INTRODUCTION TO RELATIONAL DATABASES IN SQL

Keys and superkeys

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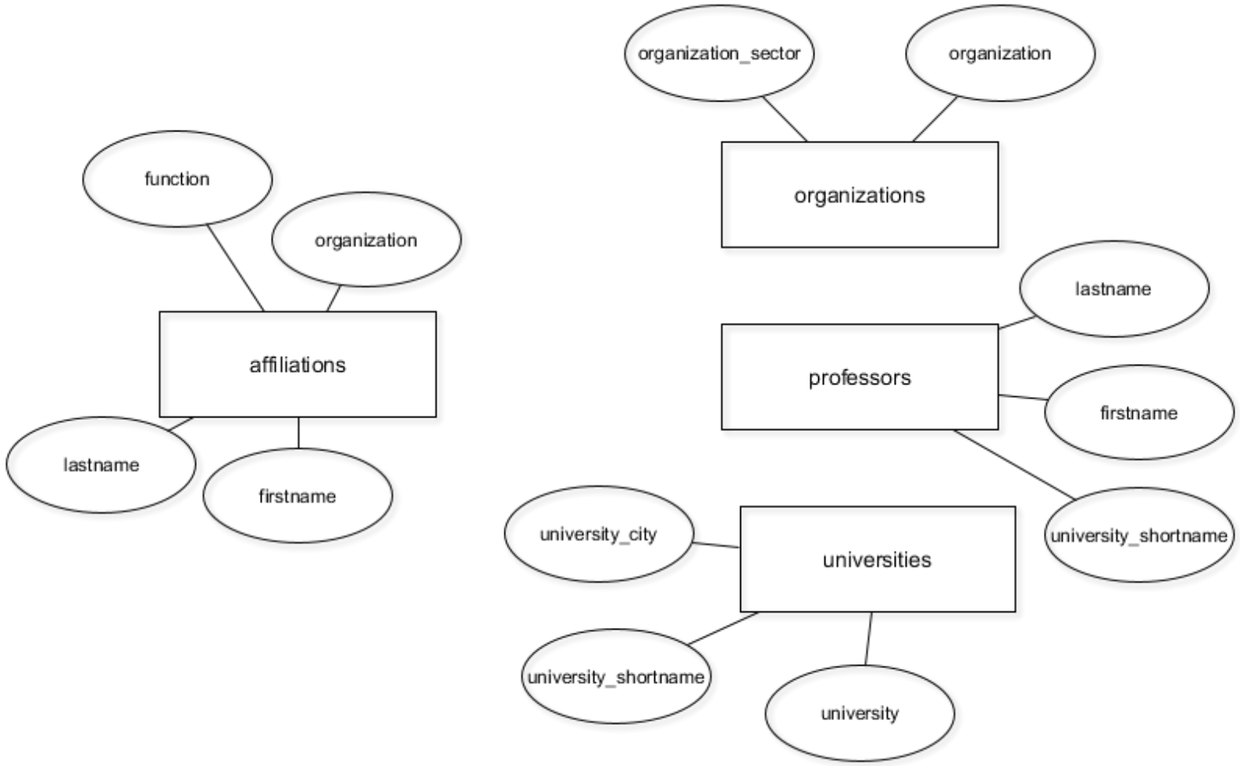
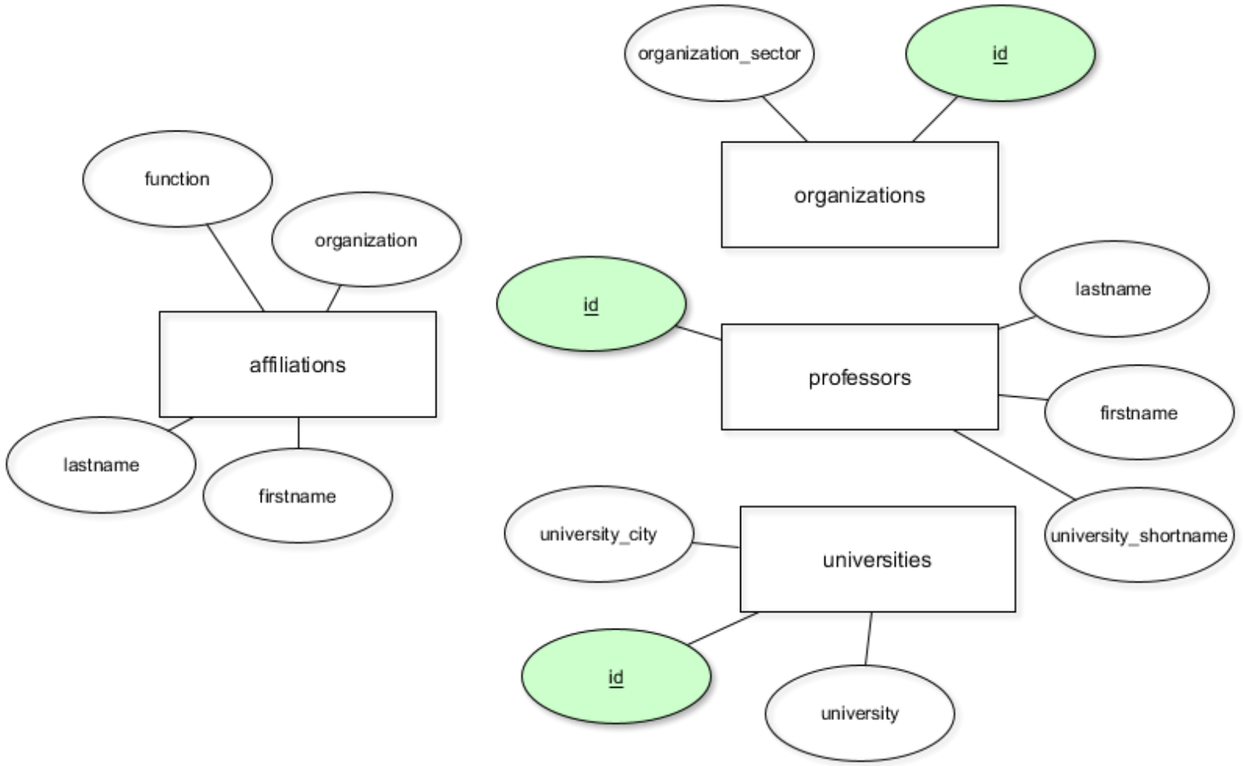
The current database model



