

**The use of books and notes is allowed.**

Questions:

1. Is there a binary linear code (over the alphabet  $\{0,1\}$ ) that has length 3, size 4, minimum distance 2, and which contains 111 as a codeword?
3. Is the binary code  $\{0000, 0001, 0010, 0100, 1000\}$  linear?
4. Is it true that for each binary linear code  $C$  with minimum distance 7 there is at least one non-linear code  $K$  over the alphabet  $\{0,1\}$  that has the same length, the same size and the same minimum distance as  $C$ ?
5. Construct a generator matrix for the dual of the binary linear code  $\{0000, 1111\}$ .
6. Construct a parity check matrix for the binary linear code spanned by  $\{1100, 0110\}$ .