

# 1

## 1.1

Buchstabe	Kodierung	" $k_i/r$ "
L	000	$\frac{3}{13}$
E	001	$\frac{1}{13}$
O	010	$\frac{2}{13}$
	011	$\frac{1}{13}$
Ä	100	$\frac{3}{13}$
S	101	$\frac{1}{13}$
T	110	$\frac{2}{13}$

## 1.2

$$\begin{aligned} I &= - \sum_{i=1}^n p_i \log p_i \\ &= - \sum_{i=1}^7 p_i \log p_i \\ &= - \left( \frac{1}{7} \cdot \log \frac{1}{7} \right) \cdot 7 = - \log \frac{1}{7} \approx 2.81 \end{aligned}$$

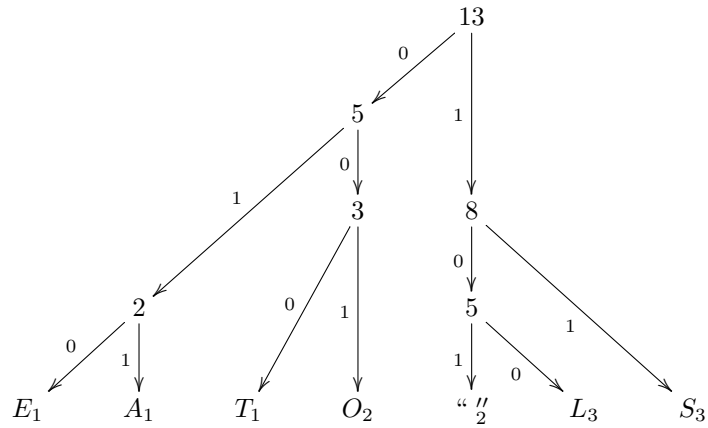
## 1.3

$$\begin{aligned} I &= - \sum_{i=1}^n p_i \log p_i \\ &= - \left( \frac{3}{13} \cdot \log \frac{3}{13} + \frac{1}{13} \cdot \log \frac{1}{13} + \frac{2}{13} \cdot \log \frac{2}{13} + \frac{2}{13} \cdot \log \frac{2}{13} \right. \\ &\quad \left. + \frac{1}{13} \cdot \log \frac{1}{13} + \frac{3}{13} \cdot \log \frac{3}{13} + \frac{1}{13} \cdot \log \frac{1}{13} \right) \approx 2.06 \end{aligned}$$

## 1.4

Der Informationsgehalt ist um etwa 0.75 verringert.

### 1.5



### 1.6

Buchstabe	Kodierung
S	11
L	100
	101
O	001
T	000
A	011
E	010

### 1.7

$$N = n_S + n_L + n + n_O + n_T + n_A + n_E = 3 \cdot 2 + 3 \cdot 3 + 2 \cdot 3 + 3 + 3 + 3 = 30$$

### 1.8

$$b = r \cdot I \approx 13 \cdot 2.06 = 26.78$$

### 1.9

Der Huffman-Kode weicht um etwa 12% ab.

### 1.10

Der Huffman-Kode braucht  $\frac{30}{13} \approx 2.31$  Zeichen, dies weicht um etwa 12% vom Informationsgehalt  $I \approx 2.06$  ab.

## 2

### 2.1

c	b	a	$\neg a \vee b$	$(\neg a \vee b) \wedge \neg c$	$(a \vee c)$	$b \wedge (a \vee c)$	$f(a, b, c)$
0	0	0	1	1	0	0	1
0	0	1	0	0	1	0	0
0	1	0	1	1	0	0	1
0	1	1	1	0	1	1	1
1	0	0	1	1	0	0	1
1	0	1	0	0	1	0	0
1	1	0	1	0	1	0	0
1	1	1	1	0	1	1	1

### 2.2

$$(\neg a \wedge \neg b \wedge \neg c) \vee (\neg a \wedge \neg b \wedge c) \vee (\neg a \wedge b \wedge c) \vee (a \wedge b \wedge \neg c) \vee (a \wedge b \wedge c) = m_0 \vee m_2 \vee m_3 \vee m_6 \vee m_7 = \sum m(0, 2, 3, 6, 7)$$

### 2.3

$$\neg y = \sum m(1, 4, 5)$$

### 2.4

$$\neg y = \prod M(0, 2, 3, 6, 7)$$

### 2.5

$$y = \prod M(1, 4, 5)$$

### 2.6

?

## 3

### 3.1

$$f_{x_1=0} = f(0, x_2, x_3) = \underbrace{[(x_2 \vee x_3) \wedge 0]}_0 \vee \underbrace{[(x_2 \wedge (x_2 \vee x_3) \wedge x_3) \wedge 0]}_0 = 0$$

$$f_{x_1=1} = f(0, x_2, x_3) = \underbrace{[(x_2 \vee x_3) \wedge 1]}_{x_2 \vee x_3} \vee \underbrace{[(x_2 \wedge (x_2 \vee x_3) \wedge x_3) \wedge 1]}_{x_2 \wedge (x_2 \vee x_3) \wedge x_3} = (x_2 \vee x_3) \vee [x_2 \wedge (x_2 \vee x_3) \wedge x_3]$$

### 3.2

$$f_{x_1=1, x_2=0} = f(0, 0, x_3) = \underbrace{(0 \vee x_3)}_{x_3} \vee \underbrace{[0 \wedge (0 \vee x_3) \wedge x_3]}_0 = x_3$$

$$f_{x_1=1, x_2=1} = f(0, 1, x_3) = \underbrace{(1 \vee x_3)}_1 \vee \underbrace{[1 \wedge (1 \vee x_3) \wedge x_3]}_{x_3} = x_3$$

### 3.3

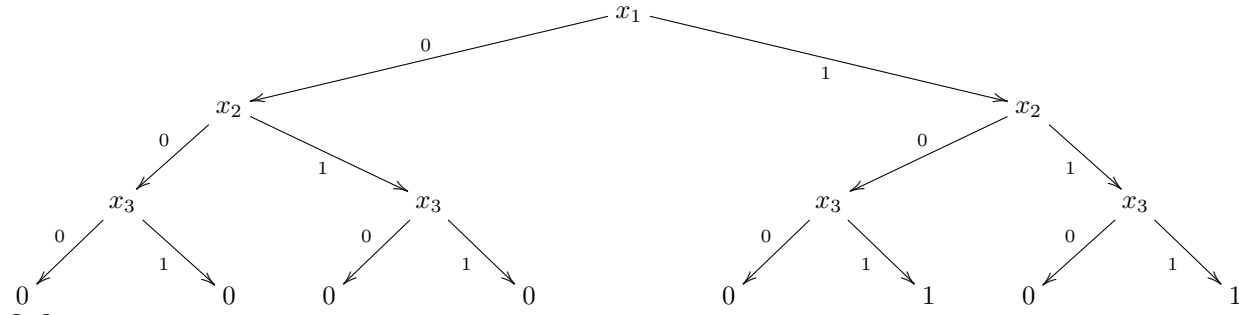
$$f_{x_1=1, x_2=1, x_3=0} = f(0, 1, 0) = 0$$

$$f_{x_1=1, x_2=1, x_3=1} = f(0, 1, 1) = 1$$

### 3.4

$$y = \underbrace{(x_1 \wedge \neg x_2 \wedge x_3)}_{101} \vee \underbrace{(x_1 \wedge x_2 \wedge x_3)}_{111} \vee \underbrace{(x_1 \wedge x_2 \wedge \neg x_3)}_{110} = \sum m(5, 6, 7)$$

### 3.5



### 3.6