The database model with primary keys



What is a key?

- Attribute(s) that identify a record uniquely
- As long as attributes can be removed: **superkey**
- If no more attributes can be removed: minimal superkey or **key**

An example

license_no	serial_no	make	model	year
Texas ABC-739	A69352	Ford	Mustang	2
Florida TVP-347	B43696	Oldsmobile	Cutlass	5
New York MPO-22	X83554	Oldsmobile	Delta	1
California 432-TFY	C43742	Mercedes	190-D	99
California RSK-629	Y82935	Toyota	Camry	4
Texas RSK-629	U028365	Jaguar	XJS	4

SK1 = {license_no, serial_no, make, model, year}

SK2 = {license_no, serial_no, make, model}

SK3 = {make, model, year}, SK4 = {license_no, serial_no}, SKi, ..., SKn

Adapted from Elmasri, Navathe (2011): Fundamentals of Database Systems, 6th Ed., Pearson

An example (contd.)

license_no	serial_no	make	model	year
Texas ABC-739	A69352	Ford	Mustang	2
Florida TVP-347	B43696	Oldsmobile	Cutlass	5
New York MPO-22	X83554	Oldsmobile	Delta	1
California 432-TFY	C43742	Mercedes	190-D	99
California RSK-629	Y82935	Toyota	Camry	4
Texas RSK-629	U028365	Jaguar	XJS	4

K1 = {license_no}; K2 = {serial_no}; K3 = {model}; K4 = {make, year}

- K1 to 3 only consist of one attribute
- Removing either "make" or "year" from K4 would result in duplicates
- Only one candidate key can be the *chosen* key

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Let's discover some keys!

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Primary keys

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Primary keys

- One primary key per database table, chosen from candidate keys
- Uniquely identifies records, e.g. for referencing in other tables
- Unique and not-null constraints both apply
- Primary keys are time-invariant: choose columns wisely!

