

## 2017 Oral Exam: Probability and Statistics

### Overall

**Problem 1.** Let  $\epsilon_1, \dots, \epsilon_n, \dots$  be a sequence of i.i.d. random variables with mean 0 and finite variance  $\sigma^2$ . Let  $x_1$  be a constant, and

$$y_n = m(x_n) + \epsilon_n; \quad x_{n+1} = x_n - cy_n/n, \quad \forall n \geq 1,$$

where  $c$  is a positive constant. Suppose that  $m(x)$  is smooth and strictly increasing and  $m(x^*) = 0$ . Show that  $x_n$  converges to  $x^*$  in probability.