

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 $a = x_0 < x_1 < x_2 < x_3 < \dots < x_n = b$

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

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 $i = 0, 1, 2, \dots, n-2$

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

2 Question 2

3 Question 3

3.1 Question 3a

3.2 Question 3b

4 Question 4

5 Question 5

5.1 Question 5a

5.2 Question 5b

6 Question 6

7 Question 7