

### 3 Übungsblatt von Informatik 3 zum Mittwoch, den 11.5.2011

#### 3.1 Aufgabe

Shannon-Fano:

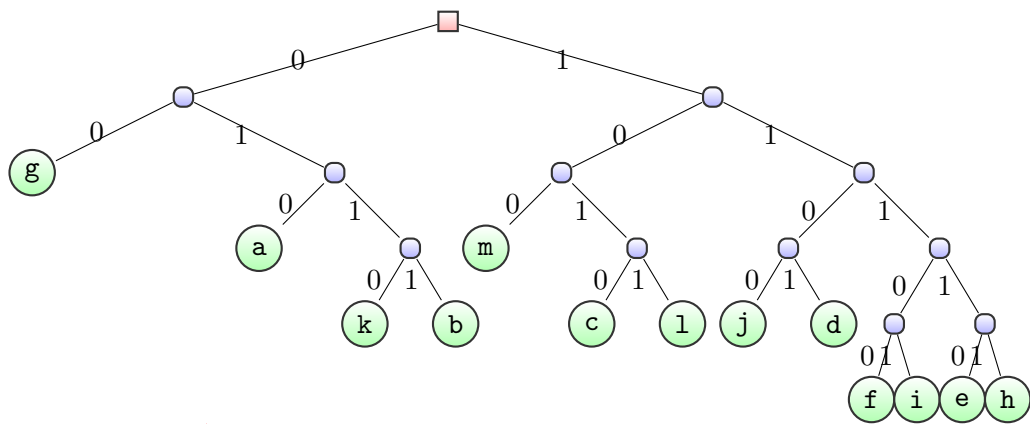
a) 

|    |   |   |   |   |   |    |   |   |   |    |   |   |
|----|---|---|---|---|---|----|---|---|---|----|---|---|
| a  | b | c | d | e | f | g  | h | i | j | k  | l | m |
| 15 | 8 | 7 | 5 | 3 | 5 | 20 | 2 | 4 | 6 | 10 | 7 | 8 |

Absteigend sortiert:

|    |    |    |   |   |   |   |   |   |   |   |   |   |
|----|----|----|---|---|---|---|---|---|---|---|---|---|
| g  | a  | k  | b | m | c | l | j | d | f | i | e | h |
| 20 | 15 | 10 | 8 | 8 | 7 | 7 | 6 | 5 | 5 | 4 | 3 | 2 |

|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 |   |   |   | 1 |   |   |   |   |   |   |   |   |
| 0 | 1 |   |   | 0 |   |   | 1 |   |   |   |   |   |
|   | 0 | 1 |   | 0 | 1 |   | 0 |   | 1 |   |   |   |
|   |   | 0 | 1 |   | 0 | 1 | 0 | 1 | 0 |   | 1 |   |
|   |   |   |   |   |   |   |   |   | 0 | 1 | 0 | 1 |

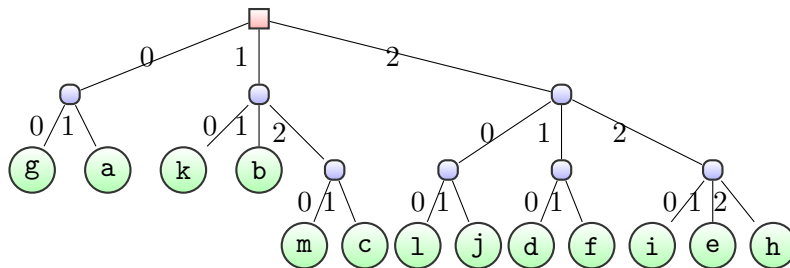


$\Rightarrow \bar{\lambda} = 3.51$  ✓

b) 

|    |    |    |   |   |   |   |   |   |   |   |   |   |
|----|----|----|---|---|---|---|---|---|---|---|---|---|
| g  | a  | k  | b | m | c | l | j | d | f | i | e | h |
| 20 | 15 | 10 | 8 | 8 | 7 | 7 | 6 | 5 | 5 | 4 | 3 | 2 |

|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 |   | 1 |   |   |   | 2 |   |   |   |   |   |   |
| 0 | 1 | 0 | 1 | 2 |   | 0 |   | 1 | 2 |   |   |   |
|   |   |   |   | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 2 |



$\Rightarrow \bar{\lambda} = 2.47$  ✓

Huffman:

a) 

|    |   |   |   |   |   |    |   |   |   |    |   |   |
|----|---|---|---|---|---|----|---|---|---|----|---|---|
| a  | b | c | d | e | f | g  | h | i | j | k  | l | m |
| 15 | 8 | 7 | 5 | 3 | 5 | 20 | 2 | 4 | 6 | 10 | 7 | 8 |

Absteigend sortiert:

$\Rightarrow$ 

|    |    |    |   |   |   |   |   |   |   |   |   |   |
|----|----|----|---|---|---|---|---|---|---|---|---|---|
| g  | a  | k  | b | m | c | l | j | d | f | i | e | h |
| 20 | 15 | 10 | 8 | 8 | 7 | 7 | 6 | 5 | 5 | 4 | 3 | 2 |

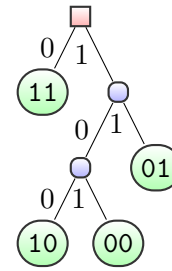
$\Rightarrow$ 

|    |    |    |   |   |   |   |   |   |   |    |   |
|----|----|----|---|---|---|---|---|---|---|----|---|
| g  | a  | k  | b | m | c | l | j | d | f | eh | i |
| 20 | 15 | 10 | 8 | 8 | 7 | 7 | 6 | 5 | 5 | 5  | 4 |



### 3.2 Aufgabe

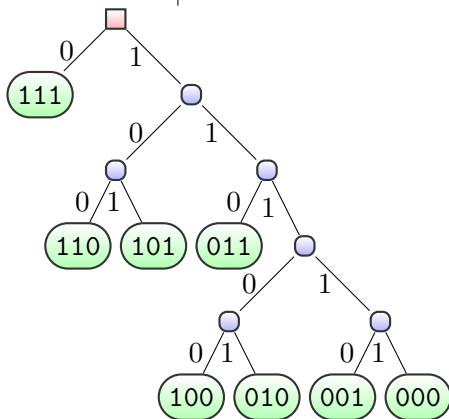
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$$S^2: \begin{array}{c|c|c|c} 00 & 01 & 10 & 11 \\ \hline 0.0225 & 0.1275 & 0.1275 & 0.7225 \\ \hline \Rightarrow & 11 & 01 & 10 & 00 \\ \hline & 0.7225 & 0.1275 & 0.1275 & 0.0225 \\ \hline \Rightarrow & 11 & (10,00) & 01 & 11 & ((10,00),01) \\ \hline & 0.7225 & 0.15 & 0.1275 & \Rightarrow 0.7225 & 0.2775 \end{array}$$


$$\bar{\lambda} = 1.4275, \quad H(S^2) = 2H(S) = -2 \sum_{s \in S^2} p(s) \log_2(p(s)) = 2 \cot 0.422709 = 2 * 0.61 = 1.22$$

$$0.845418, \quad 2 * (0.15 * \log(0.15) + 0.81 * \log(0.85))$$

$$\Rightarrow E = \frac{H}{\bar{\lambda}} = 0.592237 \quad \text{ff} \quad 0.854$$

$$S^3: \begin{array}{c|c|c|c|c|c|c|c} 000 & 001 & 010 & 011 & 100 & 101 & 110 & 111 \\ \hline 0.003375 & 0.019125 & 0.019125 & 0.108375 & 0.019125 & 0.108375 & 0.108375 & 0.614125 \\ \hline \Rightarrow & 111 & 110 & 101 & 011 & 100 & 010 & 001 & 000 \\ \hline & 0.614125 & 0.108375 & 0.108375 & 0.108375 & 0.019125 & 0.019125 & 0.019125 & 0.003375 \\ \hline \Rightarrow & 111 & 110 & 101 & 011 & (001,000) & 100 & 010 \\ \hline & 0.614125 & 0.108375 & 0.108375 & 0.108375 & 0.0225 & 0.019125 & 0.019125 \\ \hline \Rightarrow & 111 & 110 & 101 & 011 & (100,010) & (001,000) \\ \hline & 0.614125 & 0.108375 & 0.108375 & 0.108375 & 0.03825 & 0.0225 \\ \hline \Rightarrow & 111 & 110 & 101 & 011 & ((100,010),(001,000)) \\ \hline & 0.614125 & 0.108375 & 0.108375 & 0.108375 & 0.06075 \\ \hline \Rightarrow & 111 & (011,((100,010),(001,000))) & 110 & 101 \\ \hline & 0.614125 & 0.169125 & 0.108375 & 0.108375 \\ \hline \Rightarrow & 111 & (110,101) & (011,((100,010),(001,000))) \\ \hline & 0.614125 & 0.21675 & 0.169125 \\ \hline \Rightarrow & 111 & ((110,101),(011,((100,010),(001,000)))) \\ \hline & 0.614125 & 0.385875 \end{array}$$


$$\bar{\lambda} = 1.89325, \quad H(S^3) = 3H(S) = 1.26813, \quad E = 0.669815 \quad \text{ff}$$

### 3.3 Aufgabe

| a   | b   | c   | d   |
|-----|-----|-----|-----|
| 0.4 | 0.2 | 0.2 | 0.2 |

