AMCS 602
Problem set 3, due September 20, 2016
Dr. Epstein

Reading: Page numbers below refer to *Numerical Linear Algebra* by Trefethen and Bau.

Standard problems: The following problems should be done, but do not have to be handed in.

1. Page 55, problem 7.2.
2. Page 55, problem 7.5.
3. Page 68, problem 9.3.

Homework assignment: The solutions to the following problems should be carefully written up and handed in.

1. Page 55, problem 7.3.
2. Page 55, problem 7.4.
3. Page 62, problem 8.2.
4. Page 68, problem 9.1.
5. Page 68, problem 9.2.
6. Explain how to modify the definition of the Householder reflector so that it works for a vector with complex entries. That is, given $x \in \mathbb{C}^m$, how should we define the unit vector v and the phase $e^{i\theta}$, so that $(\mathrm{Id} - 2vv^*)x = e^{i\theta}\|x\|e_1$? How many choices are there for θ?
7. If P is a projection, then $R_P = \mathrm{Id} - 2P$ is a reflection. Which points are fixed by R_P? For the case of $P : \mathbb{R}^3 \to \mathbb{R}^3$ give a geometric description of the action of R_P, when P is a rank 2 projection.

   If $P : \mathbb{R}^m \to \mathbb{R}^m$ is an orthogonal projection of rank $k < m$, then find a basis for $\mathbb{R}^m$ in which the action of R_P is as simple as possible, and explain what that is. What is $\det R_P$?