Lund University and Institute of Technology
Computer Science
Lennart Andersson

2004–04–15, 14.00–18.00
DAT130, EDA145
Examination

Examination in Programming language theory

This exam has 6 problems, each worth 5 marks. For passing the exam at most 15 marks will be required.

The following texts may be used during the exam:
Nielson, Nielson, Semantics with Applications.
Andersson, Programming language theory, Lecture notes.

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1. Reduce $SKSK$, where $S = \lambda x\, y\, z\, .\, x\, z\, (y\, z)$ and $K = \lambda x\, y\, .\, x$, to normal form showing the result after each single conversion.

2. Extend **Aexp** by integer division and redefine $\mathcal{A} \in \mathbf{Aexp} \to \mathbf{State} \to (\mathrm{N} \cup \{\, \mathit{error} \,\})$ so that every expression containing a division by 0 has the meaning *error*.

3. Prove by induction that $\langle\, S, \sigma \,\rangle \to \sigma'$ implies that $\sigma = \sigma'$ for all statement S in **While** not containing any assignment statement.

4. Consider the functions in $D \to D$ where $D \stackrel{\Delta}{=} \{\, \bot, \top \,\}$ and $d \sqsubseteq d'$ iff $d = d'$ or $d = \bot \wedge d' = \top$.

   (a) How many functions are there?

   (b) Which of the functions are monotonic?

   (c) Which of the functions are continuous?

5. Suggest an inference rule for `repeat` S `until` b to be added to Table 6.1 in the text book. You are not allowed to rely on the existence of the while statement.

6. Extend **While** with a `break` statement. The `break` statement may only occur inside a `while` statement and its execution will immediately finish the execution of the smallest enclosing `while` statement. Provide a formal semantics for this statement using continuation style semantics.