ENGR 250 Numerical Methods with MATLAB
2015 Winter Quarter

Homework Assignment #4

Due : Feb. 25 (Wednesday)

You should submit your M-file, named **HW4_yourEmailAccount**, by email "pandrist@greenriver.edu" . As a reminder, due times will be: Wednesday before class, Thursday (any time), Friday (any time)

1. Least-Square : Linear Line

Write your own least-squares method to fit a straight line to:

x	0	2	4	6	9	11	13	15	17	19
y	5	6	7	6	9	8.5	7	10	12	12.5

Plot the data and the regression line with $0 \leq x \leq 19$ and $\Delta x = 0.1$. Comment out plot before submission. I will be checking to see if plot is there.

- save the regressed y value when $x = 7.83$ on **HW4_1.dat** file
- save the regressed y value when $x = 14.04$ on **HW4_2.dat** file
- save the y values of the regression line on **HW4_3.dat** file

Repeat the problem, but regress x versus y - that is, switch the variable. Plot the data and the regression line with $5 \leq y \leq 12$ and $\Delta y = 0.1$.

- save the regressed x value when $y = 6.24$ on **HW4_4.dat** file
- save the regressed x value when $y = 11.32$ on **HW4_5.dat** file
- save the x values of the regression line on **HW4_6.dat** file

2. Least-Square : Power Model

Fit the following data with the power model ($y = ax^b$) using Matlab's fminsearch to minimize the squared error. Start with an initial guess of $a = 1, b = 1$

x	2.5	3.5	5	6	7.5	10	12.5	15	17.5	20.2
$f(x)$	13.2	10.8	8.5	8.2	7	6.2	5.2	4.8	4.6	4.4

Plot the data and the regression line with $2.5 \leq x \leq 20.2$ and $\Delta x = 0.1$.

- save the regressed $f(9.8)$ value on **HW4_7.dat** file
- save the regressed $f(18.75)$ value on **HW4_8.dat** file
- save the $f(x)$ values of the regression line on **HW4_9.dat** file

3. Least-Square : MatLab Commands

Use the MatLab commands, i.e., 'polyfit', 'polyval', 'interp1' and so on, make dat files.

x	2.5	3.6	5	6	7.5	10.1	12.5	15.2	17.6	20
$f(x)$	13.1	11	8.5	8.2	7	6.2	5.2	4.8	4.6	4.3

With 'polyfit' (7^{th} order polynomial) & 'polyval' command and $2.5 \leq x \leq 20$ and $\Delta x = 0.1$, make following dat files and submit them.

- save the regressed $f(9.5)$ value on **HW4_10.dat** file
- save the regressed $f(13)$ value on **HW4_11.dat** file
- save the $f(x)$ values of the regression line on **HW4_12.dat** file

With 'interp1' command and $2.5 \leq x \leq 20$ and $\Delta x = 0.1$, make following dat files and submit them.

- save the regressed $f(9.5)$ value on **HW4_13.dat** file
- save the $f(x)$ values of the regression line on **HW4_14.dat** file

With 'interp1' (nearest option) command and $2.5 \leq x \leq 20$ and $\Delta x = 0.1$, make following dat files and submit them.

- save the regressed $f(9.5)$ value on **HW4_15.dat** file
- save the $f(x)$ values of the regression line on **HW4_16.dat** file

With 'interp1' (spline option) command and $2.5 \leq x \leq 20$ and $\Delta x = 0.1$, make following dat files and submit them.

- save the regressed $f(9.5)$ value on **HW4_17.dat** file
- save the $f(x)$ values of the regression line on **HW4_18.dat** file

4. Multi-Dimensional Interpolation

Temperatures are measured at various points on a heated plate.

	$x = 0$	$x = 2$	$x = 4$	$x = 6$	$x = 8$
$y = 0$	100.00	90.00	80.00	70.00	60.00
$y = 2$	85.00	64.45	53.56	48.15	50.00
$y = 4$	70.00	48.90	38.43	35	40.00
$y = 6$	55.00	38.79	30.39	27.27	30.00
$y = 8$	40.00	35.00	30.00	25.00	20.00

Make following dat files and submit them using Matlab's interp2 command with the linear (default) option.

- save the estimated temperature at $x = 4.2$, $y = 3.3$ on **HW4_19.dat** file
- save the estimated temperature at $x = 4.4$, $y = 2.8$ on **HW4_20.dat** file
- save the estimated temperature at $x = 6.6$, $y = 5.7$ on **HW4_21.dat** file
- save the estimated temperatures with $0 \leq x \leq 8$, $0 \leq y \leq 8$, and $\Delta x = \Delta y = 0.25$ on **HW4_22.dat** file