

Due by 5pm on September 25. Do not forget to attach the honor code. Each problem is worth 10 points.

- (1) Suppose that codewords from the binary code $\{000, 100, 111\}$ are being sent over a BSC (binary symmetric channel) with crossover probability $p = 0.03$. Use the maximum likelihood decoding rule to decode the following received words:

(a) 010, (b) 011, (c) 001.

- (2) Consider a memoryless binary channel with channel probabilities

$$\mathcal{P}(0 \text{ received} | 0 \text{ sent}) = 0.7, \quad \mathcal{P}(1 \text{ received} | 1 \text{ sent}) = 0.8.$$

If codewords from the binary code $\{000, 100, 111\}$ are being sent over this channel, use the maximum likelihood decoding rule to decode the following received words:

(a) 010, (b) 011, (c) 001.

- (3) Let $C = \{001, 011\}$ be a binary code.

- (a) Suppose we have a memoryless binary channel with the following probabilities:

$$\mathcal{P}(0 \text{ received} | 0 \text{ sent}) = 0.1, \quad \mathcal{P}(1 \text{ received} | 1 \text{ sent}) = 0.5.$$

Use the maximum likelihood decoding rule to decode the received word 000.

- (b) Use the nearest neighbour decoding rule to decode 000.

- (4) For the binary code $C = \{01101, 00011, 10110, 11000\}$, use the nearest neighbour decoding rule to decode the following received words:

(a) 00000, (b) 01111, (c) 10110, (d) 10011, (e) 11011.

- (5) For the ternary code $C = \{00122, 12201, 20110, 22000\}$, use the nearest neighbour decoding rule to decode the following received words:

(a) 01122, (b) 10021, (c) 22022, (d) 20120.

- (6) Construct the IMLD (incomplete maximum likelihood decoding) table for each of the following binary codes:

(a) $C = \{101, 111, 011\}$, (b) $C = \{000, 001, 010, 011\}$.