Exam: Models of Computation TDA183 – DIT310

Date: April 16, 2015, 14:00 – 18:00, Horsalsvagen.

Permitted aids: English-Swedish or English-other language dictionary.

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All solutions must be explained! The examination of the course consists of three parts: homework assignments count up to 40 points, weekly exercises up to 20 points and this written exam up to 140 points (20 points for each problem). You have to have 100 points in total in order to pass the course.

Solutions to the exam will be available from the homepage of the course.

1. Prove or disprove the following statements:

    (a) The function `f :  N -> N` which is undefined for all even arguments and 0 for all even arguments is computable.

    (b) If an open expression in lambda-calculus has a normal form, then this normal form is open.

    (c) The set of total functions `Bool -> N` is enumerable.

    (d) If we fully evaluate a program in **X** which has a weak head normal form then the evaluation terminates.

2. There are two different definitions of what it means for a set `A` to be enumerable. A third definition could be that the set is enumerable if it fits in a hotel, with an infinite number of rooms. Each room number is a unique natural number. That the set fits in the hotel means that (1) each element is in at least one room, and (2) each room has not more than one element (we don't want all elements to share the same room). Explain how these two requirements are satisfied in the two alternative definitions of enumerable!

3. What does it mean that a function `f :  N -> N` is computable in lambda calculus?

4. Define a program `Y` in **X** such that the application `(Y f)` computes to the same value as the application `(f (Y f))` for all functions `f`. (Don't forget to explain why!)

Good Luck!

Bengt