



CS213

Principles of Database Systems(H)

Chapter 8

Update, Delete, Function, Procedure

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Most contents are from Stéphane Faroult's slides



8.1 Update

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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

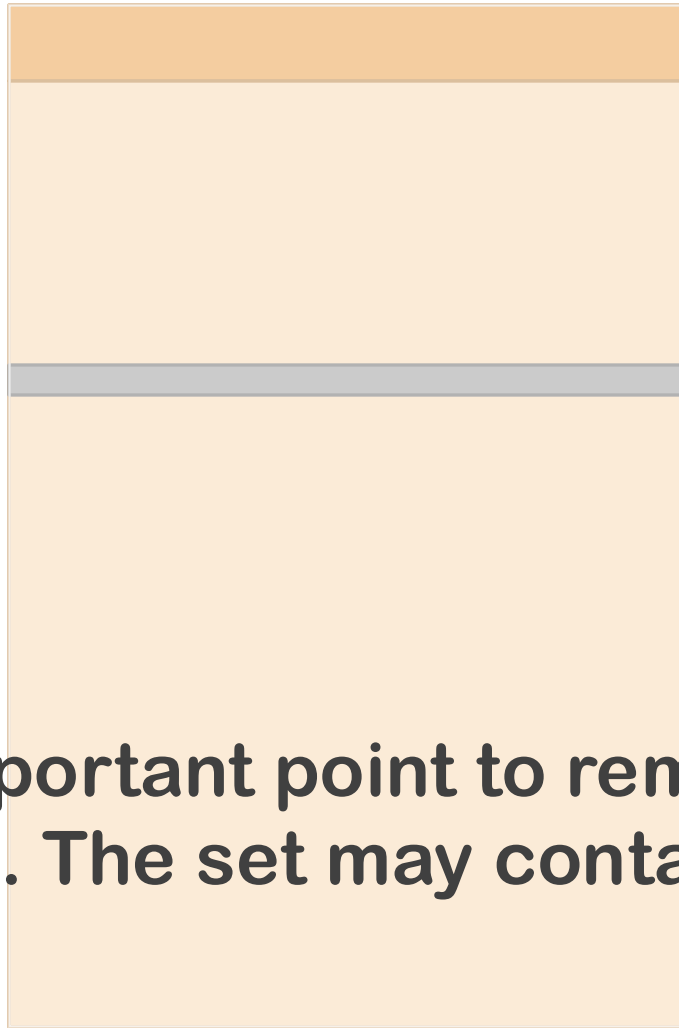


We may want to modify some names in such a way as they sort as they should.

```
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)'



