

Kviz 2

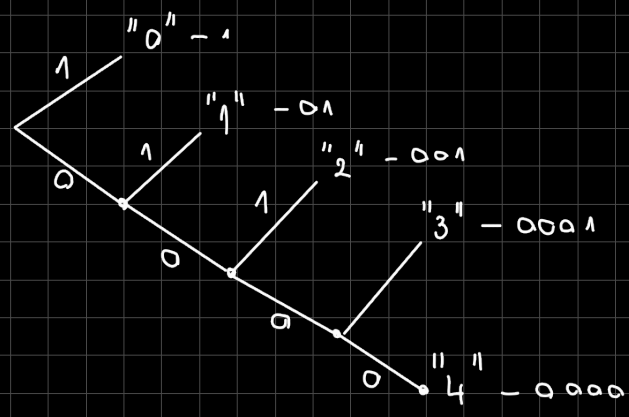
4. $A = \{0, 1, 2, 3, 4\}$ $L = \{1, 2, 3, 4, 4\}$

$B = \{0, 1\}$

$L = 2$

$P_0 = 0,8$

$P_1 = 0,2$



$P_{0^1} = P_1$

$P_{0^2} = P_0 \cdot P_1$

$P_{0^3} = P_0^2 \cdot P_1$

$P_{0^4} = P_0^3 \cdot P_1$

$P_{0^4} = P_0^4$

$$L = \sum_{i=1}^n r_i \cdot l_i$$

3.3 Haffmanov kod

- spodaj pa združeval

1. Združevanje

- Vzamemo n ^{→ št. znakov kodne} najmanj ^{Abecede} verjetnih znakov in jih združimo v sestavljeni znak
- Postopek ponovimo z sestavljenim znakom
(verjetnost = $\sum_{i=1}^r P$ verjetnosti znakov)
- ZAKljučimo ko ostane en sam znak

2. Razdruževanje

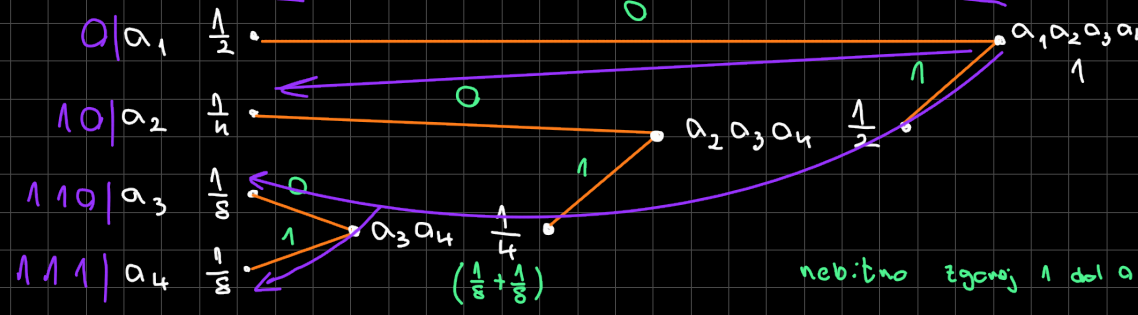
- sestavljeni znak rastavimo, vsakemu znaku priredimo eno znak kodne Abecede
- postopek ponovimo dokler imamo sestavljene znake
- kodne besede preberemo od korena proti listom drevesa. (oznake vej)

