Updated on March 15, 2021

Math 3607: Homework 8

Due: 11:59PM, Monday, March 22, 2021

TOTAL: 20 points

1. (**FNC** 5.1.3) The following two point sets define the top and bottom of a flying saucer shape:

   Top:

x	0	0.51	0.96	1.06	1.29	1.55	1.73	2.13	2.61
y	0	0.16	0.16	0.43	0.62	0.48	0.19	0.18	0

   Bottom:

x	0	0.58	1.04	1.25	1.56	1.76	2.19	2.61
y	0	-0.16	-0.15	-0.30	-0.29	-0.12	-0.12	0

   Use piecewise cubic interpolation to make a picture of the flying saucer.

2. (**FNC** 5.1.4) Define

   $$q(x) = \frac{a}{2}x(x-1) - b(x-1)(x+1) + \frac{c}{2}x(x+1).$$

   (a) Show that q is a polynomial interpolant of the points $(-1, a)$, $(0, b)$, $(1, c)$.

   (b) Use a change of variable to find a quadratic polynomial interpolant p for the points $(x_0 - h, a)$, (x_0, b), $(x_0 + h, c)$.

3. (**FNC** 5.3.5) Although the cardinal cubic splines are intractable in closed form, they can be found numerically. Each cardinal spline interpolates the data from one column of an identity matrix. Define the nodes $\mathbf{t} = [0, 0.075, 0.25, 0.55, 1]^{\mathrm{T}}$. Plot over $[0, 1]$ the five cardinal functions for this node set over the interval $[0, 1]$.

4. (Adapted from **FNC** 5.3.6.) Do this problem by hand. Suppose you were to define a piecewise quadratic spline that interpolates n given values and has a continuous first derivative. Follow the derivation presented in lecture to express all of the interpolation and continuity conditions. How many additional conditions are required to make a square system for the coefficients? Justify your answer.

5. (Cubic splines in 2-D) Do **LM** 12.2–15.