

Numerical Analysis Semester 081 Problem Set 9

Reference: Chapter 06.03 Least Squares Approximation and Class Notes.

1. a) Find the least squares line $y = a_0 + a_1x$ for the following data points. Show all your work.

x_k	y_k
-4	-3
-1	-1
0	0
2	1
3	2

b) Compute the root mean square error for your linear fit.

- 2 a) Find 10 adults and measure the length of their humerus (measure from “knot” in shoulder to “knot” in elbow, their height in centimeters, and the circumference of their head.
b) Perform least squares linear regression on the (humerus length, height) data values as you did in problem one, including your calculation of the Root Mean Square Error.
c) Also perform the least squares linear regression on the (circumference, height) ordered pairs. You can do your tabulations in a spreadsheet if you wish.

Use Maple, MATLAB, or Excel to graph the data points and your least squares line for each.

d) Which is a better predictor of height – humerus length or head circumference (justify your answer)?

3. For some data values, it is appropriate to have a least squares line fit that passes through the origin (i.e. a linear fit of the form $y = ax$). This is a special case of a more general type of curve fit, the power fit of the curve $y = ax^m$ where m is a fixed known constant.

- a) Set up the equation for the sum of the squares of the residuals S_r for the power fit.
b) Since this sum is now a function of only the single variable a , you can use single variable calculus to find a formula for a that minimizes the S_r in terms of the data points (x_i, y_i) . Derive the formula.

4. Use your power fit formula in problem 3 with $m = 2$ to compute the fit $y = ax^2$ for the following data points. You may do the computations in Maple, MATLAB, or Excel if you wish.

2	5.1
2.3	7.5
2.6	10.6
2.9	14.4
3.2	19