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Exercises in Modeling Methods in Computer Science, Winter 2005/06
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Exercise 4Submit until **22.11.2005, 4 pm**

Task 7: Marking algorithm

Given is the alphabet $\mathcal{A} := \{A, B, C, D, E\}$.

Apply the marking algorithm on the following formulas. Show all intermediate steps. Are the formulas satisfiable or unsatisfiable? Also, if a formula is satisfiable, give a minimum model.

- (a) $F_1 := A \wedge (\neg B \vee \neg C \vee \neg A) \wedge (C \vee \neg D) \wedge (B \vee \neg C \vee \neg A) \wedge C$
- (b) $F_2 := (\neg A \vee B \vee \neg C) \wedge (C \vee \neg D) \wedge (E \vee \neg A \vee \neg C) \wedge (A \vee \neg C) \wedge C$

10 Points

Task 8: Resolution rule in propositional logic

Given is the formula

$$F := (A \vee \neg B \vee C) \wedge (A \vee B) \wedge (B \vee \neg C)$$

- (a) Give the set of clauses for the above formula.
- (b) Give explicitly the set of resolvents $Res^i(F)$ for every number $i \geq 0$.
- (c) Give the smallest number n , for which $Res^*(F) = Res^n(F)$ holds?
- (d) Is F satisfiable, or is it unsatisfiable? Why?

10 Points

Additional problem (do not submit, will not be corrected):

Compare the marking algorithm with the resolution rule in propositional logic:

- (a) Can we use the marking algorithm on all formulas in propositional logic?
Can the resolution rule be applied to all formulas in propositional logic?
If not, then under what conditions can they be applied?
- (b) How come we need the CNF of the formula for both the methods?
- (c) If the formula is satisfiable, will both methods also yield a model? If yes, how?

- (d) How can we show that a formula is a tautology using resolution rule in propositional logic? Can we show the same using marking algorithm?
- (e) Does the marking algorithm terminate in all cases, or in other words, does it reach a terminating condition in every case? How does the resolution rule fare, does it always terminate?
- (f) Can we eliminate two literals at the same time in just a single resolution step with the resolution rule of propositional logic? If yes, why, if not why not?
- (g) What is the connection between the marking algorithm and Horn formulas?