EPITA / InfoS3 December 2015

Name : ..... First name : ..... Group : .....

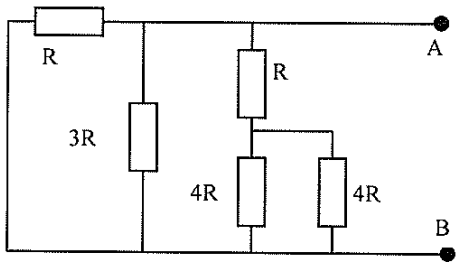
Midterm exam of Electronics

Calculators and documents are not allowed. The number of points per question is indicative. Answers to be written on this document only. If you need more space, you can use the back of the sheets.

Exercise 1. MCQ (7 points – without negative points)

Choose the correct answer:

Q1. What is the equivalent resistor between A and B?



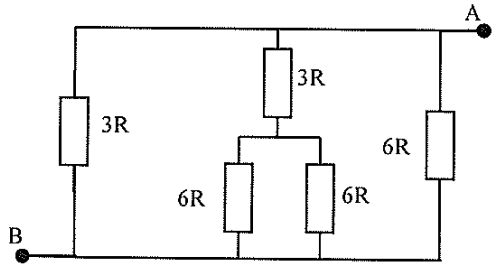
a. $\frac{15}{23}R$

b. $\frac{3}{5}R$

c. $\frac{5}{2}R$

d. $\frac{5}{3}R$

Q2. What is the equivalent resistor between A and B?



a. $3R$

b. R

c. $\frac{3}{2}R$

d. $\frac{2}{3}R$

Q3. If we apply the Ohm's law with the resistor in $M\Omega$ and the voltage in V, we obtain the current in:

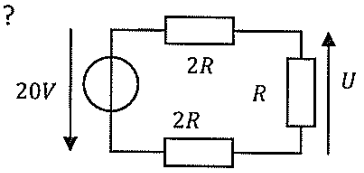
a. A

b. mV

c. mA

d. μA

Q4. We consider the following circuit. What is the value of U?



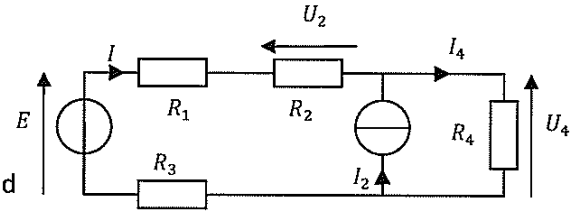
a- $20\,V$

b- $-4\,V$

c- $4\,V$

d- $-8\,V$

We consider the following circuit:



Q5. What is the expression of U_4 when E is off and I_2 is on?

a- $U_4 = R_4.I_2$

b- $U_4 = \frac{R_4^2}{R_1+R_2+R_3+R_4} I_2$

c- $U_4 = \frac{(R_1+R_2+R_3).R_4}{R_1+R_2+R_3+R_4} I_2$

d- $U_4 = \frac{R_4}{R_1+R_2+R_3+R_4}.I_2$

Q6. What is the expression of U_2 when I_2 is off and E is on?

a- $U_2 = \frac{R_2}{R_1+R_2} E$

b- $U_2 = \frac{R_2}{R_1+R_2+R_3} E$

c- $U_2 = \frac{R_2}{R_1+R_2+R_3+R_4} E$

d- $U_2 = R_2 E$

Q7. The Thevenin's theorem is:

a- A voltage source in parallel with a resistor.

b- A current source in series with a resistor.

c- A current source in parallel with a resistor.

d- A voltage source in series with a resistor.

Q8. The Norton's theorem is:

a. A voltage source in parallel with a resistor.

b. A current source in series with a resistor.

c. A current source in parallel with a resistor.

d. A voltage source in series with a resistor.

