CS-Grad1 Scientific Computing–Midterm

Nov. 14–21, 2013

1. (a) (30%) Write three MATLAB *functions* to computes the *coefficients* of polynomial interpolant by the three methods: Vandermonde approach, Newton representation, and divided differences with input arguments x and y. (Hint: see **InterpV.m**, **InterpN.m** **InterpN2.m**)

(b) (20%) Write two MATLAB *functions* to evaluates the values of any polynomial function $p(x)$, which is represented by the ascending form

$$p(x) = a_0 + a_1 x + \cdots + a_n x^n$$

or by the Newton's form using Hoener's algorithm. The input arguments are the coefficients **a** and the x-coordinates **z** which we want to evaluate. (Hint: see **HornerV.m** and **HornerN.m**)

(c) (20%) Write a MATLAB *program* (script file) to interpolates the given data to obtain

x	-2	-1	0	1	2	3
y	31	5	1	1	11	30

a polynomial, say $p(x)$, by using the *functions*, which you have created in part (a) for the coefficients, and then to evaluate the values on $[-3, 5]$ for 65 points by using the *functions*, which you have created in part (b), and plot the curves by the two ways, Vandermonde approach and Newton representation. Also answer the values of $p(4)$ and $p(5)$.

(d) (20%) Do the problem **P2.2.1** (in textbook) and check your answer by the above example. (Hint: That is, you need to write a MATLAB *function* **a = N2V(c, x)**, and a *program* to test the example in 1.(c).)

2. (20%) Plot the function $y = \sin(x)$ for $x \in [-\pi, \pi]$ and their Taylor polynomials

$$S_2(x) = x - \frac{x^3}{3!}, \quad S_3(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!}, \quad S_4(x) = ?$$

on the same figure with different line types and different colors, also it should have the labels, title, and legend. (Note: You should write $S_4(x)$ by yourself).

Note: Turn in your programs and results in a hard copy, and also demonstrate your work in class.