Advanced SQL

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Adapted from

Silberchatz et al. slides

NULL Values

- It is possible for tuples to have a null value, denoted by *null*, for some of their attributes
- *null* signifies an unknown value or that a value does not exist.
- The predicate **is null** can be used to check for null values.
  - Example: Find all loan number which appear in the *loan* relation with null values for *amount.*

select *loan_number*
from *loan*
where *amount* **is null**

NULL Values

- The result of any arithmetic expression involving *null* is *null*
  - Example: 5 + *null* returns null
- Any comparison with *null* returns *unknown*
  - Example*: 5 < null or null <> null or null = null*
- Result of **where** clause predicate is treated as *false* if it evaluates to *unknown*

NULL Values and Three Valued Logic

- Three-valued logic using the truth value *unknown*:
  - OR: (*unknown* **or** *true*) = *true*,
    (*unknown* **or** *false*) = *unknown*
    (*unknown* **or** *unknown*) = *unknown*
  - AND: *(true* **and** *unknown)* = *unknown,*
    (false **and** *unknown)* = *false,*
    (unknown **and** *unknown)* = *unknown*
  - NOT*:* (**not** *unknown)* = *unknown*
  - "*P* **is unknown**" evaluates to true if predicate *P* evaluates to *unknown*

Null Values and Aggregates

- Total all loan amounts

  select sum (*amount*)
  from *loan*

  – Above statement ignores null amounts
  – Result is *null* if there is no non-null amount
- All aggregate operations except **count(*)** ignore tuples with null values on the aggregated attributes.

The Unique Constraint

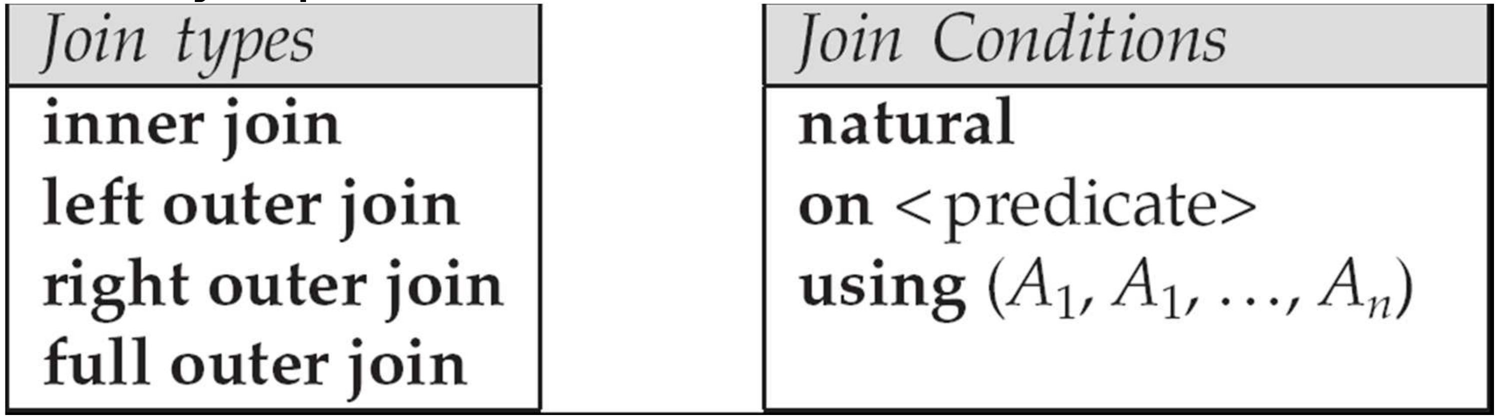
- **unique** (A_1, A_2, …, A_m)
- The unique specification states that the attributes

  *A*1, *A*2, … *A*m

  form a candidate key.
- Candidate keys are permitted to be null (in contrast to primary keys).

Joined Relations

- **Join operations** take two relations and return as a result another relation.
- These additional operations are typically used as subquery expressions in the **from** clause
- **Join condition** – defines which tuples in the two relations match, and what attributes are present in the result
- **Join type** – defines how tuples in each relation that do not match any tuple in the other relation are treated.

