Due Wednesday, 12/13

Answers to homework problems should include any computations necessary to get the final answer. To receive full credit, you must also explain what you've done and why you did it. You should write in complete sentences with (reasonably) correct grammar. Granted, this is not a writing intensive course, but it *is* a 5000-level mathematics course, and at this level you're expected to be able to explain your work in a coherent, organized and logical manner.

Note that many of the problems in the textbook have answers in the back. If I assign any of those, explaining your reasoning becomes even more important, because it's assumed you have the right answer. Even if I don't assign them, it might be a good idea to do those problems and check your answers before working on the assigned problems.

Chapter 12: 12.17, as a warmup for things to come.

12.A Let C be the Hamming $[7, 4]$ code. Find a generating matrix for its dual code, and list all of the codewords in $C^\perp$. Does $C^\perp$ share the property that it can correct one error?

Chapter 14: 14.02. You should not attempt any sort of direct calculation of the rowspace. Instead, find a polynomial $g(x)$ of minimal degree which generates the same cyclic code and use it to find a "true" generating matrix (that is, with linearly independent rows) for the code, and answer the question accordingly.

14.A Do 14.04, but add: find a true generating matrix for the code, and verify that the rows of your generating matrix are "orthogonal" (in the sense used in class) to the rows of your check matrix.

The following problem is a blend of chapters. Remember that we covered syndrome decoding a bit differently than the book, avoiding terms like "coset."

14.B Let C be an $[n, k]$ code generated by

$$G = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

(1) Find n and k, being careful to justify your answers.
(2) Find the standard form of the generating matrix and its corresponding check matrix.
(3) Analyze the check matrix to find the minimum distance of C. Can this code detect or correct any errors?
(4) Compute the syndromes for all error vectors corresponding to 0 or 1 transmission errors.
(5) Use syndrome decoding and your lookup table to decode the following words:

011011 110110

Chapter 17: 17.06, but for credit you must find it *intelligently*, without using direct calculation.