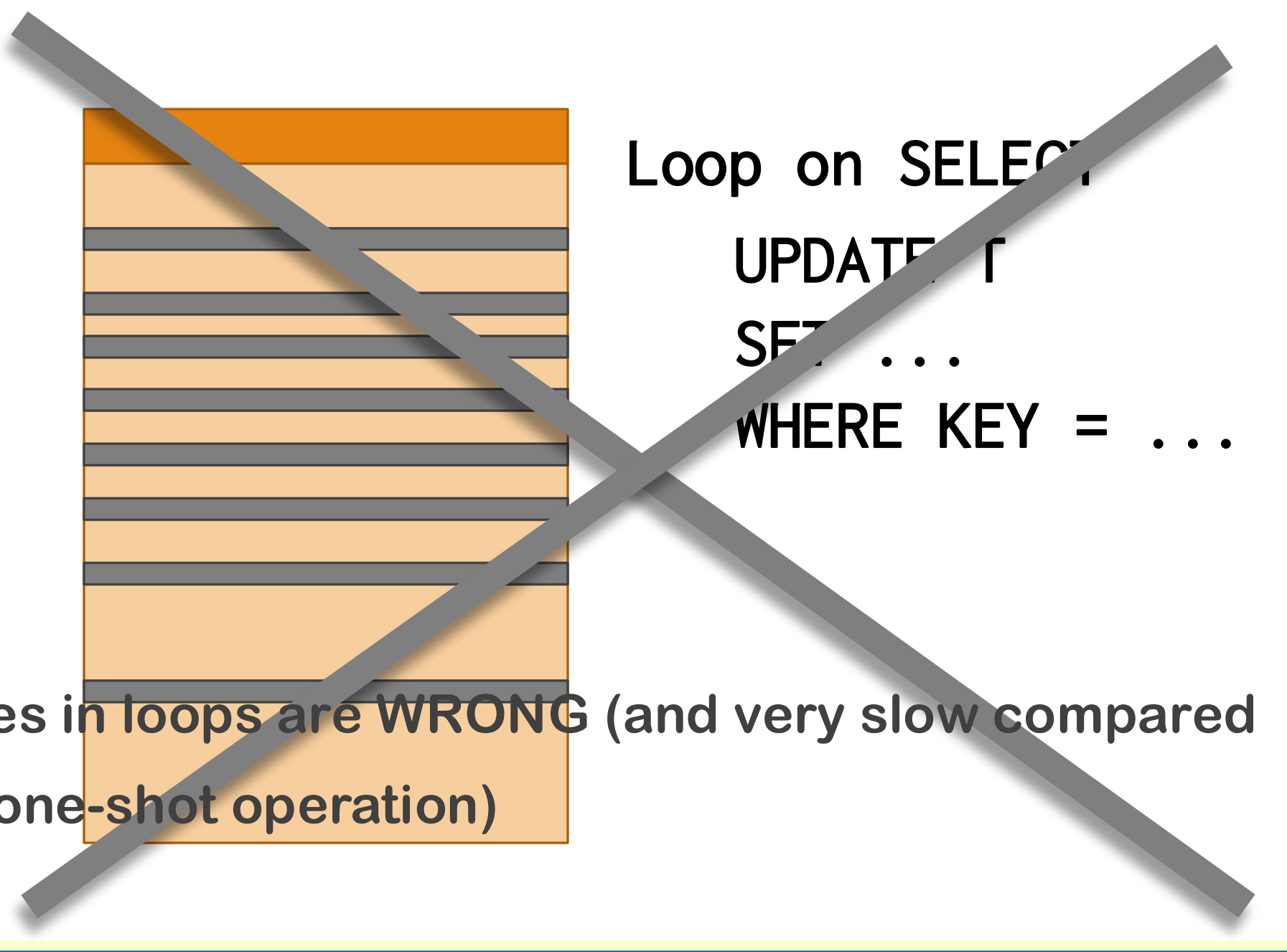


~~row~~

update

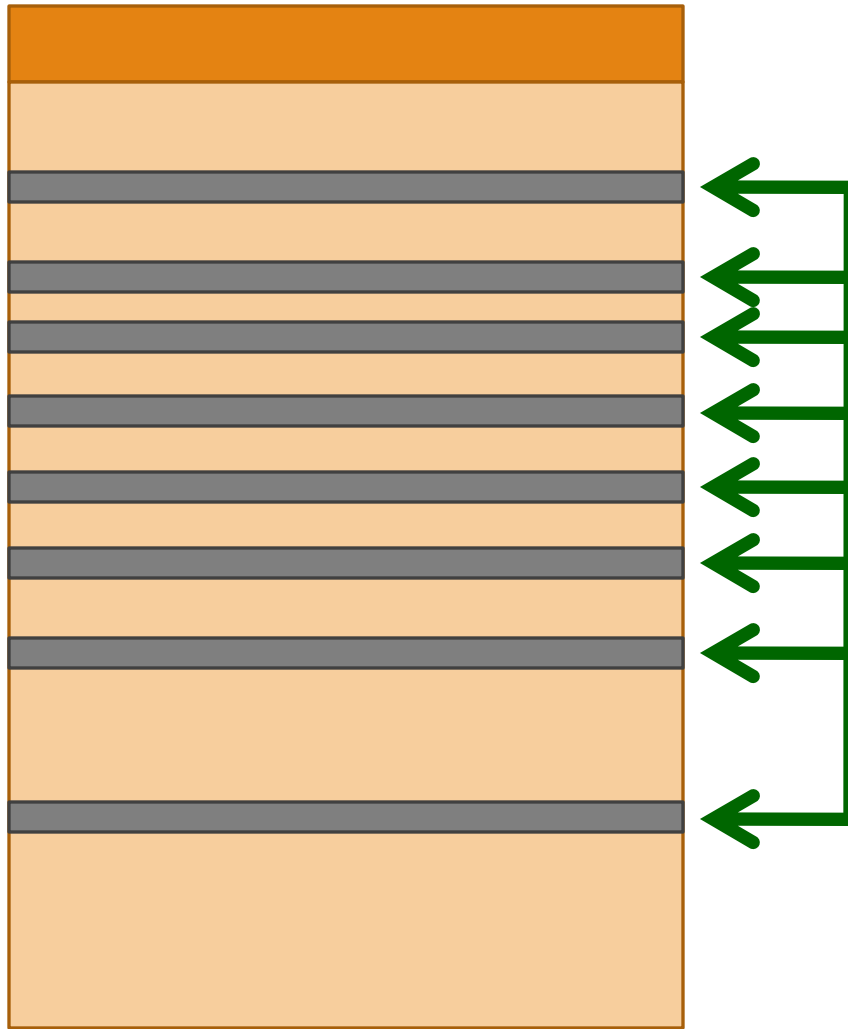
set

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

movieid	title	country	year_released	duration	color

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
1234	Chang An San Wan Li	cn	2021	120	Y

us_movies_info

title	year_released	duration	color
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```
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)
```

