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EECS 40 **Summer 2002**

Problem Set 6 (Short)
Due Friday, July 19 at 12 PM

Prob 1) Thévenin and Norton Equivalents

(a) Refer to Figure 4.41, page 172 in the Textbook. This is a voltage amplifier (its actually a model of a bipolar transistor amplifier, but you do not need to know that). Suppose $R_L = r_\pi = 5K$, and $\beta = 100$. What is the voltage gain V_{AB} / V_1. (Note the sign of voltage gain can be positive or negative).

(b) Imagine the circuit placed in a box with only the input terminals (where V_1 is attached) sticking out. Nothing is connected to A-B. You are to find the Thévenin equivalent of the input (with V_1 removed of course). Note that the Thévenin resistance is not simply r_π.

(c) Now do the reverse; find the Thévenin equivalent circuit of the circuit as seen from the terminals AB. Assume V_1 is 1V.

Prob 2) Load –line method

Box A below has the non-linear I-V characteristics shown in Figure 1. The box is connected to circuit B below. Find the voltage V_{AB} as well as the current, I, when the two circuits are connected with terminals a and b of box A connected to the corresponding terminals a and b of circuit B.

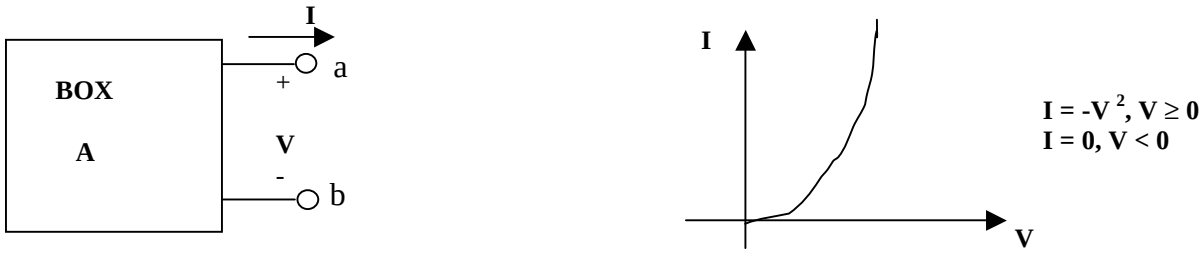
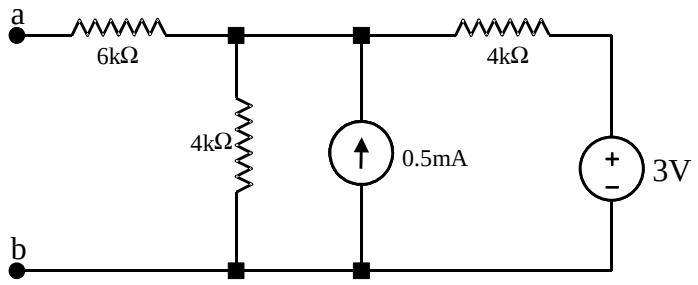


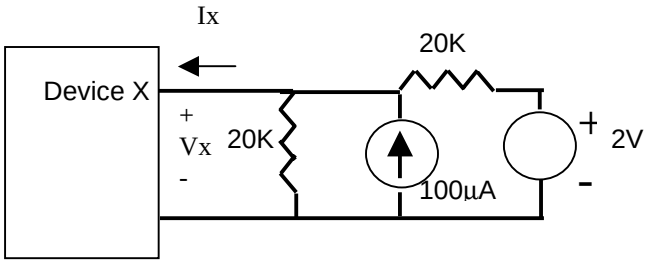
Figure 1: Non-linear circuit



Circuit B

Prob 4) Nonlinear problems

Consider the following circuit. You are find the "bias point" of the nonlinear device X. In other words find the current Ix and the Voltage Vx .



You may use graphical analysis and the answer need only be accurate within 20% or 1mA or 1mV, whichever is greater. Solve for the following two cases:

a) Device X has a nonlinear I-V characteristic of $Ix = 10^{-15} \exp(Vx/.026)$

b) Device X has a nonlinear I-V characteristic with $Ix = 10^{-4} V^2$

Prob 5) Operational Amplifier (use the ideal op-amp model)

Solve for Vout in terms of Iin for the following circuit: