CSI T5300: Advanced Database Systems

L05: Extraneous Attributes (Supplementary Slides)

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Extraneous Attributes

• There may be extraneous/redundant attributes on the LHS of a dependency
  - Let $\alpha \rightarrow \beta$ be a functional dependency in $F$. Attribute $A$ is extraneous in $\alpha$ if $F$ logically implies $F' = (F - \{\alpha \rightarrow \beta\}) \cup \{\alpha - A \rightarrow \beta\}$

  - To test if attribute $A$ is extraneous in $\alpha$ is extraneous in:
    1. compute ($\{\alpha\} - A)^+$ using the dependencies in $F$
    2. check that ($\{\alpha\} - A)^+$ contains $A$; if it does, $A$ is extraneous

  - Example:
    \[
    F = \{\{A\} \rightarrow \{B\}, \{B\} \rightarrow \{C\}, \{A,C\} \rightarrow \{D\}\} \quad \text{can be simplified to} \quad F' = \{\{A\} \rightarrow \{B\}, \{B\} \rightarrow \{C\}, \{A\} \rightarrow \{D\}\}
    \]
    \[
    \text{Because: Compute } (\{A,C\} - C)^+ = A^+ \text{ using the dependencies in } F
    \]
    \[
    A^+ = \{A,B,C,D\} \text{ contains } C
    \]
    \[
    \text{Thus, } C \text{ in } \{A,C\} \rightarrow \{D\} \text{ is extraneous, and } F \text{ can be simplified to } F'
    \]
Extraneous Attributes

• There may be extraneous/redundant attributes on the RHS of a dependency
  - Let \( \alpha \rightarrow \beta \) be a functional dependency in F. Attribute A is extraneous in \( \beta \) if
    \[
    F' = (F - \{\alpha \rightarrow \beta\}) \cup \{\alpha \rightarrow (\beta - A)\}
    \]
    logically implies F
  
  - To test if attribute A is extraneous in \( \beta \)
    1. compute \( \alpha^+ \) using only the dependencies in \( F' \)
    2. check that \( \alpha^+ \) contains A; if it does, A is extraneous

  - Example:
    \[
    F = \{\{A\} \rightarrow \{B\}, \{B\} \rightarrow \{C\}, \{A\} \rightarrow \{C,D\}\}
    \]
    can be simplified to
    \[
    F' = \{\{A\} \rightarrow \{B\}, \{B\} \rightarrow \{C\}, \{A\} \rightarrow \{D\}\}
    \]
    Because: Compute \( \alpha^+ \) using \( F' \)
    \[
    \alpha^+ = \{A,B,C,D\}
    \]
    contains C
    Thus, C in \( \{A\} \rightarrow \{C,D\} \) is extraneous, and F can be simplified to \( F' \)