

Name: \_\_\_\_\_ (please print)

Signature: \_\_\_\_\_

ECE 3355 – Quiz #4  
October 24, 2019

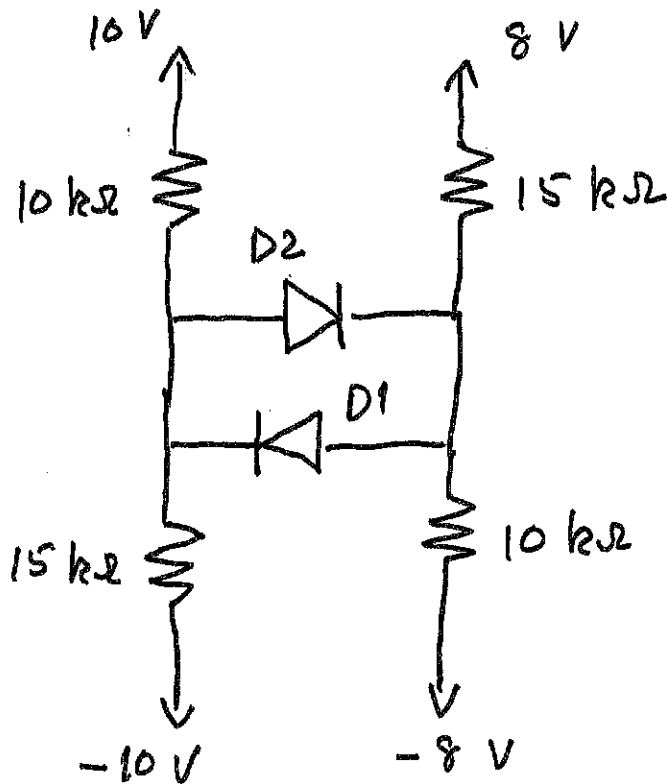
**Keep this quiz closed and face up  
until you are told to begin.**

