CMSC 460 - HW3

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1

1.a

Figure 1 shows the interpolated value of x and y using each of the interpolation methods.

1.b

For each of the interpolation methods I evaluated the function at $x = -0.3$.

piecelin
$p(-0.3) = 0.42996$

polyinterp
$p(-0.3) = -0.999$

splinetx
$p(-0.3) = -0.1957$

pchiptx
$p(-0.3) = 0.43218$

In this case I prefer the result of *pchiptx* and *piecelin*. Its intuitively between the values at the surrounding points. Its makes minimal assumptions about the shape of the function.

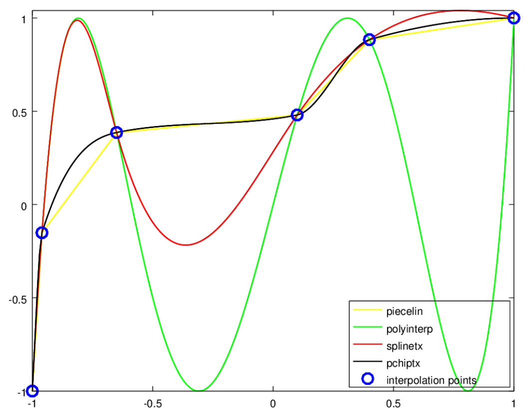


Figure 1: 4 different ways to interpolate between 6 points

1.c

By using *polyfit* and testing a few different degrees I found the coefficients $0, 5, 0, -20, 0, 16$. The polynomial is $p(x) = 0 + 5x + 0 - 20x^3 + 0 + 16x^5$. Figure 2 shows a plot of $p(x)$.

Turns out *polyinterp* provided the best interpolation.

2

Figure 3 shows my hand plotted using two different methods. I prefer the one plotted using *splinetx*, it looks much smoother. The one plotted using *pchiptx* looks jagged.

Figure 3.11 in the book looks like it was plotted with *splinetx*.

3

Suppose that $p(x)$ and $q(x)$ are two polynomials of degree less than n that agree on n points. That implies that there are n distinct values $x_1, x_2, \ldots, x_n$ such that $p(x_i) - q(x_i) = 0$. A polynomial of degree n can have at most n zeros unless it is the zero polynomial. Since $p-q$ has greater number of zeros than the degree of p and q it follows that the difference between p and q is 0, therefore $p = q$.

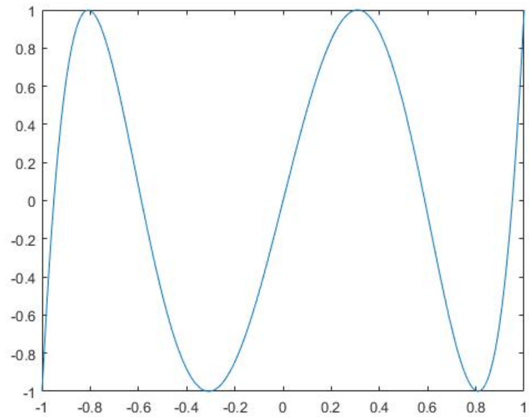
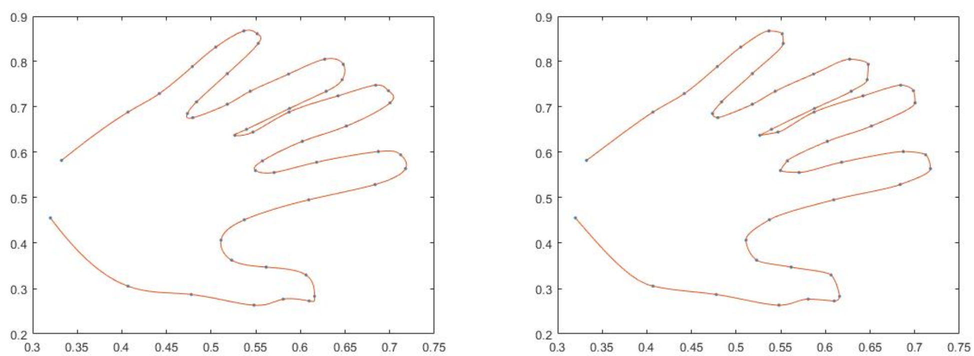


Figure 2: $p(x) = 0 + 5x + 0 - 20x^3 + 0 + 16x^5$



(a) My hand plotted with *splinetx* (b) My hand plotted with *pchiptx*

Figure 3: My hand plotted using 53 points