Data Smoothing

Exercise 3

Data Smoothing Report

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1 Introduction

This exercise asks to use the linearly independent basis functions:

$$\Phi_{3,i}(x) =$$

to find the optimal combination

$$\Phi(x) = \lambda_0(x)$$

that minimizes
for the 20 data points (x_j, y_j) given in

j	x_j	y_j
0	0.0	-0.80
1	0.6	-0.34
2	1.5	0.59
3	1.7	0.59
4	1.9	0.23
5	2.1	0.10
6	2.3	0.28
7	2.6	1.03
8	2.8	1.50
9	3.0	1.44
10	3.6	0.74
11	4.7	-0.82
12	5.2	-1.27
13	5.7	-0.92
14	5.8	-0.92
15	6.0	-1.04
16	6.4	-0.79
17	6.9	-0.06
18	7.6	1.00
19	8.0	0.00

2 Tools

The following programming language and libraries have been used in this exercise:

- Item 1
- C Math Library
- GSL (GNU Scientific Library)

The following double-precision GSL data types have been used in the exercise:

- `gsl_vector ?`

The following GSL methods have been used in the exercise:

- `gsl_matrix_alloc(size1, size2)`
- `gsl_matrix_set_zero(matrix)`
- `gsl_matrix_set(matrix, row, column, value)`
- `gsl_matrix_get(matrix, row, column)`
- `gsl_vector_alloc(size)`
- `gsl_vector_set_zero(vector)`
- `gsl_vector_set(vector, index, value)`
- `gsl_vector_get(vector, index)`
- `gsl_matrix_memcpy(matrixToCopyFrom, matrix)`
- `gsl_linalg_SV_decomp(A, V, S, workspaceVector)`
- `gsl_vector_minmax(vector, minInVector, maxInVector)`

In order to factorize a matrix into the LU decomposition, and then solve the square system $Ax = y$ using the decomposition of A, I've used the following methods:

- `gsl_linalg_LU_decomp(A, permutation, signum)`
- `gsl_linalg_LU_solve(LU, permutation, b, x)`
- `gsl_permutation_alloc(size)`

The following method from the C Math library was used in this exercise to calculate the absolute value of a number:

- `fabs(x)`

3 Computation

4 Plot

5 Observations