

CAS 741: Problem Statement

Polynomial Interpolation

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Table 1: Revision History

Date	Developer(s)	Change
18/19/2019	Zhi Zhang	Initial Draft

1 Problem

Polynomial interpolation is a method to estimate values with a given data set. Given a set of $n + 1$ data points (x_i, y_i) where no two x_i are the same, we want to compute a polynomial p_n of degree at most n such that

$$p_{n-1}(x_i) = f_i, i = 0, 1, \dots, n.$$

Various methods can be used to construct a polynomial interpolation. In this project, we will introduce 3 methods: monomial, Newton and Lagrange.

In monomial basis, the polynomial will be generated in the form of:

$$p_n(x) = a_0 + a_1x + \dots + a_{n-1}x^{n-1} + a_nx^n.$$

In Newton basis, the polynomial will be generated in the form of:

$$p_n(x) = \sum_{i=0}^n c_i n_i(x) = c_0 + c_1(x - x_0) + c_2(x - x_0)(x - x_1) + \dots + c_n \prod_{j=0}^{n-1} (x - x_j).$$

In Lagrange basis, the polynomial will be generated in the form of:

$$L(x) = \sum_{j=0}^k y_j l_j(x)$$

where $l_j(x) = \prod_{0 \leq m \leq k, m \neq j} \frac{x - x_m}{x_j - x_m}.$

2 Context of Problem

The stakeholders of this project would be all students taking SFWR ENG 4X03 course. And the environment for this software is MacOS.