Relational Algebra Equivalences

- Allow us to choose different join orders and to `push' selections and projections ahead of joins.
- Rules on joins, cross products and union

$R \bowtie S = S \bowtie R$

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

R x S = S x R

(R x S) x T = R x (S x T)

R U S = S U R

R U (S U T) = (R U S) U T

Rules: Selects

$\sigma_{p1 \wedge p2}(R) = \sigma_{p1} [\sigma_{p2} (R)]$

$\sigma_{p1 \vee p2}(R) = [\sigma_{p1} (R)] \cup [\sigma_{p2} (R)]$

Rules: Project

Let: X = set of attributes

Y = set of attributes

XY = X U Y

$$\pi_{xy}(R) = \pi_x[\pi_y(R)]$$

Rules: Project

Let: X = set of attributes

Y = set of attributes

XY = X U Y

$$\pi_{xy}(R) = \pi_x[\pi_y(R)]$$

$$\pi_x(R) = \pi_x[\pi_y(R)] \text{ if y contains x}$$

Rules: $\sigma + \bowtie$ combined

Let P = predicate with only R attribs

Q = predicate with only S attribs

M = predicate with only R,S attribs

$$\sigma_p (R \bowtie S) = [\sigma_p(R)] \bowtie S$$

$$\sigma_q (R \bowtie S) = R \bowtie [\sigma_q(R)]$$

More Rules

Let x = subset of R attributes

z = attributes in predicate P

(subset of R attributes)

$$\pi_x[\sigma_p (R)] = \pi_x \{\sigma_p [\pi_{xz} (R)]\}$$

More Rules

Let x = subset of R attributes

y = subset of S attributes

z = intersection of R,S attributes

$\pi_{xy}(R \bowtie S) =$

$$\pi_{xy}\{[\pi_{xz}(R)] \bowtie [\pi_{yz}(S)]\}$$

More Rules

$\pi_{xy}\{\sigma_p(R \bowtie S)\} =$

$$\pi_{xy}\{\sigma_p[\pi_{xz'}(R) \bowtie \pi_{yz'}(S)]\}$$

$z' = z \cup \{\text{attributes used in } P\}$