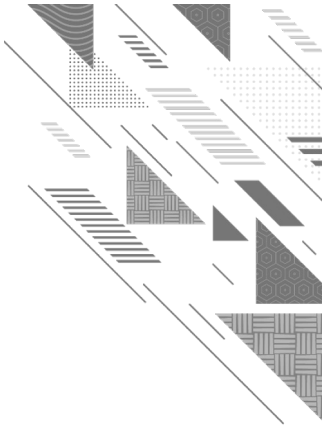
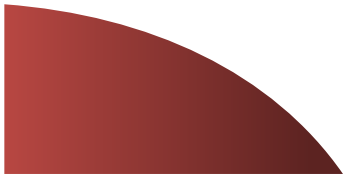


Closure of attribute sets



What is a closure of attribute sets?

- Given a set of attributes α, the closure of α under F is the **set of attributes that are functionally determined by α under F**.
- It is denoted by **α^+**.
- **Use of Closure of Attributes:**
  - To identify the additional FDs.
  - To identify the keys
  - To identify the equivalence of FD
  - To identify the standard form, canonical form or irreducible set of FD.

Algorithm

- Algorithm to compute α^+, the closure of α under F
  - Steps
    1. result = α
    2. *while* (changes to result) *do*
       - for each $\beta \rightarrow \gamma$ in F do
         - begin
           - if $\beta \subseteq$ result then result = result U γ
           - else result = result
         - end

Closure of attribute sets [Example]

- Consider the relation schema R = (A, B, C, G, H, I).

For this relation, a set of functional dependencies F can be given as

F = {A → B, A → C, CG → H, CG → I, B → H}

Find out the closure of A^+, B^+, C^+, $(AG)^+$.

A^+ = {ABCH}

B^+ = {BH}

C^+ = {C}

➥ Step 1.

result = α => result = AG

A → B	A ⊆ AG	result = ABG
A → C	A ⊆ ABG	result = ABCG
CG → H	CG ⊆ ABCG	result = ABCGH
CG → I	CG ⊆ ABCGH	result = ABCGHI
B → H	B ⊆ ABCGHI	result = ABCGHI

AG^+ = {ABCGHI}

Closure of attribute sets [Exercise]

- Consider the relation schema R = (A, B, C, D, E).

For this relation, a set of functional dependencies F can be given as

$F = \{A \rightarrow B, B \rightarrow D, C \rightarrow DE, CD \rightarrow AB\}$

Find out the closure of A^+, B^+, C^+, D^+ , E^+, $(CD)^+$, $(AD)^+$.

CK = {C}

A^+	{A, B, D}
B^+	{B, D}
C^+	{C, D, E, A, B}
D^+	{D}
E^+	{E}
$(CD)^+$	{A, B, C, D, E}
$(AD)^+$	{A, D, B}

Closure of attribute sets [Exercise]

Given functional dependencies (FDs) for relational schema R = (A,B,C,D,E):

F = {A → BC, CD → E, B → D, E → A}

Find Closure for A

Find Closure for CD

Find Closure for B

Find Closure for BC

Find Closure for E

Answer

A^+ = ABCDE

CD^+ = ABCDE

B^+ = BD

BC^+ = ABCDE

E^+ = ABCDE

Exercise:

Q1.) Given R(A, B, C, D, E) and
F = {A → BC, CD → E, B → D, E → A}, **then,** A^+ = ?

A^+ = {A, B, C, D, E}

Q2.) Given R(A, B, C, D, E, F) and
F = {AB → C, BC → AD, D → E, CF → B}, **then,** AB → F is a member of FD Set ?