IISS FOSSATI DA PASSANO
La Spezia
A.S. 14-15

Materia TELECOMUNICAZIONI

Alunno.....

3R Compito in classe del 09/12/14

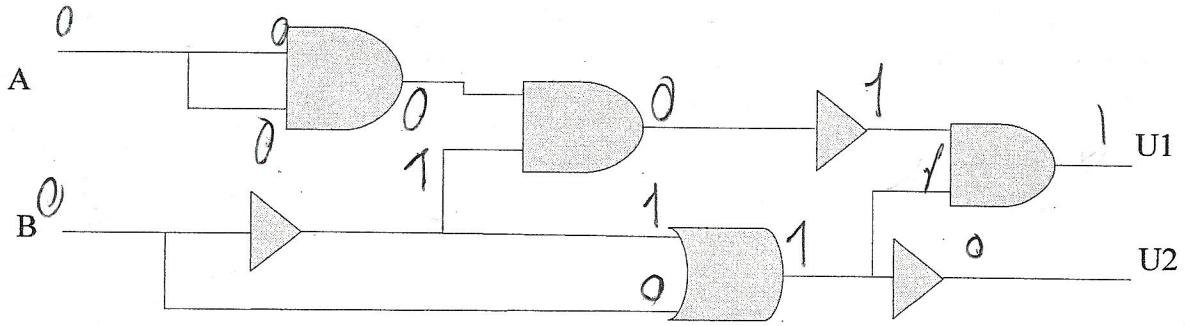
Fila 1

1. Progettare e disegnare lo schema funzionale e circuitale di un de-mux con 2 ingressi selezione S0-S1

2. Progettare e disegnare lo schema funzionale e circuitale di un Codificatore con 2 linee digitali in uscita

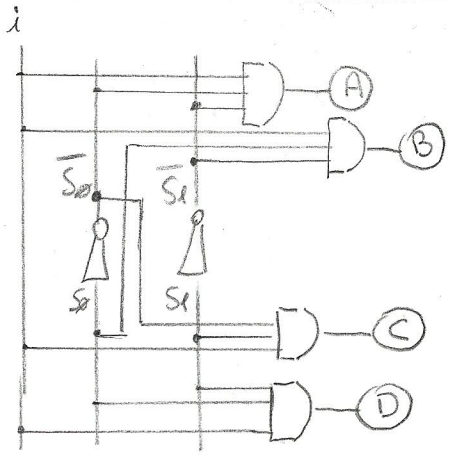
3. Progettare un sistema in porte logiche che discrimini dei numeri compresi fra 0 e 15 i numeri primi

4. Del seguente schema compilare la tabella di verità facendo variare gli ingressi fra i valori 0 e 1

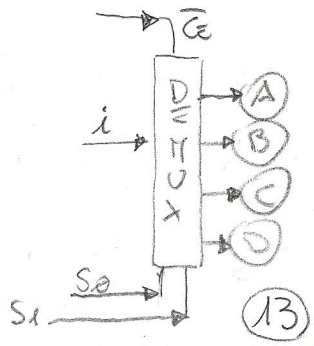


A	B	U1	U2
0	0	1	0
0	1	1	0
1	0	0	0
1	1	1	0

1)

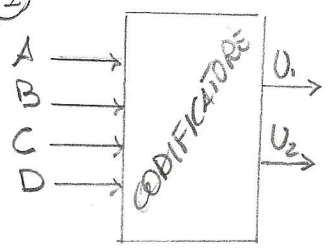


i	S_0	S_1	U
x	0	0	$i\,\bar{S}_0\,\bar{S}_1 \rightarrow A$
x	0	1	$i\,\bar{S}_0\,S_1 \rightarrow B$
x	1	0	$i\,S_0\,\bar{S}_1 \rightarrow C$
x	1	1	$i\,S_0\,S_1 \rightarrow D$



13

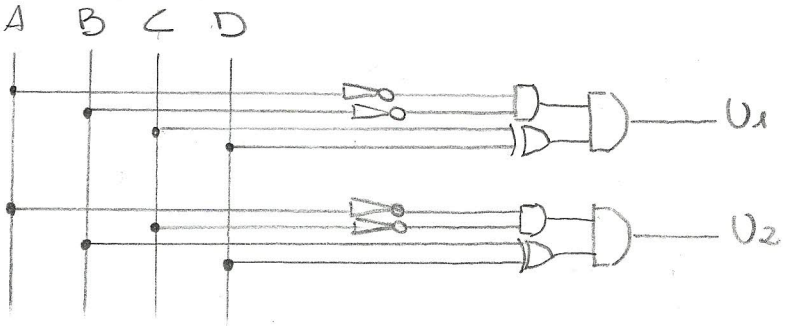
②



A	B	C	D	U1	U2
1	0	0	0	0	0
0	1	0	0	0	1
0	0	1	0	1	0
0	0	0	1	1	1

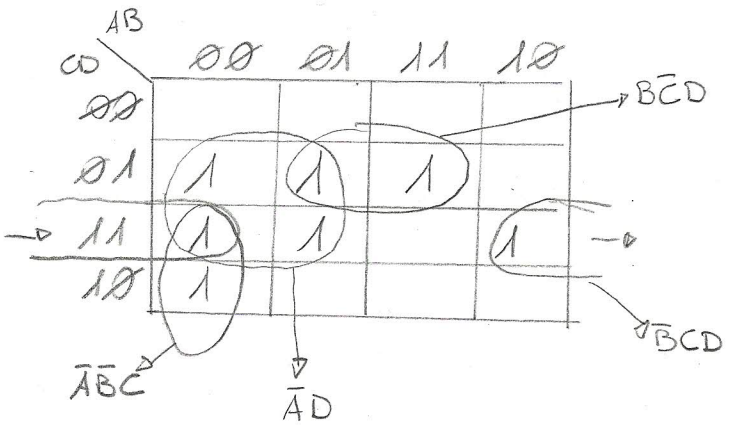
$U_1 = \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D = \bar{A}B(C\bar{D} + \bar{C}D)$