Primer 1

$A = \{a_1, a_2, a_3, a_4\}$

$P = \{ \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8} \}$

$B = \{0, 1\}$
 $r = 2$

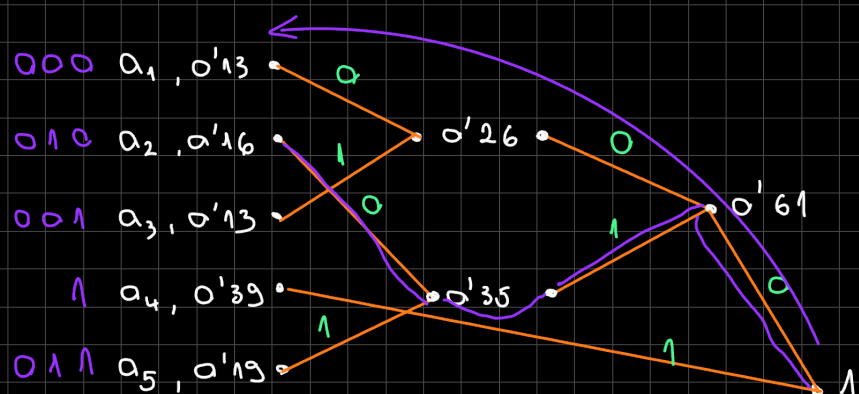


$H(A) = L = \frac{7}{4}$ (Enako kot pri Shannonovaj in ...)

Primer 2

$$A = \{a_1, a_2, a_3, a_4, a_5\}$$

$$p = \{0'13, 0'16, 0'13, 0'39, 0'19\}$$



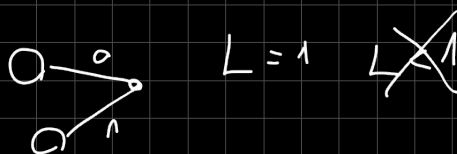
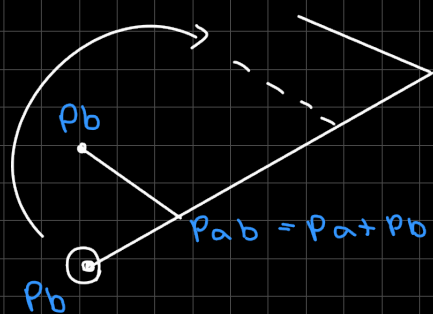
$$H(A) = 2'17$$

$$L = 2'22$$

$$\eta = 0,98$$

Hoffmanov kod je OPTIMALEN, trenutni, eno značen

1. Ni neizrabljenih vej
2. Najdaljše kodne besede so v parih (r-terci)
3. $L \rightarrow L - 1 \cdot (P_a + P_b)$



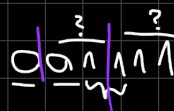
Ali je vsak optimalen kod Hoffmanov?

