Functional Dependencies:

$X \to Y \iff$ if two instances have the same x value their y values are the same.

$\iff t_1 \in r$ and $t_2 \in r$ $\quad \pi_x(t_1) = \pi_x(t_2) \Rightarrow \pi_y(t_1) = \pi_y(t_2)$

→ Key terminology

Primary Key $\subseteq$ Candidate Key $\subseteq$ Super Key

one particular key chosen from candidate keys.

(minimal superkey)

set of attributes determining all other attributes.

→ K is a candidate key for R

$K \to R$ $\quad$ (does not require K to be minimal)

FDs are a generalisation of keys.

Armstrong's Axioms $\quad X, Y, Z$ sets of attributes

if $X \subseteq Y$ then $Y \to X$

if $X \to Y$ then $XZ \to YZ$

if $X \to Y$ and $Y \to Z$ then $X \to Z$

$\Rightarrow$

$X \to Y$ and $X \to Z \Rightarrow X \to YZ$

$X \to YZ \Rightarrow X \to Y$ and $X \to Z$

$A \to A$

A	B	C	D	E

$R = ABCDE$

$F = \{A \to B,\ CD \to E,\ A \to C\}$

F^+ = set of all FDs deduced by F

Determining closure:

for $X \to Y$ with $X \subset F$ we want F^+

calculate X^+ ? : $\forall A$ $X \to A$ is in F^+

check if Y in X^+

$L := X$

$F := \{X \to A\}$

$F := F \cup \{X \to A\}$

Example: $R = \{A, B, C, D, E\}$

$F = \{B \to CD,\ D \to E,\ B \to A,\ E \to C,\ AD \to B\}$

$B^+ = \{B, A, CD, CE, C, D, E\}$ ✓ $\quad B \to E$ in F^+ ✓

D : key?

$D^+ = \{D, E, C\}$ NO ✗

AD key?

$AD^+ = F$ Yes ✓

ADE candidate key?

No since $AD \subset ADE$ and AD is a key.