電路學(10320EE221000)第一次期中考

2015年4月22日
時間：2 小時
Close Book

學號：_____

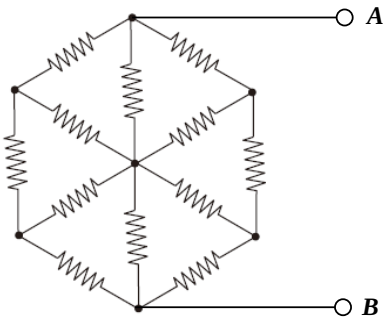
姓名：_____

- There are 9 pages in this midterm exam, including this cover page. Please check that you have them all.
- Please write your **學號 姓名** in the space provided above.
- **IMPORTANT:** The problems in this exam vary in difficulty; moreover, questions of different levels of difficulty are distributed throughout the exam. If you find yourself spending a long time on a question, consider moving on to later problems in the exam, and then working on the challenging problems after you have finished all of the easier ones.
- Do your work and enter your answer for each question within the boundaries of that question. You may do your work on the back of the preceding page. Give a brief explanation if you are asked to explain.
- Remember to include the sign and units for all numerical answers.
- This is a closed-book exam, but you may use a calculator.
- You have 2 hours to complete this exam.
- Good luck!

Table of grades:

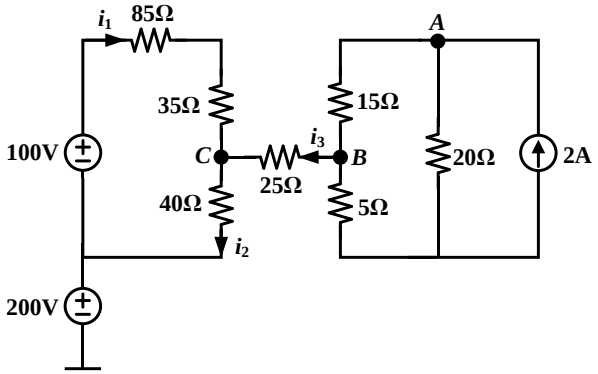
1.	**2.**	**3.**	**4.**	**5.**
6.	**7.**	**8.**	**9.**	**10.**
11.	**Total Grade:**			

1. Find the voltage drop between nodes *A* and *B* (V_{AB}) in following figure. Assume that all of the resistors have a value of 1kΩ, and that 1mA current flows into node *A* and out of node *B*. (6%)



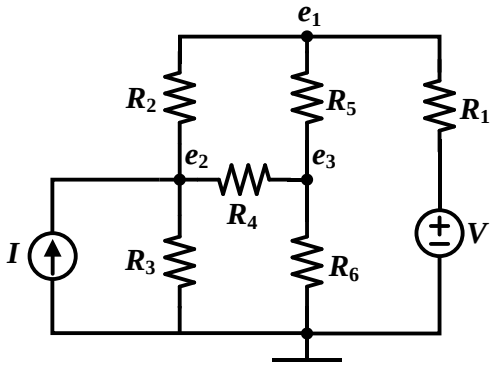
V_{AB} = _____.

2. Find the voltage at node *C* with respect to the ground node. (7%)



v_C = _____.

3. The network shown below has three nodes with unknown node voltages e_1, e_2 and e_3. Use conductance instead of resistance to write the node equations. Simplify the equations by collecting terms and arranging them in the "standard" form for n linear equations in n unknowns. Express these n linear equations in matrix form as shown below. (*Do not solve the equations*.) (12%)



Matrix Form: $\begin{bmatrix} G_{11} & G_{12} & G_{13} \\ G_{21} & G_{22} & G_{23} \\ G_{31} & G_{32} & G_{33} \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} S_1 \\ S_2 \\ S_3 \end{bmatrix}$

