

# Class worksheet 12: Combinatorics and Graphs 1

January 10, 2024

Name: \_\_\_\_\_

This is just to practice, no points are awarded.

1. Which of the following binary codes are linear?
  - (a)  $C_1 = \{011, 101, 110\}$
  - (b)  $C_2 = \{000, 011, 101, 110\}$
  - (c)  $C_3 = \{0000, 0110, 1001, 1110\}$
  - (d)  $C_4 = \{0000, 0111, 1001, 1110\}$
2. Recall the parity check matrix for the Hamming  $[7, 4, 3]_2$ -code  $C$  discussed in the last lecture. For each of the following vectors  $\mathbf{w}_i$  find the unique vector  $\mathbf{x}_i \in C$  such that  $d(\mathbf{w}_i, \mathbf{x}_i) = 1$ 
  - (a)  $\mathbf{w}_1 = (1, 0, 0, 0, 0, 1, 1)$
  - (b)  $\mathbf{w}_2 = (1, 1, 0, 1, 0, 1, 1)$
  - (c)  $\mathbf{w}_3 = (1, 0, 1, 1, 0, 1, 1)$
3. How many different generator matrices does an  $[n, k, d]_2$ -code have?