

Formal Reasoning 2014
Additional Test
(07/01/15)

Before you read on, write your name, student number and study on the answer sheet! The mark for this test is the number of points divided by ten. The first ten points are free. The test is *closed book*. Good luck!

1. Give three distinct models in which the proposition $a \rightarrow b \leftrightarrow c$ holds. (15 points)
2. Translate the following English sentence to a formula of predicate logic with equality.

There is exactly one man who loves exactly one woman.

Use this dictionary:

M	the domain of men
V	the domain of women
$H(x, y)$	x loves y

(20 points)

3. Give a finite (deterministic) automaton for the language

$$L_3 := \mathcal{L}((ab)^*) \cap \overline{\{w \in \{a, b\}^* \mid w \text{ does not contain } b\}^*}$$

(20 points)

4. We want to show that the sum of the degrees of all vertices in a graph is always even. Prove this by induction to the number of edges in the graph.

(20 points)

5. Give an LTL formula that formalizes the following property and explain your answer:

a becomes true before b

More precisely: a and b are both at least once true (but they don't have to stay true), and the moment on which a becomes true for the first time, is strictly earlier than the moment on which b becomes true for the first time.

(15 points)