

## Homework 15 (due Thursday 6 December)

Second half of Exercise 3.1.12. from the syllabus and Exercise 3.1.13. from the syllabus.

**Exercise 3.1.12.** (Second half) Let  $\{\tilde{P}_e\}_{e \in \omega}$  be an effective coding of oracle Turing programs. Write  $\Phi_e^A$  to denote the function computed by Turing program  $\tilde{P}_e$ , using oracle  $A$ .

Prove that under this coding,  $\theta_e := \Phi_e^\sigma$  is an acceptable numbering (see Definition 1.6.5.iii) of the partial computable functions. [10 pts]

**Exercise 3.1.13.**

- (a.) Prove that  $\{\langle e, \sigma, x, y, s \rangle \mid \Phi_{e,s}^\sigma(x) = y\}$  is computable. [10 pts]
- (b.) Prove that  $\{\langle e, \sigma, x, y \rangle \mid \Phi_e^\sigma(x) = y\}$  is c.e., and that this set and the set  $L$  of the Master Enumeration Theorem 2.1.4. are each  $\Sigma_1$ , 1-complete and hence computably isomorphic to  $K$ . [20 pts]