$$A = \{a_1, a_2, a_3, a_4\}$$

$$K_H = \{0, 10, 110, 111\}$$

$$K_? = \{0, 01, 011, 111\} \text{ ni trenutni}$$

← breme v nazad



$$L_H = L?$$

⇓
VSAK OPTIMALEN KOD NI HOFFMANOV

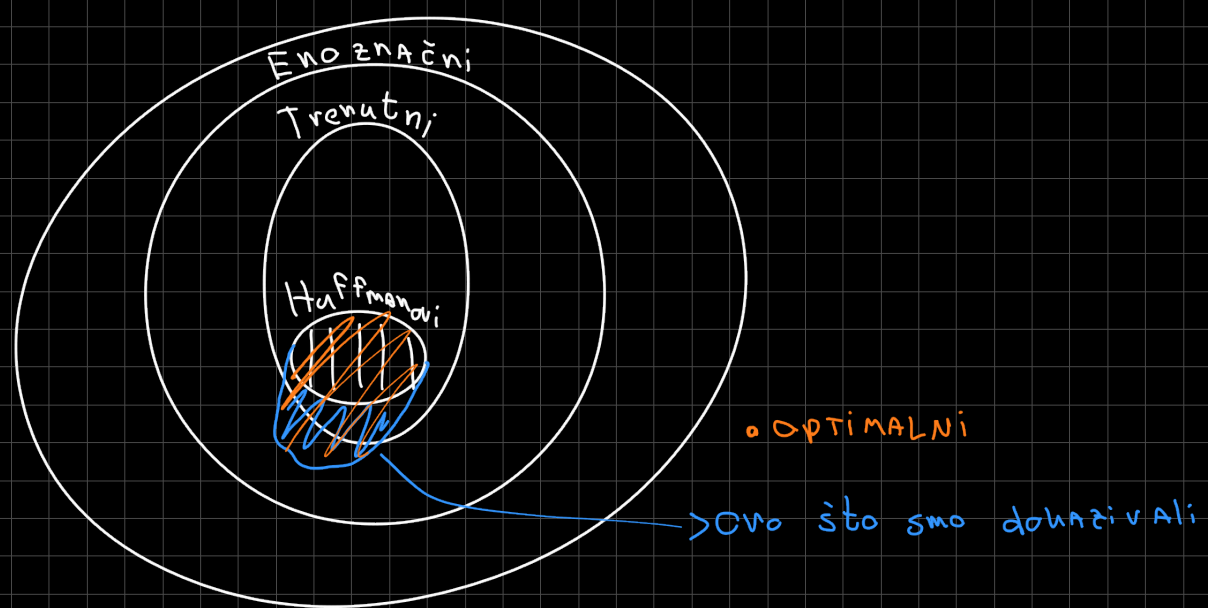
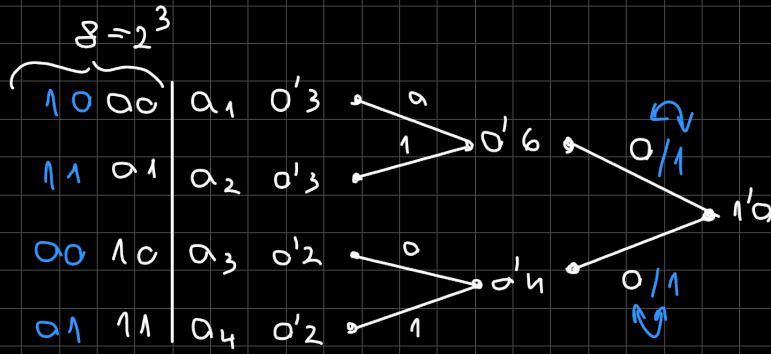
Ali je vsak optimalni trenutni kod HAFMANOV?

$$A = \{a_1, a_2, a_3, a_4, a_5\}$$

$$P = \{0.3, 0.3, 0.2, 0.2\}$$

$$B = \{0, 1\}$$

Ni

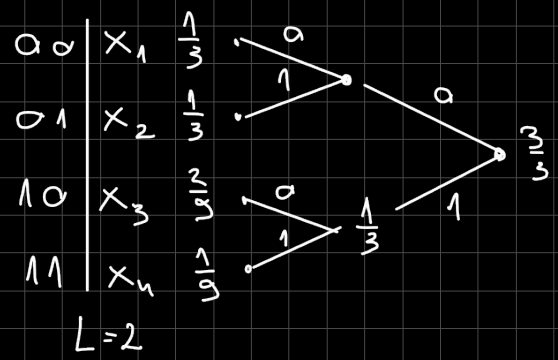


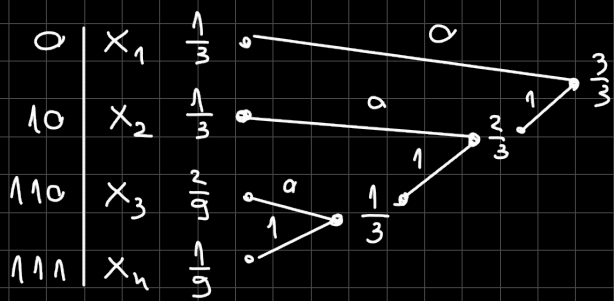
Primer

$$X = \{x_1, x_2, x_3, x_4\}$$

$$P = \left\{ \frac{1}{3}, \frac{1}{3}, \frac{2}{5}, \frac{1}{5} \right\}$$

$$B = \{0, 1\}$$





$$L = \frac{1}{3} \cdot 1 + \frac{1}{3} \cdot 2 + \frac{2}{9} \cdot 3 + \frac{1}{9} \cdot 3 = \frac{1}{3} + \frac{2}{3} + \frac{2}{3} + \frac{1}{3} = 2 //$$

