Linear least squares

\[ \min \sum_{i=1}^{3} (a - \ell(x_i))^2 + (b - \ell(x_i))^2 + (c - \ell(x_i))^2 \]

\[ || \cdot ||_2 \]

Equation of line: \((1-x_i)c_0 + x_i c_1 = y_i\) for \(i = 0, 1, 2\)

\[
\begin{align*}
(1-x) c_0 + (-1) c_1 &= 1 \\
(1-0) c_0 + 0 c_1 &= 0 \\
(1-1) c_0 + 1 c_1 &= 1
\end{align*}
\]

\[ \min ||Ac-b||_2^2 = \min (Ac-b)^T (Ac-b) \]

\[ 0 = (Ac-b)^T A = A^T A c - b^T A \]

Exercises (book) p. 42

1.10 \( \frac{1}{1-x} = \frac{1}{1+x} \)

Programming

1.05 Hospital’s Rule

1.13 Interest

1.18 \( x_{k+1} = \ldots \)
\[ O = A^T A c - A^T b \]

\[ (\cdot) c = (\cdot) \]

\[ c = \left( \frac{2}{3}, \frac{2}{3} \right) \]

\[ \text{Error} = \left( \frac{1}{3} \right)^2 + \left( \frac{2}{3} \right)^2 + \left( \frac{1}{3} \right)^2 = \cdots \]

Remark:

\[ (b^T A)^T = A^T b \]

So if \( b \) is a "column vector",

\( A^T b \) is a "column vector"

\( b^T A \) is a "row vector"

However:

we are differentiating

with respect to one \( c_i \)

at a time!

\[ (b^T A) (i) = (A^T b) (i) \]

So when I collect

\[ (A^T A) (i, :) \backslash (b^T A) (i) \] it does not matter