CS770: Assignment 4

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1 Question 1

1.1 Question 1a

For cubic spline, let the function $S(x)$ define the spline function
where $a = x_0 < x_1 < x_2 < x_3 < \ldots\ldots < x_n = b$

$$S(X) = \begin{cases} S_0(x), & x_0 < x < x_1 \\ S_1(x), & x_1 < x < x_2 \\ \ldots\ldots \\ S_i(x), & x_i < x < x_{i+1} \\ \ldots\ldots \\ S_{n-1}(x), & x_{n-1} < x < x_n \end{cases} \tag{1}$$

Where each $S_i(x)$ has degree 3 in this case.
In cubic spline, $S(x)$ satisfies

$$\begin{cases} S_i(x_i) = S_{i+1}(x_i) \\ S_i'(x_i) = S_{i+1}'(x_i) \\ S_i''(x_i) = S_{i+1}''(x_i) \\ S_i(x_i) = y_i \end{cases}$$

Where each $i = 0, 1, 2, \ldots\ldots, n-2$
By the definition of natural cubic spline, we have two additional constraints,

$$\begin{cases} S_0''(x_0) = 0 \\ S_{n-1}''(x_{n-1}) = 0 \end{cases}$$

1.2 Question 1b