

COSC 4111/5111 — Winter 2013

Posted: Jan 19, 2013

Due: TBA by a NEWS item on the course web page.

Problem Set No. 1

NB. *All problems are equally weighted out of 5.* The problem set list for *grad students* enrolled in CSE5111 is the entire list here. Undergrads *should omit the problems marked “Grad”*. If however 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*, but not completely solved, by undergrads.



This is not a course on *formal* recursion theory. Your proofs should be *informal* (but NOT sloppy), *completely argued*, correct, and informative (and if possible *short*). Please do not trade length for correctness or readability.



All problems are from the “Theory of Computation Text”, or are improvisations I completely articulate here.

- (1) Do Exercises 2.1.2.10, 2.1.2.26, 2.1.2.35 and 2.1.2.42.

From Section 2.12.

- (2) **(Grad)**. Do problems 5, 20, 22, 25.
- (3) Do problems 6, 7, 10, 11, 19, 35.
- (4) Prove that the function $\lambda x. \|x\|$, where $\|x\|$ denotes the number of binary digits of $x \in \mathbb{N}$, is in \mathcal{PR} .
- (5) Write a “nice and clean” loop program which computes $\lambda x. \lfloor x/3 \rfloor$. The program must only allow instruction-types $X \leftarrow 0$, $X \leftarrow X + 1$, $X \leftarrow Y$ and **Loop** $X \dots$ **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.
- (6) Can loop programs
- (Add to our loop program syntax the stipulation that all instructions are labelled by numbers.)
- (a) A forward **go to**? If yes, exactly how? If no, why not?
- (b) A backward **go to**? If yes, exactly how? If no, why not?
- (7) **(Grad)**. Do problem 29.