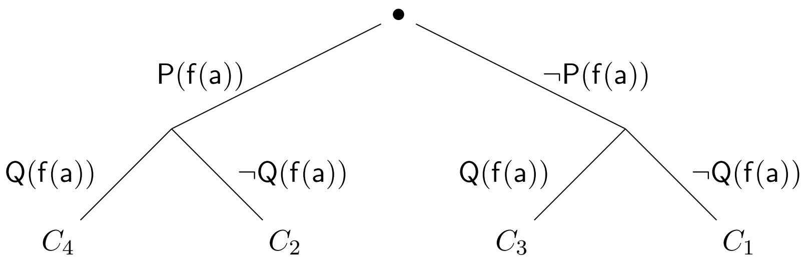
1. *Solution.*



□

2. *Solution.* Define the tableau-consistent set of sentences, as those that do not have a tableau proof of $\bot$. Show that these sets fufill the satisfaction properties. Apply model existence. □

3. *Solution.* Definition 10.20 in the lecture notes. □

a) *Solution.* Definition 10.21. □

b) *Solution.* There exists clause sets, where structural Skolemisation yields non-elementary shorter refutations than prenex Skolemisation. □

4. *Solution.* Consider a ground factoring step:

$$\frac{C\tau \vee A\tau \vee B\tau}{C\tau \vee A\tau} \quad ,$$

where τ is ground. By definition there exists a mgu σ such that $A\sigma = B\sigma$. Hence the following inference is a valid factoring step:

$$\frac{C\sigma \vee A\sigma \vee B\sigma}{C\sigma \vee A\sigma} \quad .$$

□

5. Determine whether the following statements are true or false. Every correct answer is worth 2 points. (20 pts)

statement	yes	no
Let $\mathcal{G}$ denote a set of universal formulas. Then $\mathcal{G}$ is satisfiable iff $\mathcal{G}$ has a Herbrand model.	☐	☑
The DPLL-method includes a) the tautology rule, b) the pure literal rule, c) the splitting rule, and d) the zero-one law rule.	☐	☑
Optimised Skolemisation is an example of an inner Skolemisation technique.	☑	☐
Strong Skolemisation is an example of an outer Skolemisation technique.	☐	☑
A literal L is *strictly maximal* if there exists a ground substitution σ such that for no other literal M: $M\sigma \succ_{\mathsf{L}} L\sigma$ holds.	☐	☑
If $\mathcal{C}$ is the clause representation of the (negated) word problem $\mathcal{E} \models s = t$, then the saturation of $\mathcal{C}$ wrt to superposition (and equality resolution) contains $\Box$ iff $\mathcal{E} \models s = t$.	☑	☐
A clause $C \lor s = t$ is reductive if $s \succ t$ and $s = t$ is maximal with respect to C.	☐	☑
A reductive conditional rewrite system is confluent only if all critical pairs converge.	☑	☐
A candidate model is a model.	☐	☑
All non-redundant superposition inferences are liftable	☑	☐