys may not like it.

Update



```
insert into movies_2(title, year_released, country,  
duration, color)  
select i.title, i.year_released, 'us', i.duration,  
case i.color  
when 'C' then 'Y'  
when 'B' then 'N'  
end  
from us_movie_info i  
left outer join movies_2 m  
on m.title = i.title  
and m.year_released = i.year_released  
and m.country = 'us'  
where m.movieid is null
```

then Update ~~or~~ Insert

When none of the above is available, you should try to update, and if nothing is affected insert.

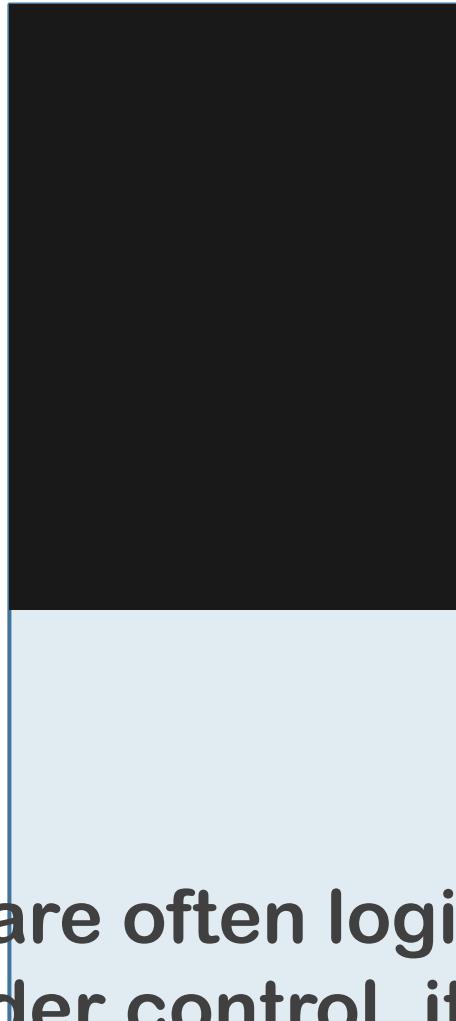
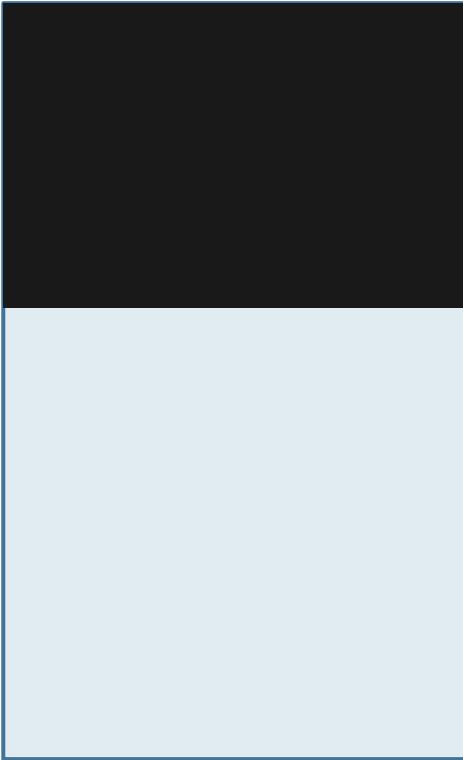
8.2 Delete

Shiqi Yu 于仕琪

yusq@sustech.edu.cn

history_table

operational_table



I have told you that deletions are often logical (flagged rows). However, to keep volumes under control, it's frequent to copy old rows to a history table, then delete them from the "active" table.

delete from table_name
where ...

If you omit the WHERE clause, then (as with UPDATE)
the statement affects all rows and you

Empty table_name !

But of course you NEVER work in autocommit mode and always
execute a big update or delete in a transaction, don't you?



rollback

That's when you feel
grateful for some
features



As `DELETE` saves data for rollback before removing it, it can be slow. There is a `TRUNCATE` (without a `WHERE` clause) that cannot be rolled back and is far more efficient. It's better not to use it.

Constraints

= **guarantee**

One important point with constraints (foreign keys in particular) is that they guarantee that data remains consistent. They don't only work with INSERT, but with UPDATE and DELETE as well.

Try to delete rows from table **countries**

For instance, you can delete a country for which there are no movies. As soon as you have one movie, you are prevented from deleting the country otherwise the foreign key on table MOVIES would no longer work for films from that country.

To delete the row for China in table countries.

The constraint will prevent you to do that.

