



Keys — Part 1

Relational Databases Basics

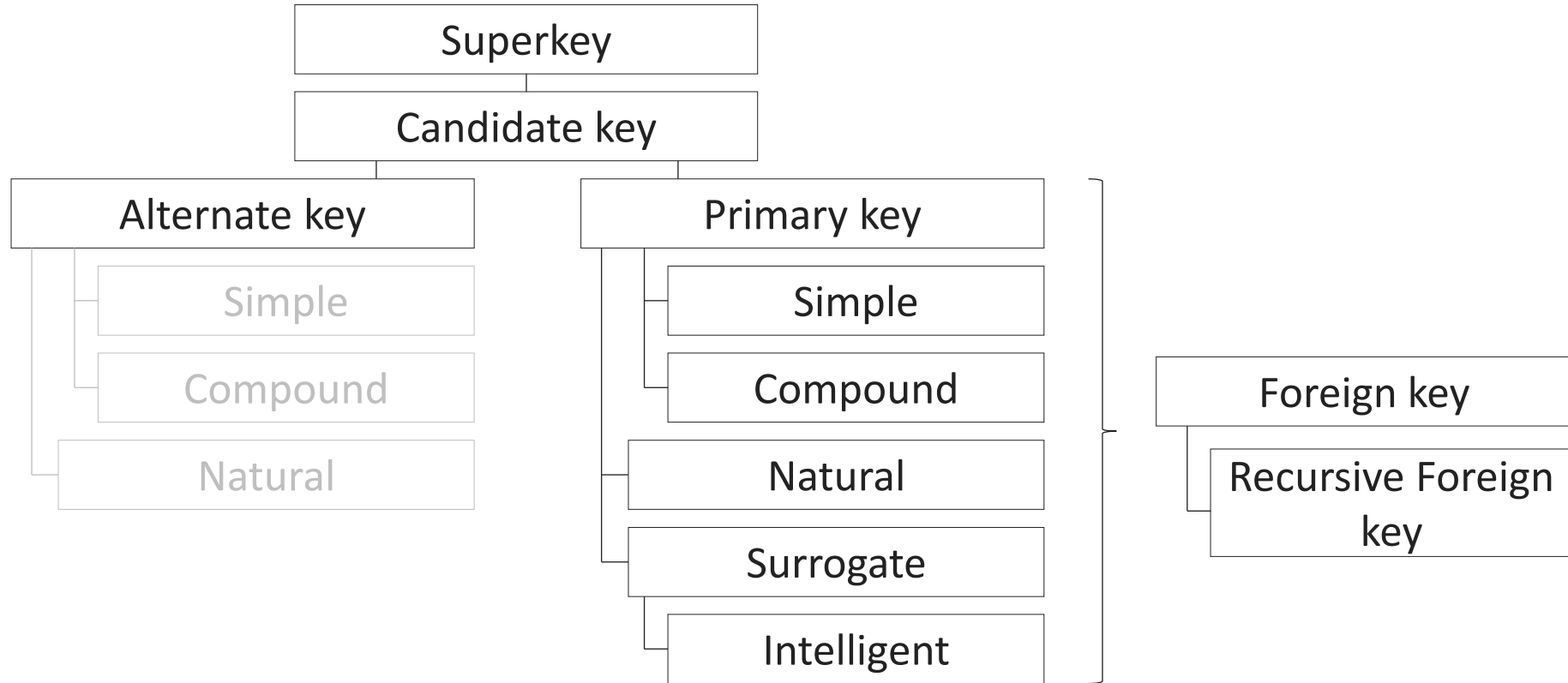


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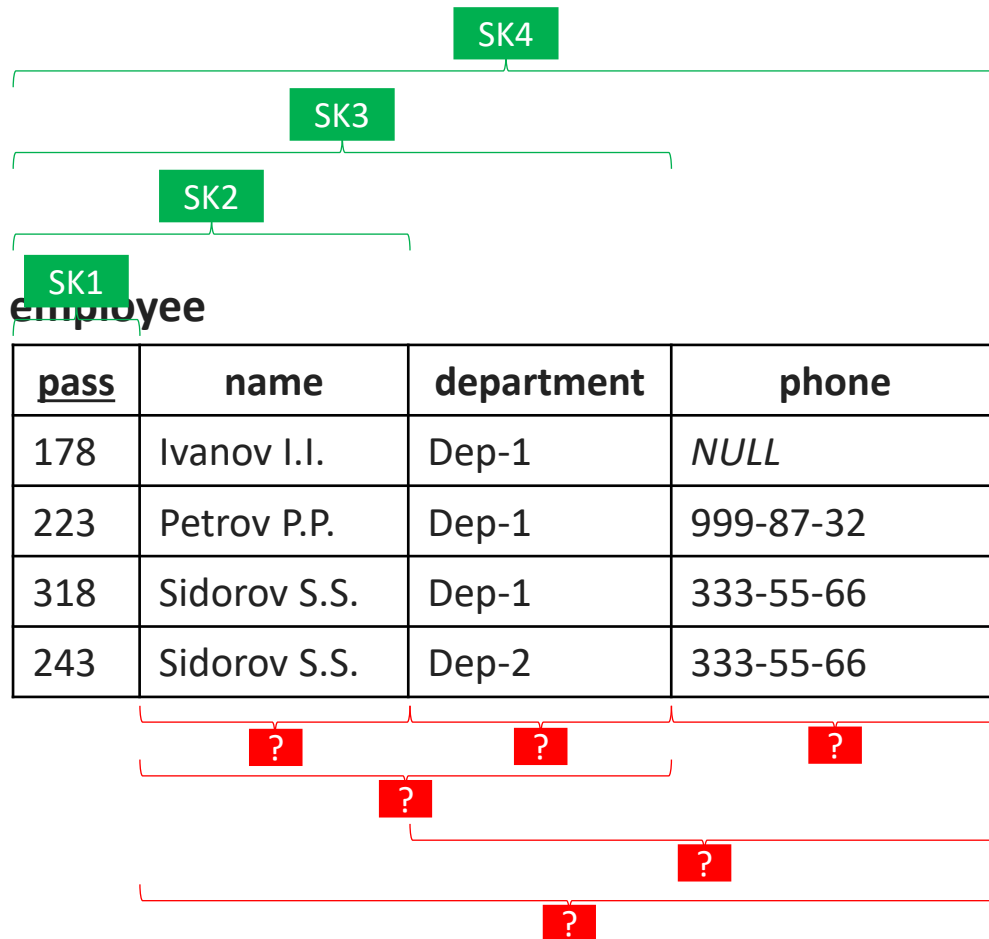
Key – identifier that is part of a set of data elements.

Keys hierarchy



Superkey – a superset of a candidate key. A superkey has the uniqueness property but not necessarily the irreducibility property.

Superkey



Candidate key – a set of attributes that has both of the following properties: uniqueness and irreducibility.

