

# Homework 9

Problem 1).

$$(\sum x_i^2)a + (\sum x_i)b = \sum x_i y_i$$

$$(\sum x_i)a + nb = \sum y_i$$

$$-(1+4+9+16)a + (-10-5)b = 0+2+3+8$$

$$30a + 10b = 13$$

$$\rightarrow 30a + 10 - 25b = 13$$

$$-10a + 4b = 4$$

$$5a + 10 = 13$$

$$b = 1 - \frac{5}{2}a$$

$$y = 5a - 3$$

Problem 2).

$$\min E(x, y) = \sum (Y_i - ax^2 + b)^2$$

$$\frac{\partial E(x, y)}{\partial a} = \sum 2(Y_i - ax^2 + b)x^2 = 0$$

$$\frac{\partial E(x, y)}{\partial b} = \sum 2(Y_i - ax^2 + b) = 0$$

$$2\sum Y_i x^2 - 2ax^n + 2bx^2$$

$$2\sum Y_i - 2ax^2 + 2b = 0$$

$$\sum 2Y_i x^2 + 2bx^2 = \sum ax^4$$

$$\sum 2Y_i + 2b = \sum ax^4$$

$$\sum Y_i = 6.9$$

$$\sum x^2 Y_i = 6 \quad \sum x^2 = 2 \quad \sum x^4 = 2$$

$$13.8 + 2b = 4a$$

$$12 + 4b = 4a$$

$$b = 2a - 6.9$$

$$12 + 8a - 27.6a = 4a$$

$$y = 0.508x^2 - 5.883$$

$$12 = 23.6a$$

$$a = 0.508$$

$$b = -5.883$$

Problem 3)  $\min E(\alpha, \beta) = \sum (Y_i - \alpha \sin x + \beta \cos x)^2$

$$\frac{\partial E(\alpha, \beta)}{\partial \alpha} = \sum 2(Y_i - \alpha \sin x + \beta \cos x) \sin x$$

$$\frac{\partial E(\alpha, \beta)}{\partial \beta} = \sum 2(Y_i - \alpha \sin x + \beta \cos x) \cos x$$

$$2\sin x Y_i - 2\alpha \sin^2 x + 2\beta \cos x \sin x = 0$$

$$2\cos x Y_i - 2\alpha \sin x \cos x + \beta \cos^2 x = 0$$

$$2 \sum \sin x_i Y_i + 2\beta \sum \cos x \sin x = 2\alpha \sum \sin^2 x$$

$$2 \sum \cos x Y_i + \beta \sum \cos^2 x = 2\alpha \sum \sin x \cos x$$

$$\sum \sin x_i Y_i = -0.035 \quad \sum \cos x \sin x = -0.3326 \quad \sum \sin^2 x = 2.880$$

$$\sum \cos x Y_i = 3.1253 \quad \sum \cos^2 x = 1.11194$$

$$-0.07 - 0.6652\beta = 5.776\alpha$$

$$6.4506 + 1.11194\beta = -0.6652\alpha$$

$$1.11194\beta = 6.4506 - 0.6652\alpha$$

$$\beta = 5.8012 + 0.5982\alpha$$

$$6.4506 + 6.4506 - 0.6652\alpha = -0.6652\alpha$$

Problem 4).

a)  $\sum (\ln(y_k) - A_0 + A_1 x + A_2 \ln(1+x))^2$

$$\sum 2(\ln(y_k) - A_0 + A_1 x + A_2 \ln(1+x)) = 0$$

$$\sum 2(\ln(y_k) - A_0 + A_1 x + A_2 \ln(1+x))x = 0$$

$$\sum 2(\ln(y_k) - A_0 + A_1 x + A_2 \ln(1+x))\ln(1+x) = 0$$

then  $\ln(y(x)) = A_0 + A_1 x + A_2 \ln(1+x)$