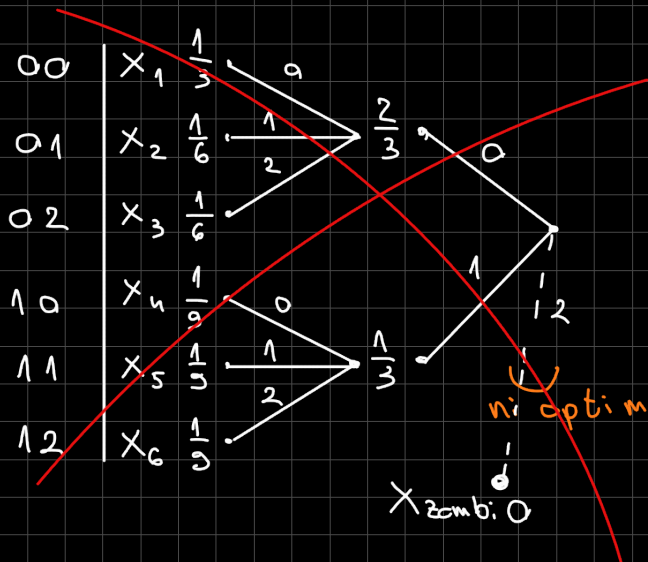
Katerega izbrat? vseeno
ZA kodiranje/dekodiranje

Primer n znakov

$$X = \{x_1, x_2, x_3, x_4, x_5, x_6\}$$

$$P = \left\{ \frac{1}{3}, \frac{1}{6}, \frac{1}{6}, \frac{1}{3}, \frac{1}{9} \right\}$$

$$\text{trojisko } B = \{0, 1, 2\}$$



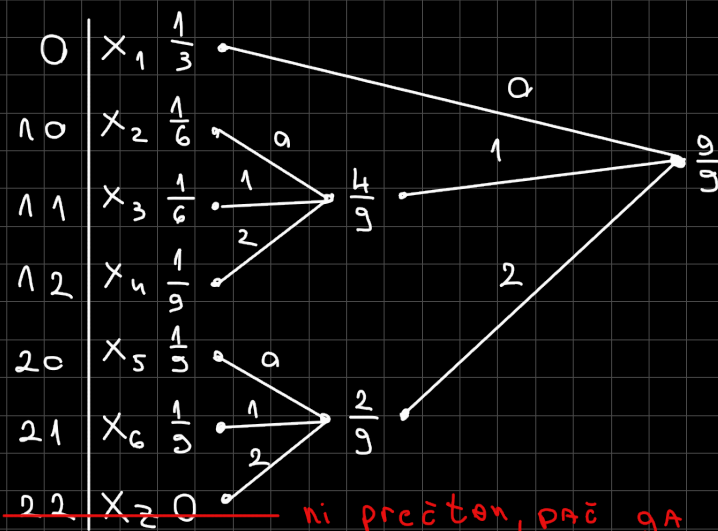
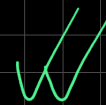
ni optimalon saj imamo neizrabljeno vejo
ZA PREVERJANJE

$$n = r + k \cdot (r-1), \quad k \in \mathbb{N}_0$$

$$n-1 = (r-1) + k \cdot (r-1)$$

$$n-1 = k' \cdot (r-1), \quad k' \in \mathbb{N}$$

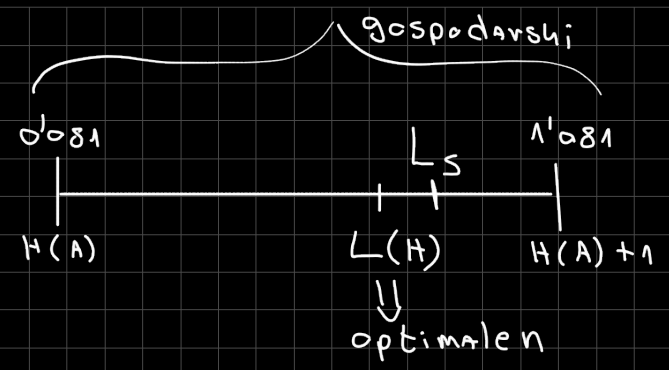
če ni \rightarrow + en znak



ni prečten, pač ga niholi ne bomo dobili.

