Lab 12 – Interpolation and Curve Fitting

0 Unit of Study Evaluation Survey

0.1 Your valuable feedback

Please go to **http://sydney.edu.au/itl/surveys/complete/** then sign in using your MyUni username and password.

Your answers are completely anonymous. Please write specific and detailed comments to help us improve the course. We value your opinion and read all comments.

If you are not sure about your tutor's name, you can find their name and photo on the course website (click on **Staff** on the left of screen). If you attended many tutors' labs, please comment on each of them.

When you have finished the survey, make sure to click **Save and Submit**

1 Interpolation

1.1 Thermodynamics

Consider the table below, which shows data for steam at constant pressure:

Temperature [°C]	**Internal energy [kJ/kg]**
100	2506.7
150	2582.8
250	2633.7
300	2810.4
400	2967.9
500	3131.6

Write a Matlab program to:

a) Determine the internal energy at 350°C using linear and spline interpolation
b) Plot the data in the above table as circles. Then, on the same plot, show a plot of linear interpolation and cubic spline interpolation. You can use the **linspace** function, as introduced in lecture 4-2.
c) Determine the value of temperature if the internal energy is 2900kJ/kg using both linear interpolation and cubic spline interpolation.

(This Q is based on Exercise 1, Chapter 15 from "Engineering Computation with Matlab", D. Smith, 2008)

2 Curve Fitting

2.1 Water flow

The rate of flow of fluid through a channel depends on the height of the channel, as follows:

Height [ft]	Flow [ft^3/sec]
0.00	0.00
1.70	2.60
1.95	3.60
2.60	4.03
2.92	6.45
4.04	11.22
5.24	30.61

a) Compute 3 different best polynomial fit curves for the data: linear, quadratic and cubic. Plot the data (as '+') and models on the same figure. Use the **legend** function to label each model. Visually, which model appears to best represent the data?
b) Compute the error of each model, which is equal to the sum of residuals, as used in the least squares fitting algorithm. Which model best fits the data?

(This Q is based on Exercise 3, Chapter 12 from "Engineering Computation with Matlab", D. Smith, 2008)

2.2 Temperature scales with curve fitting

Solve the same problem in Lab 10, Exercise 4.1, but use curve fitting instead of using matrix algebra.

Hint: In general, if you have **n+1** points, then you can definitely find a degree-**n** polynomial that goes through all those points. So in this problem, there are only 2 points, so the straight line of best fit (degree 1 polynomial) will go through both points.

2.3 And the last Q, just for fun…

Download the file **marks.csv** from the course website. Do ***not*** modify this csv file at all. These are the actual marks from last year's students in ENGG1801 in semester 1, 2016.

Use Matlab to plot the "total mark before the final exam" (3^{rd} column) on the x-axis, versus the "final mark in the course" (2^{nd} column) on the y-axis, with each student being represented as a dot. Also plot the straight line of best fit and include the equation of this line on the plot. Label the axes and give an appropriate title.

What final mark would you like to score? Using the graph, and the marks that you scored for Lab Exams 1 and 2, and Lab Participation, estimate the mark that you will need in Lab Exam 3 to achieve this target final mark.

On the course website (after Lab Exam 3), there will be additional resources to help you in the Final Exam. This includes 2 sample exams with sample solutions to all Q's.