

Math 350
Spring, 2003

HOMEWORK #7

Do 100 points of the following problems (due 3/18/03).

- 15 pts. **1** Define C to be self-dual if $C = C^\perp$. Find a generator matrix of a linear binary self-dual code of length 10.
- 15 pts. **2** Find the largest n so that there is a linear binary code with $d = 3$ and at most 3 redundancy bits.
- 20 pts. **3** Let $R_{r,q}$ denote the rate of the Hamming code $H(r, q)$. Find an equation for $R_{r,q}$, and calculate $\lim_{r \rightarrow \infty} R_{r,q}$.
- ★ 35 pts. **4** Show that the minimum distance of the ternary Golay code of length 11 is 5. You may either use the generator matrix on page 102, or you can construct a parity check matrix for this in the same spirit as Theorem 8.4. You will NOT get star credit for doing this brute force (listing all $3^6 = 729$ codewords and showing that the minimum weight is 5): you need to give a theoretical reason why it has minimum distance of 5.
- ★ 35 pts. **5** Find all binary cyclic codes of length 15.
- 20 pts. **6** Find all cyclic codes of length p over $GF(p)$, where p is a prime.
- 15 pts. **7** Find all ternary cyclic codes of length 6.
- 15 pts. **8** Find THE generating polynomial for the binary code of length 8 that is generated by $x^6 + x^4 + x^2$. What is its check polynomial?