

Least Squares - Questions

1. Fit a straight line to the data

i	0	1	2	3	4	5	6	7
x_i	1	2	3	4	5	6	7	8
y_i	3	3	4	5	5	6	6	7

using the Least Squares method.

2. Fit the function

$$y(x) = a_0 + a_2x^2$$

to the data

i	0	1	2	3	4
x_i	0	1	2	3	4
y_i	10	12	18	28	42

using the Least Squares method. Calculate the variance of the fit.

3. In the table below the number N of radioactive nuclei in a sample is given as a function of time. Use a linear fit to determine the half-life of the isotope.

t (min)	1	2	3	4	5	6
N	4887	3757	3923	2742	2655	2001

HINTS: The radioactive decay law is $N(t) = N_0e^{-\lambda t}$. Use the logarithmic form of this law. The half-life t_{half} satisfies $N(t + t_{half}) = \frac{1}{2}N(t)$.

4. If a straight line is fitted to the data

i	0	1	2	3
x_i	0	1	2	3
y_i	-7	-5	-3	θ

what value must θ have for the fit to be perfect (zero variance)?

5. Fit the polynomial

$$f(x) = ax^2 + b$$

to the data

x_i	-2	0	2	3
$y(x_i)$	6	-7	8	20

What is the variance of this fit?

6. Fit the polynomial

$$f(x) = ax^4 + b$$

to the data

x_i	-3	0	2	3
$y(x_i)$	79	-1	15	78

7. Fit the polynomial

$$f(x) = ax^3 + bx$$

to the data

x_i	-1	0	1	3
$y(x_i)$	-7	1	6	-3

8.