

## Math 2300 Assignment #3

due by 4:30pm March 11, 2010

Please include your Maple worksheet with your assignment. You may email your Maple worksheet to me. If you do email, please print to a .pdf file and email me a .pdf document.

1. *Lagrange form of the Polynomial.* Using the Lagrangian form of the polynomial (given in a theorem in class), write the unique polynomial of degree 5 to interpolate the data below.

$x$	1.0	1.3	1.6	1.9	2.2
$y$	0.77	0.62	0.46	0.28	0.11

2. *Divided Differences.* Consider the following data:

$x_i$	0.55	1	2.2	4	6.5	12	16
$y_i$	0.13	0.64	5.8	102	210	2030	3900

- (a) Construct the divided difference table for this data.
  - (b) Sometimes negative divided differences indicate that there may be errors in the data and these may propagate through the table. If we were concerned about this, what order of polynomial would we use? Using the divided differences, what is this polynomial?
3. *Applying the Least Squares criterion.*

- (a) Using the Least Squares equations developed in class, estimate the coefficients of the line  $y = ax + b$  such that the sum of the squared deviation between the line and the following data points is minimized:

$x$	2.5	3.0	3.5	4.0	4.5	5.0	5.5
$y$	4.32	4.83	5.27	5.74	6.26	6.79	7.23

- (b) Using the data in part (a), use the Least Squares fitting in Maple to determine the coefficients  $a$  and  $b$ . Does this agree with your results from (a)? (See the Maple worksheet “Sample Maple Worksheet for Least Squares fitting” on the course website)
- (c) In class, we derived the equations for fitting a power curve applying the Least Squares criterion. In a similar way, derive the equations that minimize the sum of the squared deviations between a set of data points and the quadratic model  $y = ax^2 + bx + c$ .
- (d) Using the equations you derived in part (c), find estimates of  $a$ ,  $b$  and  $c$  for the following data set:

$x$	1	2	3	4	5
$y$	0.06	0.12	0.36	0.65	0.95

- (e) Using the data in part (d), use the Least Squares fitting in Maple to determine the coefficients  $a$ ,  $b$  and  $c$ . Does this agree with your results from (d)?

4. *Cubic Splines.*

- (a) Using the data given in question 2 on Assignment # 2 (given below), where  $x$  represents of the diameter of a ponderosa pine measured at chest height and  $y$  is the measure of volume, use the Maple command `spline` to determine the cubic spline interpolating this data.

$x$	17	19	20	23	25	28	32	38	39	41
$y$	19	25	32	57	71	113	123	252	259	294

- (b) In Maple, using your interpolant, what is the volume of a pine with diameter of 26 ft?
- (c) Plot the cubic spline you determined in part (a) along with the given data points.