R

(A, B, C, D, E)

F : $\alpha \rightarrow \beta$

$\beta \rightarrow \gamma$

← set of functional dependencies

$F^+ = \{ \alpha \rightarrow \beta,\ \beta \rightarrow \gamma,\ \alpha \rightarrow \gamma \}$

← closure

F^+ check :

$\alpha \rightarrow \beta$ is trivial (i.e., $\beta \subseteq \alpha$)

α is a superkey for R

→ as per defn you have to find out F^+ but you don't need to

If a relation is in BCNF → chances of redundant info is very low

example:

not BCNF { in_dep (ID, name, salary, dept_name, building, budget)

α : dept_name → β : building, budget

→ $\alpha \not\supseteq \beta$

→ α is not a superkey

∴ decompose

instructor (ID, name, salary, dept_name)

department (dept_name, building, budget)

Decomposing a schema into BCNF

→ Let $\alpha \rightarrow \beta$ be FD that causes violation of BCNF

decompose R into

$\alpha \cup \beta$: R_1 → α candidate key

$R - (\beta - \alpha)$: R_2

→ lossless

Is this decomposition lossless? What about dependency preservation?

in_dep (ID, name, salary, dept_name, building, budget)

α: dept_name

β: building, budget

dept_name → building, budget

R_1 : dept_name, building, budget

R_2 : ID, name, salary, dept_name

Example

$R = (A, B, C)$

$F = \{ A \rightarrow B, \; B \rightarrow C \}$ ⟹ $A \rightarrow C$, $A \rightarrow BC$, $AB \rightarrow C$

(✓) (✗)

∴ A is a candidate key

$R_1 := (A, B)$

$R_2 := (B, C)$

functional depencies MUST be satisfied they come from the business rules

... to preserve dependency

Not always possible to

dept_advisor (s_ID, i_ID, dept_name)

violates BCNF

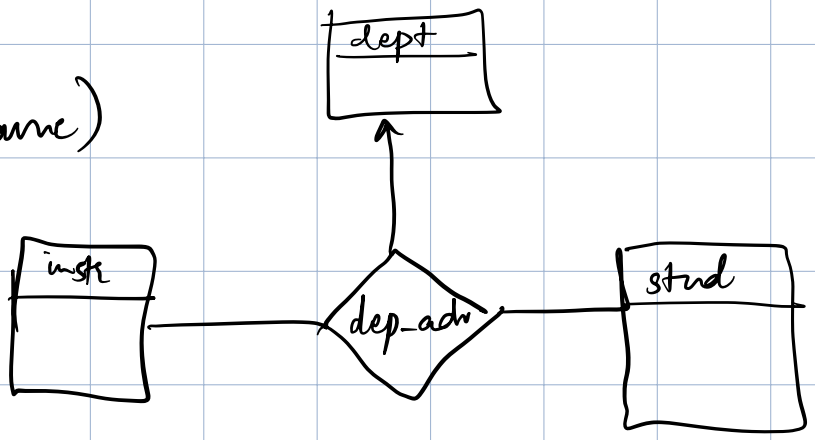
✗ $i\_ID \rightarrow dept\_name$

$s\_ID, dept\_name \rightarrow i\_ID$

not satisfying

R_1 : i_ID, dept_name

R_2 : s_ID, dept_name



each instructor can mentor only one student from a department

Third Normal Form

→ guaranteed to preserve dependency

→ some redundancy