

Homework 7: CS537, Fall 2008

Due Date: 3:15pm, December 2, 2008

Please show all steps in your work. Please be reminded that you should do your homework independently.

1. (10 points) Show that if a straight line is fitted to a table (x_i, y_i) by the method of least-squares, then the line will pass through the point (x^*, y^*) where x^* and y^* are the average of the x_i 's and y_i 's, respectively.
2. (10 points) An experiment involves two independent variables x and y and one dependent variable z . How can a function $z = a + bx + cy$ be fitted to the table of points (x_k, y_k, z_k) ? Give the normal equations.
3. (10 points) What constant c makes the expression

$$\sum_{k=0}^m [f(x_k) - ce^{x_k}]^2$$

as small as possible?

4. (10 points) There is a function of the form

$$f(x) = \alpha x^{12} + \beta x^{13}$$

for which $f(0.1) = 6 \times 10^{-13}$ and $f(0.9) = 3 \times 10^{-2}$. What is it? Are α and β sensitive to perturbations in the two given values of $f(x)$?

5. (10 points) Consider polynomials g_0, g_1, \dots, g_n defined by $g_0(x) = 1, g_1(x) = x - 1$, and $g_j(x) = 3xg_{j-1}(x) + 2g_{j-2}(x)$. Develop an efficient algorithm for computing values of the function $f(x) = \sum_{j=0}^n c_j g_j(x)$.