$U_2 = \bar{A}B\bar{C}\bar{D} + \bar{A}BCD = \bar{A}C(B\bar{D} + \bar{B}D)$

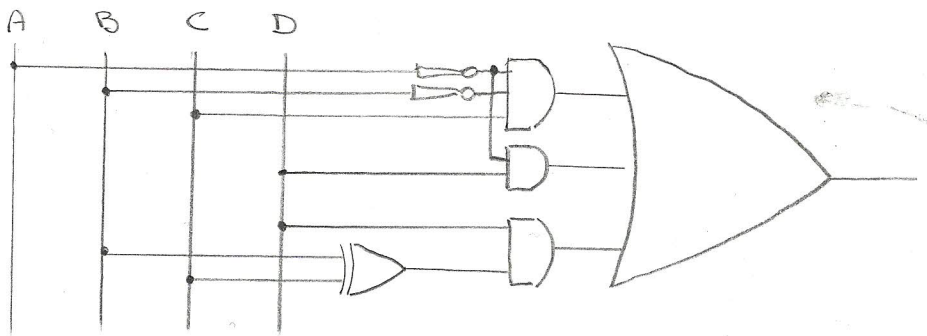


③

NOM	A	B	C	D	U
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	0
7	0	1	1	1	1
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	0
15	1	1	1	1	0

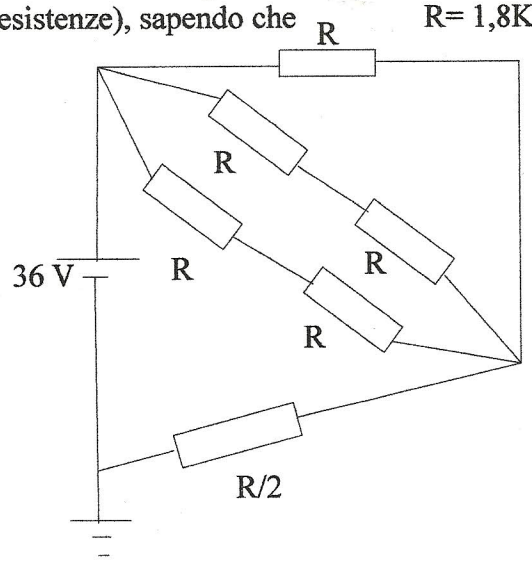


$\bar{A}\bar{B}C + \bar{A}D + B\bar{C}D + \bar{B}CD = \bar{A}BC + \bar{A}D + D(B\bar{C} + \bar{B}C)$



Compito di telecomunicazioni del 16/12 /14 Fila 4

1. Risolvere il seguente circuito elettrico (calcolare tutte le correnti e tensioni ai capi di tutte le resistenze), sapendo che R= 1,8KΩ ed alimentato con tensione continua paria a 36 Volts.

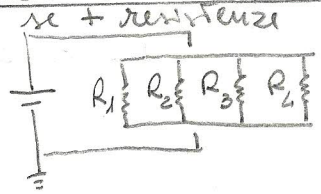


(*) regola generale resistenze parallelo

se 2 resistenze

$$R_{eq} = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

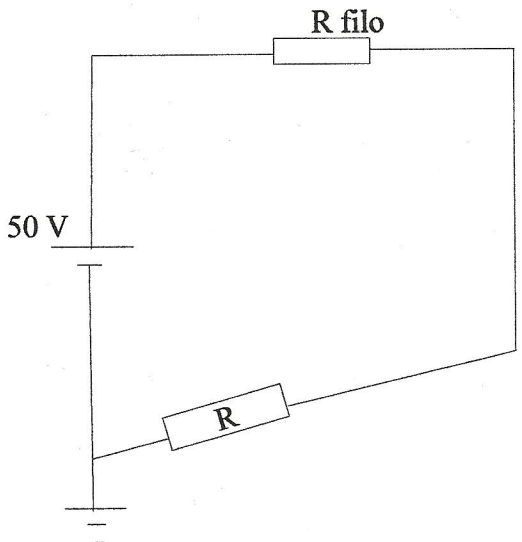
se + resistenze



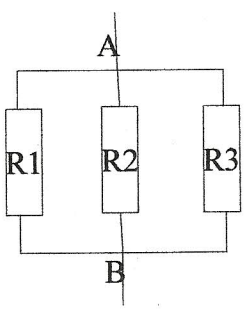
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} =$$

$$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} \right)^{-1}$$

2. Risolvere il seguente circuito elettrico alimentato in tensione continua pari a 50V (calcolare tutte le correnti e tensioni ai capi di tutte le resistenze) sapendo che la lunghezza del filo L= 1000 m sezione S= 1,5 mm^2
ρ_{Cu}= 1.7 x 10^{-8} Ω m e che R= 89 Ω.



