Name: _____

Date: _____

Collaborators:

(If applicable, collaborators submit their individually written assignments together)

Question:	1	2	3	4	5	6	7	Total
Points:	20	10	5	10	5	25	10	85
Score:								

Instructor/grader comments:

QR factorization

1. (20 points) Find the Housholder reflector *P* that

$$P\begin{bmatrix} -6\\2\\9\end{bmatrix} = \begin{bmatrix} a\\0\\0\end{bmatrix}$$

What is the value of *a*?

2. (10 points) Let A = QR be the factorization of a square matrix A. Show that

$$\kappa_2(A) = \kappa_2(R),$$

where $\kappa_2(V)$ is the condition number of matrix V calculated using two-norm.

Vector and matrix norms

- 3. (5 points) Find l_2 and l_{∞} norms of the vector. $x = (\sin k, \cos k, 1)$ for arbitrary real k
- 4. (10 points) Find l_p norm of the identity $n \times n$ matrix.

Hint: start from the definition of the matrix norm

5. (5 points) Find l_{∞} and l_1 norms of the matrix. $\alpha = \frac{1}{\sqrt{2}}$

[1	0	α	-1	$-\alpha$	0	0	0	[0
0	0	α	0	α	0	0	0	0
0	α	$-\alpha$	0	0	-1	$-\alpha$	0	0
0	α	α	0	0	0	$-\alpha$	0	0
0	0	0	0	0	0	α	0	α
0	0	0	0	0	0	α	0	α
0	0	0	0	α	α	0	$-\alpha$	α
0	0	0	0	α	0	0	α	$-\alpha$
0	0	0	1	0	0	0	α	0]

Matlab

6. (25 points) Write a matlab script (call it hw06p6.m) that uses QR algorithm to find the least squares fit of a quadratic polynomial to a noisy data. Use the provided function hw06p6noisydata() to generate 100 'noisy' data points. Use matlab's qr function for thin QR factorization. Use matlab's backslash operator for solving the resulting system of linear equations. Include the help commands for the function hw06p6nosydata() in your script. choice. Place the commands clear, clf at the top of your script. Plot the graphs of nosy data (as scatter plot) and the best fit curve (as connected data points). For comparison plot the 'noiseless' function (as dashed line). Provide grid, labels, legend, title for your graph.

Gitlab

7. (10 points) Create a gitlab project called hw06 (name it exactly as shown). Upload all matlab files that are required to run your code. Scan your solutions of Problems 1–5, combine all scans into a single pdf file (call it hw06.pdf) and upload it to gitlab. Create README.md file - leave it empty if appropriate. Share the project with the instructor (gitlab user name m3510_20f_in) and the TA (gitlab user name m3510_20f_ta) and grant them the Reporter privileges.