1 ! `delete from countries where country_code='cn';`

[23503] ERROR: update or delete on table "countries" violates foreign key constraint "movies_country_fkey" on table "movies"
详细: Key (country_code)=(cn) is still referenced from table "movies".

movies

countries

credits

people

This is why constraints are so important: they ensure that whatever happens, you'll always be able to make sense of ALL pieces of data in your database.

8.3 Functions

Shiqi Yu 于仕琪

yusq@sustech.edu.cn

Build-in functions:

lower()

upper()

substring()

trim()

...

Functions

Most DBMS (the exception is SQLite, not a true DBMS) implement a built-in, SQL-based programming language, that can be used when a declarative language is no longer enough. Let's start with the simplest thing, defining functions.

Sort ??

first_name	surname
Erich	von Stroheim

I gave an update example in which I was modifying every name starting with 'von ' so that they sort properly.

```
select first_name || '' || surname as full_name  
from people;
```

Erich Stroheim (von)

Sorting is one thing, but if I ever want to display the full name of a person by concatenating first_name and surname, it will look weird for von Stroheim. What I really want to see is

Erich von Stroheim



first name?

```
case when first_name is null then ''  
else   first_name || ''  
end  
|| case position('(' in surname)  
when 0 then surname  
else      trim(')' from      substr(surname,  
                                         position('(' in surname) + 1) )  
|| ''  
|| trim(substr(surname, 1,  
                position('(' in surname) - 1))  
end full_name
```

Left parenthesis?

