

**Please solve the following exercises at home prior to the tutorial:**

**Exercise 1**

Given is the alphabet  $A = \{a, e, i, o, u\}$  with occurrence probabilities

$$p(a) = 0.25, p(e) = 0.2, p(i) = 0.1, p(o) = 0.3, \text{ and } p(u) = 0.15.$$

Calculate the information contents of the symbols in A and the entropy of A.

**Exercise 2**

Provide simple logical operations using bit masks for the following manipulations of ASCII characters:

- Extraction of the real numerical value 0 to 9 from the ASCII-Codes for the characters 0 to 9.
- Conversion from lower case to upper case and in reverse.

The solution is a series of binary digits which – using certain logical operations (e.g., AND, OR, NOT, XOR, ...) on the ASCII-Code – yield the stated result.

**The following exercises will be done during the tutorial:**

**Exercise 3**

Given are the following two binary codes for the alphabets  $A = \{x_i\}$  and  $B = \{y_i\}$  as well as the respective occurrence probabilities  $p_i$ :

$x_i$	a	e	i	o
$p_i$	0.3	0.25	0.3	0.15
Code	10	010	00	0110

$y_i$	1	2	3	4
$p_i$	0.7	0.05	0.1	0.15
Code	0	1000	111	110

- Considering a typical message of length  $n$ , what is the size in bits of a binary coded message consisting of symbols from either alphabet A or alphabet B?
- By how many percent is the larger message larger than the smaller one?
- Determine the entropy of the alphabets A and B.
- How large is the redundancy of a typical message from A or B?