Specifying primary keys

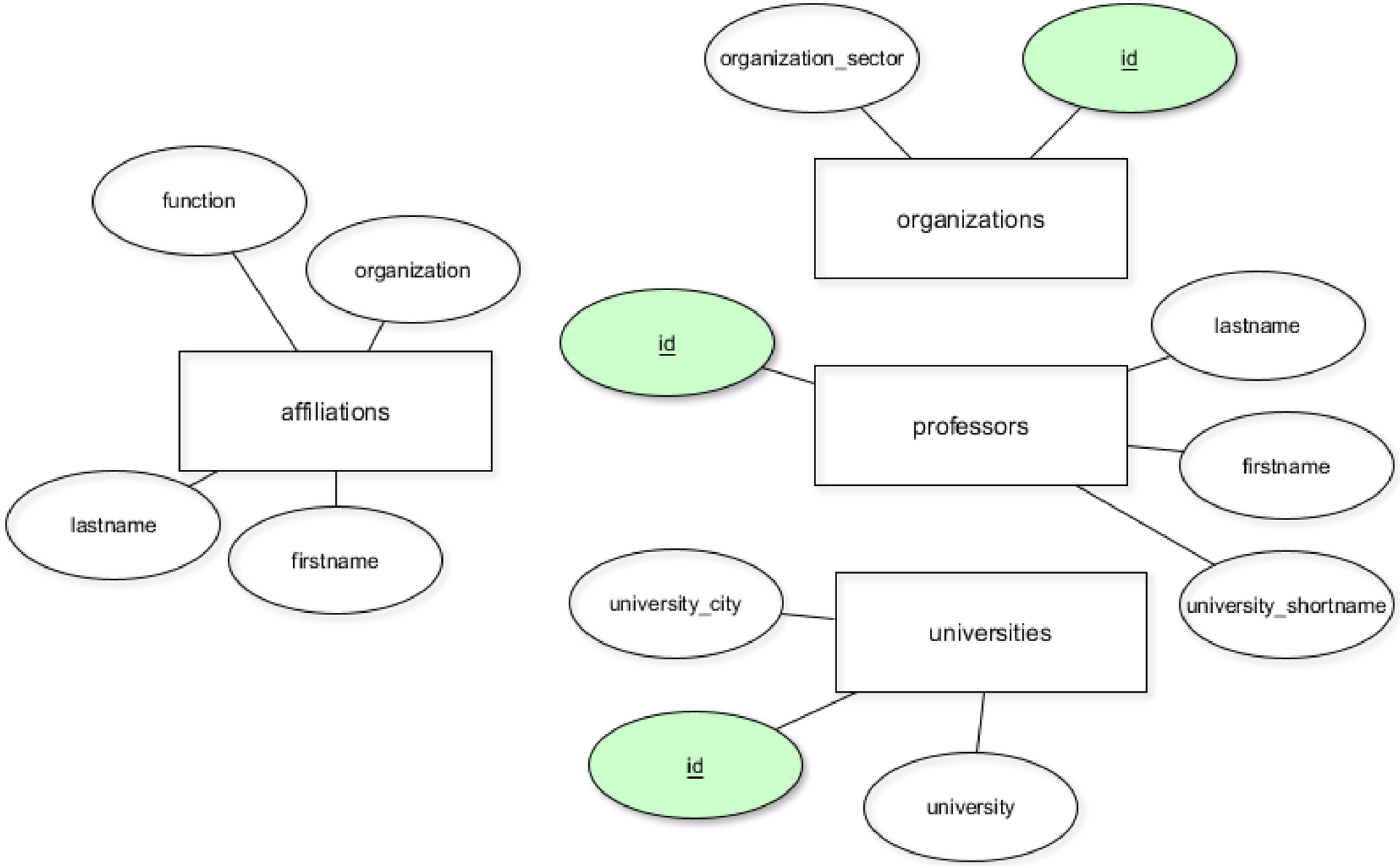
```
CREATE TABLE products (
    product_no integer UNIQUE NOT NULL,
    name text,
    price numeric
);

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

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

Taken from the PostgreSQL documentation.

Specifying primary keys (contd.)

```
ALTER TABLE table_name
ADD CONSTRAINT some_name PRIMARY KEY (column_name)
```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professors
firstname
university_city
universities
university_shortname
id
university

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Let's practice!

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Surrogate keys

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Surrogate keys

- Primary keys should be built from as few columns as possible
- Primary keys should never change over time

An example

```
     license_no     | serial_no |    make    |  model   | color
--------------------+-----------+------------+----------+------
 Texas ABC-739      | A69352    | Ford       | Mustang  | blue
 Florida TVP-347    | B43696    | Oldsmobile | Cutlass  | black
 New York MPO-22    | X83554    | Oldsmobile | Delta    | silver
 California 432-TFY | C43742    | Mercedes   | 190-D    | champagne
 California RSK-629 | Y82935    | Toyota     | Camry    | red
 Texas RSK-629      | U028365   | Jaguar     | XJS      | blue
```

```
    make    |  model   | color
------------+----------+------
 Ford       | Mustang  | blue
 Oldsmobile | Cutlass  | black
 Oldsmobile | Delta    | silver
 Mercedes   | 190-D    | champagne
 Toyota     | Camry    | red
 Jaguar     | XJS      | blue
```

Adding a surrogate key with serial data type

```
ALTER TABLE cars
ADD COLUMN id serial PRIMARY KEY;
```

```
INSERT INTO cars
VALUES ('Volkswagen', 'Blitz', 'black');

    make    |  model  | color       | id
------------+---------+-------------+-------------
 Ford       | Mustang | blue        | 1
 Oldsmobile | Cutlass | black       | 2
 Oldsmobile | Delta   | silver      | 3
 Mercedes   | 190-D   | champagne   | 4
 Toyota     | Camry   | red         | 5
 Jaguar     | XJS     | blue        | 6
 Volkswagen | Blitz   | black       | 7
```

Adding a surrogate key with serial data type (contd.)

