Exercises for the programs ORIGIN and MATLAB

Exercise for ORIGIN:

A charged capacitor with a capacity of C = 4.7 nF is discharged via a resistance R = 1 kΩ (the tolerances in R and C being negligible). The discharge leads to an exponential drop of the voltage U at the capacitor in the course of time t:

(1) $$U(t) = U_0 \cdot \mathrm{e}^{-\frac{t}{RC}}$$

U_0 is the voltage at the capacitor at time t = 0 (here: U_0 = 2 V, error negligible). At the predefined times t the following voltages U were measured at the capacitor with the measuring uncertainties ΔU:

t / µs	U / mV	ΔU / mV
1	1680	100
2	1260	50
3	1210	50
4	850	30
5	660	25
6	570	25
8	340	20
11	210	15
14	100	10
17	48	5
20	30	4
23	13	4
25	8	4

Plot U (in mV) over t (in µs) including the measuring uncertainties ΔU in the form of error bars. Plot the voltages theoretically expected at times t in the diagram as well. Use open symbols for both data sets. Then change the linear representation of measured values into a semilog plot (logarithmic scale for U). How do the function course and the error bars change? Before using ORIGIN for plotting the graphs please use as well the millimeter paper and create the graphs manually.

Exercise for MATLAB:

The charging of a capacitor is described with the law

(2) $$U(t) = U_0 \left(1 - \mathrm{e}^{-\frac{t}{RC}} \right)$$

(quantities as stated above). The quantity $\tau = RC$ is called time constant of the charging of the capacitor. Plot the course of $U(t)$ in the time interval [0; 5 τ] using the same values as above for R, C, and U_0. Plot the course of $U(t)$ for R = 0.5 kΩ in the same diagram (C, U_0, and range of t as stated above) [1]. Insert the following line at the end of your script (m-file):

```
title(strcat('First Name Surname, Group nn - ',datestr(clock)));
```

[1] In order to plot two or more curves in one diagram the command `hold on` is introduced in front of the first `plot`-command and the command `hold off` behind the last `plot`-command.