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Exercise:
Thévenin, Resistors, Capacitors

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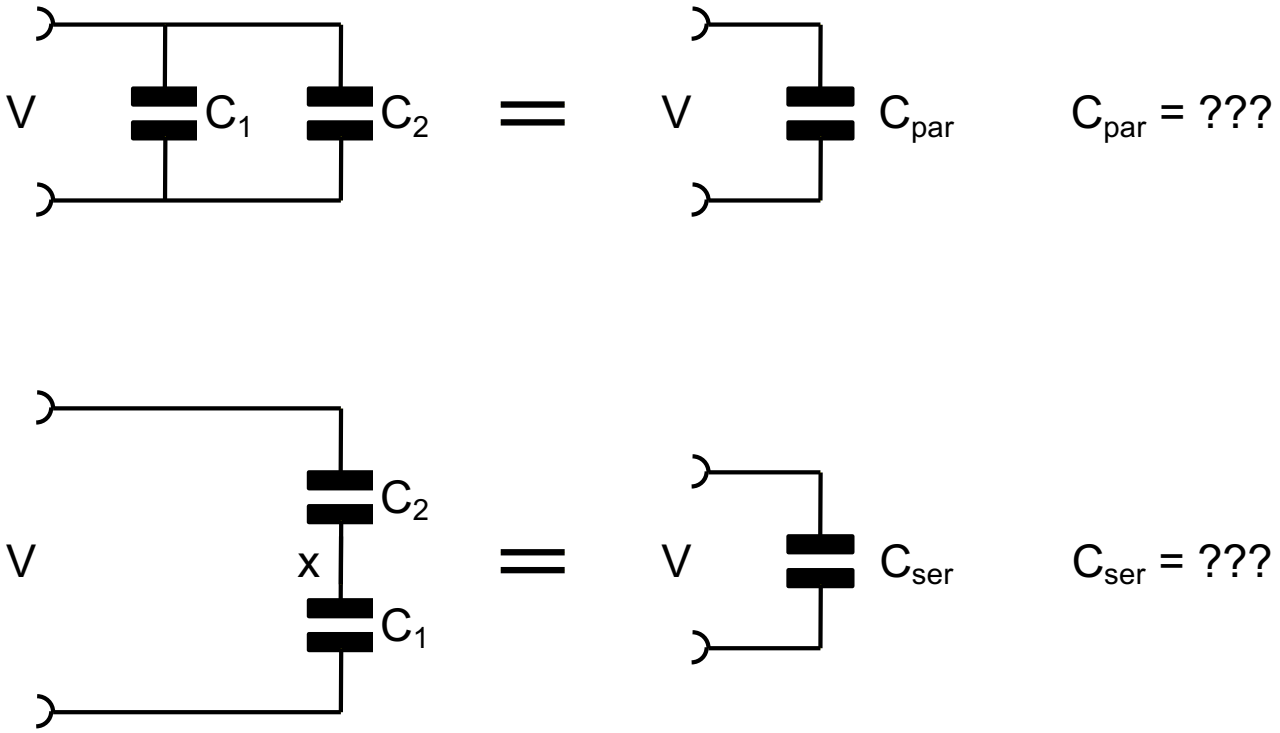
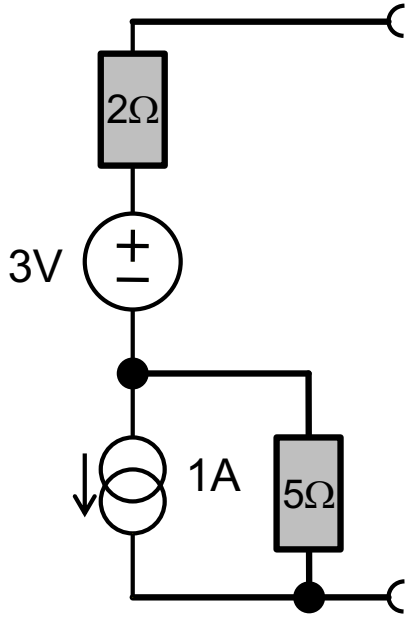
Exercise 1

- Derive the expressions for the series and parallel connection of capacitors
- Use charge conservation (at node x)



Exercise 2

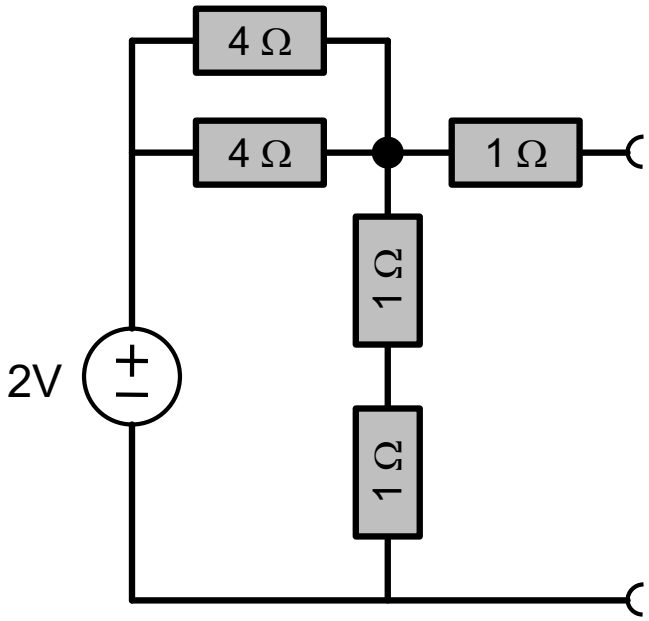
- Derive the Thévenin Equivalent for the following circuit:



- Try two different methods:
  - Use the Open/Short method with Kirchhoff's rules
  - Convert the I-source part to a voltage source first…

Exercise 3

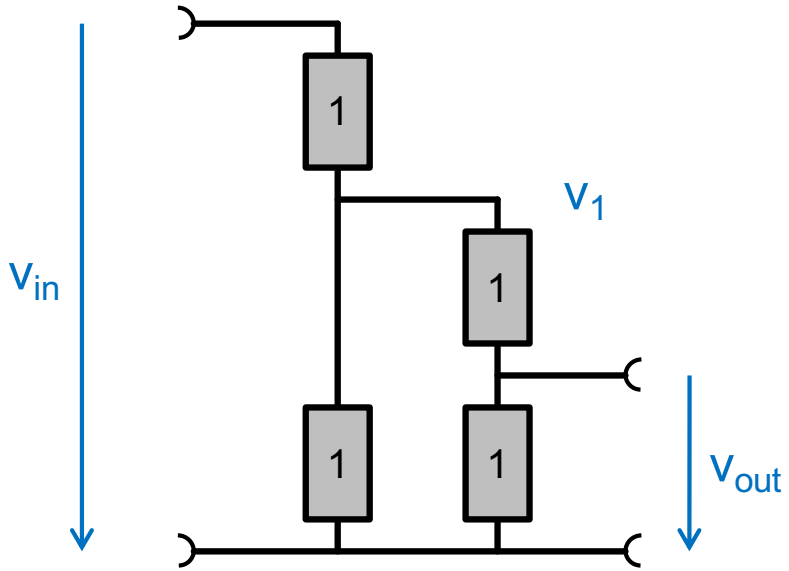
- What is the Thévenin Equivalent of the following circuit?



- Use two methods to find the result:
  - parallel / series connection of resistors and your knowledge about the voltage divider
  - short/open method

Exercise 4

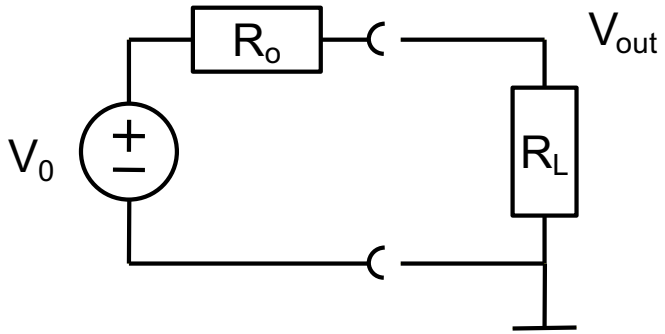
- What is the ‘gain’ (attenuation) of the following voltage divider (all resistors have 1 Ohm):



- Try two different methods:
  - Your knowledge of parallel / serial connection of resistors
  - Kirchhoff’s law

Exercise 5

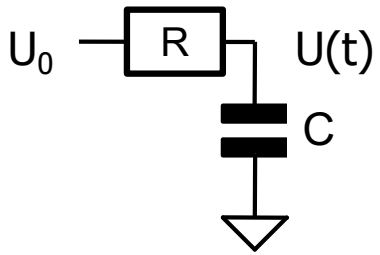
- A voltage source with voltage V_0 and output resistance R_0 is loaded by a resistor R_L:

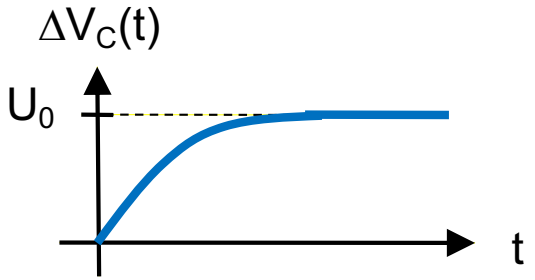


- What is the output voltage V_{out} ?
- Which current flows in R_L ?
- What power (P = U I) is dissipated in R_L ?
  - Check that noting is dissipated for R_L=0 and $R_L \rightarrow \infty$
- For which value of R_L is the dissipation maximized?
  - What is the dissipation?

Exercise 6

- We consider charging of a capacitor C though a resistor R to a voltage U_0.





- Show that $U(t) = U_0 - U_0\, e^{-\frac{t}{RC}}$ satisfies the differential equation
- Simplify U(t) for small times t<<RC.
- What is the initial slope ?
- Derive this slope directly (assuming U(0) = 0).