Q9. The Thevenin's voltage source E_{th} is also called:

a- The voltage of the open-circuit

b- The voltage of the short-circuit

c- None of this

Q10. The Norton's current source I_N is also called:

a- The current of the open-circuit

b- The current of the short-circuit

c- None of this

Q11. A voltage source E in series with a resistor R is equivalent to a current source I in parallel with a resistor r if:

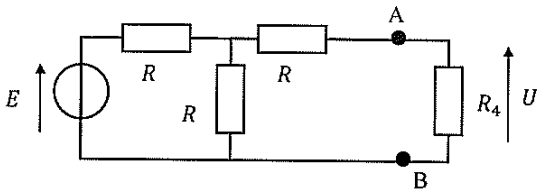
a- $R.E = \frac{R}{r}I$ and $r = R$

b- $r = R$ and $E = R.I$

a- $E = R.I$ and $I = \frac{E}{\left(\frac{R+r}{R.r}\right)}$

b- $R = r$ and $E = \frac{I}{R}$

We consider the following circuit:



Q12. The Thevenin's voltage source seen by the resistor R_4 is:

a- $E_{th} = U$ and $R_{th} = R_4$

b- $E_{th} = E$ and $R_{th} = R$

c- $E_{th} = \frac{E}{2}$ and $R_{th} = 2R$

d- $E_{th} = \frac{E}{2}$ and $R_{th} = \frac{3}{2}.R$

Q13. The Norton's current source seen by the resistor R_4 is:

a- $I_N = \frac{U}{R_4}$ and $R_N = R_4$

b- $I_N = \frac{E}{R}$ and $R_N = R$

c- $I_N = \frac{E}{2R}$ and $R_N = 2R$

d- $I_N = \frac{E}{3.R}$ and $R_N = \frac{3}{2}.R$

Q14. Choose the wrong formulas? (E_i and U in Volts, I_i in Amperes, R_i in Ohms) (2 answers)

a. $I = \frac{R_1.R_2}{R_1+R_2}.I_1$

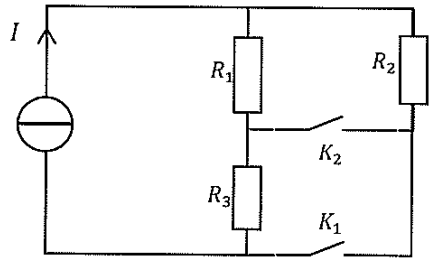
b. $U = \frac{R_1.R_2}{R_1+R_2}.I_1$

c. $U = \frac{R_1.E_1-R_2.I_2}{R_1.R_2+R_1.R_3+R_2.R_3}$

d. $U = \frac{E}{\frac{R_1}{R_2}+\frac{R_3}{R_4}+1}$

Exercise 2. KIRCHOFF LAWS(6 POINTS)

We consider the following circuit:



The current I and the three resistors are assumed known.

We need to determine the expression of the current flowing through each resistor (the index of each current in the following table is associated to the corresponding resistor).

Complete the following table (you put only the expression of each current without detailing how have you obtained it). All the currents have to be expressed only function of I and/or R_1, R_2 or R_3.

Ask yourself the right questions ... you'll have the right answers!!

Note: Expected answers depend on the states of the switches and are independent of each other. *In other words you have one circuit with two switches that gives four independent circuits to solve.*

You can start with the simplest case!

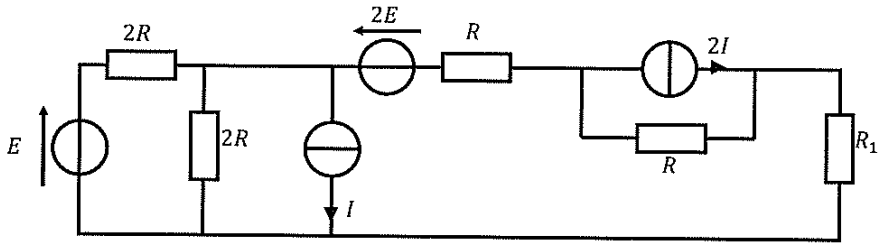
K_1	K_2	I_1	I_2	I_3
O	O			
O	C			
C	O			
C	C			