3. Calcolare la resistenza equivalente del seguente parallelo fra resistenze sapendo che R1=100 Ω , R2= 90 Ω , e R3= 350 Ω



14

CALCOLO MINIMO COMUNE MULTIPLO (mcm)

100	2
50	2
25	5
5	5
1	

$100 = 2^2 \cdot 5^2$

- si scompone ogni denominatore in fattori primi
- si prende ogni fattore una sola volta con il massimo esponente.

90	2
45	5
9	3
3	3
1	

$90 = 2 \cdot 5 \cdot 3^2$

350	2
175	5
35	5
7	7
1	

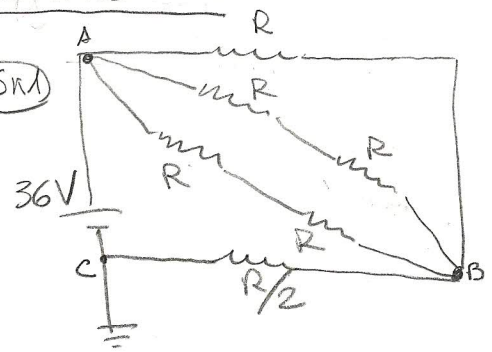
$350 = 2 \cdot 5^2 \cdot 7$

$mcm(100, 90, 350) = 2^2 \cdot 3^2 \cdot 5^2 \cdot 7 = 4 \cdot 9 \cdot 25 \cdot 7 = 3600$

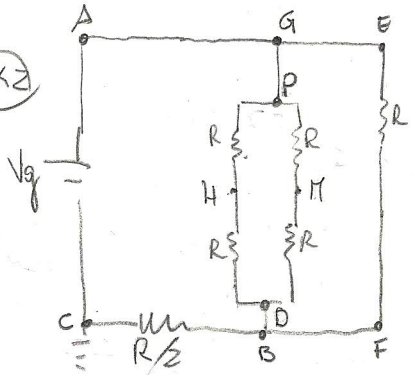
COMPITO n°1

$R = 1{,}8\ k\Omega$

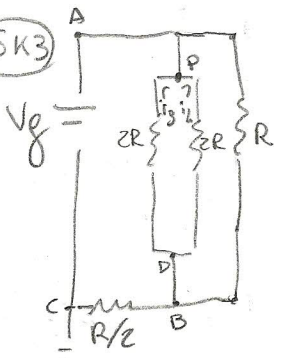
SK1



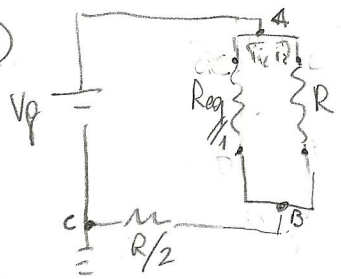
SK2



SK3



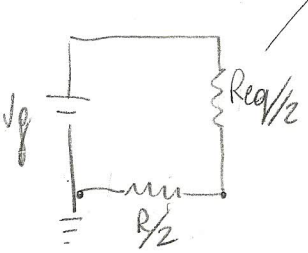
SK4



$$Req_{//1} = \frac{2R \cdot 2R}{2R+2R} = \frac{4R^2}{4R} = R\,\Omega$$ (oppure usando la regola generale ⊛)

$$Req_{//2} = \frac{R \cdot R}{R+R} = \frac{R^2}{2R} = \frac{R}{2}\,\Omega$$

SK5



SK6

$$Req = Req_{//2} + R_{/2} = \frac{R}{2} + \frac{R}{2} = \frac{R+R}{2} = \frac{2R}{2} = R\,\Omega$$

$$i_L = \frac{Vg}{Req} = \frac{36V}{1800\,\Omega} = 2 \cdot 10^{-2}\ A$$

risaliamo a SK4

$$V_{AB} = Req \cdot i_L = \frac{R}{2}\,\Omega \cdot 2 \cdot 10^{-2}\,A = \frac{1800}{2}\,\Omega \cdot 2 \cdot 10^{-2}\,A = 900\,\Omega \cdot 2 \cdot 10^{-2} = 18\,V$$

$$i_1 = \frac{V_{AB}}{Req_{//1}} = \frac{18V}{1800\,\Omega} = 0{,}01\ A$$

$$i_2 = \frac{V_{AB}}{R} = \frac{18V}{1800\,\Omega} = 0{,}01\ A$$

$0{,}01\ A + 0{,}01\ A = 0{,}02\ A$ (su $0{,}02\ A$ di i_L)

$18\,V + 18\,V = 36\,V$ (su $36\,V$ di Vg)

$V_{CB} = V_{AB}$ (1)

risaliamo a SK3

$$V_{PD} = Req_{//1} \cdot i_1 = R\,\Omega \cdot 0{,}01\,A = 18 \cdot 10^2\,\Omega \cdot 1 \cdot 10^{-2} = 18\,V$$

$$i_3 = i_4 = \frac{V_{PD}}{2R} = \frac{18V}{2 \cdot 18 \cdot 10^2\,\Omega} = \frac{1}{200} = 0{,}005\,A$$

$0{,}005\,A + 0{,}005\,A = 0{,}01\,A$ (su $0{,}01\,A$ di i_2)