1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

\_\_\_\_\_ /25

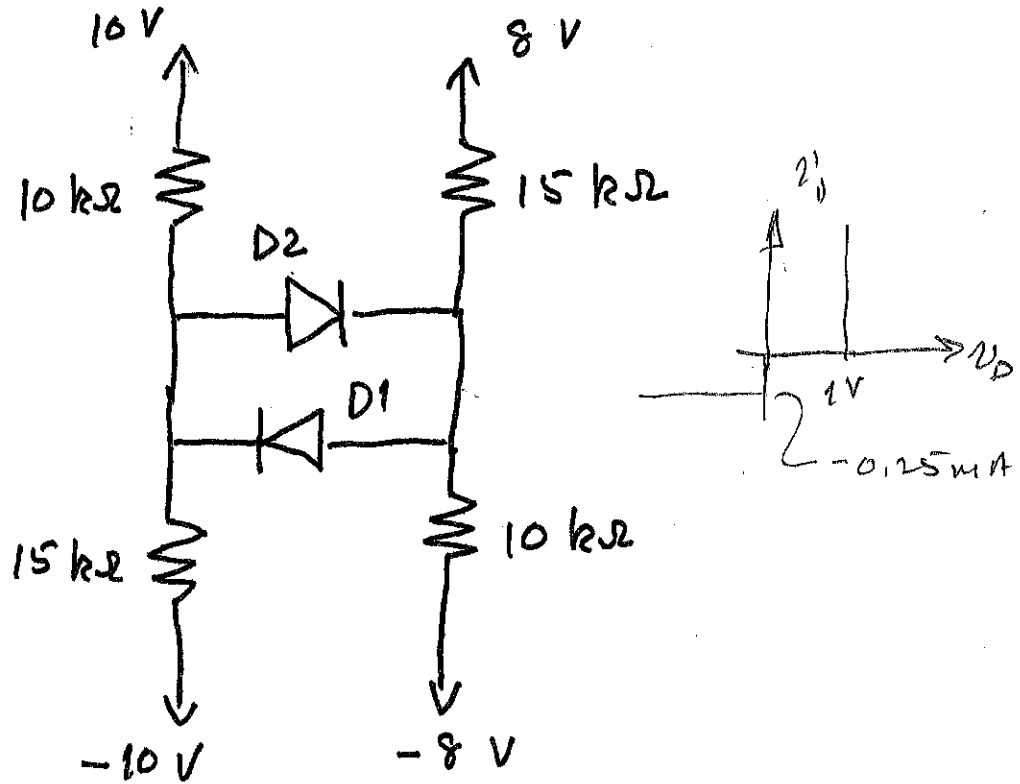
Room for Extra Work

In the circuit below, the diodes are characterized by a piece-wise linear model with  $V_{th} = 1\text{ V}$ ,  $r_D = 0$ , and  $I_s = 0.25\text{ mA}$ . Determine in which linear region the diodes are operating. Be sure to prove that any assumptions you make are correct. Note that you can get partial credit for an incorrect assumption if you prove it is incorrect.



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We will Thevenize both biasing circuits:

$$\text{right side: } V_{th}^r = 16 \cdot \frac{10}{10+15} - 8 = -1.6\text{ V}$$

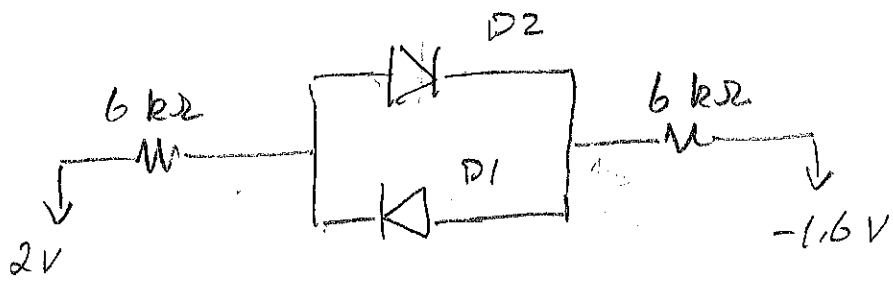
$$\text{left side: } V_{th}^l = 20 \cdot \frac{15}{10+15} - 10 = 2\text{ V}$$

$$\text{both sides: } R_{th} = 10 \parallel 15 = 6\text{ k}\Omega$$

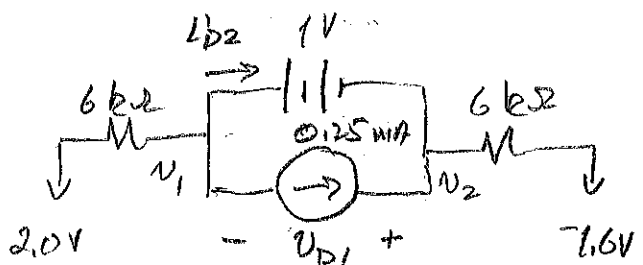
+1  
+7  
+2

So redrawing we have...

Room for Extra Work



Guess D1 reverse bias, D2 ON

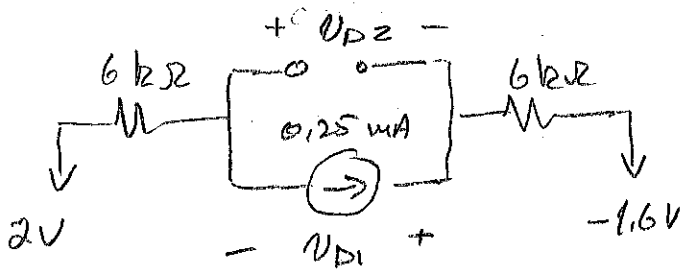


$$V_{D1} = -1V \quad \checkmark$$

$$I_{D2} = \frac{2 - 1 - (-1.6)}{18} = 0.25$$

$$= -0.033 \text{ mA} \quad \times$$

Try D2 open circuit:



KVL:

$$-2 + 0.25(12) - V_{D1} - 1.6 = 0$$

$$V_{D1} = -0.6V \quad \checkmark$$

$$V_{D2} = -V_{D1} = +0.6V \quad \checkmark$$

$< V_{th}$

$$-2 + 6(0.2167) + 1 + V_2 = 0 \quad V_2 = -0.13V$$

$$-2 + 6(0.2167) + V_1 = 0 \quad V_1 = 0.7V$$