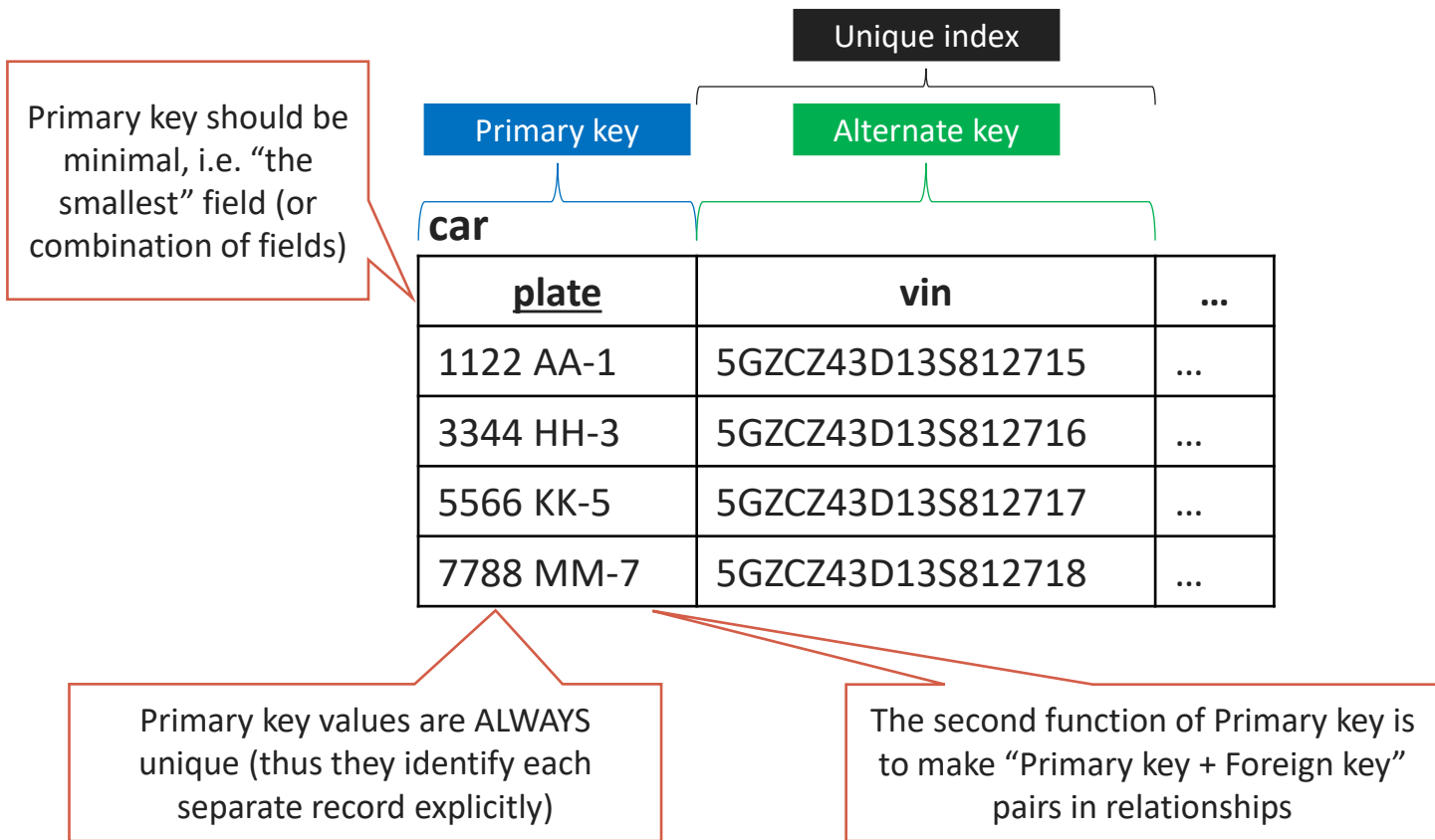
Candidate key

car		
plate	vin	...
1122 AA-1	5GZCZ43D13S812715	...
3344 HH-3	5GZCZ43D13S812716	...
5566 KK-5	5GZCZ43D13S812717	...
7788 MM-7	5GZCZ43D13S812718	...

Primary key – a set of attributes that has both of the following properties: uniqueness and irreducibility, and identifies one record.

Alternate key – a set of attributes that has both of the following properties: uniqueness and irreducibility, and is NOT a primary key.

Primary key and Alternate key



Simple key – a key that consists of one attribute.

Compound key – a key that consists of two or more attributes.

Simple key and Compound key

Simple primary key

car

<u>plate</u>	vin
1122 AA-1	5GZCZ43D13S812715
3344 HH-3	5GZCZ43D13S812716
5566 KK-5	5GZCZ43D13S812717
7788 MM-7	5GZCZ43D13S812718

Compound primary key

employee

<u>pass</u>	<u>department</u>	name	phone
1	Dep-1	Ivanov I.I.	<i>NULL</i>
2	Dep-1	Petrov P.P.	999-87-32
3	Dep-1	Sidorov S.S.	333-55-66
1	Dep-2	Sidorov S.S.	333-55-66

Compound key: field position matters!

It is crucial to place fields in a compound key in the right order. DBMS may use either **all** fields, or the **first** field to accelerate the search, but it can NOT use the 2nd, the 3rd and so on fields “by themselves”.