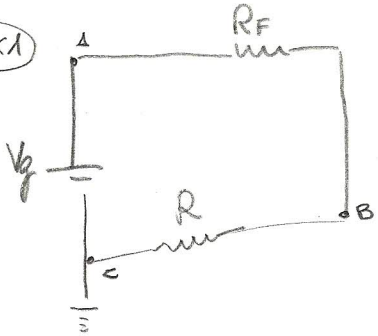
risaliamo a SK2

$$V_{PH} = V_{HD} = V_{PM} = V_{MD} = R \cdot i_3 = 1800\,\Omega \cdot 0{,}005\,A = 1{,}8 \cdot 10^3 \cdot 5 \cdot 10^{-3} = 9\,V$$ (su $18\,V$ di V_{PD})

(1) $V_{CB} = \frac{R}{2} \cdot i_L = 900 \cdot 2 \cdot 10^{-2} = 9 \cdot 10^2 \cdot 2 \cdot 10^{-2} = 18\,V$ trovo che $V_{AB} = V_{CB}$

COMPITO n 2

SK1



$V_g = 50V$

$L = 1000mm$

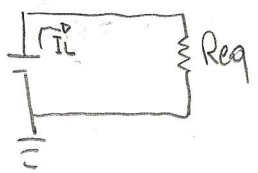
$S = 1,5 mm\,mm^2 = 1,5 \cdot 10^{-6} m^2$

$\rho_{Cu} = 1.7 \cdot 10^{-8}$

$R = 89\,\Omega$

$$R_F = \rho \frac{L}{S} = 1.7 \cdot 10^{-8}\,\Omega\,\frac{10^3}{1.5 \cdot 10^{-6}} = \frac{1.7}{1.5} \cdot 10^{-8} \cdot 10^3 \cdot 10^6 = 1,1\bar{3} \cdot 10^1 = 11,\bar{3}\,\Omega$$

SK2



$Req = R_F + R = 11\,\Omega + 89\,\Omega = 100\,\Omega$

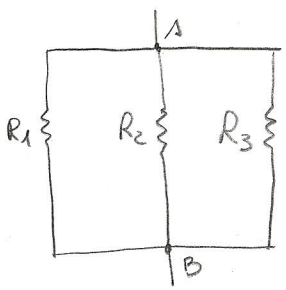
$$I_L = \frac{V_g}{Req} = \frac{50V}{100\,\Omega} = 0,5A$$

$V_{AB} = 11\,\Omega \cdot 0,5\,A = 5,5\ V$ +

$V_{BC} = 89\,\Omega \cdot 0,5A = 44,5\ V$

$50\ V$ su 50 di V_g

COMPITO n 3



$R_1 = 100\,\Omega$

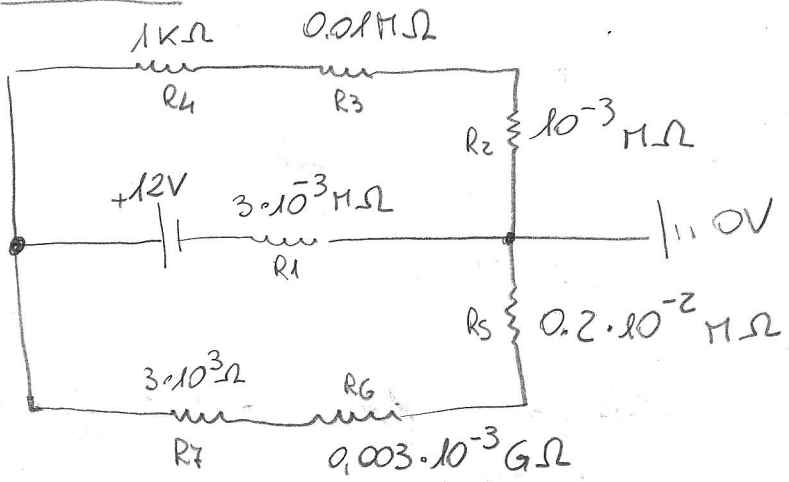
$R_2 = 90\,\Omega$

$R_3 = 350\,\Omega$

$$Req = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)^{-1} = \left(\frac{1}{100} + \frac{1}{90} + \frac{1}{350}\right)^{-1} = \left(\frac{36+40+9}{3600}\right)^{-1} = \left(\frac{85}{3600}\right)^{-1} =$$

$$= \frac{3600}{85} = 42,352(941176)\,\Omega$$

Esercizio



Ω
G = 10^9
M = 10^6
K = 10^3
m = 10^{-3}

$R_3 = 0.01\ M\Omega = 0{,}01 \cdot 10^6 = 10^{-2} \cdot 10^6 = 10^4 = 10\ K\Omega$

$R_1 = 3 \cdot 10^{-3}\ M\Omega = 3 \cdot 10^{-3} \times 10^6 = 3 \cdot 10^3 = 3\ K\Omega$

$R_2 = 10^{-3}\ M\Omega = 10^{-3} \times 10^6 = 10^3 = 1\ K\Omega$

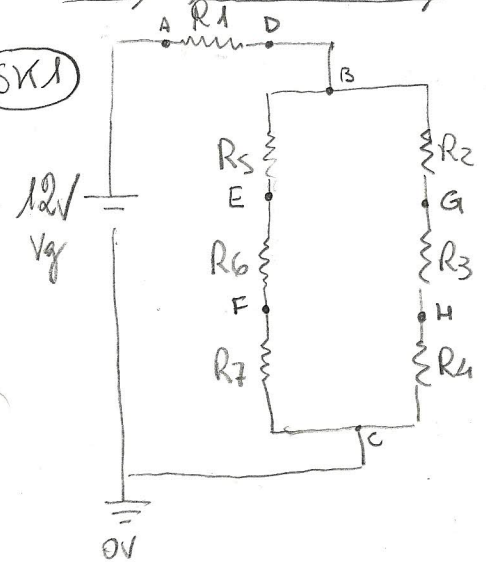
$R_7 = 3 \cdot 10^3\ \Omega = 3\ K\Omega$

