Notes lecture 6

Let:

* R[A] - a *relation*
* F, G - sets of *functional dependencies*
* 𝛼– a subset of *attributes*
* F and G are **equivalent** (F ≡ G) if F+ = G+.
* A **minimal cover** for F is a set of functional dependencies such that

1. (so )
2. no  allowed
3. the left side of every dependency in is irreducible
4. no dependency in is redundant

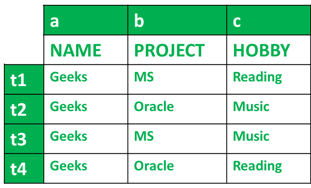
* Let the set of attributes 𝐴 = 𝛼 ∪ 𝛽 ∪ 𝛾.

The **multi-valued dependency** 𝛼 ⇉ 𝛽 (𝛼 multi-determines 𝛽) is said to hold over 𝑅

if a value of 𝛼, is associated with a set of values 𝑣 for 𝛽: ,

the values of 𝛾.

Ex.:



* = the tuples of 𝑅 where 𝛼 = 𝑢
* **Prop.:** Let 𝑅[𝐴] be a relation, 𝐴 = 𝛼 ∪ 𝛽 ∪ 𝛾. If 𝛼 ⇉ 𝛽, then 𝛼 ⇉ 𝛾.
* **4NF** if:
  + BCNF
  + should not have any non-trivial Multi-valued Dependency
* **Decomposition:** if 𝑅 [𝛼, 𝛽, 𝛾] and 𝛼 ⇉ 𝛽, R is decomposed into:

A mathematical equation with numbers and symbols

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* **3-decomposability**
  + if (F1, P1) ∈ FaPr and (F1, C1) ∈ FaCo and (P1, C1) ∈ PrCo

then (F1, P1, C1) ∈ FaPrCo

* + if (F1, P1, C2) ∈ 𝐹𝑎𝑃𝑟𝐶𝑜 and (F1, P2, C1) ∈ 𝐹𝑎𝑃𝑟𝐶𝑜 and (F2, P1, C1) ∈ 𝐹𝑎𝑃𝑟𝐶𝑜

then (F1, P1, C1) ∈ 𝐹𝑎𝑃𝑟𝐶𝑜

* Let be a relation and , the projections of 𝑅 on .

𝑅 satisfies the **join dependency** ∗{} if 𝑅 =

* **5NF** = every non-trivial JD is implied by the candidate keys in 𝑅

Relational algebra

# Conditions

1. attribute\_name relational\_operator value
2. attribute\_name IS [NOT] IN single\_column\_relation
3. relation {IS [NOT] IN | = | <>} relation
4. NOT condition

condition1 AND condition2

condition1 OR condition2

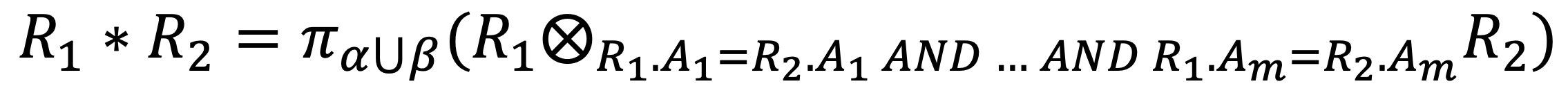
# Operators in the Algebra

* Selection: = SELECT \* FROM R WHERE C
* Projection: = SELECT 𝛼 FROM R
* Cross-product:
  + the attributes of 𝑅1 followed by the attributes of 𝑅2
  + 𝑅1 × 𝑅2 = SELECT \* FROM R1 CROSS JOIN R2
* union, set-difference, intersection
  + 𝑅1 ∪ 𝑅2, 𝑅1− 𝑅2, 𝑅1 ∩ 𝑅2

A screen shot of a computer

Description automatically generated

* join operators:
  + condition join (or theta join):
    - the records in the cross-product of 𝑅1 and 𝑅2 that satisfy a certain condition
    - A black symbol with a white background

      Description automatically generated
    - SELECT \* FROM R1 INNER JOIN R2 ON Θ
  + natural join:
    - the union of the attributes of the two relations (attributes with the same name in 𝑅1 and 𝑅2 appear once in the result)
    - 
    - SELECT \* FROM R1 NATURAL JOIN R2
  + left outer join: (SELECT \* FROM R1 LEFT OUTER JOIN R2 ON C)
  + right outer join: (SELECT \* FROM R1 RIGHT OUTER JOIN R2 ON C)
  + full outer join: (SELECT \* FROM R1 FULL OUTER JOIN R2 ON C)
  + left semi join:
    - schema: 𝑅1's schema (only R1 attributes/columns)
    - tuples: the tuples in 𝑅1 that are used in the natural join 𝑅1 ∗ 𝑅2
  + right semi join:
    - schema: 𝑅2's schema (only R2 attributes/columns)
    - tuples: the tuples in 𝑅2 that are used in the natural join 𝑅1 ∗ 𝑅2
  + division
    - notation: 𝑅1÷𝑅2
    - the tuples in R1 that are associated with every tuple of R2

A diagram of a square with a square and a square with a square and a square with a square and a square with a square and a square with a square and a square with a square and

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