

Functional Dependencies (Armstrong's Axioms)

COMP3278B 2020

Functional Dependencies – quick check

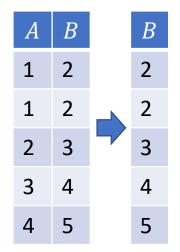
- Which of the following is satisfied in R?
 - $A \rightarrow B$
 - $A \rightarrow C$
 - $A \rightarrow D$
 - $A \rightarrow E$

R

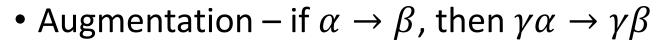
A	В	С	D	E
1	2	3	5	7
1	2	3	4	7
2	3	5	3	7
3	4	2	2	7
4	5	7	1	7

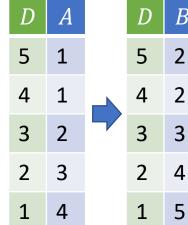
Armstrong's Axioms – basic

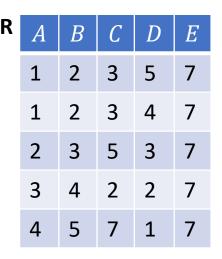
• Reflexivity – if $\beta \subseteq \alpha$, then $\alpha \to \beta$

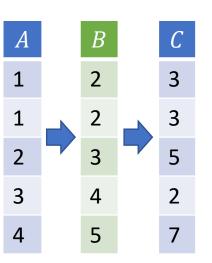


• Transitivity – if $\alpha \to \beta$ and $\beta \to \gamma$, then $\alpha \to \gamma$



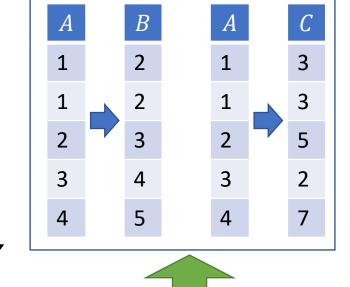




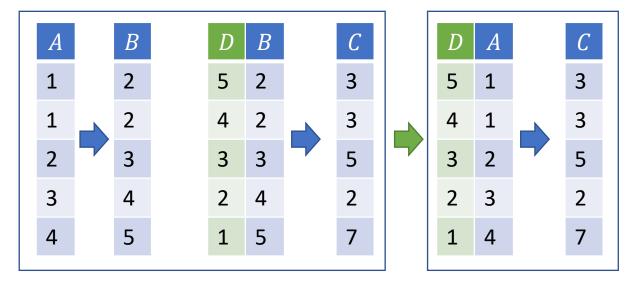


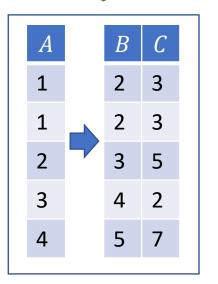
Armstrong's Axioms

- Union if $\alpha \to \beta$ and $\alpha \to \gamma$, then $\alpha \to \beta \gamma$
- Decomposition if $\alpha \to \beta \gamma$, then $\alpha \to \beta$ and $\alpha \to \gamma$



• Pseudo-transitivity – if $\alpha \to \beta$ and $\gamma\beta \to \delta$, then $\alpha\gamma \to \delta$





Exercise

Estimated time: 15 – 20min

Basic rules

Reflexivity – if $\beta \subseteq \alpha$, then $\alpha \to \beta$.

Transitivity – if $\alpha \rightarrow \beta$ and $\beta \rightarrow \gamma$, then $\alpha \rightarrow \gamma$

Augmentation – if $\alpha \rightarrow \beta$, then $\gamma \alpha \rightarrow \gamma \beta$

Secondary rules

Union – if $\alpha \to \beta$ and $\alpha \to \gamma$, then $\alpha \to \beta \gamma$

Decomposition – if $\alpha \to \beta \gamma$, then $\alpha \to \beta$ and $\alpha \to \gamma$

Pseudo-transitivity – if $\alpha \to \beta$ and $\gamma\beta \to \delta$, then $\alpha\gamma \to \delta$

- 1. Show that the following rules are special cases of a basic rule.
 - Self determination $\alpha \rightarrow \alpha$ for any α
 - Extensivity if $\alpha \rightarrow \beta$, then $\alpha \rightarrow \alpha\beta$

Clearly state the rule that you have applied in each step in your proof.

- 2. Proof the secondary rules using basic rules only.
- 3. Proof the following composition rule using basic rules only.
 - If $\alpha \to \beta$ and $\gamma \to \delta$, then $\alpha \gamma \to \beta \delta$
- 4. Given the rules on the right on attributes A, B, C, D, E, F, proof that $AB \rightarrow DE$.
 - You can use any rule.

$$AC \rightarrow D$$

$$AC \rightarrow E$$

$$B \rightarrow F$$

$$F \rightarrow C$$