$R_5 = 0.2 \cdot 10^{-2}\ M\Omega = 0.2 \cdot 10^{-2} \cdot 10^6 = 2 \cdot 10^{-3} \cdot 10^6 = 2\ K\Omega$

$R_6 = 0{,}003 \cdot 10^{-3}\ G\Omega = 0{,}003 \cdot 10^{-3} \cdot 10^9 = 3 \cdot 10^{-6} \cdot 10^9 = 3 \cdot 10^3 = 3\ K\Omega$

Semplifico il disegno del circuito riportandolo a forma più comoda:

SK1



$V_g = 12V$

$R_1 = 3\ K\Omega$

$R_2 = 1\ K\Omega$

$R_3 = 10\ K\Omega$

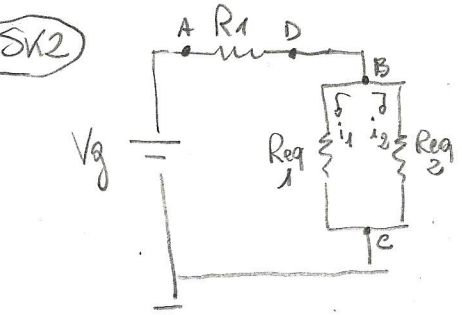
$R_4 = 1\ K\Omega$

$R_5 = 2\ K\Omega$

$R_6 = 3\ K\Omega$

$R_7 = 3\ K\Omega$

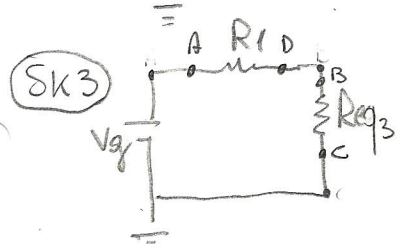
SK2



$Req_1 = R_5 + R_6 + R_7 = 2k + 3K + 3K = 8\ K\Omega$

$Req_2 = R_2 + R_3 + R_4 = 1k + 10K + 1k = 12k\ \Omega$

SK3

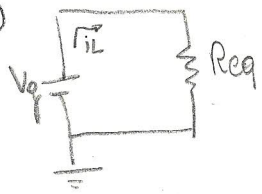


$$\frac{1}{Req_3} = \frac{1}{Req_1} + \frac{1}{Req_2} \quad \text{da cui} \quad Req_3 = \left(\frac{1}{Req_1} + \frac{1}{Req_2}\right)^{-1}$$

$$Req_3 = \left(\frac{Req_1 + Req_2}{Req_1 \cdot Req_2}\right)^{-1} = \frac{Req_1 \cdot Req_2}{Req_1 + Req_2} = \frac{8k + 12k}{8k + 12k} =$$

$$= \frac{48\ k^2}{20k} = 4{,}8\ K\Omega$$

SK4



$Req = R1 + Req3 = 3K\Omega + 4,8K\Omega = 7,8k\Omega$

$i_L = \frac{Vg}{Req} = \frac{12V}{7800\Omega} = 0,001(5384)A = 1,5\ mA$

Risalgo a SK3

$VAD = R_1 \cdot i_L = 3k\Omega \cdot 0,0015A = 3\cdot10^3\Omega \cdot 1,5\cdot10^{-3}A = 4,5\ V$

$VBC = R_{eq3} \cdot i_L = 4,8K\Omega \cdot 0,0015A = 48\cdot10^2\Omega \cdot 1,5\cdot10^{-3}A = 72\cdot10^{-1} = 7,2\ V$

$11,7\ V$ (su $12V$ di Vg)

$i_1 = \frac{VBC}{Req1} = \frac{7.2V}{8K\Omega} = \frac{72}{8}\cdot10^{-1}\cdot10^{-3} = 9\cdot10^{-4}A$

$i_2 = \frac{VBC}{Req2} = \frac{7,2V}{12K\Omega} = \frac{72}{12}\cdot10^{-1}\cdot10^{-3} = 6\cdot10^{-4}A$

$15\cdot10^{-4}A = 1.5\cdot10^{1}\cdot10^{-4} = 1,5\cdot10^{-3}A$

Risalgo a SK1

$VBE = R_5 \cdot i_1 = 2k\Omega \cdot 9\cdot10^{-4}A = 2\cdot10^3\cdot9\cdot10^{-4} = 18\cdot10^{-1} = 1,8\ V$

$VEF = R_6 \cdot i_1 = 3K\Omega \cdot 9\cdot10^{-4}A = 3\cdot10^3\cdot9\cdot10^{-4} = 27\cdot10^{-1} = 2,7\ V$

$VFC = R_7 \cdot i_1 = 3K\Omega \cdot 9\cdot10^{-4}A = 3\cdot10^3\cdot9\cdot10^{-4} = 27\cdot10^{-1} = 2,7\ V$

$7,2\ V$ (di VBC)

