18.06 Problem Set 7

Due Thursday, 1 April 2010 at 4pm in the undergrad math office. Please note that the problems from the textbook are out of the 4th edition: make sure to check that you are doing the correct problems. For MATLAB problems, please include a printout of your code with your problem set. You can type `diary("filename")` at the beginning of your session to save a transcript, and `diary` off when you are done.

Non-challenge problems are worth 4 points, while challenge problems are worth 12.

1. Do problems 16, 32, and 33 from section 5.2.

2. Do problems 8, 28, 40, and 41 from section 5.3.

3. Do problems 19 and 29 from section 6.1.

4. Do problems 6, 16, and 37 from section 6.2.

5. Challenge problem: in MATLAB, the command $A = \mathbf{toeplitz}(v)$ produces a symmetric matrix in which each descending diagonal (from left to right) is constant and the first row is v. For instance, if $v = [\ 0 \quad 1 \quad 0 \quad 0 \quad 0 \quad 1\ ]$, $A = \mathbf{toeplitz}(v)$ is the matrix with 1s on both sides of the main diagonal and on the far corners, and 0s elsewhere. More generally, let $v(n)$ be the vector in $\mathbf{R}^n$ with a 1 in the second and last places and 0s elsewhere, and let $A(n) = \mathbf{toeplitz}(v(n))$.

   a Experiment with $n = 5, \cdots, 12$ in MATLAB to see the repeating pattern of $\det A(n)$.

   b Expand $\det A(n)$ in terms of cofactors of the first row and in terms of cofactors of the first column. Use the known determinants from problems 5.2.13-14 to obtain the same pattern found in part (a).