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2. Übung zur Vorlesung „Logische Methoden in der Wissensrepräsentation“

Exercise 6:

Define a generic frame that describes the prototypical object “computer science course”. Use slots

- *Title*,
- *Lecturer*,
- *Type of course*, and
- *Hours per week*.

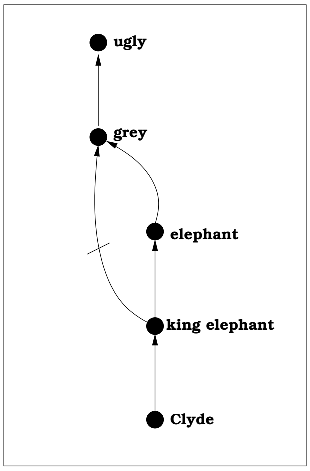
Find other meaningful slots. Then construct an instance frame for the generic frame.

Exercise 7:

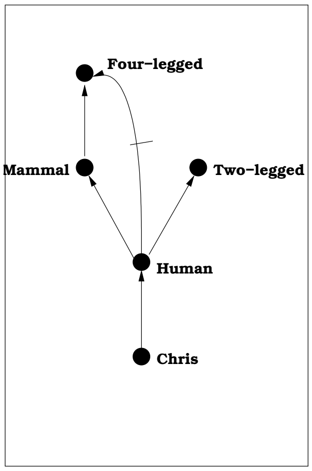
Consider the following non-monotonic inheritance networks and try to resolve the conflicts:

(a) As is well known, king elephants are white rather than gray. Which color has Clyde?

(b) How many legs has Chris?



Network for Part (a)



Network for Part (b)

Exercise 8:

Let α and β be propositional formulae. Prove or disprove the following propositions:

(a) If $\alpha \Rightarrow \beta$ and α are valid, then β is valid.

(b) If $\alpha \Rightarrow \beta$ and α are satisfiable, then β is satisfiable.

(c) If $\alpha \Rightarrow \beta$ is valid and α is satisfiable, then β is satisfiable.

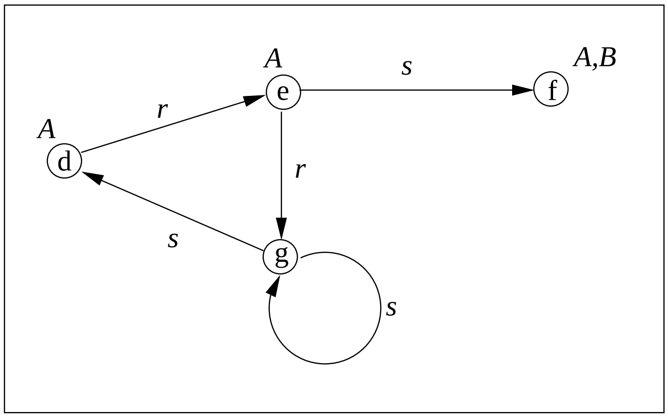
Exercise 9:

A propositional formula is in *negation normal form* (NNF) if it is built using $\wedge$, $\vee$, and $\neg$ only, and if negation occurs only in front of propositional variables. Two propositional formulae α and β are *equivalent* if $\alpha \Leftrightarrow \beta$ is valid. Prove that each propositional formula α can be transformed into an equivalent one in NNF by first rewriting α into an equivalent formula α' that uses $\wedge$, $\vee$, and $\neg$ only, and then by "pushing negation inwards", i.e., by applying the following three rules exhaustively to all sub-formulae of α':

$$\begin{aligned}
\neg\neg\beta &\rightsquigarrow \beta \\
\neg(\beta_1 \vee \beta_2) &\rightsquigarrow \neg\beta_1 \wedge \neg\beta_2 \\
\neg(\beta_1 \wedge \beta_2) &\rightsquigarrow \neg\beta_1 \vee \neg\beta_2
\end{aligned}$$

Exercise 10:

Consider the (graphical representation of the) interpretation $\mathcal{I}$ with $\Delta^{\mathcal{I}} = \{d, e, f, g\}$:



For each of the following concepts C, list all elements x of $\Delta^{\mathcal{I}}$ such that $x \in C^{\mathcal{I}}$:

- $A \sqcup B$
- $\exists s.\neg A$
- $\forall s.A$
- $\exists s.\exists s.\exists s.\exists s.A$
- $\forall t.A \sqcap \forall t.\neg A$
- $\neg\exists r.(\neg A \sqcap \neg B)$
- $\exists s.(A \sqcap \forall S.\neg B) \sqcap \neg\forall r.\exists r.(A \sqcup \neg A)$