

CENG 216 – NUMERICAL COMPUTATION

Homework 2

March 26, 2017

Due Date: April 04, 2017

Exercise 1 Textbook Exercises

Solve exercises 3.3, 3.13(a), 3.13(b), 5.5, and 5.11(a).

Exercise 2 Quadratic Fitting

Write a C++ program that reads a text file containing N point pairs in the format

```
x1 y1
x2 y2
. .
. .
. .
xN yN
```

The program should then calculate the parameters a, b, c of a quadratic function $y = f(x) = ax^2 + bx + c$ that best fits the N points read from the file (minimizing the distance $y_i - f(x_i)$ for all points, see the line fitting example in the slides for Lecture 04 Gaussian elimination for a hint on how to form the linear system of equations).

- If $N = 3$, then use LU decomposition (You may use Eigen or CLAPACK libraries) to compute the solution.
- If $N > 3$ then solve the linear least square system
 - using LU decomposition.
 - using QR decomposition if the program is launched with a command line argument `--qr`
- If $N \leq 2$ then an error message should warn the user.

- Your program should print the number of points, calculated parameter values a, b , and c , and finally the resulting backwards squared error $E(a, b, c) = \sum_{i=1}^N (y_i - f(x_i))^2$.
- *BONUS (+20 pts to HW1+HW2 sum):* Optionally, your program should save a GNUPlot file that draws the points and the calculated quadratic curve.

NOTE: There will be a small bonus for those submitting a homework prepared in L^AT_EX.