Programming Project PART 2
CS 323 - Numerical Analysis

1 Introduction

For this second part of the project you will write matlab code for the following algorithms. Instructions are the same as in the first part of the project.

2 Algorithms

The following is the list of all the algorithms that you must implement for this second part:

1. **Cubic Splines:** Given a set of points find the coefficients of all the 3rd degree polynomials that go through all the given points using the cubic splines method.

   Input:

   Sample input representing the points $(1, 5), (2, 6), (3, 6.5), (4, 5.5), (5, 5.5), (6, 7)$

   ```
   6
   1
   5
   2
   6
   3
   6.5
   4
   5.5
   5
   5.5
   6
   7
   ```

   where the first number corresponds to the number of points.

   Output:

   (a) Coefficients of $n-1$ polynomials. The coefficients of each polynomial in a row separated by spaces (see lecture notes for lecture 14):

   ```
   5 1.014354 0 -0.014354
   6 0.971291667 -0.043062 -0.42822967
   6.5 -0.39952167 -1.327751 0.727272667
   5.5 -0.87320567 0.854067 0.019138667
   5.5 0.89234467 0.911483 -0.30382767
   ```

   (b) A plot like the one shown on lecture notes (14).

2. **Least Squares:** Given a set of points you will find a polynomial of degree n that approximates the points minimizing the error squared.

Input:

Sample input representing the points $(0, 45.13), (1, 51.71), (2, 60.17), (3, 64.83), (4, 65.24), (5, 65.17), (6, 67.65), (7, 79.8), (8, 96.13), (9, 115.19),$

```
10
3
1
5
2
6
3
6.5
4
5.5
5
5.5
6
7
```

where the first number corresponds to the number of points and the second number is the degree of the desired polynomial.

Output:

(a) The coefficients of the polynomial, separated by spaces:

   43.9719 13.4363 -3.3048 0.3005

(b) A plot like the one shown on lecture notes (16).

3. **Simpson's Rule:** Compute the definite integral of a given function using the *Composite Simpson's rule.*

Input: Function (of x) as a string (use matlab's `inline` and `feval`), the limits of integration (a and b), and the number of subintervals. Sample input:

```
x^3
1
5
20
```

Output: The approximate value of

$$\int_a^b f(x)dx$$

using Simpson's rule with n subintervals