T, S sets. A relation between T and S is

$$R \subseteq T \times S$$

in particular: $T = S$

S (binary relation)

$$R \subseteq S \times S$$

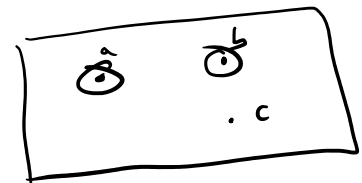$$R = \{(a,b), (a,a), (c,b)\}$$
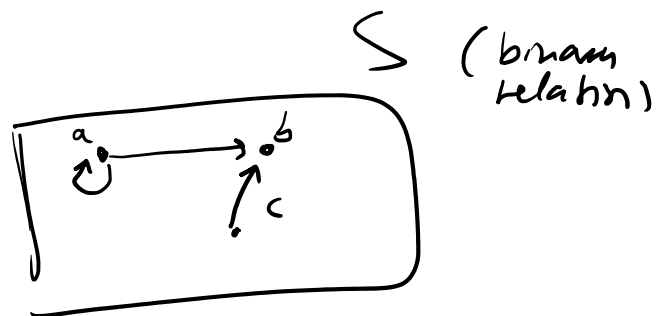
unary relation on S : $R \subseteq S$

$$R = \{a, b\}$$

$S = \{1, 2, 3\}$

relation : $\leq$

$"\leq" \subseteq S \times S$

$= \{(1,1), (1,2), (1,3), (2,2), (2,3), (3,3)\}$

$"\leq 1 2"$ $"1 \leq 2"$

$"Rab"$ $"aRb"$

Models:

$$\forall x \, (P_x \lor \neg P_x)$$

always holds
         in all models

$$\forall x \, (P_x \to Q_x)$$

Model:

Set $\{a, b\} = D$

$Q = \{a\}$

$P = \{b\}$

Then $P_b \to Q_b$ false

Thus $\forall x \, (P_x \to Q_x)$
does not hold in this model.

$\{d, v, w\} = D$

relation:

$K = know$ (binary)

w knows ✓
v know w

$K = \{(v,w), (w,v)\}$

$I(d) =$ 🙂
$I(w) =$ 🙂
$I(v) =$ 🙂

$I(K) = \{(\bigcirc, \bigcirc), (\bigcirc, \bigcirc)\}$

$g = $ identity funct~

$g[x := \bigcirc]$