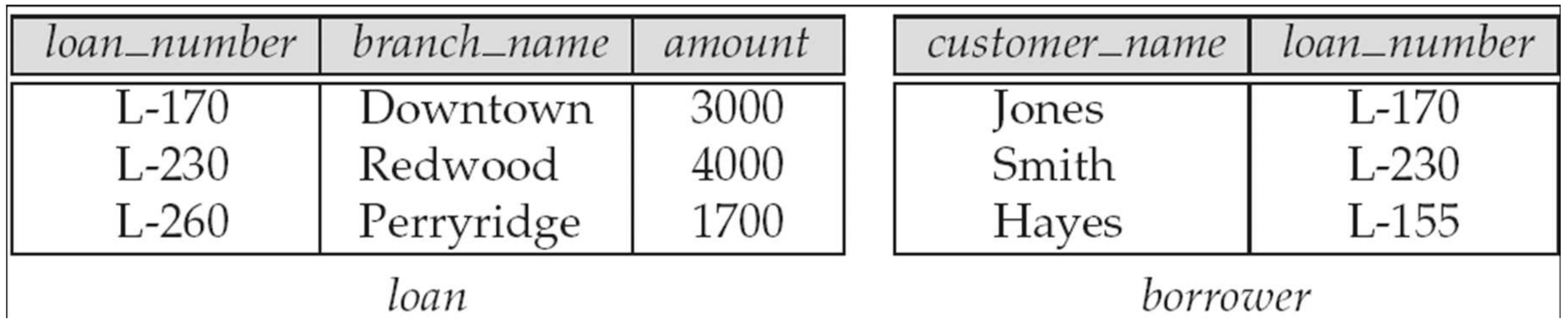


Join types
inner join
left outer join
right outer join
full outer join

Join Conditions
natural
on <predicate>
using $(A_1, A_1, \ldots, A_n)$

Joined Relations – Datasets for Examples

- Relation *loan and borrower*



loan_number	*branch_name*	*amount*
L-170	Downtown	3000
L-230	Redwood	4000
L-260	Perryridge	1700

loan

customer_name	*loan_number*
Jones	L-170
Smith	L-230
Hayes	L-155

borrower

Joined Relations – Examples

- *loan* **inner join** *borrower* **on** *loan.loan_number = borrower.loan_number*

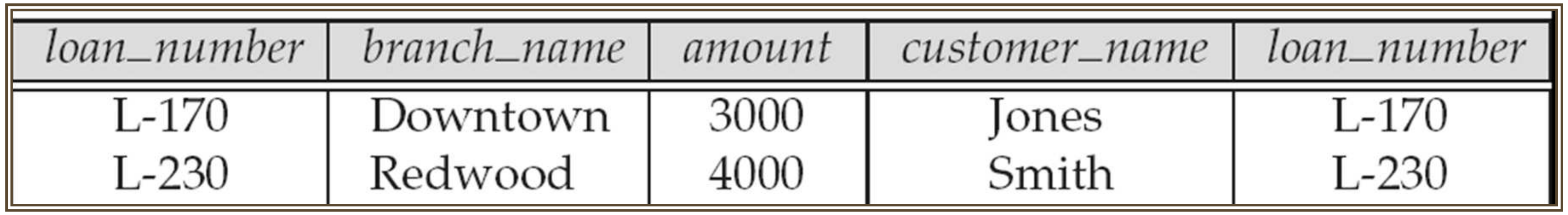
loan_number	*branch_name*	*amount*	*customer_name*	*loan_number*
L-170	Downtown	3000	Jones	L-170
L-230	Redwood	4000	Smith	L-230

- *loan* **left outer join** *borrower* **on** *loan.loan_number = borrower.loan_number*

loan_number	*branch_name*	*amount*	*customer_name*	*loan_number*
L-170	Downtown	3000	Jones	L-170
L-230	Redwood	4000	Smith	L-230
L-260	Perryridge	1700	*null*	*null*

