

## MATH 108 - FALL 2002

### HOMEWORK 5, DUE THURSDAY NOVEMBER 14

- (1) Show that all caps with four points in  $\mathbb{F}_3^2$  are isomorphic. In other words, show that there is an *affine transformation*  $v \mapsto Av+b$  with  $A$  an invertible 2 by 2 matrix with entries in  $\mathbb{F}_3$  and  $b$  a vector in  $\mathbb{F}_3^2$  which takes the four points  $\{(0, 0), (1, 0), (0, 1), (1, 1)\}$  to any other collection of four points which do not contain any lines.
- (2) Show that the ISBN code can detect any mistake in one number, or that two adjacent numbers have been switched. You can find a description of the code at  
<http://www.ams.org/new-in-math/cover/barcodes5.html>
- (3) Find a code  $C$  of weight 4 with codewords in  $\mathbb{F}_3^4$ . Your code will have three code words.
- (4) Find a code  $C$  of weight 3 with codewords in  $\mathbb{F}_3^{13}$ . You should have  $3^9$  different codewords. Hint: Look for a parity check matrix which is 4 by 13.