CS 383C
CAM 383C/M 383E Numerical Analysis: Linear Algebra Fall 2008

Homework 3

Lecturer: Inderjit Dhillon Date Due: Sep 24, 2008

Keywords: *Singular Value Decomposition, Projectors, QR Factorization, Gram Schmidt Orthogonalization*

1. Problems 5.3, 5.4, 6.2, 7.5

2. (Gram-Schmidt Process) Let

$$v_1 = \begin{bmatrix} 1 \\ \varepsilon \\ 0 \\ 0 \end{bmatrix}, \quad v_2 = \begin{bmatrix} 1 \\ 0 \\ \varepsilon \\ 0 \end{bmatrix}, \quad v_3 = \begin{bmatrix} 1 \\ 0 \\ 0 \\ \varepsilon \end{bmatrix},$$

   and ε be such that $fl(1 + \varepsilon^2) = 1$.

   a Apply Classical Gram-Schmidt and show that the computed vectors are not numerically orthogonal, i.e., computed vectors have dot products much larger than ε.

   b Apply Modified Gram-Schmidt and show that the computed vectors are numerically orthogonal, i.e., computed vectors have dot products $= O(\varepsilon)$.