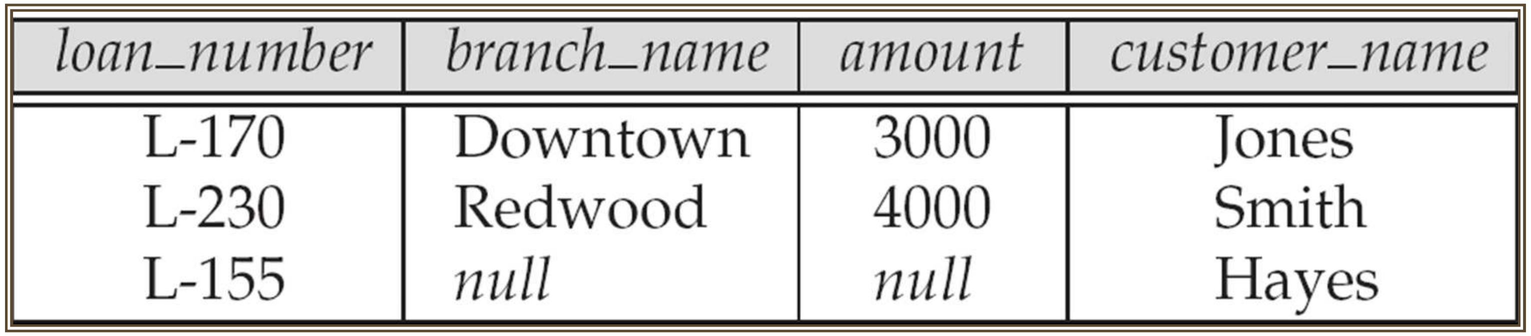
Joined Relations – Examples

- *loan* **natural inner join** *borrower*



loan_number	*branch_name*	*amount*	*customer_name*	*loan_number*
L-170	Downtown	3000	Jones	L-170
L-230	Redwood	4000	Smith	L-230

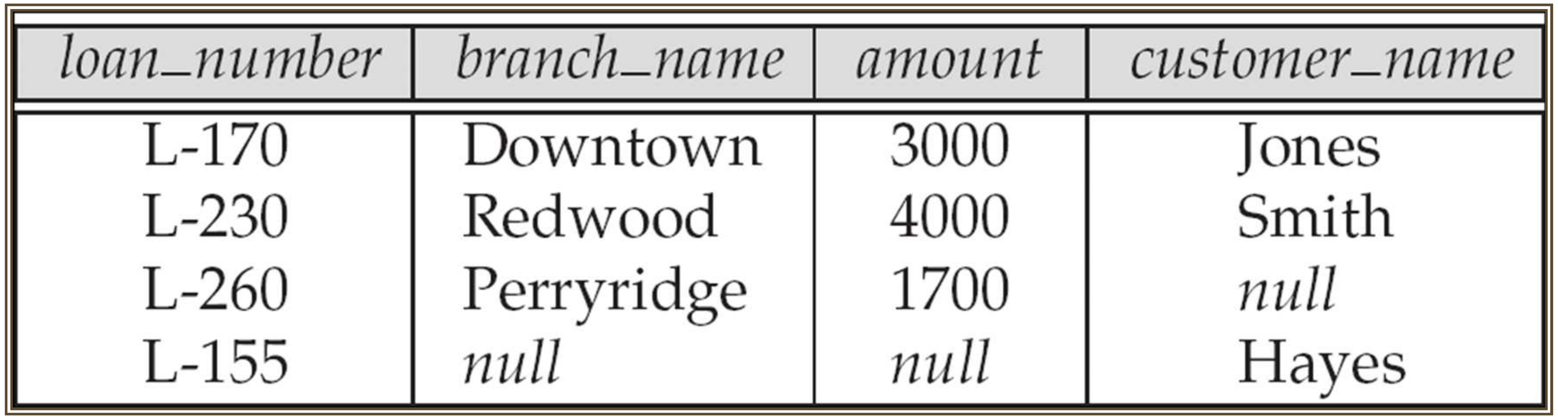
- *loan* **natural right outer join** *borrower*



loan_number	*branch_name*	*amount*	*customer_name*
L-170	Downtown	3000	Jones
L-230	Redwood	4000	Smith
L-155	*null*	*null*	Hayes

Joined Relations – Examples

- *loan* **full outer join** *borrower* **using** (*loan_number*)



loan_number	*branch_name*	*amount*	*customer_name*
L-170	Downtown	3000	Jones
L-230	Redwood	4000	Smith
L-260	Perryridge	1700	*null*
L-155	*null*	*null*	Hayes