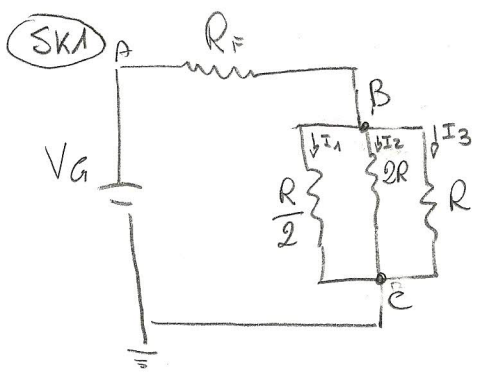
$VBG = R_2 \cdot i_2 = 1K\Omega \cdot 6\cdot10^{-4}A = 10^3\cdot6\cdot10^{-4} = 6\cdot10^{-1} = 0,6\ V$

$VGH = R_3 \cdot i_2 = 10K\Omega \cdot 6\cdot10^{-4}A = 10^4\cdot6\cdot10^{-4} = 6\ V$

$VHC = R_4 \cdot i_2 = 1K\Omega \cdot 6\cdot10^{-4}A = 10^3\cdot6\cdot10^{-4} = 6\cdot10^{-1} = 0,6\ V$

$7,2\ V$ (di VBC)

Esercizio



$\rho_{Cu} = 1{,}7 \cdot 10^{-8}\ \Omega \cdot m$

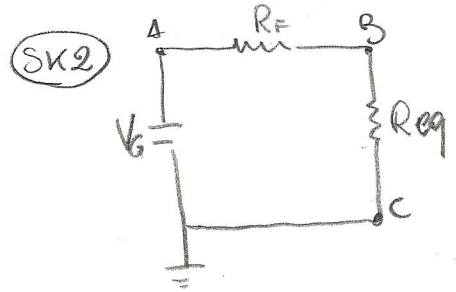
$L = 0.01 \cdot 10^5\ m = 10^{-2} \cdot 10^5\ m = 10^3\ m$

$S = 2\ mm^2 = 2 \cdot 10^{-6}\ m^2$

$R = 0.5\ k\Omega = 500\ \Omega$

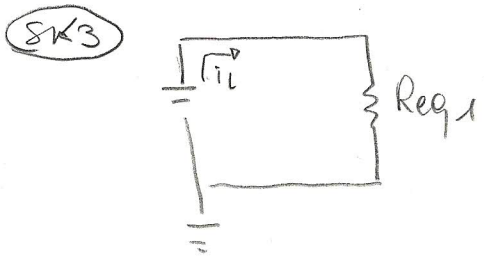
$V_G = 10^2\ V$

$$R_F = \rho \frac{L}{S} = 1.7 \cdot 10^{-8}\ \Omega\,\cancel{m}\ \frac{0.01 \cdot 10^5\ \cancel{m}}{2 \cdot 10^{-6}\ \cancel{m^2}} = \frac{1{,}7}{2} \cdot 10^{-8} \cdot 10^3 \cdot 10^6 = 0.85 \cdot 10^1 = 8{,}5\ \Omega$$



$$R_{eq} = \left(\frac{1}{\frac{R}{2}} + \frac{1}{2R} + \frac{1}{R}\right)^{-1} = \left(\frac{2}{R} + \frac{1}{2R} + \frac{1}{R}\right)^{-1} =$$

$$= \left(\frac{4 + 1 + 2}{2R}\right)^{-1} = \left(\frac{7}{2R}\right)^{-1} = \frac{2}{7} R\ \Omega$$



$$R_{eq1} = R_F + R_{eq} = 8{,}5\ \Omega + \frac{2}{7} R\ \Omega =$$

$$= 8{,}5\ \Omega + \frac{500 \cdot 2}{7}\ \Omega = 8.5\ \Omega + \frac{1000}{7}\ \Omega =$$

$$= 8{,}5\ \Omega + 142{,}85\ \Omega = 151{,}4\ \Omega$$

$$i_L = \frac{V_G}{R_{eq1}} = \frac{10^2\ V}{151{,}4\ \Omega} = \frac{100}{151.4} = 0.66(050198)\ A$$

$V_{AB} = 8.5\ \Omega \cdot 0{,}66\ A =$ 5.61 V +

$V_{BC} = 142.9\ \Omega \cdot 0{,}66\ A =$ 94.41 V

100.02 V (su 100 V di V_G)

$$I_1 = V_{BC} \cdot \frac{2}{R} = 94.41 \cdot \frac{2}{500} = \frac{94{,}51}{250} = 0{,}37764\ A = 0.38\ A$$

$$I_2 = \frac{V_{BC}}{2R} = \frac{94.41}{2 \cdot 500} = \frac{94.41}{1000} = 0{,}09441\ A = 0{,}09\ A$$

$$I_3 = \frac{V_{BC}}{R} = \frac{94.41}{500} = 0{,}1882\ A = 0{,}19\ A$$

0,66 A

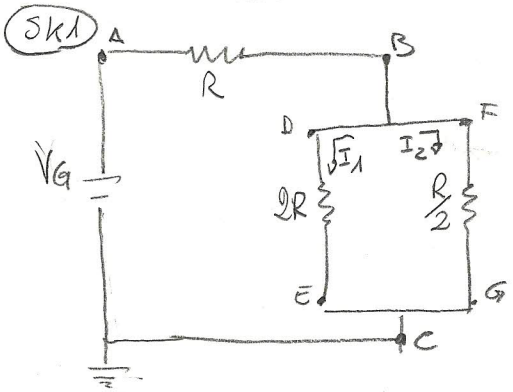
(su 0,66 A di I_L)

