Outline

- Armstrong’s Axioms
- Problem solving on Armstrong’s Axioms

Armstrong’s Axioms

- Armstrong's Axioms is a set of rules.
- It provides a simple technique for reasoning about functional dependencies.
- It was developed by William W. Armstrong in 1974.
- It is used to infer all the functional dependencies on a relational database.

Primary Rules

Rule 1	**Reflexivity** If A is a set of attributes and B is a subset of A, then A holds B. { A ⟶ B }
Rule 2	**Augmentation** If A hold B and C is a set of attributes, then AC holds BC. {AC ⟶ BC} It means that attribute in dependencies does not change the basic dependencies.
Rule 3	**Transitivity** If A holds B and B holds C, then A holds C. If {A ⟶ B} and {B ⟶ C}, then {A ⟶ C} A holds B {A ⟶ B} means that A functionally determines B.

Secondary Rules

Rule 1	**Union** If A holds B and A holds C, then A holds BC. If{A → B} and {A → C}, then {A → BC}
Rule 2	**Decomposition** If A holds BC and A holds B, then A holds C. If{A → BC} and {A → B}, then {A → C}
Rule 3	**Pseudo Transitivity** If A holds B and BC holds D, then AC holds D. If{A → B} and {BC → D}, then {AC → D}

Problem Solving using Armstrong's Axioms

1) Example:

Consider relation E = (P, Q, R, S, T, U) having set of Functional Dependencies (FD).

$P \rightarrow Q$ $\quad$ $P \rightarrow R$

$QR \rightarrow S$ $\quad$ $Q \rightarrow T$

$QR \rightarrow U$ $\quad$ $PR \rightarrow U$

Calculate some members of Axioms are as follows,

1. $P \rightarrow T$
2. $PR \rightarrow S$
3. $QR \rightarrow SU$
4. $PR \rightarrow SU$

Solution

1. P → T

In the above FD set, P → Q and Q → T

So, Using Transitive Rule: If {A → B} and {B → C}, then {A → C}

∴ If P → Q and Q → T, then **P → T.**

P → T

Solution

2. PR → S

In the above FD set, P → Q

As, QR → S

So, Using Pseudo Transitivity Rule: If{A → B} and {BC → D}, then {AC → D}

∴ If P → Q and QR → S, **then PR → S.**

PR → S

Solution

3. QR → SU

In above FD set, QR → S and QR → U

So, Using Union Rule: If{A → B} and {A → C}, then {A → BC}

∴ If QR → S and QR → U, **then QR → SU.**

QR → SU

Solution

4. PR → SU

So, Using Pseudo Transitivity Rule: If{A → B} and {BC → D}, then {AC → D}

∴ If PR → S and PR → U, then PR → SU.

PR → SU

End of Lecture