```
INSERT INTO cars
VALUES ('Opel', 'Astra', 'green', 1);
```

```
duplicate key value violates unique constraint "id_pkey"
DETAIL:  Key (id)=(1) already exists.
```

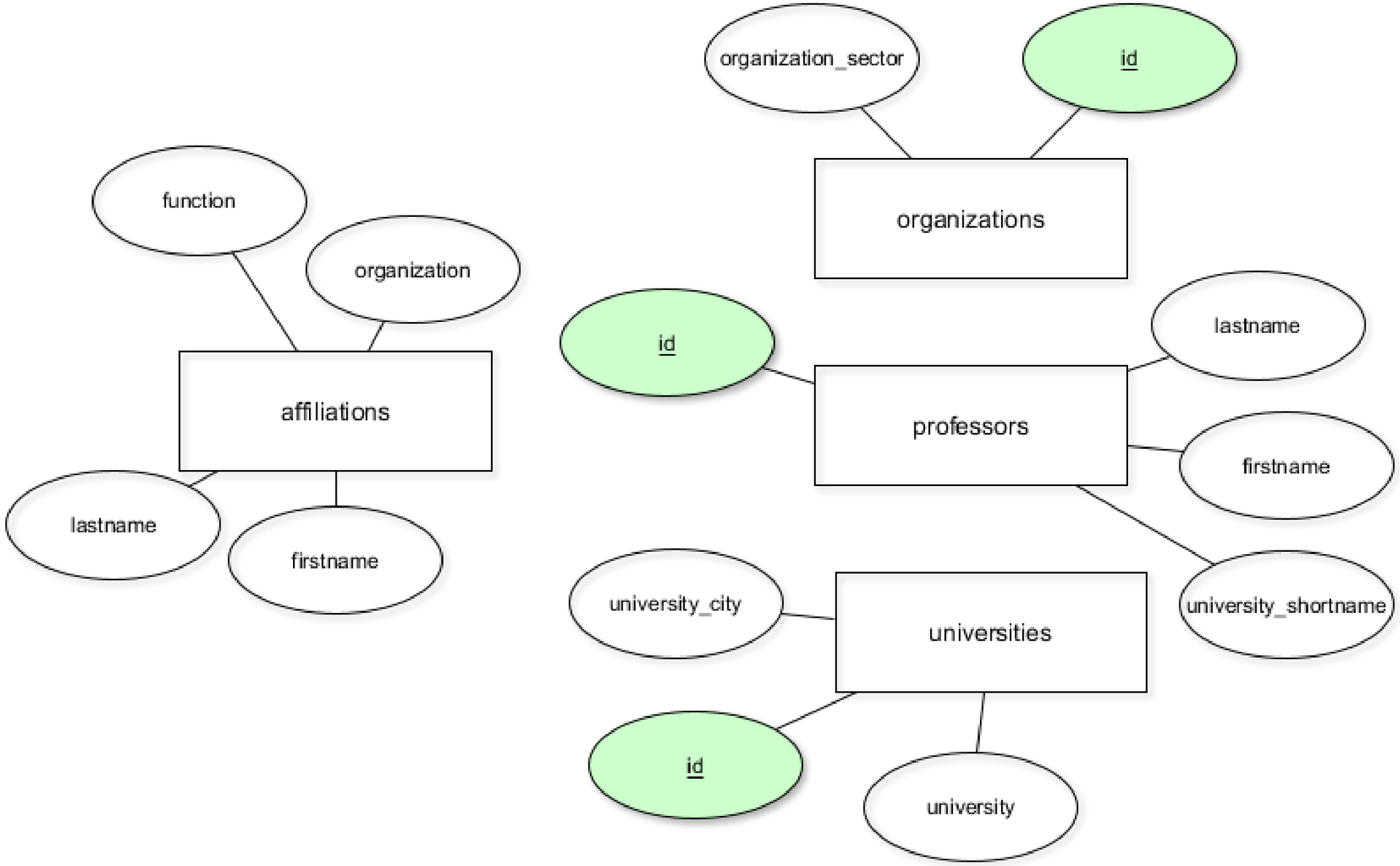
- "id" uniquely identifies records in the table – useful for referencing!

Another type of surrogate key

```
ALTER TABLE table_name
ADD COLUMN column_c varchar(256);

UPDATE table_name
SET column_c = CONCAT(column_a, column_b);

ALTER TABLE table_name
ADD CONSTRAINT pk PRIMARY KEY (column_c);
```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id
university

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Let's try this!