Primer 5

$A = \{a, b\}$
 $P = \{0.999, 0.001\}$
 $H(A) = 0.081 \text{ bit}$



Shanon

$l = \lceil -\log p_i \rceil \rightarrow l_a = 1, l_b = 10$
 $L_S = 0.999 \cdot 1 + 0.001 \cdot 10$
 $L_S = 1.009$

Če kodiramo znaki po znaku NE moremo boljše.

Huffmanov - najboljši (optimalen)

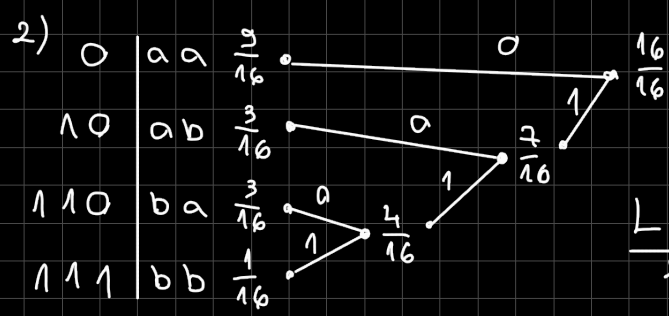
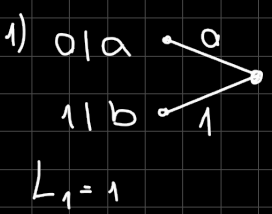
$0|a \xrightarrow{a} \rightarrow l_a = l_b + 1 \rightarrow L_H = 1$
 $1|b \xrightarrow{1}$

Primer 6

$A = \{a, b\}$ $B = \{0, 1\}$
 $P = \{\frac{3}{4}, \frac{1}{4}\}$

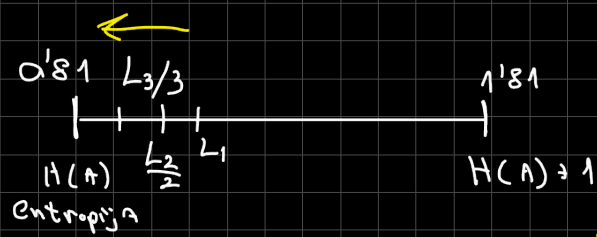
$A^2 = \{aa, ab, ba, bb\}$
 $P^2 = \{\frac{9}{16}, \frac{3}{16}, \frac{3}{16}, \frac{1}{16}\}$