Live demo on fields order in a compound key

Compound primary key			
pass	department	name	Phone
1	Department-1	Ivanov I.I.	111-22-33
1	Department-6	Petrov P.P.	111-22-44
1	Department-18	Sidorov S.S.	111-22-55
1	Department-21	Sidorov S.S.	222-22-33
2	Department-1	Orlov O.O.	222-22-11
2	Department-2	Berkutov B.B.	222-22-00
2	Department-3	Boborov B.B.	222-66-33
4	Department-34	Sinitsyn S.S.	999-12-11
5	Department-1	Vorobyov V.V.	999-12-12
5	Department-3	Voronov V.V.	999-12-15
5	Department-7	Lvov L.L.	999-12-17
6	Department-4	Volkov V.V.	888-10-01
7	Department-3	Zaytsev Z.Z.	888-10-02
7	Department-5	Okunev O.O.	888-10-03
8	Department-2	Karasev K.K.	888-10-05
11	Department-3	Shchukin S.S.	888-10-91
12	Department-1	Petrov P.P.	888-10-81
12	Department-5	Sidorov S.S.	888-10-81
13	Department-6	Sidorov S.S.	999-12-11
13	Department-9	Orlov O.O.	999-12-12
14	Department-17	Berkutov B.B.	999-12-15
18	Department-17	Boborov B.B.	999-12-17
23	Department-9	Sinitsyn S.S.	888-10-01
23	Department-12	Vorobyov V.V.	888-10-02
31	Department-11	Voronov V.V.	999-12-11
32	Department-14	Lvov L.L.	999-12-12
34	Department-17	Volkov V.V.	999-12-15
45	Department-1	Zaytsev Z.Z.	999-12-17
45	Department-2	Okunev O.O.	888-10-01
46	Department-1	Karasev K.K.	888-10-02
56	Department-3	Orlov O.O.	999-12-12
56	Department-53	Berkutov B.B.	999-12-15
71	Department-3	Boborov B.B.	999-12-17
82	Department-1	Sinitsyn S.S.	888-10-01

How quick can we answer the following questions?

- Is there an employee with the pass "87"?
- How many employees do have the pass "1"?
- What department does employee with the pass "34" work in?
- What is the name of the employee with the pass "1" and the department "Department-18"?
- What is the phone number of the employee with the pass "7" and the department "Department-3"?

How quick can we answer the following questions?

- How many employees are there in the department "Department-3"?
- Is there at least one employee in the department "Department-15"?
- What is the largest pass number in the department "Department-2"?

Natural key – a set of attributes that has both of the following properties: uniqueness and irreducibility, and is originated from the subject matter.

Surrogate key – a set of attributes that has both of the following properties: uniqueness and irreducibility, and is NOT originated from the subject matter. It only serves the purpose of identifying tuples.

Natural key and Surrogate key

Natural primary key

employee

<u>passport</u>	name
AA1122334	Ivanov I.I.
AB4455667	Petrov P.P.
AC5566778	Sidorov S.S.
BP8877665	Sidorov S.S.

Surrogate primary key

employee

<u>id</u>	passport	name
1	AA1122334	Ivanov I.I.
2	AB4455667	Petrov P.P.
3	AC5566778	Sidorov S.S.
4	BP8877665	Sidorov S.S.

Natural key pros and cons

Pros

It already exists 😊

Its values may be meaningful and useful (if no security issues exist)

It may serve as a good primary index in many cases

Cons

Cascade operations

Security issues

Size (bigger than surrogate)

Insert anomalies

Sometimes compound only

Surrogate key pros and cons

Cons

We have to add it to the table (and lose some memory)

Its values are never meaningful or useful

Some DBMS do not allow primary indexes on non-PK-fields

Pros

No cascade operations

No security issues

Size (smaller than natural)

No insert anomalies

Always simple (not compound)

Natural key: cascade operations

employee

<u>passport</u>	name
AA1122334	Ivanov I.I.
AB4455667	Petrov P.P.
AC5566778	Sidorov S.S.
BP8877665	Sidorov S.S.
CO1122771	

payment

<u>id</u>	person	money
1	AB4455667	100
2	AB4455667	100
3	BP8877665	100
4	BP8877665	150
5	BP8877665	120

Surrogate key: no cascade operations

employee

<u>id</u>	passport	name
1	AA1122334	Ivanov I.I.
2	AB4455667	Petrov P.P.
3	AC5566778	Sidorov S.S.
4	BP8877665	Sidorov S.S.
	CO1122771	

payment

<u>id</u>	person	money
1	2	100
2	2	100
3	4	200
4	4	150
5	4	130

Intelligent key – a single-attribute key whose values, in addition to their main purpose of serving as unique identifiers (typically for certain real world “entities”), carry some kind of encoded information embedded within themselves.

Nowadays intelligent key are extremely rare (one can say, that no one uses such keys).

Intelligent key

employee

<u>id</u>	passport	name
AAIvII1	AA1122334	Ivanov I.I.
ABPePP1	AB4455667	Petrov P.P.
ACSiSS1	AC5566778	Sidorov S.S.
BPSiSS1	BP8877665	Sidorov S.S.



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