Review of material covered before midterm exam

Sections covered: Chapters 2 and 3, and 4, sections 4.1 through 4.8

1 Chapter 2

programming language $\mathcal{L}$, instructions increment, decrement, conditional branch, no-op, labels, programs, macros, macro expansion, GOTO L, $V \leftarrow 0$, $V \leftarrow V'$, $V \leftarrow V' + V''$, $V \leftarrow V' * V''$, partial functions, the empty program, state of a program, snapshot, terminal snapshot, value of a variable, a computation, initial state, initial snapshot, computable function, partially computable function, total functions, partial recursive functions, recursive functions, $W \leftarrow f(V_1, \cdots, V_n)$, IF $P(V_1, \cdots, V_n)$ GOTO L, $\Psi^{(n)}_{\mathcal{P}}(x_1, \cdots, x_n)$.

2 Chapter 3

composition, recursion, PRC classes, successor (s), nil (n), projection (u^n_i) functions, primitive recursive functions, examples of primitive recursive functions, including monus ($\dot{-}$) and α, primitive recursive predicates and the Boolean operators, definition by cases, iterated operations ($\sum_{i=k}^{y}, \prod_{i=k}^{y}$), bounded quantifiers ($(\exists x)_{\leq y}, (\forall x)_{\leq y}$), bounded and unbounded minimization, computation of $\lfloor x/y \rfloor$ and remainder $R(x, y)$, pairing functions, $< x, y >$, $l(x)$, $r(x)$, Gödel numbers, $[a_1, \cdots, a_n]$, $(x)_i$, pairing function theorem, sequence number theorem, simultaneous recursion.

3 Chapter 4

Coding numbers (#) for variables, labels, instructions and programs, the halting problem, $HALT(x, y)$, algorithms, Church's thesis, Goldbach's conjecture, $\Phi^{(n)}(x_1, \cdots, x_n, y)$, universality theorem, the universal program $\mathcal{U}_n$, $STP^{(n)}(x_1, \cdots, x_n, y, t)$, step-counter theorem, $SUCC(x, y)$, $INIT^{(n)}(x_1, \cdots, x_n)$, $TERM(x, y)$, $SNAP^{(n)}(x_1, \cdots, x_n, y, t)$, normal form theorem, theorems 3.4 and 3.5 which say that all partially computable functions can be obtained if we use unbounded minimization in addition to composition and recursion, proper minimalization, recursively enumerable sets, recursive sets, W_n, enumeration theorem, theorem 4.11, the parameter theorem, diagonalization, TOT, many-one reducibility ($\leq_m$), m-complete sets, $\equiv_m$ relation, K, K_0, $EMPTY$, Rice's theorem, recursion theorem, fixed-point theorem.

Note: we started to cover material from section 4.9, but we will save that for the final exam.