

Problem 6-32:

	English	FOL
Names	Claire Max Melanie Mary	Claire Max Melanie Mary
Predicates	x is the mother of y x is older than y	MotherOf(x, y) Older(x, y)
Functions	x 's mother	mother(x)

- Older(mother(Claire), mother(Max))
 $\exists x \exists y [\text{MotherOf}(x, \text{Claire}) \wedge \text{MotherOf}(y, \text{Max}) \wedge \forall z (\text{MotherOf}(z, \text{Claire}) \rightarrow x = z) \wedge \forall w (\text{MotherOf}(w, \text{Max}) \rightarrow y = w) \wedge x \neq y \wedge \text{Older}(x, y)]$
- $\forall x \text{Older}(\text{mother}(\text{mother}(x)), \text{Melanie})$
 $\forall x \exists y \exists z [\text{MotherOf}(y, x) \wedge \text{MotherOf}(z, y) \wedge x \neq y \wedge y \neq z \wedge x \neq z \wedge \forall w [\text{MotherOf}(w, x) \rightarrow y = w] \wedge \forall w [\text{MotherOf}(w, y) \rightarrow z = w] \wedge \text{Older}(z, \text{Melanie})]$
- $\exists x \text{Older}(\text{Mary}, \text{mother}(\text{mother}(x)))$
 $\exists x \exists y \exists z [\text{MotherOf}(x, y) \wedge \text{MotherOf}(z, y) \wedge x \neq y \wedge x \neq z \wedge y \neq z \wedge \forall w (\text{MotherOf}(w, x) \rightarrow y = w) \wedge \forall w (\text{MotherOf}(w, y) \rightarrow z = w) \wedge \text{Older}(\text{Mary}, z)]$

Problem 6-33:

- $[\text{height}(\text{father}(\text{Max})) > \text{height}(\text{Max})] \wedge \neg[\text{height}(\text{father}(\text{Max})) > \text{height}(\text{father}(\text{Claire}))]$
- $\exists x [\text{height}(x) > \text{height}(\text{father}(\text{Claire}))]$
- $\forall x \exists y [\text{height}(x) > \text{height}(y)]$
- $\neg \exists x (\text{height}(x) > \text{height}(x))$
- $\forall x [(\text{height}(x) > \text{height}(\text{Claire})) \rightarrow (\text{height}(x) > \text{height}(\text{Max}))]$
- $\forall x \{(\text{height}(\text{Claire}) > \text{height}(x)) \rightarrow \exists y[(\text{height}(y) > \text{height}(x)) \wedge (\text{height}(\text{father}(\text{Max})) > \text{height}(y))]\}$

2.7. Chapter 7 Solutions

Problem 7-1: Tarski's World Drill**Problem 7-2:**

- There is exactly one Tove.
- There is at most one Tove.
- There is exactly one Tove.
- There is at most one Tove.
- Objects are identical iff they are Toves.

Problem 7-3: Reserved for Logical Project Three (the solution will be provided later)

Problem 7-4: Reserved for Logical Project Three (the solution will be provided later)

Problem 7-5: Reserved for Logical Project Three (the solution will be provided later)