

Name: _____ (please print)

Signature: _____

ECE 3455
Quiz #4
April 2, 2007

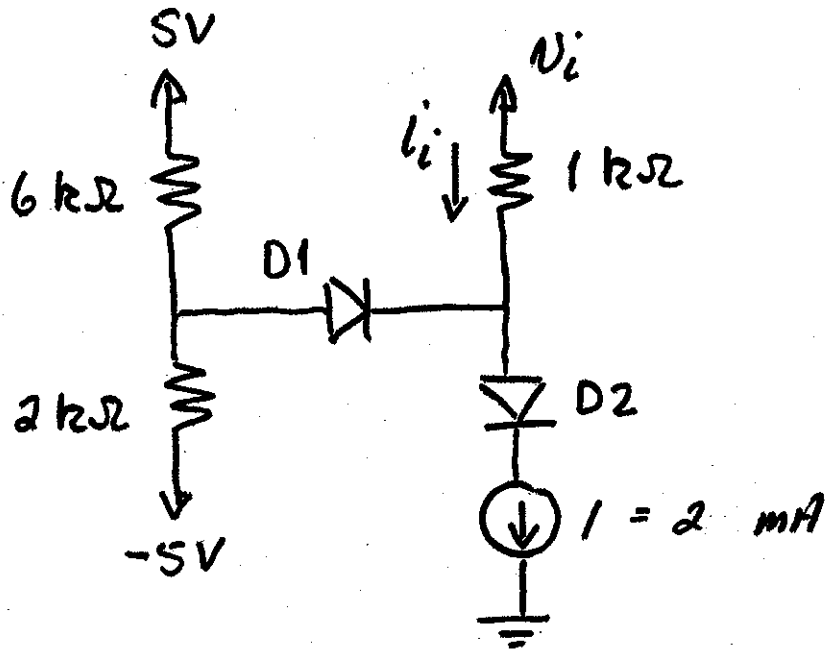
Quiz duration: 30 minutes

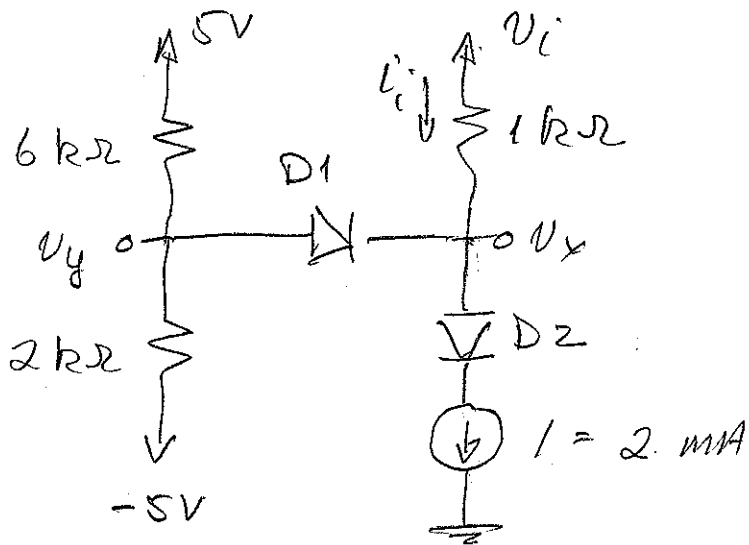
1. You may have one 8 ½ x 11 in. “crib” sheet, written on both sides, during the quiz. You may have any calculator you choose, but no computers. No other notes or materials will be allowed.
2. Show all work necessary to complete the problem on these pages. A solution without the work shown will receive no credit.
3. Show units in intermediate and final results, and in figures.
4. If your work is sloppy or difficult to follow, points will be subtracted.

_____ /20

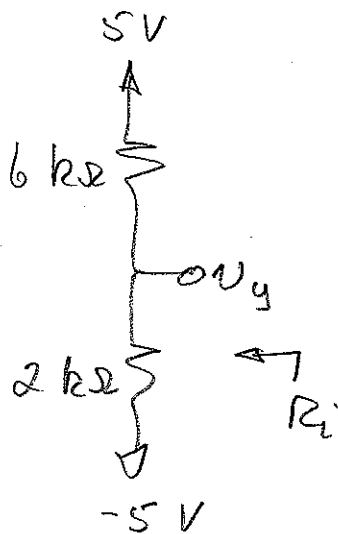
In the circuit below, the diodes are identical, and have the following properties:
 $v_{Th} = 1 \text{ V}$; $r_D = 10 \Omega$; $I_S = 0$. Find i_i for

- a) $v_i = 0 \text{ V}$;
- b) $v_i = -2 \text{ V}$.