Esercizio

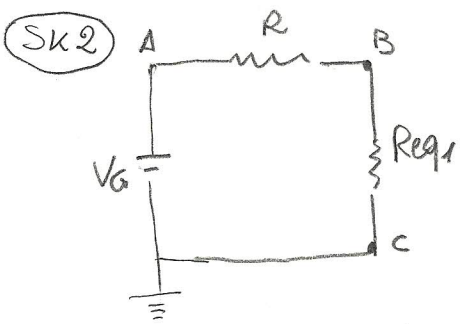
$V_G = 50\,V$

$R = 0{,}1 \cdot 10^3\,\Omega$

Sk1



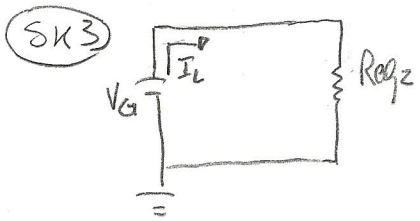
Sk2



$$\frac{1}{Req_1} = \left(\frac{1}{2R} + \frac{1}{R/2}\right)^{-1} = \left(\frac{1}{2R} + \frac{2}{R}\right)^{-1} = \left(\frac{1+4}{2R}\right)^{-1} =$$

$$= \left(\frac{5}{2R}\right)^{-1} = \frac{2R}{5}\,.$$

Sk3



$$Req_2 = R + Req_1 = R + \frac{2R}{5} = \frac{5R + 2R}{5} = \frac{7R}{5}$$

$$I_L = \frac{V_G}{Req_2} = \frac{50}{0{,}1 \cdot 10^3 \cdot \frac{7}{5}} = \frac{50}{\frac{100}{20} \cdot \frac{7}{5_1}} = \frac{5}{2 \cdot 7} = \frac{5}{14} =$$

$$= 0{,}35714(2857)\,A$$

rivalgo a Sk2

$$V_{AB} = R \cdot I_L = 0{,}1 \cdot 10^3\,\Omega \cdot 0{,}35714\,A = 35{,}714\,V$$

$$V_{BC} = Req_1 \cdot I_L = \frac{2}{5} \cdot 0{,}1 \cdot 10^3\,\Omega \cdot 0{,}35714\,A =$$

$$= \frac{2}{5} \cdot 10^2\,\Omega \cdot 0{,}35714\,A = 0{,}4 \cdot 10^2 \cdot 0{,}35714 = 40 \cdot 0{,}35714 = 14{,}286\,V$$

$14{,}286\,V$ / $50{,}000\,V$ (su 50V di V_G)

$$I_1 = \frac{V_{BC}}{2R} = \frac{14{,}286\,V}{2 \cdot 0{,}1 \cdot 10^3\,\Omega} = \frac{14{,}286}{2 \cdot 100} = \frac{14{,}286}{200} = 0{,}07143\,A$$

$$I_2 = \frac{V_{BC}}{R/2} = \frac{14{,}286\,V}{\frac{0{,}1 \cdot 10^3\,\Omega}{2}} = \frac{14{,}286}{\frac{100}{2}\,50} = \frac{14{,}286}{50} = 0{,}28572\,A$$

$$V_{DE} = 2R \cdot I_1 = 2 \cdot 0{,}1 \cdot 10^3\,\Omega \cdot 0{,}07143\,A = 2 \cdot 100 \cdot 0{,}07143 = 200 \cdot 0{,}07143 = 14{,}286\,V$$

$$V_{FG} = \frac{R}{2} \cdot I_2 = \frac{0{,}1 \cdot 10^3}{2}\,\Omega \cdot 0{,}28572\,A = \frac{50}{\frac{100}{2_1}} \cdot 0{,}28572 = 14{,}286\,V$$

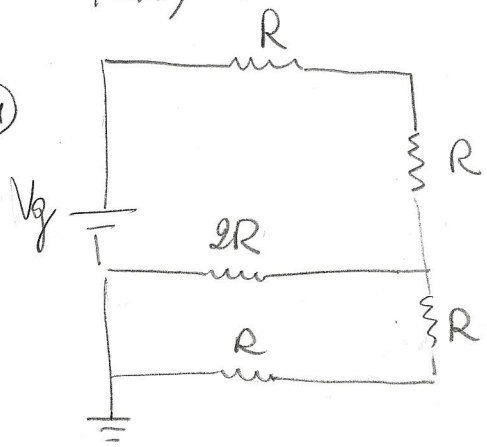
$$V_{DE} = V_{FG} = V_{BC}$$

POTENZE

Esercizio

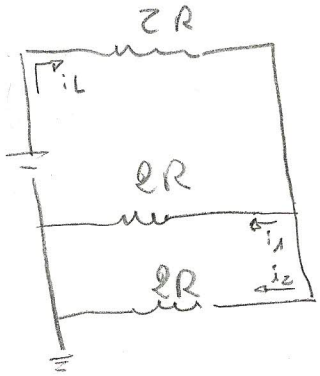
Risolvere il seguente circuito calcolando:
- La potenza totale dissipata
- Calcolare l'energia in kWh consumata dall'impianto in un giorno (24h) di funzionamento
- calcolare la spesa sapendo che il costo di kWh di energia elettrica è pari a 0,6 €/kWh

