Elementi elektronike – SEPTEMBAR 2018 - REŠENJA

3. a) DC analiza:

$$V_I = V_{D2} + V_{R2} = V_{D2} + R_2 I_{R2}$$

$$I_G = I_{D1} + I_{R1} = \frac{V_X - V_{D1}}{R_3} + \frac{V_X - V_{D2}}{R_1 + R_2}$$

$$V_X = V_G - V_{D3} = V_G - V_D = 2.6 \text{ V}$$

$$I_{R1} = I_{R2} = \frac{V_X - V_{D2}}{R_1 + R_2} = 19 \text{ mA}$$

$$V_I = V_{D2} + V_{R2} = V_{D2} + R_2 I_{R2} = 1.08 \text{ V}$$

b) AC analiza:

$$r_{d1} = \frac{V_t}{I_{D1}} = 1.32 \ \Omega$$

$$r_{d2} = \frac{V_t}{I_{D2}} = 1.32 \ \Omega$$

$$r_{d3} = \frac{V_t}{I_{D3}} = 0.66 \ \Omega$$

$$V_i = \frac{\dfrac{R_3(R_2 + r_{d2})}{R_3 + R_2 + r_{d2}}}{\dfrac{R_3(R_2 + r_{d2})}{R_3 + R_2 + r_{d2}} + \dfrac{R_1 \cdot r_{d1}}{R_1 + r_{d1}} + r_{d3}} V_g = 90 \text{ mV}$$

$$v_i = V_i \sin(\omega t)$$

Ukupni signal je jednak $v_I = V_I + v_i$.

4. a)

$$I_{RE} = \frac{-V_{BE} + V_{EE}}{R_E} = 2 \text{ mA}$$

$$I_{E1,2} = \frac{I_{RE}}{2} = 1 \text{ mA}$$

$$V_I = V_{CC} - \frac{\beta}{\beta + 1} I_{E2} R_C = 11.08 \text{ V}$$

b)

$$A_d = \frac{g_m R_c r_\pi}{2(R_B + r_\pi)} = \frac{\beta R_c}{2(R_B + r_\pi)}$$

c)

$$A_S = \frac{-g_m R_c r_\pi}{R_B + r_\pi + (1+\beta)2 r_{ce3}}$$

d)

$g_m = 39.2 \text{mS}$, $r_\pi = 1275\Omega$, $A_d = 10.78$,
$\rho = 275.5$
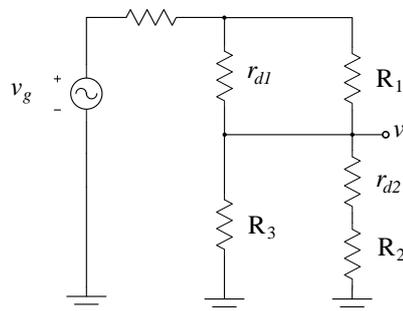
Slika 2.

$A_s = -0.039$,

7.

$$v_I = \begin{cases} V_{CC} & v_U < -V_{CC} \\[2mm] -\dfrac{R_2}{2R_1} v_U = -v_U & -V_{CC} \leq v_U < 2V_D \\[2mm] -(2v_U - 2V_D) & 2V_D \leq v_U < \dfrac{V_{CC} + 2V_D}{2} \\[2mm] -V_{CC} & v_U \geq \dfrac{V_{CC} + 2V_D}{2} \end{cases}$$

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$$v_I = \begin{cases} 5\text{V} & v_U < -5\text{V} \\ -v_U & -5\text{V} \le v_U < 1.4\text{V} \\ -(2v_U - 1.4\text{V}) & 1.4\text{V} \le v_U < 3.2\text{V} \\ -5\text{V} & v_U \ge 3.2\text{V} \end{cases}$$

8.
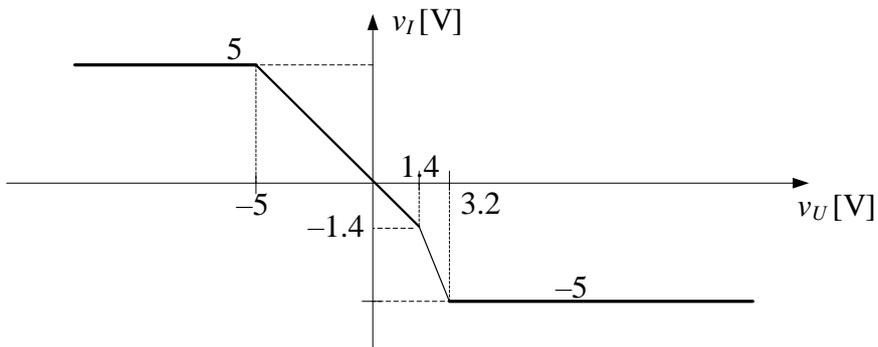
$$y_2 = \overline{x_0}$$

Slika 1. Rešenje za y_2.

$$y_1 = \overline{x_3}\,\overline{x_2}\,\overline{x_1}\,\overline{x_0} + \overline{x_3}\,\overline{x_2}x_1x_0 + \overline{x_3}x_2x_1\overline{x_0} + x_3\overline{x_2}\,\overline{x_1}x_0 + x_3x_2\overline{x_1}\,\overline{x_0} + x_3x_2x_1x_0$$

Slika 2. Rešenje za y_1.

$$y_0 = \overline{x_1}\,\overline{x_0}$$

Slika 3. Rešenje za y_0.

9.

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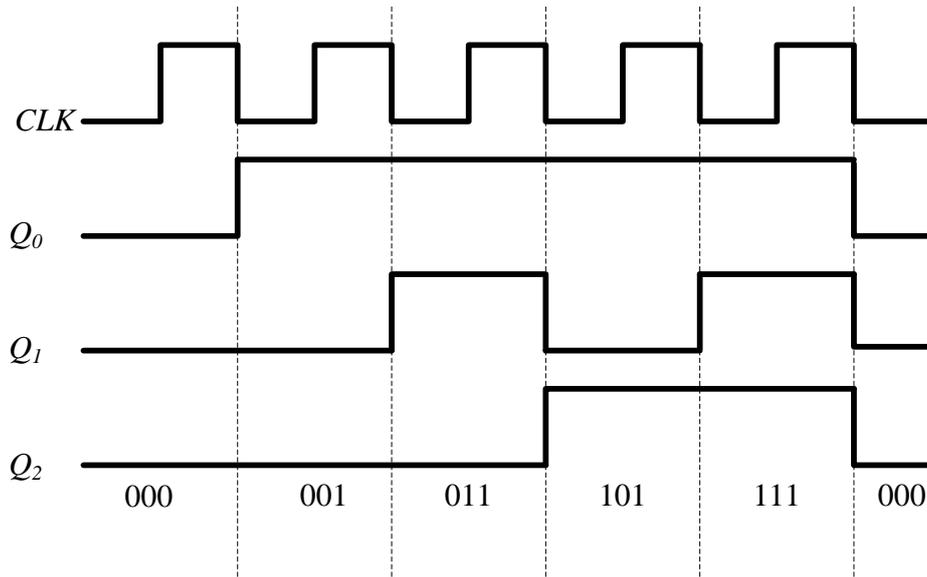
Moduo brojanja brojača je pet.