UNIVERSITY OF CALIFORNIA, BERKELEY

Department of Electrical Engineering and Computer Sciences

EE100 Fall 2004

Intro. to Electronics Engineering

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MIDTERM REVIEW PROBLEMS

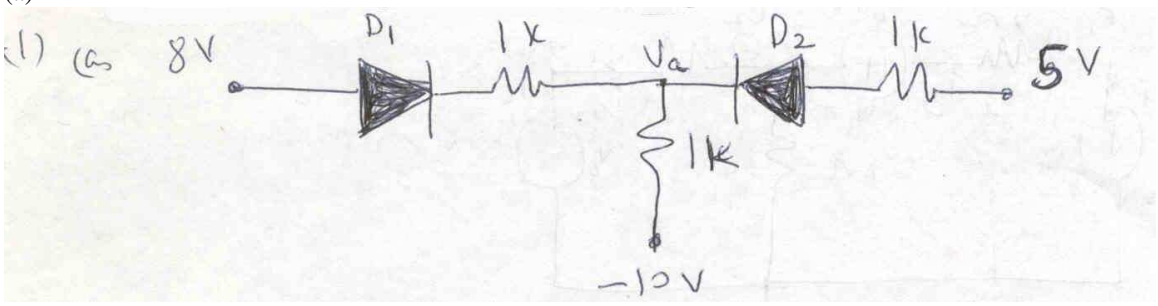
Note(s):

1. **The midterm is CLOSED BOOK/CLOSED NOTES. You may use a calculator. The midterm is on Monday, October 18th 2004 from 4:00 – 5:30 pm in 4 LeConte Hall (note the room change).**
2. **There are 6 questions on the exam, they are NOT equally weighted. Concepts covered are:**
   - **i. Ideal diode model**
   - **ii. Op-amp model**
   - **iii. Digraphs, Reduced Incidence Matrix and obtaining KCL/KVL equations from the Reduced Incidence Matrix by inspection.**
   - **iv. Tellegen's theorem**
   - **v. Superposition, Thevenin/Norton (including dependent sources).**
3. **If you UNDERSTAND and SOLVE the problems in this review packet, you should do well on the midterm. DO NOT WASTE YOUR TIME MEMORIZING THESE PROBLEMS AND/OR SOLUTIONS. Rather, understand the concepts behind them.**
4. **The TAs will be holding office hours instead of lab next week. Make judicious use of their time.**

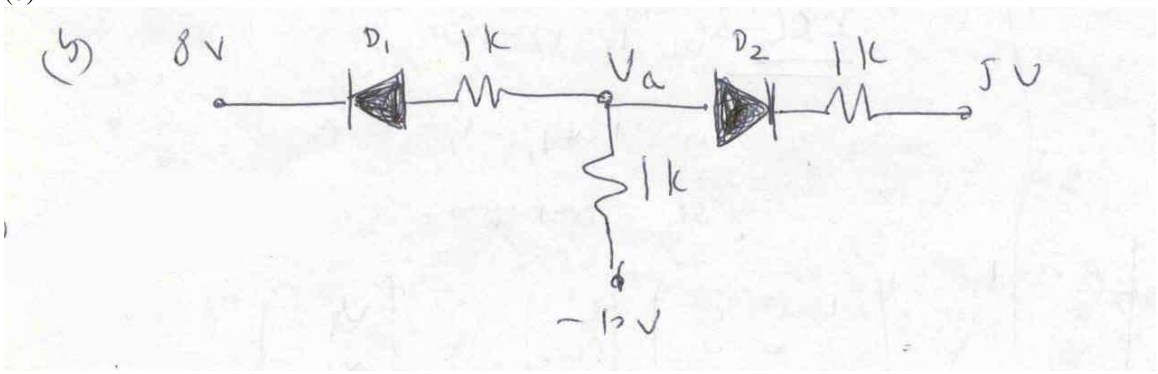
PROBLEM 1

Determine whether the **IDEAL DIODE** in the following two circuits is "ON" or "OFF". You **MUST** show $i_D > 0$ if diode is "ON", and $v_D < 0$ if diode is "OFF".