Sol 1

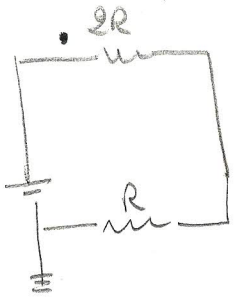


$R = 100\ \Omega$
$V_g = 200\ V$

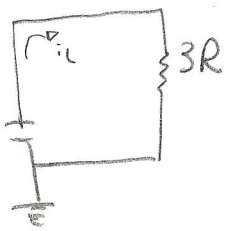
Sol 2



Sol 3



Sol 4



$$i_L = \frac{200}{300} = 0,66\bar{6}\ A \qquad i_1 = i_2 = \frac{i_L}{2} = 0,33\bar{3}\ A$$

Legenda

q = carica
L = lavoro
ΔV = delta
t = tempo
P = Potenza
R = Resistenza
I = corrente

Potenza $P = \frac{L}{t} = \frac{q\Delta V}{t} = \Delta V \cdot I$

$L = q\Delta V$

$\Delta V = \frac{L}{q}$

$V = V_1 - \emptyset$

$\Delta V = V_1 - V_\emptyset$

$t = t - \emptyset$

$\Delta t = t_1 - t_\emptyset$

$P = V \cdot I$

$V = R_i$

$P = V \cdot I$

$P = \frac{V^2}{R}$

$P = R i^2$

P si misura in WATT (W) ovvero joule × secondo $\left(W = \frac{J}{s}\right)$

---

quindi:
$P_I = V_G \cdot I_L = 200 \cdot 0,6\bar{6} = 133\ W$

CONTINUA →

1 kWh energia dispersa da un utilizzatore o carico della potenza di 1 kW che funziona per 1 h.

$1\,kW = 1000\,W \cdot 3600\,s = 3{,}6 \cdot 10^6\,J$

$E_L = P \cdot t = 133\,W \cdot 86400\,s = 11\,491\,200\,J$ ($86400\,s = 3600\,s \times 24\,h$)

impostiamo la proporzione:

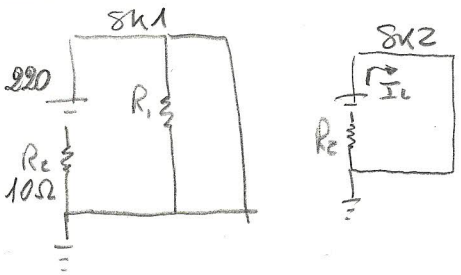
$1\,kW : 3600\,000\,J = x : 11\,491\,200\,J$

$x = \frac{11\,491\,200\,J}{3\,600\,000\,J} = 3{,}192 = 3{,}2\ kWh$

La spesa è quindi:

$3{,}2\,kWh \cdot 0{,}6\,€/kWh = 1{,}91\,€$ (iva compresa sulla bolletta)

Esercizio



{ parallelo di una resistenza con un'altra resistenza tendente a 0 è zero. perciò R1 è come se non ci fosse!!

$I_L = \frac{220}{10} = 22\,A$

$P = 220 \cdot 22 = 4840\,W$ $\quad E_L = P \cdot t = 4840\,W \cdot \frac{3600}{4} = 1210 \cdot 3600 = 4\,356\,000\,J$

Calcoliamo ora: kWh dispersi in $\frac{1}{4}\,h$ (15m)

$1\,kW : 3600\,000\,J = x : 4\,356\,000\,J$

$x = \frac{4\,356\,000\,J}{3\,600\,000\,J} = 1{,}21\ kWh$

Costo = $1{,}21\,kWh \cdot 0{,}6\,€/kWh = 0{,}73\,€$ (iva compresa)

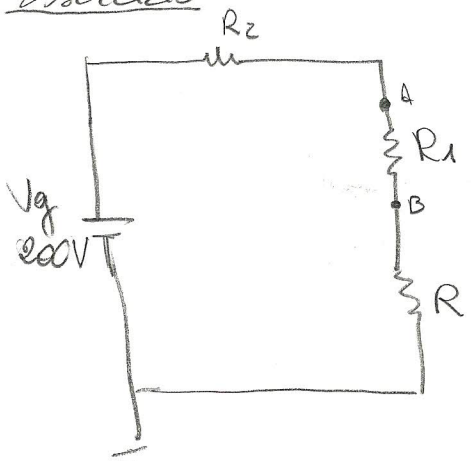
$V \cdot A = W_{att}$

$P = V \cdot I$

I dimensione in Ampere

V dimensione Volt

Esercizio



$R = 40\Omega$

$R_1 = 10\Omega$

$R_2 = 50\Omega$

P_{R_1} = calcolare solo potenza di rispetto su R_1

se V_g fase = 100V dato che $V = R \cdot i$ la corrente si scarica alla fari quindi

$R = 40V \quad R_1 = 10V \quad R_2 = 50V$

Ma V_g è = 200V quindi $R_1 = 20V$ $I_L = \frac{200V}{100\Omega} = 2A$ $V_{AB} = R_1 \cdot I_L = 20 \cdot 2 = 40V$

Calcolare il consumo in KWh in un mese di 40W di R_1

$E_L = P \cdot t = 40W \cdot 86400s = 3456000J$

1KW : 3600000J = x : 3456000J

$x = \frac{3\,456\,000}{3\,600\,000} = 0,96\,KWh$

Costo per un giorno = 0,96 KWh · 0.6 €/KWh = 0,576 € iva compresa

un mese = 0,576 · 30 = 17,28 € iva compresa