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Math128B: Numerical Analysis

Homework #7, Due March 16, 2009

- Let $a \in \mathbf{R}^n$ be a non-zero vector. Consider the Householder transformation matrix H such that $Ha = \begin{pmatrix} \tau \\ 0 \end{pmatrix}$. It is known that the choice $\tau = \|a\|_2$ is in general unstable. Download the matlab code `house2.m`. Run the code with $n = 10$ and $a = [\pm 1; \sqrt{\epsilon} * rand(n-1, 1)]$, where ϵ is the machine precision. Verify that `house2.m` does return a unit vector, and that $Ha = \begin{pmatrix} \tau \\ 0 \end{pmatrix}$ in finite precision when the first component of a is -1. On the other hand, also verify that $Ha \neq \begin{pmatrix} \tau \\ 0 \end{pmatrix}$ in finite precision when the first component of a is 1. Modify `house2.m` so the resulting Householder transformation is always stable.

- **Section 9.3**: Problems **2ad**.

- **Section 9.4**: Problems **2b, 6b, 8, 9**.