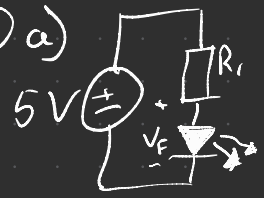
① a)



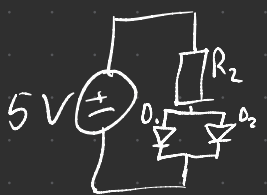
Motstand R_1 er viktig for å redusere strømmengden inn i lysdioden, slik at det ikke går for mye strøm inn i dioden

b) $I_F = 20mA$ $V_F = 2,5V$

$V_{R_1} = V - V_F = 5V - 2,5V = 2,5V$

$R_1 = \frac{2,5V}{20 \cdot 10^{-3} A} = 125\Omega$

c)



$I_{tot} = 2 \cdot 20mA = 40mA$

$V_R = 2,5V$

$R_2 = \frac{2,5V}{40 \cdot 10^{-3} A} = 62,5\Omega$

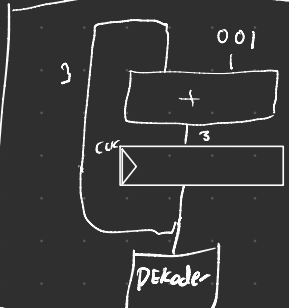
d) Gul, siden den krever minste strøm per spenning. Dette kan vi se i tabellen.

② a)

L_2	L_1	L_0	Q
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

$Q = \bar{L}_2 \bar{L}_1 L_0 + \bar{L}_2 L_1 \bar{L}_0 + L_2 L_1 \bar{L}_0$

$Q = \bar{L}_2 \bar{L}_1 L_0 + L_1 \bar{L}_0$



Detkoder

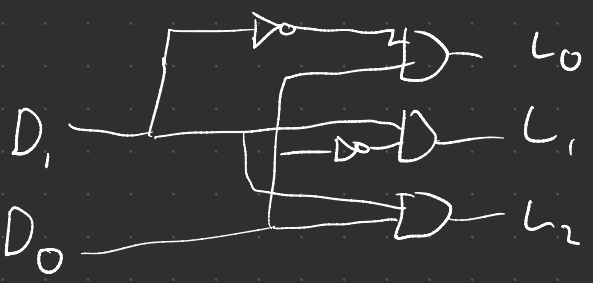
② b)

D_1	D_0	L_2	L_1	L_0
0	0	0	0	0
0	1	0	0	1
1	0	0	1	0
1	1	1	0	0

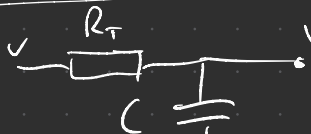
$L_0 = \bar{D_1} D_0$

$L_1 = D_1 \bar{D_0}$

$L_2 = D_1 D_0$



③ a)



$C = 100\,nF$

$V_C = V_C = v(t) = 5 - 5e^{-\frac{t}{RC}}$

$v(0,1) = 4 \Rightarrow$

$5 - 5e^{-\frac{0,1}{RC}} = 4$

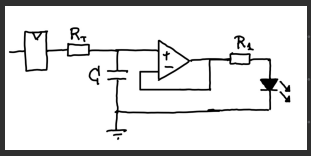
$e^{-\frac{0,1}{RC}} = \frac{1}{5}$

$\frac{0,1}{RC} = -\ln\left(\frac{1}{5}\right)$

$R = -\frac{0,1}{\ln\left(\frac{1}{5}\right) \cdot C} = \frac{-0,1}{\ln\left(\frac{1}{5}\right) \cdot 100 \cdot 10^{-9}} = \underline{621\ k\Omega}$

b) Ut utgang V_c vil nå ha en utgang som krever strøm. Dette gjør at kondensator ligningen laget: A) ikke gjelder og vi kan da ikke vite oppførselen til dioden

② c)



Denne kretsen løser problemet siden det ikke går strøm i V+ siden det nå er inni en opperasjonsforsterker så lenge forsterkningen er 1.

d)

Vippen

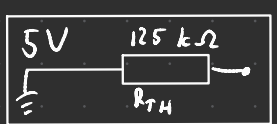
$$5 - 5e^{-\frac{0,1}{RC}} = 4$$

$$e^{-\frac{0,1}{RC}} = \frac{1}{5}$$

$$\frac{0,1}{RC} = -\ln\left(\frac{1}{5}\right)$$

$$R = -\frac{0,12}{\ln\left(\frac{1}{5}\right)\cdot C} = \frac{-0,12}{\ln\left(\frac{1}{5}\right)\cdot 100\cdot 10^{-9}} = 746\,k\Omega$$

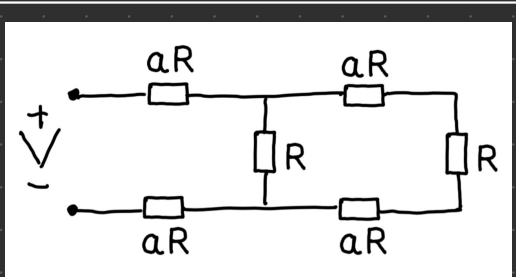
$$R_{th} = (746 - 621)k\Omega = 125\,k\Omega$$



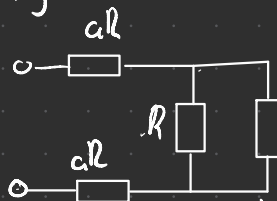
Vippen

---

④ a)



$$R_{ny} = aR + aR + R = 2aR + R$$



$$R_{tot} = \frac{R\cdot(2aR+R)}{2aR+2R} + aR + aR$$

$$R_{tot} = \frac{2aR^2 + R^2 + 2aR(2aR+2R)}{2R(a+1)} \quad /:\frac{R}{R}$$

$$R_{tot} = \frac{(2a+1+4a^2+4a)R}{2(a+1)} = \frac{(4a^2+6a+1)R}{2(a+1)}$$

$$P = \frac{V^2}{R} = \frac{V^2}{\frac{(4a^2+6a+1)R}{2(a+1)}} = \frac{V^2}{R}\cdot\frac{2(a+1)}{4a^2+6a+1}$$

(9) b) Ved et større n ser vi at det vil oppstå et større og større spenningsfall gjennom ledene. Slik at spenningen i de ytterst diodene er så lav at de ikke lyser.