

# CS282K: Numerical Methods for Scientific Computing and Machine Learning

## Homework 4

**Issued:** September 18

**Due:** September 29 (11:59PM, Beijing time)

Please submit the PDF file of your solution to the “Drop Box” on Sakai.

### Problem 1: Nonlinear Equation Solver

Apply Newton-Raphson method to solve the following nonlinear equations. Show your equations to calculate the solution  $x$  for the first three iterations.

$$x^3 = 0 \quad \text{where} \quad x^{(0)} = 1 \quad (1)$$

$$e^x = 1 \quad \text{where} \quad x^{(0)} = 1 \quad (2)$$

$x^{(0)}$  represents the initial starting point.

### Problem 2: Newton Method

Apply Newton method to solve the following optimization problem. Show your equations to calculate the solution  $x$  for the first three iterations.

$$\min_x x^4 \quad \text{where} \quad x^{(0)} = 1 \quad (3)$$

$x^{(0)}$  represents the initial starting point.

### Problem 3: Lagrange Multiplier

Solve the following optimization problem based on Lagrange multiplier. Show your equations to calculate the solution  $x$  for the first three iterations.

$$\begin{aligned} \min_{x,y} \quad & x^4 + y^4 \\ \text{S.T.} \quad & x + y = 1 \end{aligned} \quad \text{where} \quad x^{(0)} = 1 \quad \text{and} \quad y^{(0)} = 1 \quad (4)$$

$x^{(0)}$  and  $y^{(0)}$  represent the initial starting point.