Math 350
Spring, 2003

HOMEWORK #1

Do 50 points of the following problems (due 1/14/03).

15 pts. **1** The Chemical Abstract Service uses the following scheme for registry numbers: $a_1a_2\ldots a_7$ are the identification digits, and the check digit is $a_8 = 7\cdot a_1 + 6\cdot a_2 + 5\cdot a_3 + 4\cdot a_4 + 3\cdot a_5 + 2\cdot a_6 + 1\cdot a_7 (modulo 10)$. What mistyped digits will not be detected? What about transpositions?

15 pts. **2** Generalize problem 1.5, p.10, to a 3-ary (k,M,2)-code (do parts (i) and (ii)).

30 pts., $\star$ **3** If you have 16 messages to send, and you want to be able to correct errors, one way to do that is to use a binary (12,16,3) repetition code. This code is created by numbering the 16 messages in binary, then repeating them 3 times while sending. Discuss the error correcting capabilites of this system (when can it correct 2 errors, 3 errors, ...)? Explain how you would do your error correcting. If each digit has a probability of .99 of being received properly and we assume that errors in digits are independent events, what is the probability that the word is received correctly?

20 pts. **4** Let C be the binary code of length 6 made up of all of the codewords of even weight. What is M? What is d? What received words can be decoded unambiguously? What received words will give problems? What properties will this code have if it is repeated twice? How would you correct errors?