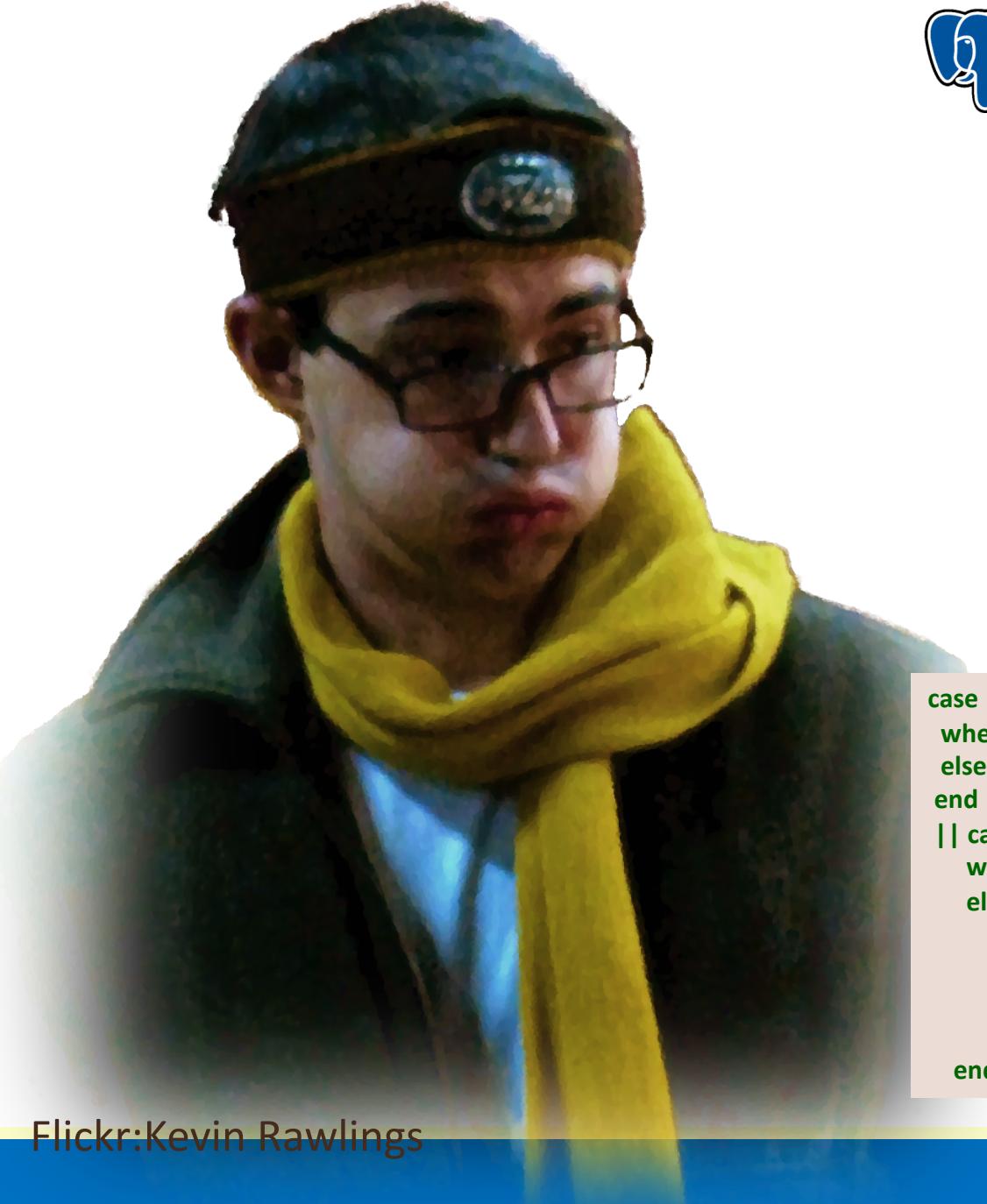
first_name

surname

Erich

Stroheim (von)

Erich von Stroheim



Needless to say, whenever you have painfully written something as complicated, which is pretty generic, you'd rather not copy and paste the code every time you need it.

```
case
when first_name is null then ""
else first_name || ''
end
|| case position('(' in surname)
when 0 then surname
else trim(')' from substr(surname,
position('(' in surname) + 1))
|| ''
|| trim(substr(surname, 1,
position('(' in surname) - 1))
end full_name
```

STORE FOR REUSE

You'd like to store the expression and reuse it in another context. In fact you can.

Here is a PostgreSQL example

```
create function full_name(p_fname varchar, p_sname varchar)
returns varchar
as $$

begin
    return case
        when p_fname is null then ''
        else p_fname || ''
    end |
    case position('(' in p_sname)
        when 0 then p_sname
        else trim('0' from substr(p_sname,
                                position('(' in p_sname) + 1))
                || ''
                || trim(substr(p_sname, 1,
                                position('(' in p_sname) - 1)))
    end;
end;
$$ language plpgsql;
```

```
select full_name(first_name, surname) as name,  
       born, died  
  from people  
 order by surname
```

Once your function is created, you can use it as if it were any built-in function.

Note that you usually have to write your functions in the provided language for safety: a badly coded C function could take down a whole server, corrupt data, etc. The provided language provides a kind of sand-boxed environment.

Procedural extensions to SQL



T-SQL



(no name)

ORACLE®

PL/SQL

PostgreSQL



PL/PGSQL

IBM® DB2®

SQL PL



nothing ...

You can use C or any language with SQLite. If you crash your program, it only affects you.

Procedural ?

variables

conditions

loops

arrays

error management

Procedural extensions provide all the bells and whistles of true programming languages (they were often inspired by programming languages such as PL/I or ADA). They are a mixed blessing, because they often incite programmers to do the wrong things with them.

... TRUE PROGRAMMING LANGUAGE

They also support all DML statements (no always DDL, but you can cheat)

```
select col1, col2, ...  
into local_var1, local_var2, ...  
from ...
```

+ CURSORS

To retrieve data from the database into your variables, you can use `SELECT ... INTO ...` if your query returns a single row, or you can use cursors, which are basically "row variables" that are used for iterating over what a query returns.



Cultural mismatch

row-by-row

set processing

And here we have a problem,
because there is a big cultural gap
between the relational mindset
and procedural processing.

Bad example

In the category "never, ever do that even if you encounter it often" there is the infamous "look-up" function that returns for instance the label associated with a value.

Because it's a procedure stored inside the database, many developers believe in good faith that's how things should be done. Definitely no.

```
select country_name(country_code), title, ...
from movies
where ...
```

```
create function country_name(p_code varchar2)
return countries.country_name%type
as
  v_name  countries.country_name%type;
begin
  select country_name
  into v_name
  from countries
  where country_code = p_code;
  return v_name;
end;
```

NO

```
select c.country_name, m.title, ...
from movies m
    inner join countries c
        on c.country_code = m.country
where ...
```

Why is it bad? You can retrieve the same data with a join. I have hardly talked about the query optimizer so far but there are many ways to perform a join, some of which are particularly efficient on big volumes. A look-up function forces a "one row at a time" join which in most cases will be dreadful. A function shouldn't query the database.

SQL FIRST!



Tom Kyte, who is Senior Technology Architect at Oracle, says that his mantra is:

- You should do it in a single SQL statement if at all possible.
- If you cannot do it in a single SQL statement, then do it in PL/SQL (as little PL/SQL as possible!)

What Prof. Yu says:

- You should ask for help from someone more experienced than you, Google, forums, etc.