NB : O = Open

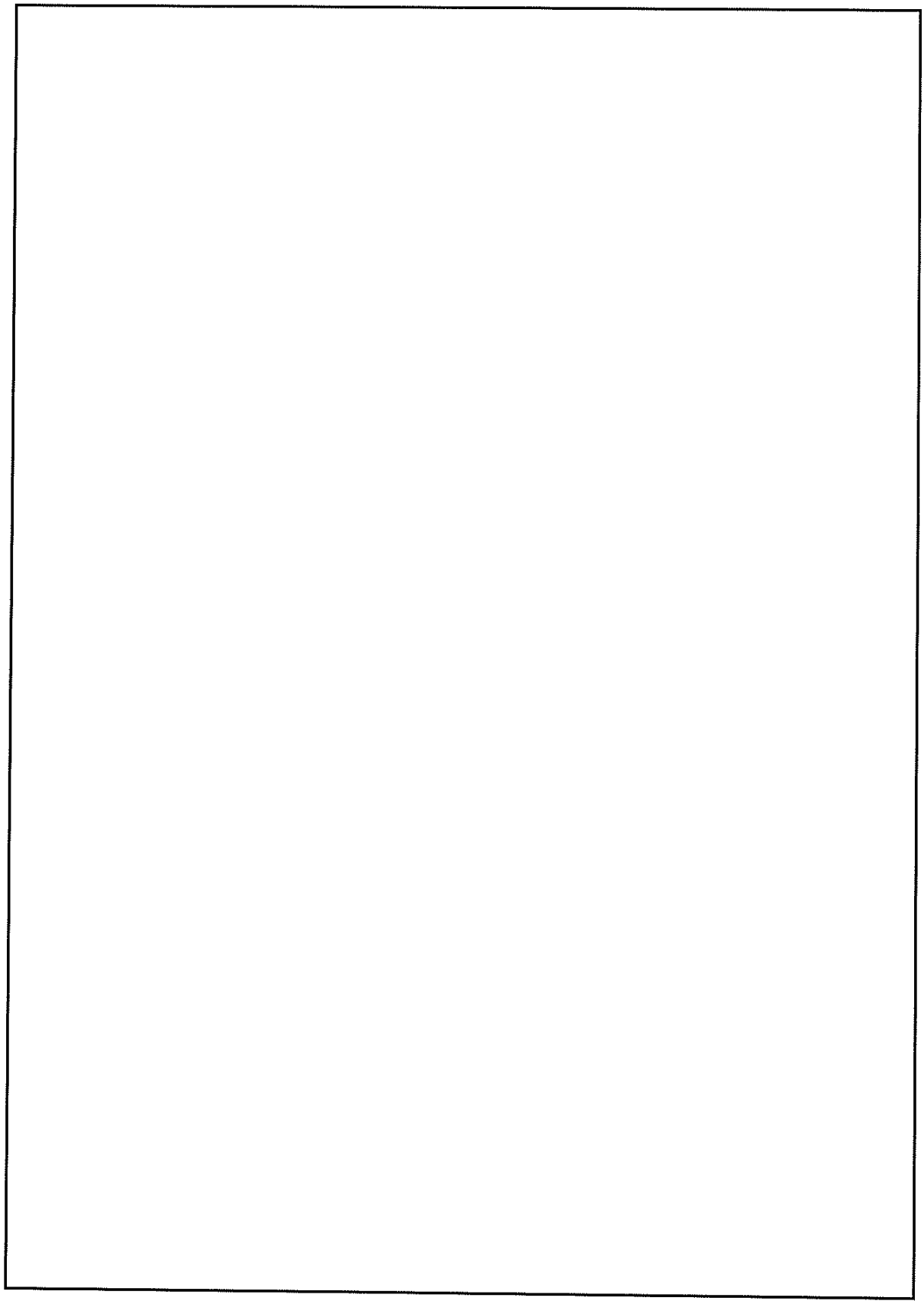
C = Closed

Exercise 3. The general theorems (7 points)

We consider the following circuit:



Using the method of your choice, determine the expression of the current flowing through the resistor R_1 function of E, I, R and R_1 (you have to precise the direction of this current on the circuit and the chosen method).



BONUS

We consider the following circuit. Express U using the Millman's theorem.