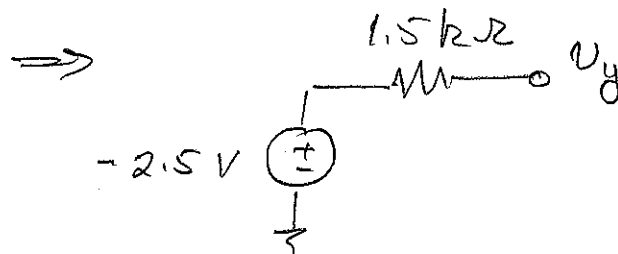


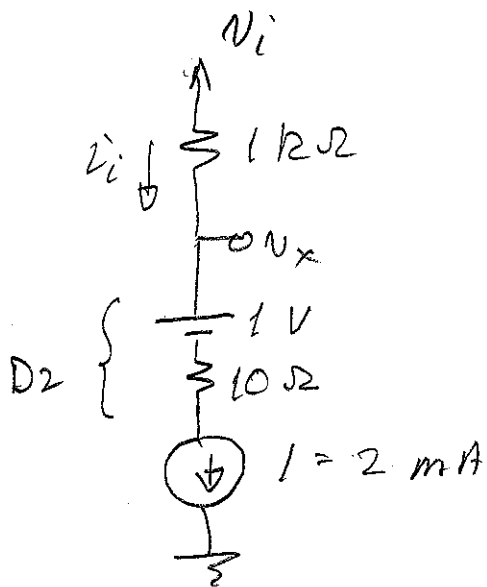
As discussed in class and suggested in HW problem 3.10, we substitute Thevenin equivalents on either side of the diode.



$$V_y = -5 + (5 - (-5)) \cdot \frac{2}{2+6}$$
$$= -2.5V$$

$$R_i = 2 \parallel 6 = 1.5k\Omega$$

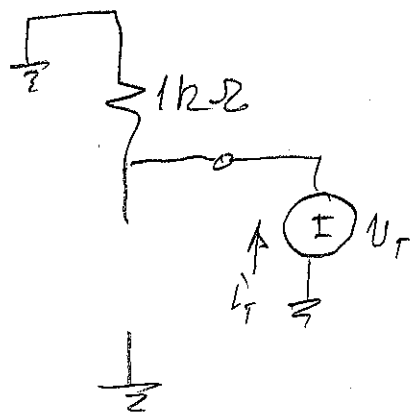




The current source clearly turns D2 on, so we have replaced it with 1V in series with 10Ω.

$$\begin{aligned} \text{Now } V_x &= V_i - (1k)(2 \text{ mA}) \\ &= V_i - 2 \text{ [V]} \end{aligned}$$

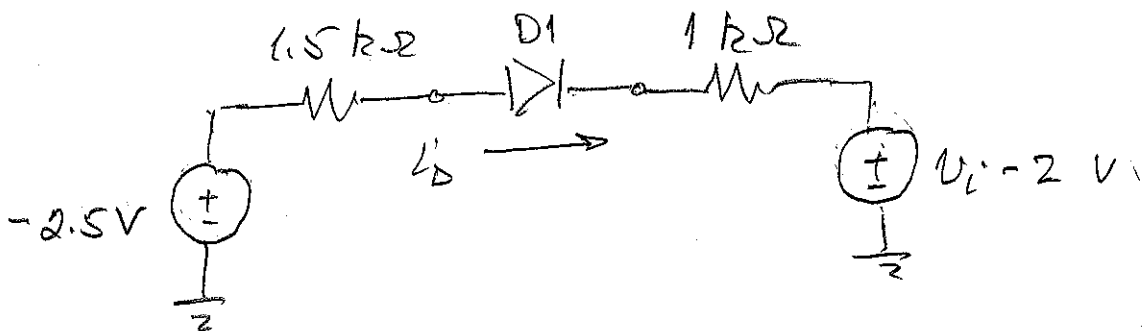
So the open-circuit voltage depends on V_i . Also.



clearly $R_{th} = 1k\Omega$.

Putting this together, we get

$$\left. \begin{array}{l} 1V \quad 10\Omega \\ \text{---|---} \end{array} \right\} \text{ IF } D1 \text{ is ON}$$



IF D1 is ON, then

$$-(-2.5) + I_D(1500 + 1000 + 10) + 1 + (V_x - 2) = 0$$

$$\Rightarrow I_D' = \frac{2 - V_i' - 2.5 - 1}{2510} = \frac{-V_i' - 1.5}{2510} \quad -3'$$

So for $V_i' = 0$, $I_D' < 0$ which is impossible.
In that case D1 is OFF and

$$V_i' = 0 \Rightarrow I_i' = 2 \text{ mA}$$

$$\text{For } V_i' = -2\text{V}, \quad I_D' = \frac{0.5}{2510} \approx 0.2 \text{ mA}$$

So this is OK and

$$V_i' = -2\text{V} \Rightarrow I_i' = 2 \text{ mA} - 0.2 \text{ mA} = 1.8 \text{ mA}$$