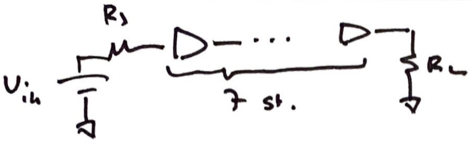
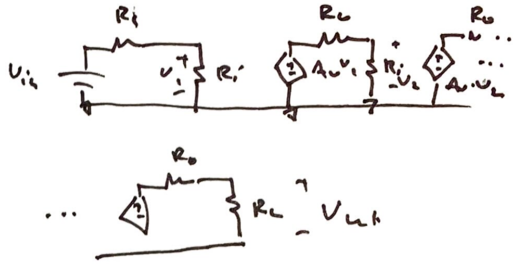
1) 

→ Ekvivalent krets

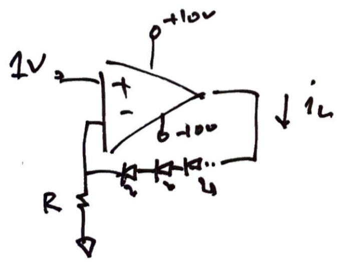


Från ekv. krets (sp. delning)

a) $$V_{ut} = V_{in} \cdot \frac{R_i}{R_S + R_i} \cdot \underbrace{A_v \frac{R_i}{R_o + R_i} \cdot \ldots}_{\text{upprepas 6 ggr}} \cdot A_v \frac{R_L}{R_L + R_o} = \underline{A_v^7 \cdot \frac{R_i}{R_S + R_i} \cdot \frac{R_L}{R_L + R_o} \cdot \left(\frac{R_i}{R_o + R_i}\right)^6}$$

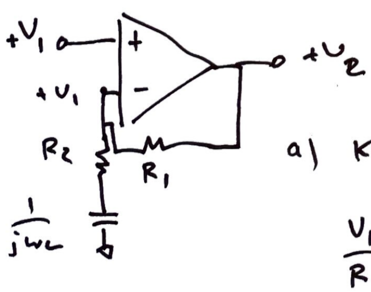
b) Ideal förstärkare: $R_i \to \infty$, $R_o \to 0$ $\to$ $\underline{V_{ut} = A_v^7 \cdot V_{in}}$

2) Löses ex. med en V-I förstärkare



$i_L = \frac{1V}{R} \Rightarrow R = 100\,\Omega$ om $\underline{i_L = 10\,mA}$

$$\boxed{\begin{matrix} V_P = V_N = V_1 \\ I_P = I_N = 0 \end{matrix}}$$

3) 

a) KCL på V_N: $$\frac{V_1 - V_2}{R_1} + \frac{V_1}{R_2 + 1/j\omega C} = 0$$

$$\frac{V_1}{R_1} + \frac{V_1\, j\omega C}{1 + j\omega R_2 C} = \frac{V_2}{R_1}$$

$$\Rightarrow \underline{V_2 = \left(\frac{1 + j\omega C(R_2 + R_1)}{1 + j\omega R_2 C}\right) \cdot V_1}$$

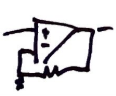
b) $\omega \to 0 \to V_2 = V_1$ (förstärkning 1)

$\omega \to \infty \to V_2 = \left(\frac{R_2 + R_1}{R_2}\right) \cdot V_1 = \left(1 + \frac{R_1}{R_2}\right) \cdot V_1$ (vanlig U→U!)

Fås även via inspektion!

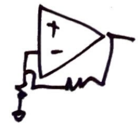
$\omega \to 0$: C avbrott

Buffer!