Not found ?



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 ↔ title

year_released ↔ 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%'
```

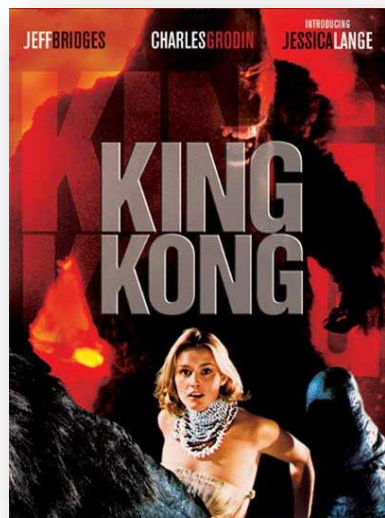
One row from the source table will be associated with both films.

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)
```

2 rows



FAILURE

...


Join

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

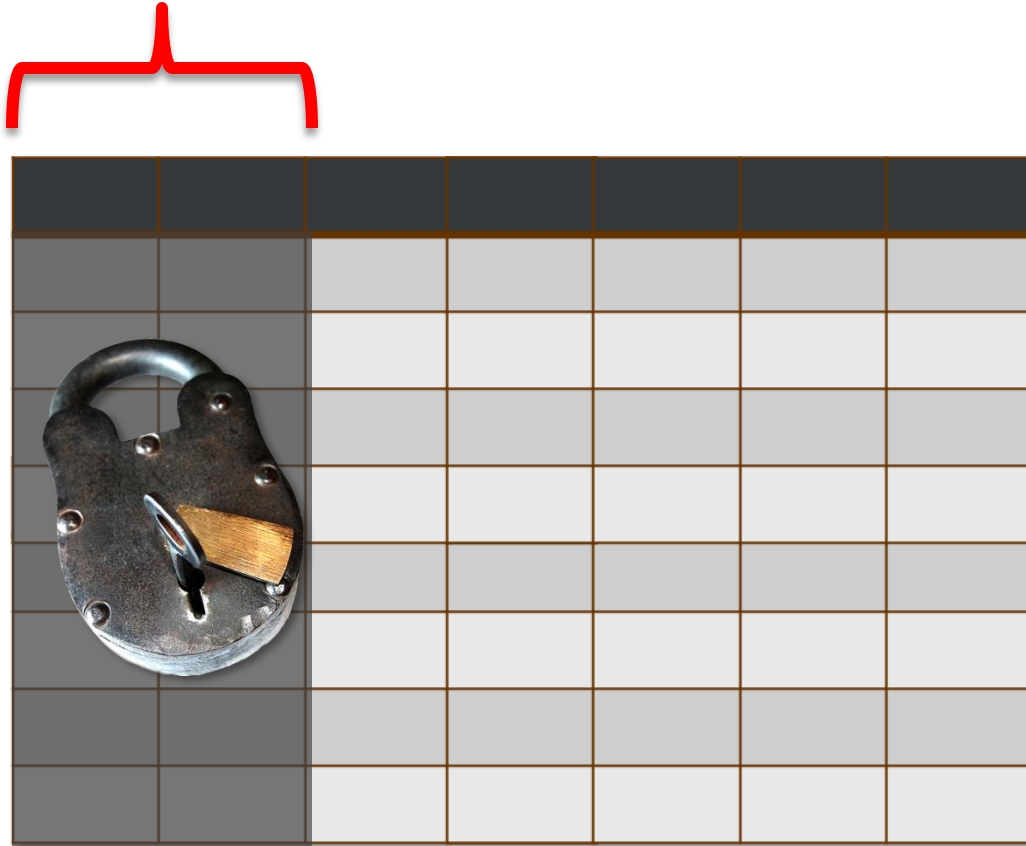
<i>Surname</i>	<i>Firstname</i>	<i>Birthdate</i>
Hepburn	 A	4-May-1929
Katharine		

