

## Ontologies (2) (solutions)

### Exercise 1

Practice

### Exercise 2

a)  $\text{Elephant} \subseteq \text{Animal} \cap \forall \text{eats.Plant}$

b)  $T \subseteq \leq 1 \text{ fatherOf}$

$\exists \text{fatherOf.T} \subseteq \text{Man}$

$T \subseteq \forall \text{fatherOf.Person}$

$\text{fatherOf} \subseteq \text{parentOf}$

### Exercise 3

$A0 = \{(\exists R. (\forall S.M) \cap \forall R. (\exists S. \neg M))(a)\}$

Conjunction rule:

$A1 = \{(\exists R. (\forall S.M))(a), (\forall R. (\exists S. \neg M))(a)\}$

Exist. Rule:

$A2 = \{R(a,b), (\forall S.M)(b), (\forall R. (\exists S. \neg M))(a)\}$

Universal rule:

$A3 = \{R(a,b), (\forall S.M)(b), (\forall R. (\exists S. \neg M))(a), (\exists S. \neg M)(b)\}$

Exist. Rule:

$A4 = \{R(a,b), (\forall S.M)(b), (\forall R. (\exists S. \neg M))(a), S(b,c), (\neg M)(c)\}$

Universal rule:

$A5 = \{R(a,b), (\forall S.M)(b), (\forall R. (\exists S. \neg M))(a), S(b,c), (\neg M)(c), M(c)\}$

Clash between:  $(\neg M)(c)$ ,  $M(c)$ , so the concept is **unsatisfiable**.

### Exercise 4

a)  $\text{ext}(\exists R.A) = \{v, y, x\}$

e)  $\text{ext}(\neg B) = \Phi$

b)  $\text{ext}(\forall R.A) = \Phi$

f)  $\text{ext}(\exists R. (\exists R.A)) = \{v, y\}$

c)  $\text{ext}(\leq 1R) = \Phi$

g)  $(\leq 2R)(v)$ , or  $(= 2R)(v)$

d)  $\text{ext}(\geq 2R) = \{v\}$  if UNA