$H(A) = 0.823$



$L_2 = 0.844$
 2 - jeren spajamo po 2

3) $\frac{L_3}{3} = 0.823$



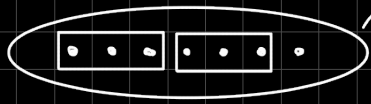
večji m, bliže entropiji

2^m znakov, problem $\rightarrow 2, 4, 8, \dots$ prehitro

Huffmanov je najboljši če uodinamo ZNAK PO ZNAK

3.4 Aritmetične kode

predstavimo na intervalu $[0, 1)$



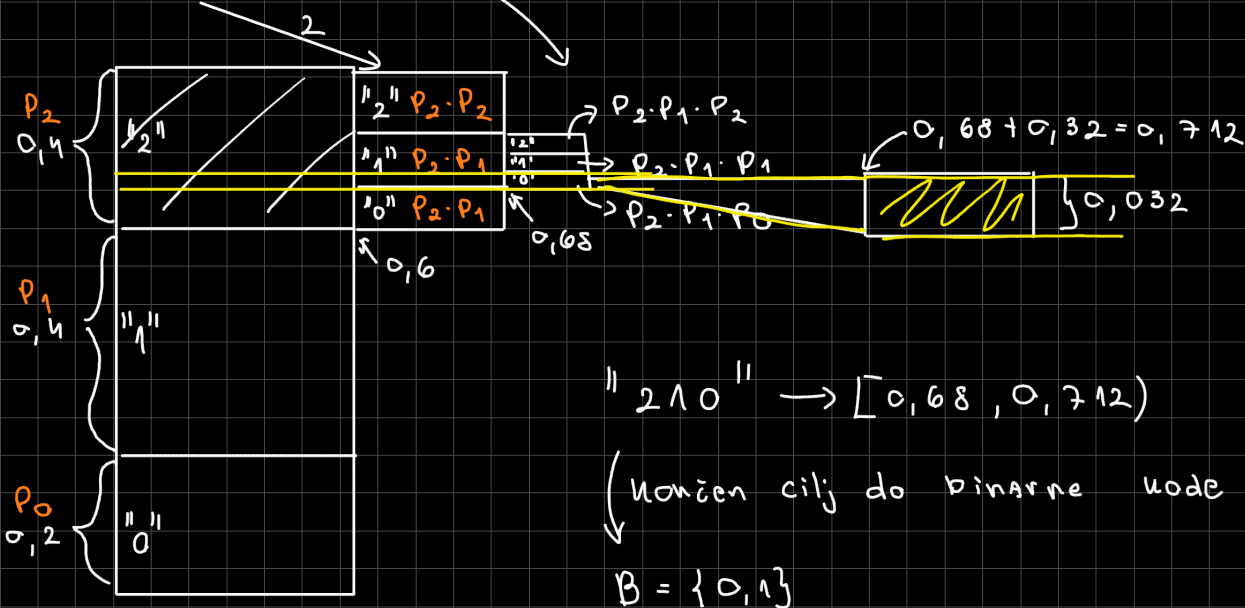
- znakov ne razvrščamo
- začnemo na intervalu $[0, 1)$
- vsakemu znaku kodirne abecede priredimo podinterval
 - ↳ velikost podintervala sorazmerno verjetnosti znaka
- izberemo podinterval, ki pripada izbranemu znaku
- postopek ponovimo na izbranem podintervalu
- niz znakov predstavimo z zadnjim podintervalom $[a, b)$

Primer

$$X = \{ "0", "1", "2" \}$$

$$P = \{ 0,2, 0,4, 0,4 \}$$

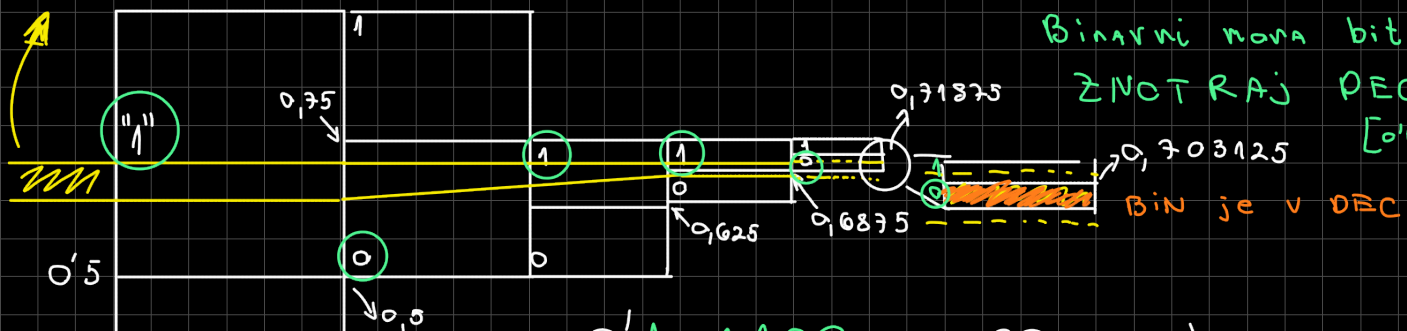
niz = "210"



na podlagi intervala se premikamo

Kad se zaustavimo?

