

**Instruction:** Hand in your work in the mail box labeled INC691 by 4 pm. or submit it via email. DO NOT copy homework from your classmates or lend it to others. Anyone who violates this regulation will be given zero for the homework.

1. Show that for a quadratic cost function  $V(\theta)$ , the steepest descent method according to  $\theta(l+1) = \theta(l) - \alpha g(l)$  will be stable if the learning rate satisfies

$$\alpha < \frac{2}{\lambda_{\max}(\nabla^2 V)},$$

where  $\lambda_{\max}(\cdot)$  denotes the maximum eigenvalue of a symmetric matrix.