COMP 350 Numerical Computing

Assignment #5: Polynomial Interpolation, Spline Interpolation, and Least Squares Approximation

Date given: Tuesday, October 30. Date due: 11:55pm, Tuesday, Nov 13, 2018.

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TA office hours: Thursday 4:00pm–5:30pm, Trottier 3110.

1. (6 points) Find the Vandermonde form, the Lagrange form, and the Newton form of the interpolating polynomial for these data

x	-2	0	1	2
y	2	4	2	2

2. (Programming by MATLAB) The US census data from 1900 to 2000 are as follows (numbers are in million):

x	1900	1910	1920	1930	1940	1950	1960
y	75.995	91.972	105.711	123.203	131.669	150.697	179.323

1970	1980	1990	2000
203.212	226.505	249.633	281.422

   (a) (8 points) Spline interpolation

      i. Find the natural cubic spline function S to interpolate the data.

      ii. Find the population estimate for 1985 by the spline function

      iii. Find the population estimate for 2010 by the spline function.

   You do not need to write an explicit expression for $S(x)$. Just plot $y = S(x)$, the given 10 data points, and the 2 points of the population estimates on the same graph. Print your MATLAB codes.

   Note: For reference, see `us_census.m` on the course website: https://www.cs.mcgill.ca/∼chang/teaching/cs350/doc.php

   (b) (6 points) LS approximation

      i. Find the straight line which best fits the data in the least-squares sense.

      ii. Find the population estimate for 1985 by this straight line.

      iii. Find the population estimate for 2010 by this straight line.

   Plot the straight line, the given 11 data points, and the 2 points of the population estimates on the same graph. Print your MATLAB codes.

Note: You are not allowed to use MATLAB built-in functions `polyfit`, `polyval`, and `spline`.