

Vježbe 5

1. Izvršiti aritmetičko kodiranje ternarnog koda sa simbolima (a, b, c). Terminacioni karakter je $\$$. Vjerovatnoća terminacionog karaktera za prvi karakter je 0.1, a za svaki naredni raste za po 0.05. Za prvi karakter se može pretpostaviti da su vjerovatnoće karaktera (a, b, c) iste. Za svaki naredni se vrši ažuriranje na osnovu broja karaktera koji su se do sada pojavili u sekvenci (Laplasovo pravilo). Kodirati poruku: **abbbc** $\$$.

Rješenje:

$$P(\$ | \text{ako je prvi}) = 0.1,$$

$$P(\$ | \text{ako je drugi}) = 0.1 + 0.05$$

$$P(\$ | \text{ako je treci}) = 0.1 + 2 \times 0.05$$

...

$$P(\$ | \text{ako je } n\text{-ti}) = 0.1 + (n-1) \times 0.05$$

$$P(a | \text{ako je prvi}) = P(b | \text{ako je drugi}) =$$

$$= P(c | \text{ako je prvi}) = \frac{1-0.1}{3} = 0.3$$

Laplasovo pravilo:

$$P(a | x_1, x_2, \dots, x_N) = \frac{Fa+1}{\sum_{i=1}^N (Fi+1)} [1 - P(\$ | x_1, x_2, \dots, x_N)]$$

$$1. \quad u=0, v=1, p=v-u=1$$

opsezi:

$$[0, P(a)) \quad [P(a), P(a)+P(b)) \quad [P(a)+P(b), P(a)+P(b)+P(c)) \quad [P(a)+P(b)+P(c), P(a)+P(b)+P(c)+P(\$))$$

odnosno:

$$[0, 0.3) \quad [0.3, 0.6) \quad [0.6, 0.9) \quad [0.9, 1)$$

$$\text{primljeni simbol: } a \rightarrow [0, 0.3)$$

2. Ažurirane granice intervala:

$$u = u + p \times DG = 0 + 1 \times 0 = 0$$

$$v = u + p \times GG = 0 + 1 \times 0.3 = 0.3$$

$$p = v - u = 0.3$$

$$P(a|a) = \frac{Fa+1}{Fa+Fb+Fc+3} [1 - P(\$|a)] = \frac{2}{4} (1 - 0.15) = 0.425$$

$$P(b|a) = \frac{Fb+1}{Fa+Fb+Fc+3} [1 - P(\$|a)] = \frac{1}{4} (1 - 0.15) = 0.2125$$

$$P(c|a) = \frac{Fc+1}{Fa+Fb+Fc+3} [1 - P(\$|a)] = \frac{1}{4} (1 - 0.15) = 0.2125$$

$$P(\$|a) = 0.15$$

$$\text{opsezi: } [0, 0.425) \quad [0.425, 0.6375) \quad [0.6375, 0.85) \quad [0.85, 1)$$

$$\text{primljeni simbol: } b \rightarrow [0.425, 0.6375)$$

3. Ažurirane granice intervala:

$$u = u + p \times DG = 0 + 0.3 \times 0.425 = 0.1275$$

$$v = u + p \times GG = 0 + 0.3 \times 0.6375 = 0.19125$$

$$p = v - u = 0.06375$$

$$P(a|ab) = \frac{2}{5}(1-0.2) = 0.32, \quad P(b|ab) = \frac{2}{5}(1-0.2) = 0.32, \quad P(c|ab) = \frac{1}{5}(1-0.2) = 0.16$$

$$P(\$|ab) = 0.2$$

opsezi: [0,0.32) [0.32,0.64) [0.64,0.8) [0.8,1)

primljeni simbol: $b \rightarrow [0.32,0.64)$

4. Ažurirane granice intervala:

$$u = u + p \times DG = 0.1275 + 0.06375 \times 0.32 = 0.1479$$

$$v = u + p \times GG = 0.1275 + 0.06375 \times 0.64 = 0.1682$$

$$p = v - u = 0.0203$$

$$P(a|abb) = \frac{2}{6}(1-0.25) = 0.25, \quad P(b|abb) = \frac{3}{6}(1-0.25) = 0.375, \quad P(c|abb) = \frac{1}{6}(1-0.25) = 0.125$$

$$P(\$|abb) = 0.25$$

opsezi: [0,0.25) [0.25,0.625) [0.625,0.75) [0.75,1)

primljeni simbol: $b \rightarrow [0.25,0.625)$

5. Ažurirane granice intervala:

$$u = u + p \times DG = 0.1479 + 0.0203 \times 0.25 = 0.153$$

$$v = u + p \times GG = 0.1479 + 0.0203 \times 0.625 = 0.1606$$

$$p = v - u = 0.0076$$

$$P(a|abbb) = \frac{2}{7}(1-0.3) = 0.2, \quad P(b|abbb) = \frac{4}{7}(1-0.3) = 0.4, \quad P(c|abbb) = \frac{1}{7}(1-0.3) = 0.1$$

$$P(\$|abbb) = 0.3$$

opsezi: [0,0.2) [0.2,0.6) [0.6,0.7) [0.7,1)

primljeni simbol: $c \rightarrow [0.6,0.7)$

6. Ažurirane granice intervala:

$$u = u + p \times DG = 0.153 + 0.0076 \times 0.6 = 0.15756$$

$$v = u + p \times GG = 0.153 + 0.0076 \times 0.7 = 0.15832$$

$$p = v - u = 0.00076$$

$$P(a|abbbc) = \frac{2}{8}(1-0.35) = 0.1625, \quad P(b|abbbc) = \frac{4}{8}(1-0.35) = 0.325,$$

$$P(c|abbbc) = \frac{2}{8}(1-0.35) = 0.1625, \quad P(\$|abbbc) = 0.35$$

opsezi: [0,0.1625) [0.1625,0.4875) [0.4875,0.65) [0.65,1)

primljeni simbol: $\$ \rightarrow [0.65,1)$

7. Ažurirane granice intervala:

$$u = u + p \times DG = 0.15756 + 0.00076 \times 0.65 = 0.15805$$

$$v = u + p \times GG = 0.15756 + 0.00076 \times 1 = 0.15832$$

$$p = v - u = 0.00027$$

Dakle, ukupno dobijeni interval je: $[0.15805, 0.15832)$. U binarnom obliku to je:

$$[0.001010000\dots, 0.001010001\dots),$$

što znači da je naša sekvenca kodirana sljedećim bitima: **00101000**