(a)



(b)

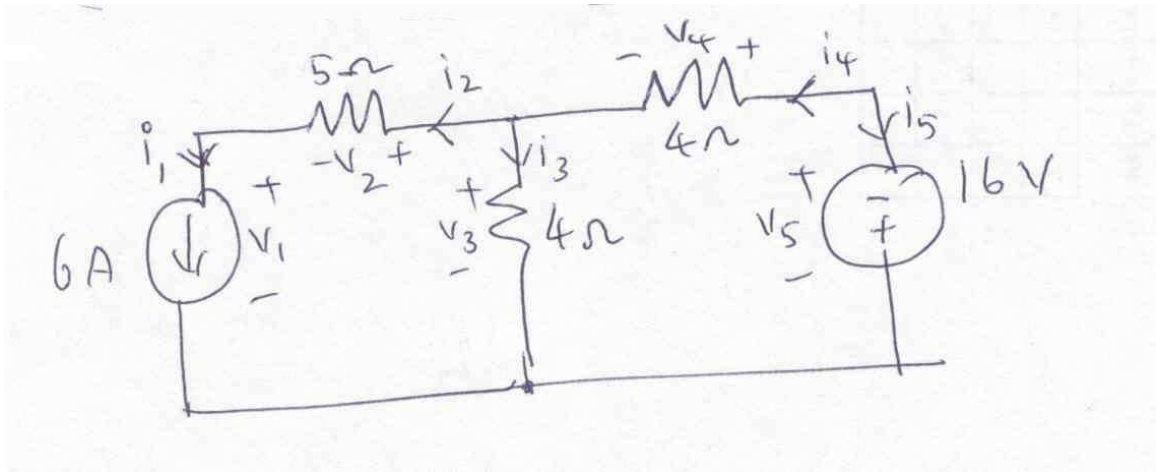


PROBLEM 2

In the circuit below:

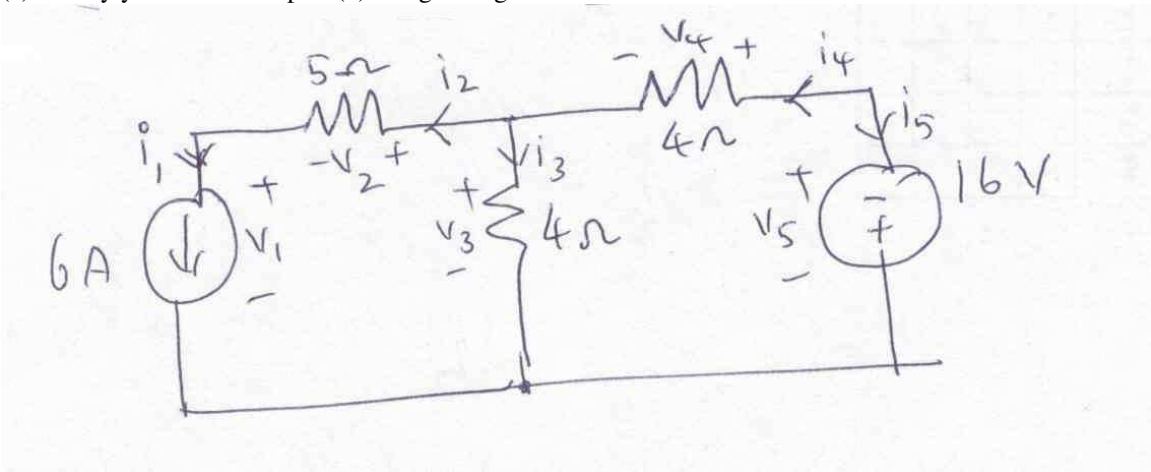
(a) draw the digraph and obtain the reduced incidence matrix from the digraph.

(b) Write 2 KCL equations and 5 KVL equations from the reduced incidence matrix. Label the bottom node as ground and the nodes on the top (starting on the leftmost node, moving clockwise) as nodes 1, 2 and 3.



