Eksistens af optimal kode som i CIT Theo 2 2.1 - renoveret

- $s \equiv n \bmod (r-1)$, $s \in \{2, \ldots, r\}$

  $p_1 \geq p_2 \geq \cdots \geq p_n$ og $l_1 \leq l_2 \leq \cdots \leq l_n = L$.

  Lad $K = \sum_{i=1}^{n} r^{-l_i}$ (Venstre side af Krafts ulig.)

  Så gælder $\begin{cases} K \leq 1 \text{ og} \\ K - r^{-L} + r^{-(L-1)} > 1 \end{cases}$ (Ellers ej optimal)

  Altså $r^L - r + 1 < r^L K \leq r^L$,

- Dvs. $r^L K = r^L - r + \alpha$, $\alpha \in \{2, \ldots, r\}$.
- Endvidere $r^L K = \sum_{i=1}^{n} r^{L-l_i} \equiv n \bmod (r-1)$

$\cdots \Rightarrow$ $\alpha \equiv s \bmod (r-1)$, dvs.

$\alpha = s$ og $r^L K = r^L - r + s$

▲ Følgelig $r^L K \equiv s \bmod r$.

Lad k være antallet af kodeord af maksimal længde

Så gælder

$$r^L K = \sum_{i=1}^{n-k}{}' r^{L-l_i} + \sum_{i=n-k+1}^{n}{}' 1 \equiv k \bmod r$$

▲ Altså $r^L K \equiv k \bmod r$

▲▲ $\Rightarrow$ $k \equiv s \bmod r$

Følgelig

$$\boxed{k = s + t \cdot r \;,\; t \in \{0,1,\dots\}}$$

TABLE 2.2.1

Probabilities	Code	Probabilities	Code	Probabilities	Code
0.24		0.24		0.38*	
0.20		0.20		0.24	
0.18		0.18		~~0.18~~ 0.20	
0.13		0.13		~~0.13~~ 0.18	
0.10		0.10			
0.06		0.09*			
0.05		0.06			
0.03					
0.01					

$n = 4$

TABLE 2.2.2

Probabilities	Code	Probabilities	Code	Probabilities	Code
0.24	1	0.24	1	0.38*	0
0.20	2	0.20	2	0.24	1
0.18	3	0.18	3	0.20 ~~0.18~~	2
0.13	00	0.13	00	0.18 ~~0.13~~	3
0.10	01	0.10	01		
0.06	03	0.09*	02		
0.05	020	0.06	03		
0.03	021				
0.01	022				

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TABLE 2.2.3

Prob	Code	Prob	Code	Prob	Code	Prob	Code	Prob	Code
0.32	00	0.32	00	0.32	00	0.38*	1	0.62*	0
0.19	10	0.19	10	0.30*	01	0.32	00	0.38	1
0.19	11	0.19	11	0.19	10	0.30	01		
0.11	011	0.19*	010	0.19	11				
0.10	0100	0.11	011						
0.09	0101								

TABLE 2.2.4

Prob	Code	Prob	Code	Prob	Code	Prob	Code	Prob	Code
0.32	00	0.32	00	0.32	00	0.38*	1	0.62*	0
0.19	11	0.19*	10	0.30*	01	0.32	00	0.30	1
0.19	010	0.19	11	0.19	10	0.30	01		
0.11	011	0.19	010	0.19	11				
0.10	100	0.11	011						
0.09	101								