Picture



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.

Picture by Andrew Magill

```
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 ~~or~~ Insert ^{then}

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
```

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

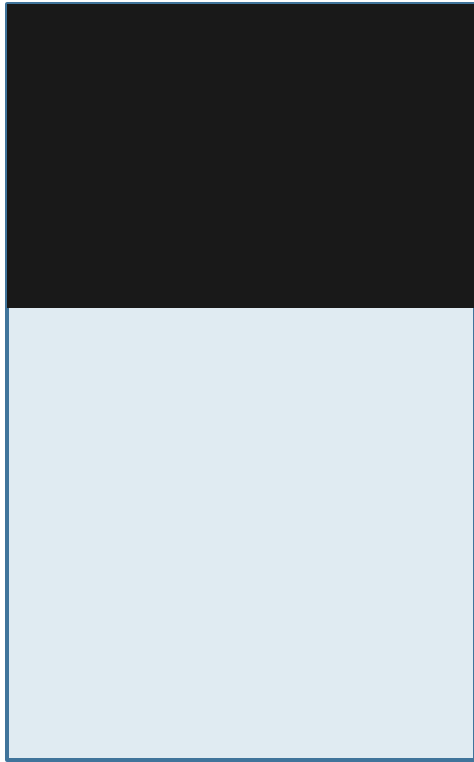
8.2 Delete

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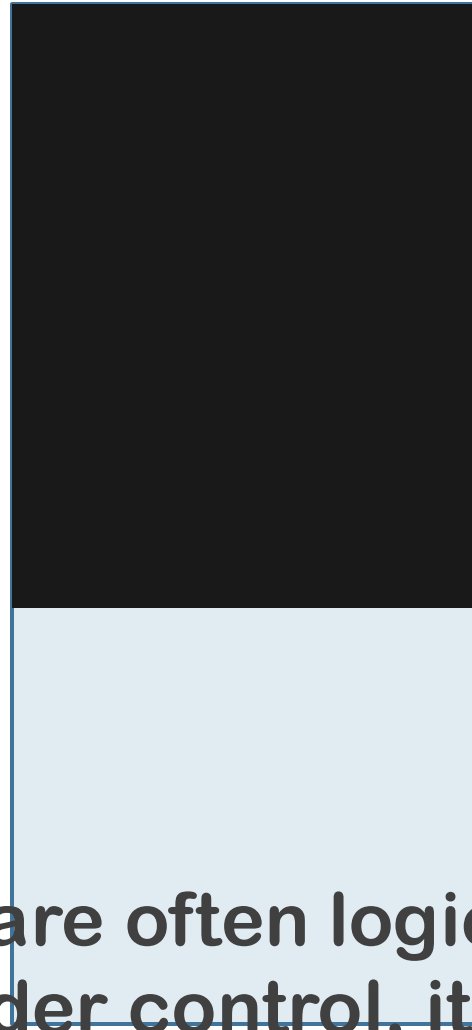
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operational_table



history_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

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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



case first name?

```
when first_name is null then ''
else first_name || ' '
end
```

Left parenthesis?

```
|| 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
```

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)



PL/SQL



PL/PGSQL



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.

A wooden circular object, possibly a cutting board or a piece of wood, with a circular hole in the center. An orange square block is placed on the surface of the wood, partially covering the hole. The wood has a natural grain pattern and a light brown color.

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, tech forums, etc.