5. BLACK BOX (10 points) — *Mihkel Heidelberg and Jaan Kalda.* The black box has three terminal wires: "blue", "black" and "white", and contains two resistors with resistances $R_1 < R_2 < 1\,\mathrm{k}\Omega$ and a single Zener diode in some arrangement. In the voltage ranges we are using, the Zener diode behaves as a regular diode — conducts current well when voltage is applied in the forward direction, and conducts little when voltage is applied in the reverse direction. We are using a Zener diode, because it has a higher leakage current of up to 1 mA when voltage is applied in reverse direction. You may neglect the internal resistance of the voltmeter in all ranges and of the ammeter in the 40 mA and 400 mA ranges. The internal resistance of the ammeter in the 400 μA and 4000 μA ranges is $R_A = 100\,\Omega$.

i) *(2 points)* Draw the electrical circuit that is inside the black box. Motivate your solution with measurements.

ii) *(4 points)* Measure the resistances R_1 and R_2, estimate the uncertainties.

iii) *(4 points)* Measure and draw the current-voltage curve of the Zener diode in the black box, use as many different datapoints as possible.

Equipment: Black box, DC voltage source, multimeter.

Do not anger Eero by shorting the voltage source with the ammeter, you will blow the fuse.