COSC 4111/5111 3.0—Winter 2006

Posted: Jan 23, 2006
Due: TBA

Problem Set No. 1

NB. *All problems are equally weighted out of 5.* The problem set list for grad students is the entire list here. Undergrads should omit the problems marked "Grad". If they wish to do some of those for extra credit the extra credit will be applied on an "all or nothing" basis. That is **no part marks will be given** for a "Grad" problem attempted by undergrads.

This is not a course on *formal* recursion theory. Your proofs should be informal ($\neq$ sloppy), correct, and informative (and if possible short). Please do not trade length for correctness or readbility.

(1) Prove Lemma 1 on p.47.

(2) Do problem 13.

There is a typo here: "$(\mu y)_{\leq z}$" should be the "$(\mathring{\mu}\, y)_{\leq z}$" of Problem 11.

(3) (**Grad**) Page 81, do problem 14.

(4) Page 81, do problems 18, 19, 20, 21, 22.

(5) (**Grad**) Regarding the function $\lambda ix.g_i(x)$ of Theorem 3 (p. 78–79 of text): It is proved there that $1 \dot{-} g_x(x) = 0$ is not in $\mathcal{PR}_*$.
How about $1 + g_x(x) = 0$? **Why?**

(6) Write a "nice and clean" loop program which computes $\lambda x.rem(x, 2)$. The program must only allow instruction-types $X = 0$, $X = X + 1$, $X = Y$ and **Loop** $X \ldots$ **end**. It must *not* nest the Loop-end instruction! It is required that you give a convincing general argument (*not* a "trace") as to why your program works as specified.

(7) Write a loop program which computes λxyz.**if** $x = 0$ **then** y **else** z. The program must only allow instruction-types $X = 0$, $X = X + 1$, $X = Y$ and **Loop** $X \ldots$ **end**.

(8) (**Grad**. This requires some research; the reference is given in the problem, p.82. Your answer must be thorough and complete, not just a sketch) Do problem 25, p.82.

(9) Do problem 34, p.83.

(10) (**Grad**). Do problem 35