Exam: Models of Computation TDA183 – DIT310

Date: April 10, 2012, 14.00 - 18.00

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

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All solutions must be explained! It is not enough to just give a program without an explanation of why it works. 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. The points for homework assignments and weekly exercises are valid for one year after the start of the course.

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

1. What does it mean that a function `f : N -> N` is Turing-computable?
2. Is the set of partial functions from `N` to $\{1\}$ enumerable? Motivate your answer!
3. Give two different definitions of what it means for a set to be enumerable.
4. Show that the lambda-term **Z** defined by

   ```
   Z = \f.((\x.f(\z.xxz))(\x.f(\z.xxz)))
   ```

   is a fixpoint combinator.
5. Describe the language **PRF** of primitive recursive functions! Give the abstract syntax and an informal description of the semantics.
6. Define what it means for a program in **X** to be a self-evaluator. In order to do this you have to explain how to represent **X**-programs in **X**. There is no need to do this in full detail, just outline the construction.
7. Give an example of a term in lambda-calculus which reduces to normal form in fewer steps using applicative order reduction than normal order reduction! Explain why!

Good Luck!

Bengt