

MATH 365 Homework #8

Due: Wednesday, Apr. 11, 2012

1. (50 points) Given the following coefficient matrix

$$A = \begin{pmatrix} 7.0605 & 9.5022 & 4.4559 & 1.19 \\ 0.3183 & 0.3445 & 6.4631 & 4.9836 \\ 2.7692 & 4.3874 & 7.0936 & 9.5974 \\ 0.4617 & 3.8156 & 7.5469 & 3.4039 \\ 0.9713 & 7.6552 & 2.7603 & 5.8527 \\ 8.2346 & 7.952 & 6.797 & 2.2381 \\ 6.9483 & 1.8687 & 6.551 & 7.5127 \\ 3.171 & 4.8976 & 1.6261 & 2.551 \end{pmatrix},$$

and the right-hand-side vector

$$b = \begin{pmatrix} 0.7585 \\ 0.5395 \\ 5.3080 \\ 7.7917 \\ 9.3401 \\ 1.2991 \\ 5.6882 \\ 4.6939 \end{pmatrix},$$

write and run a real source code on the computer based on “Householder QR Factorization” method to find the solution $x \in \mathbb{R}^4$ of the least squares problem for $Ax \approx b$.

2. Given the following 10 observations $y_i = y(x_i)$ ($i = 1, \dots, 10$):

x	y
0.1000	0.1125
0.2000	0.2227
0.3000	0.3286
0.4000	0.4284
0.5000	0.5205
0.6000	0.6039
0.7000	0.6778
0.8000	0.7421
0.9000	0.7969
1.0000	0.8427

- (2.1) (40 points) Using the Householder QR factorization program done in Question 1, find a polynomial $p(x)$ of degree 4 that fits the above data in a least squares sense, namely, find out the coefficients β_i ($i = 1, \dots, 4$) of the following polynomial $p(x)$

$$p(x) = \beta_1 x^4 + \beta_2 x^3 + \beta_3 x^2 + \beta_4 x + \beta_5.$$

- (2.2) (10 points) Indicate the residual of the above curve fitting.

Note: In your homework, the right source code and the correct output results must be shown altogether in order to obtain full score.