ECE130C **Home Work 6** Spring '09

Due on May 27, 2009.

1. **Reading assignment**: Chapter 4 and sections 5.1 and 5.2 of the text book.
2. **Reading assignment**: (These don't have to be turned in.) Problems 3.3.32, 3.4.4, 3.4.22.
3. (Problem 3.4.6) Find a third column so that the matrix

$$Q = \begin{pmatrix} \frac{-1}{\sqrt{3}} & \frac{-1}{\sqrt{14}} & * \\ \frac{-1}{\sqrt{3}} & \frac{-2}{\sqrt{14}} & * \\ \frac{-1}{\sqrt{3}} & \frac{3}{\sqrt{14}} & * \end{pmatrix}$$

is orthogonal. It must be a unit vector orthogonal to other columns; how much freedom does this leave? Verify that the rows automatically become orthonormal at the same time.

4. (Problem 3.4.24) Find the fourth Legendre polynomial. It is a cubic polynomial of the form $x^3 + ax^2 + bx + c$, that is orthogonal to 1, $x$ and $x^2 - \frac{1}{3}$, over the interval $-1 \leq x \leq 1$.
5. (Problem 3.4.28) Apply Gram–Schmidt to $(-1, 1, 0)$, $(0, -1, 1)$ and $(-1, 0, 1)$, to find an orthonormal basis on the plane $x_1 + x_2 + x_3 = 0$. What is the dimension of this subspace, and how many non-zero vectors come out of Gram–Schmidt?
6. (Problem 3.4.32)
   (a) Find a basis for the subspace $\mathbf{S}$ in $\mathbf{R}^4$ spanned by all solutions of $x_1 + x_2 - x_3 + x_4 = 0$.
   (b) Find a basis for the orthogonal complement of $\mathbf{S}^\perp$.
   (c) Find $b_1$ in $\mathbf{S}$ and $b_2$ in $\mathbf{S}^\perp$ so that $b_1 + b_2 = b = (1, 1, 1, 1)$.
7. Do the following problems from the text book: 4.2.12, 4.2.16, 4.3.26, 4.3.34, 4.4.38, 4.4.42, 4.4.44.