Numerical Analysis

CSCE 440/840 Homework 3 Fall 2018

Consider the data in Table **Particulate Matter** from a set of six weather stations, where SN is the station identification number, T is time in days and PM is the particulate matter with a mean diameter of $2.5\mu m$ or less.

1. **(undergraduates: 10 points, graduates: 0 points (skip this))** Find the piecewise linear interpolation for the fourth weather station.
2. **(10 points)** Find the piecewise quadratic interpolation for the fourth weather station.
3. **(20 points)** Find the cubic spline interpolation for the fourth weather station solving a tridiagonal matrix-vector equation and natural boundary conditions.
4. **(20 points)** Find the cubic spline interpolation for the fourth weather station solving a recurrence equation. (**Hint:** Use the example of the slides "Cubic Spline Part 2.")

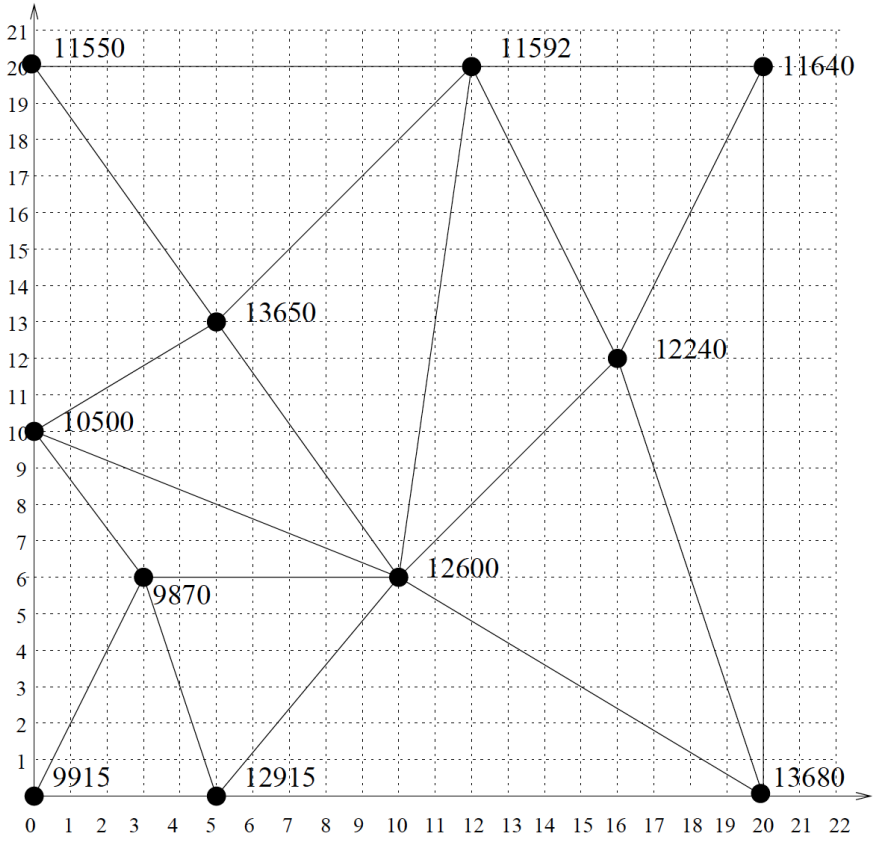

Figure 1: A set of elevation measurements.

5. **(40 points)** Write a MATLAB program that takes as input a set of vertices with elevation values and a set of triangles formed from those vertices and gives as output the linear interpolation function of each triangular surface. Apply your function to the triangles shown in Figure 1.

Bonus Question

6. **(undergraduates: 5 bonus points, graduates: 10 points (required))** Use MATLAB's `scatteredInterpolant(x, y, v)` function where x and y are the x and y coordinates of points in the plane and v is their values at those points as shown in Figure 1. Find a visualization of the elevation at the grid points also shown in Figure 1 using MATLAB's `ndgrid` and `mesh` functions.

Particulate Matter

SN	T	PM
1	1	30
1	5	33
1	8	35
1	12	27
1	15	29
1	19	32
1	22	35
1	26	37
1	29	39
2	2	36
2	4	35
2	9	30
2	11	28
2	16	34
2	18	32
2	23	36
2	25	37
2	30	40
3	6	42
3	13	36
3	20	38
3	27	40
4	7	32
4	14	34
4	21	36
4	28	35
5	5	28
5	10	30
5	15	33
5	20	31
6	8	30
6	15	37
6	22	42
6	29	44