Binarni nova biti CEO
 ZNOTRAJ DECIMALNOG
 $[0,68, 0,712)$

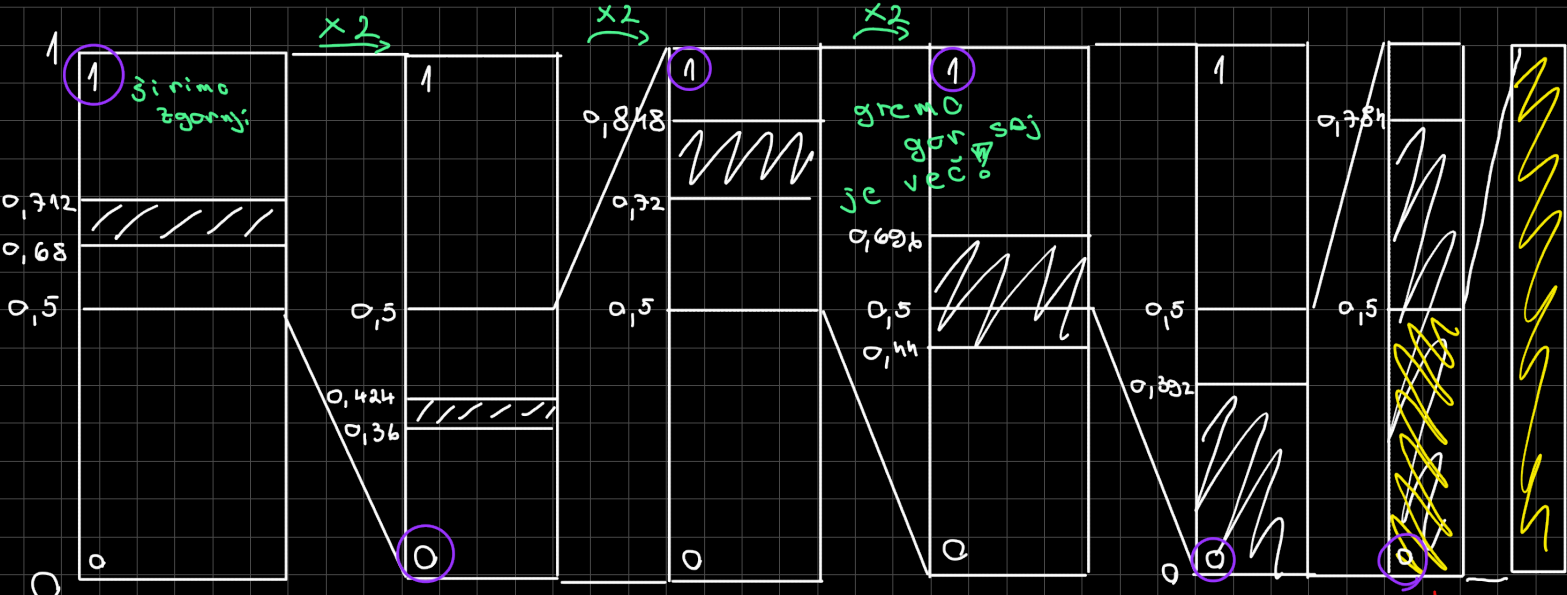


$$0'101100 \dots 00 = \text{spodnja}$$

$$0'101100 \dots 11 = \text{zgornja}$$

↳ zadržimo največ

$$[0'101100, 0'101101)$$



$0,68 \cdot 2 = 1,36 = 0,36$
 $0,712 \cdot 2 = 1,424 = 0,424$

$0,848 \cdot 2 = 1,696$
 $0,72 \cdot 2 = 1,44$

$0,5 \cdot 2 = 1,0$
 $0,686 \cdot 2 = 1,392$

↓
 cel
 interval je
 uključen