# 1 Objectives

At the end of this exercise session you should be able to:

- Apply and decode Hamming (7,4) code

# 2 Exercises

## Channel coding

**Exercise 1.** [1.5] Considering the Hamming (7,4) code. Decode the received strings:

(a) $\mathbf{r} = 1101011$

(b) $\mathbf{r} = 0110110$

(c) $\mathbf{r} = 0101111$

(d) $\mathbf{r} = 0101110$

**Exercise 2.** [1.2] Show that the error probability is reduced by the use of a repetition code $R_3$ by computing the error probability of this code for a binary symmetric channel with noise level $p$.

**Exercise 3.** [1.6] Calculate the probability of block error $p_B$ of the Hamming (7,4) code as a function of the noise level $p$ and show that to leading order it goes as $21p^2$.

**Exercise 4.** [8.1] Consider three independent random variables $\mathcal{U}$, $\mathcal{V}$, $\mathcal{W}$ with entropies $H_u, H_v, H_w$. Let $\mathcal{X} \equiv (\mathcal{U}, \mathcal{V})$ and $\mathcal{Y} \equiv (\mathcal{V}, \mathcal{W})$. What is $H(\mathcal{X}, \mathcal{Y})$? What is $H(\mathcal{X}|\mathcal{Y})$? What is $I(\mathcal{X}; \mathcal{Y})$?