REWRITE RULES

Commutative & Associative Laws

$R \times S = S \times R$

$R \times (S \times T) = (R \times S) \times T$

$R \bowtie S = S \bowtie R$

$R \bowtie (S \bowtie T) = (R \bowtie S) \bowtie T$

$R \cap S = S \cap R$

$R \cap (S \cap T) = (R \cap S) \cap T$

$R \cup S = S \cup R$

$R \cup (S \cup T) = (R \cup S) \cup T$

$R \bowtie_C S = S \bowtie_C R$

But $R \bowtie_C (S \bowtie_C T) \neq (R \bowtie_C S) \bowtie_C T$ in general

(only if needed attributes exist)

Selection Splitting

$$\sigma_{C_1 \; AND \; C_2}(R) = \sigma_{C_1}\left(\sigma_{C_2}(R)\right) = \sigma_{C_2}\left(\sigma_{C_1}(R)\right) = \sigma_{C_1}(R) \cap \sigma_{C_2}(R)$$

$$\sigma_{C_1 \; OR \; C_2}(R) = \sigma_{C_1}(R) \cup \sigma_{C_2}(R)$$

$$\sigma_C(R \cup S) = \sigma_C(R) \cup \sigma_C(S)$$

$$\sigma_C(R - S) = \sigma_C(R) \cup \sigma_C(S)$$

Where needed attributes exist in R or S:

$$\sigma_C(R \bowtie S) = \sigma_C(R) \bowtie S = R \bowtie \sigma_C(S) = \sigma_C(R) \bowtie \sigma_C(S)$$

$$\sigma_C(R \bowtie_D S) = \sigma_C(R) \bowtie_D S = R \bowtie_D \sigma_C(S)$$

$$\sigma_C(R \times S) = \sigma_C(R) \times S = R \times \sigma_C(S)$$

$$\sigma_C(R \cap S) = \sigma_C(R) \cap S = R \cap \sigma_C(S) = \sigma_C(R) \cap \sigma_C(S)$$

Projection Rules

$$\pi_L(R \cup_B S) = \pi_L(R) \cup_B \pi_L(S)$$

$$\pi_L\left(\sigma_C(R)\right) = \pi_L(\sigma_C(\pi_M(R)))$$

where $M = L \cup attributes(C)$

Join/Product Rules

$$R \bowtie_C S = \sigma_C(R \times S)$$

$$R \bowtie S = \pi_L\left(\sigma_C(R \times S)\right)$$

where C equates fields and L selects

Rules on Duplicates

$$\delta(R \times S) = \delta(R) \times \delta(S)$$

$$\delta(R \bowtie S) = \delta(R) \bowtie \delta(S)$$

$$\delta(R \bowtie_C S) = \delta(R) \bowtie_C \delta(S)$$

$$\sigma_C\left(\delta(R)\right) = \delta\left(\sigma_C(R)\right)$$

$$\delta(R \cap_{\boldsymbol{B}} S) = \delta(R) \cap_{\boldsymbol{B}} S = R \cap_{\boldsymbol{B}} \delta(S) = \delta(R) \cap_{\boldsymbol{B}} \delta(S)$$

Rules on Grouping

$$\delta(\gamma_L(R)) = \gamma_L(R)$$

$\gamma_L(R) = \gamma_L(\pi_M(R))$ if $L \subseteq M$

$\gamma_L(R) = \gamma_L\left(R\delta(R)\right)$ if γ_L is duplicate-impervious (e.g., MIN, MAX)