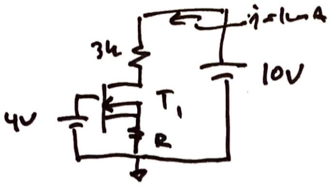
$\omega \to \infty$

C kortslutning →

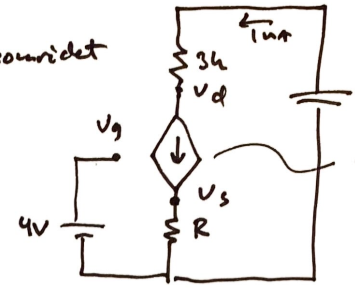


$\underline{U \to U!}$

4)



T_1 i mättnadsområdet $\rightarrow$



$V_T = 2V$

$i = 1\cdot10^{-3}(V_g - V_s - 2)$

a) $1\cdot10^{-3} = 1\cdot10^{-3}(V_{gs} - 2) \Rightarrow V_{gs} = 3V$

b) $V_{gs} = V_g - V_s = 4 - V_s = 3 \Rightarrow \underline{V_s = 4 - 3 = 1V}$

c) Strömmen genom R är ju också $i = 1$ mA, så

$V_s = R\cdot i \Rightarrow 1 = R\cdot 1\cdot10^{-3} \Rightarrow \underline{\underline{R = 1k\Omega}}$

d) $V_d = 10 - 3\cdot10^{3}\cdot1\cdot10^{-3} = 7V$

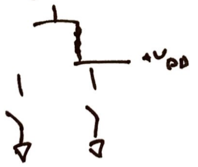
$\Rightarrow V_{ds} = V_d - V_s = 7 - 1 = \underline{\underline{6V}}$

5) a)

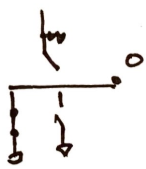
A	B	C
0	0	1
1	0	0
0	1	0
1	1	0

eftersom

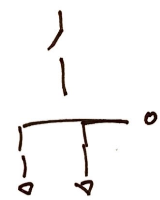
A=0 B=0



A=1 B=0
och A=0 B=1



A=1 B=1



Dvs en NOR-grind.

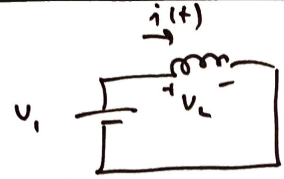
b) B är nu alltid = 0, så sanningstabellen blir

A	C
0	1
1	0

dvs en inverterare.

c) Kopplingen är ett sätt att bygga en inverterare av en NOR-grind.

6 a)



Spole, så $V_L = L \cdot \frac{di}{dt} = V_1$

Integrere: $\int_0^{t_0} V_L \cdot dt = L \int_0^{t_0} i' \, dt \Rightarrow V_1 \cdot t_0 = L\left(i(t_0) - \overset{=0}{i(0)}\right)$

$\Rightarrow \underline{\underline{i(t_0) = \frac{V_1 \cdot t_0}{L}}}$

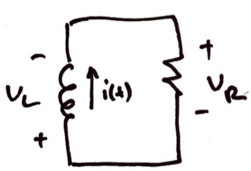
b)

KVL: $V_L = 0 \Rightarrow L \cdot \frac{di}{dt} = 0 \Rightarrow i$ konstant!

$\underline{i(t_2) = \frac{V_1 \cdot t_0}{L}}$

(vi sätter här $t_2 + t_0$ som tiden $t = 0$)

c)



$+ \; i(0) = \frac{V_1 \cdot t_0}{L}$

KVL: $V_L + V_R = 0$ $\quad V_R = i(t) \cdot R$, $\quad V_L = L \cdot \frac{di}{dt}$ $\quad \Rightarrow L \cdot \frac{di}{dt} + i \cdot R = 0$

$\frac{di}{dt} + i \frac{R}{L} = 0 \quad , \tau = L/R$

$i' + \frac{i}{\tau} = 0 \quad ,$ int. faktor $e^{t/\tau}$

$\rightarrow \int_0^t \left(i(t) \cdot e^{t/\tau}\right)' dt = 0$

$\Rightarrow i(t) \cdot e^{t/\tau} - i(0) = 0 \rightarrow \underline{i(t) = \frac{V_1 \cdot t_0}{L} \cdot e^{-t/\tau}}$

d) $V_R = i(t) \cdot R = \underline{\underline{\frac{V_1 \cdot t_0}{L} \cdot R \, e^{-t/\tau}}}$