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Normalization

The process of decomposing tables

1^{st} Normal Form

- All attributes are atomic

Example:

SSN	Telephone Number

Functional Dependency (FD)

FD: Table RA

X (is in) A, Y (is in) A

- R(A,B,C)
  - F { A→B, B→C}

The value of x determines the value of y. This means that y is functionally dependant on x.

Derivations of Functional Dependencies

The Inference Rules used to describe Functional Dependencies are called Armstrong's Axioms

IR 1 Reflexivity

If $Y \subseteq X$, then $X \rightarrow Y$

IR 2 Augmentation

If $X \rightarrow Y$, then $XZ \rightarrow YZ$ for any Z

IR 3 Transitivity

If $X \rightarrow Y$ and $Y \rightarrow Z$, then $X \rightarrow Z$

Extended set of Inference Rules

Union

If $X \rightarrow Y$ and $X \rightarrow Z$ then $X \rightarrow YZ$

Pseudo Transivity

If $A \rightarrow B$ and $CB \rightarrow D$ then $AC \rightarrow D$

Example 1

R(A, B, C)

F {AB→C, C→B, C→D}

Which of the following hold true?

AB→D ? Yes

AB→AB ? Yes

AB→ABD ? Yes

Explanation: since AB → C using Transitivity we see that AB→C and C→D therefore AB→D

Example 2

R (A, B, C, G, H, I)

F {A→B, A→C, CG→H, G→I, B→H}

Which of the following hold true?

A→H? Yes

AG→I yes

Explanation : using Psuedo Transitivity , since CG → I and A→C we can conclude that AG→I

CG →HI. Yes

Explanation: using Union we see that since CG→I and CG→H we can conclude that CG→HI

Closures

Using the values in example 1 R (A, B, C)

F {AB→C, C→B, C→D}

L	L + R	R
A	B,C	D

Closure of a given Relation is denoted by F : F^+

A^+ = {A}

$(AB)^+$ = { A, B, C, D}

$(AC)^+$ = {A,B,C,D}

Using the values in example 2

R (A, B, C, G, H, I)

F {A→B, A→C, CG→H, G→I, B→H}

L	L + R	R
A,G	C,B	H,I

A^{+} = {A, B, C, H}

G^{+} ={G}

$(AG)^{+}$ ={A,G,B,C,H,I}