Homework 6

Problem 1: In MATLAB, it supports the cubic spline data interpolation function spline(x, y, xq) [1] where x and y specify all the end points and xq specify the x coordinates which the corresponding interpolated values would be returned.

(a) Write a program that provides the same interface spline(x, y, xq) and solves cubic spline problems.

(b) Test your program by using some data and compare with the result of Matlab. For example, draw your approximation and compare with Matlab's.

Problem 2: Consider a quadratic least sqaure

$$\min_f E = \sum_{n=1}^{m} (y_i - f(x_i))^2,$$

with

$$f(x) = ax^2 + bx + c.$$

(a) Write down the three equations of

$$\nabla E = 0 \tag{1}$$

where the gradient is calculated with respect to the parameters a, b and c.

(b) Write a program that, given m pairs of (x_i, y_i), solves quadratic least square by solving (1).

(c) Randomly generate different distributions of (x_i, y_i) and draw a figure to show your generated points and the approximation. You should generate at least one distribution that can be well approximated and another distribution where the quadratic least square approximates poorly.

[1] `https://www.mathworks.com/help/matlab/ref/spline.html`