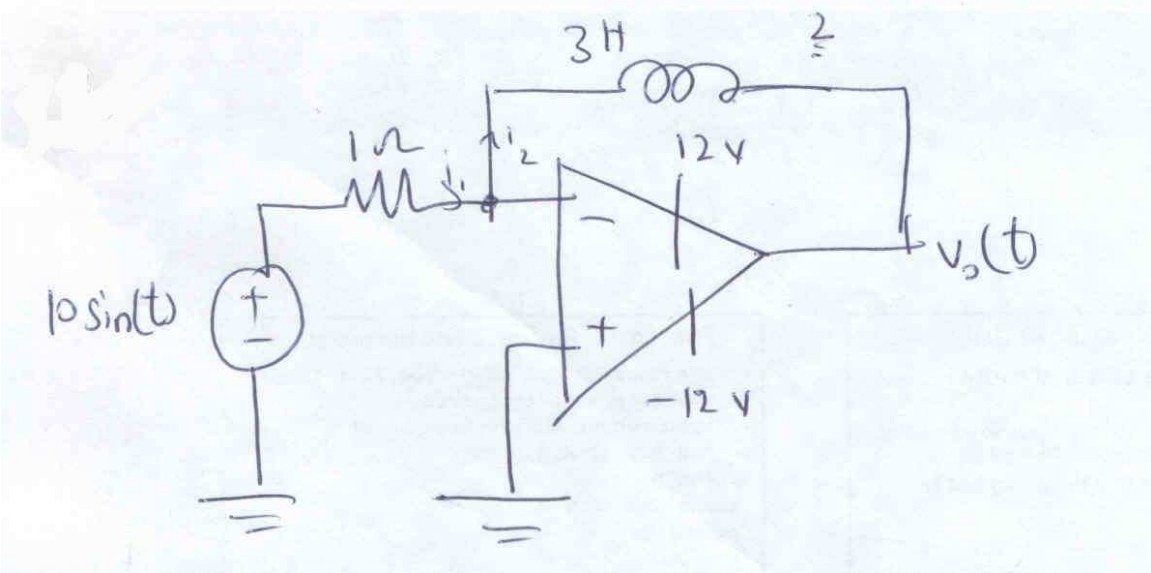
PROBLEM 3

Consider the circuit in problem 2 (reproduced below for convenience).
(a) Using superposition, find v_3.
(b) From (a), obtain v_1, v_2, v_3, v_4, v_5; i_1, i_2, i_3, i_4 and i_5 by inspection.
(c) Verify your answer to part (b) using Tellegen's Theorem.



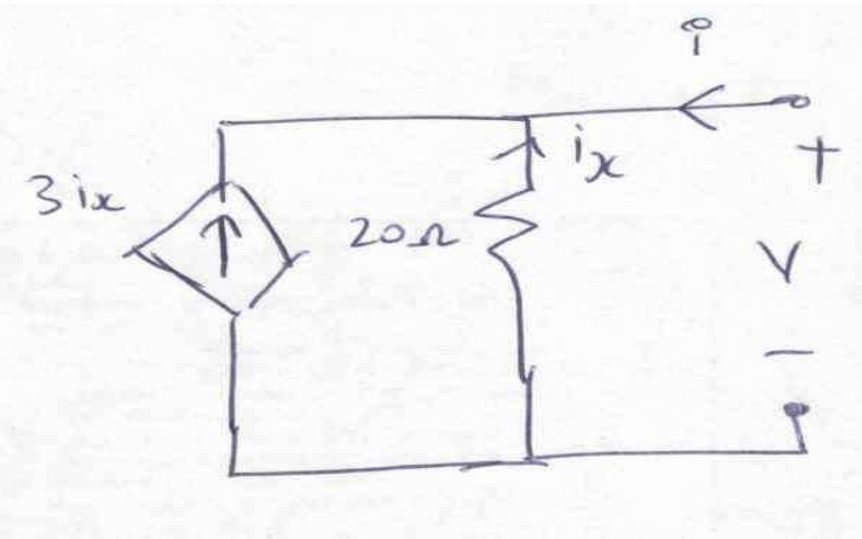
PROBLEM 4

In the circuit below, find $v_o(t)$. DO NOT IGNORE THE EFFECTS OF THE RAIL VOLTAGES. You don't need to mathematically show what happens, just write a couple of sentences (NOT a paragraph) in English.



PROBLEM 5

For the circuit below, find the Thevenin and Norton equivalent.



PROBLEM 6

In the circuit below:

(a) Find voc, the open circuit voltage when i = 0.
(b) Find isc, the short circuit current when v = 0.
(c) From (a) and (b), find the Thevenin equivalent.