Robotics 811 - HW 2

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1 Q1

2 Q2

a

Firstly, we calculate the values of $f(x_0), ...f(x_i)$ which gives us the vector $0, 0.0434, 0.1269, 0.2217, 0.3187, 0.4145, 0.5075$. By plugging it in into the method with the following variables. $dividedDifferences(6, 2.25, xs, fxs)$. The method will return the result:0.1737 which is equal to the answer given by matlab which is 0.1737.

b

- Using the procedure at $x = 0.05$ with $n = 2$, gave the estimate of 4.9878.
- Using the procedure at $x = 0.05$ with $n = 4$, gave the estimate of 4.9442
- Using the procedure at $x = 0.05$ with $n = 40$, gave the estimate of 4.5872

The actual value of $f(0.05)$ is 4.5872 which is same as the estimate of 4.5872 by $n = 40$

2(c)

The Error estimate is as following:

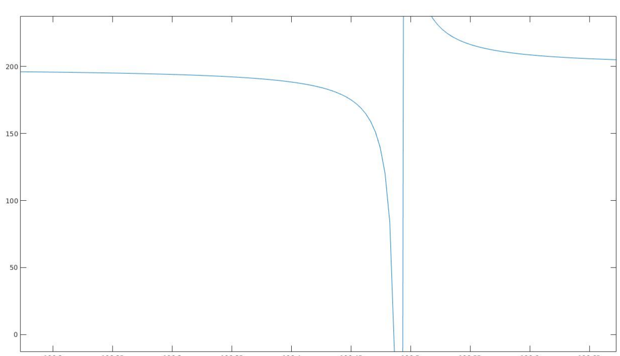
n	E_n
2	3.4911
4	2.3584
6	3.5367
8	6.4873
10	12.9702
12	27.1445
14	58.4298
16	128.1824
18	285.0742
20	640.9705
40	2830400

The Error make sense, because we are trying to fit a polynomial on a non-polynomial function. As the interpolating polynomial will never become the function that we are trying to interpolating and it will only continue to over fitting the function causing massive error at the end of the functions

3 Q3

4 Q4

First we observe the graph of the function $x - tan(x) = 0$ around the 200 point to find good values to be tested.



By visual inspection, we found that the root must be between 199.49 and 199. We tested this by inserting both values into the function and it gave us both -682.7305 and 197.1303. Since 199.49 won't be able to converge using Newton Method(implemented in the file titled *newtonMethod.m*), we first use those two values in the bisection method to give an estimate root. The code for the function is attached to this paper under the title *bisectionMethod.m*. The bisectionMethod returns 199.4861 as the root. As we plugged in the value into newton method, it gave us the same value of 199.4861. Therefore, the closet root to 200 is 199.4861

5 Q5

6 Q6

6.1 6(a)

From the two polynomials given, we can construct a Sylvester's matrix:

$$M = \begin{pmatrix} 1 & -12 & 41 & -42 & 0 \\ 0 & 1 & -23 & 41 & -42 \\ 1 & -2 & -35 & 0 & 0 \\ 0 & 0 & 1 & -2 & -35 \end{pmatrix}$$

Calculating the determinant will give us

$$det(M) = -7.1623e - 12 \approx 0$$

Because the determinant is approximately 0, this means that $p(x)$ and $q(x)$ shares a common root.

6.2 6(b)

Using the ratio method discussed in class we constructed the following equation:

$$\begin{aligned} x &= \frac{x^4}{x^3} \\ &= (-1)^{1+2} \frac{det(M_1)}{det(M_2)} \\ &= (-1) \frac{\begin{vmatrix} -12 & 41 & -42 & 0 \\ 1 & -12 & 41 & -42 \\ -2 & -35 & 0 & 0 \\ 1 & -2 & -35 & 0 \end{vmatrix}}{\begin{vmatrix} 1 & 41 & -42 & 0 \\ 0 & -12 & 41 & -42 \\ 1 & -35 & 0 & 0 \\ 0 & -2 & -35 & 0 \end{vmatrix}} \\ &= (-1) \frac{806736}{-115248} \\ &= 7 \end{aligned}$$

7 Q7

7.1 7(a)

7.2 7(b)

8 Q8

9 Q9