Scientific Computing (MA322)

Lab 07

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Q1: Hermite Interpolation
Approx f(0.25) = 1.189070e+00
Actual f(0.25) = 1.189070e+00
Absolute error: 1.699303e-07

Q2: Hermite Interpolation

The predicted position of the car at 10s: 7.425028e+02 feet.
The predicted speed of the car at 10s: 4.838174e+01 feet/sec.

Yes, the car exceeds 55 mph first at 5.651473e+00 s.
Maximum predicted speed of the car: 1.194173e+02 feet/sec.

Q3: Natural Cubic Spline Interpolation
Part a)
Coefficient matrix:
1.000000000000000 3.436563656918090 0 0

Interpolation polynomials:
(3869226701182825*x_in)/1125899906842624 - (3869226701182825*x_1)/1125899906842624 + 1

Function value at 0.43: 2.477722e+00
Function derivative value at 0.43: 3.436564e+00

Actual function value at 0.43: 2.363161e+00
Actual function derivative value at 0.43: 4.726321e+00

Absolute function value error: 1.145617e-01
Absolute function slope error: 1.289758e+00

Part b)
Coefficient matrix:

1.098612288668110 0.391528961499067 0 0

Interpolation polynomials:
(440822421277989*x_in)/1125899906842624 - (440822421277989*x_1)/1125899906842624 + 2473854946935173/2251799813685248

Function value at 0.25: 1.196495e+00
Function derivative value at 0.25: 3.915290e-01

Actual function value at 0.25: 1.189070e+00
Actual function derivative value at 0.25: 3.909913e-01

Absolute function value error: 7.424598e-03
Absolute function slope error: 5.376463e-04

Q4: Clamped Cubic Spline Interpolation

Coefficient Matrix

0.861994800000000	0.155362400000000	0.065374080000000	0.016004560000000
0.958020090000000	0.232739900000000	0.089380920000001	0.015016239999999
1.098612300000000	0.333383000000000	0.111905279999999	0.008772640000002

Interpolation polynomials:
(349845023373693*x_in)/2251799813685248 - (349845023373693*x_1)/2251799813685248 + (4710698917243019*(x_1 - x_in)^2)/72057594037927936 - (576625043617845*(x_1 - x_in)^3)/36028797018963968 + 3882079460075305/4503599627370496

(8385338615313981*x_in)/36028797018963968 - (8385338615313981*x_2)/36028797018963968 + (3220287024048277*(x_2 - x_in)^2)/36028797018963968 - (8656273007168027*(x_2 - x_in)^3)/576460752303423488 + 4314538920337449/4503599627370496

(3002847109143315*x_in)/9007199254740992 - (3002847109143315*x_3)/9007199254740992 + (8063625236940559*(x_3 - x_in)^2)/72057594037927936 - (316067665880515*(x_3 - x_in)^3)/36028797018963968 + 1236927486226161/1125899906842624

Q5 Clamped and Natural Cubic Spline Interpolation
Part a) Natural Cubic Spline Interpolation
Coefficient matrix:

1.0e+02 *

0	0.738879668049793	0	0.001235592438912
2.250000000000000	0.772240663900415	0.011120331950207	-0.001120331950207
3.830000000000000	0.803278008298755	0.004398340248963	-0.001830336560627
6.230000000000000	0.780248962655602	-0.012074688796680	0.000804979253112

Interpolation polynomials:
(17807*x_in)/241 - (17807*x_1)/241 - (268*(x_1 - x_in)^3)/2169

(18611*x_in)/241 - (18611*x_2)/241 + (268*(x_2 - x_in)^2)/241 + (27*(x_2 - x_in)^3)/241 + 225

(19359*x_in)/241 - (19359*x_3)/241 + (106*(x_3 - x_in)^2)/241 + (397*(x_3 - x_in)^3)/2169 + 383

(18804*x_in)/241 - (18804*x_4)/241 - (291*(x_4 - x_in)^2)/241 - (97*(x_4 - x_in)^3)/1205 + 623

Distance at 10s: feet.7.748639e+02
Speed at 10s: feet/s.7.416100e+01

Part b) Clamped Cubic Spline Interpolation
Coefficient matrix:

1.0e+02 *

0	0.750000000000000	-0.006592920353982	0.002197640117994
2.250000000000000	0.769778761061947	0.013185840707965	-0.001537610619469
3.830000000000000	0.804070796460177	0.003960176991150	-0.001772369714848
6.230000000000000	0.779977876106195	-0.011991150442478	0.000799115044248

Interpolation polynomials:
75*x_in - 75*x_1 - (149*(x_1 - x_in)^2)/226 - (149*(x_1 - x_in)^3)/678

(17397*x_in)/226 - (17397*x_2)/226 + (149*(x_2 - x_in)^2)/113 + (139*(x_2 - x_in)^3)/904 + 225

(9086*x_in)/113 - (9086*x_3)/113 + (179*(x_3 - x_in)^2)/452 + (721*(x_3 - x_in)^3)/4068 + 383

(35255*x_in)/452 - (35255*x_4)/452 - (271*(x_4 - x_in)^2)/226 - (903*(x_4 - x_in)^3)/11300 + 623

Distance at 10s: feet.7.748384e+02
Speed at 10s: feet/sec.7.416027e+01