G_{11} =_____, G_{12} =_____, G_{13} =_____,

G_{21} =_____, G_{22} =_____, G_{23} =_____,

G_{31} =_____, G_{32} =_____, G_{33} =_____,

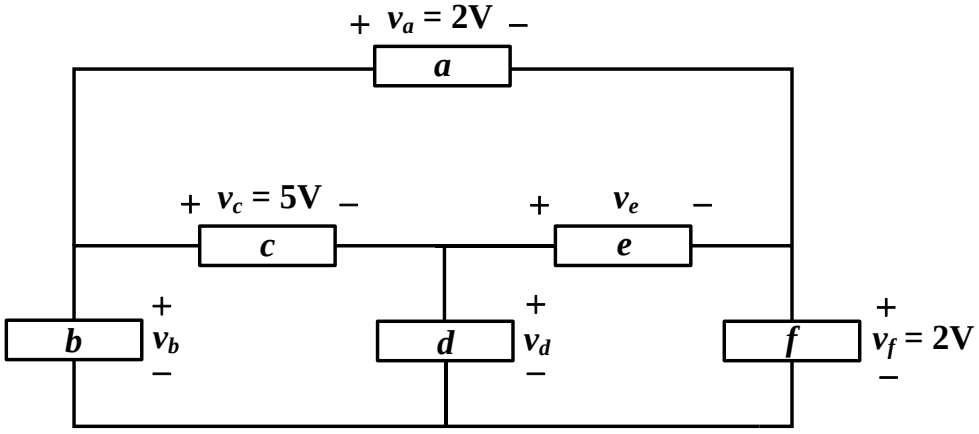
S_1 =_____, S_2 =_____, S_3 =_____.

4. For the circuit as shown below, there are five elements which observe the *Associated Variables Convention*. Among the five elements, the voltages for three elements are given on the figure. The current for element *b* is $i_b = -5$A, for element *d* is $i_d = 4$A, and for element *e* is $i_e = -1$A. By using the KVL and KCL, please find

(i) the voltages of element *d* and *e* (v_d and v_e), (4%)

(ii) the currents of element *a* and *f* (i_a and i_f), (4%)

(iii) the power of element *d* (p_d). (2%)



(i) v_d = _____, v_e = _____,

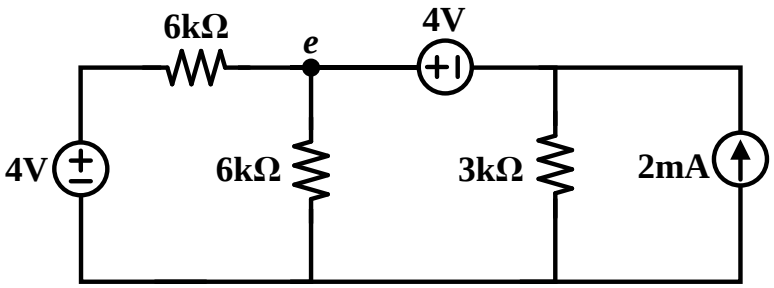
(ii) i_a = _____, i_f = _____,

(iii) p_d = _____.

5. Prove that in a network containing only linear resistors, every branch voltage and branch current must be zero. If a proof is not possible, illustrate the failure with a counter-example and restate the theorem with a suitable restriction so it can be proved. (10%)

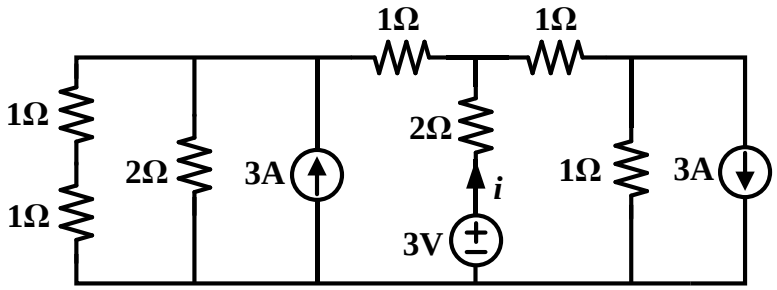
Proof:

6. Find the node potential *e* in the following circuit. (7%)



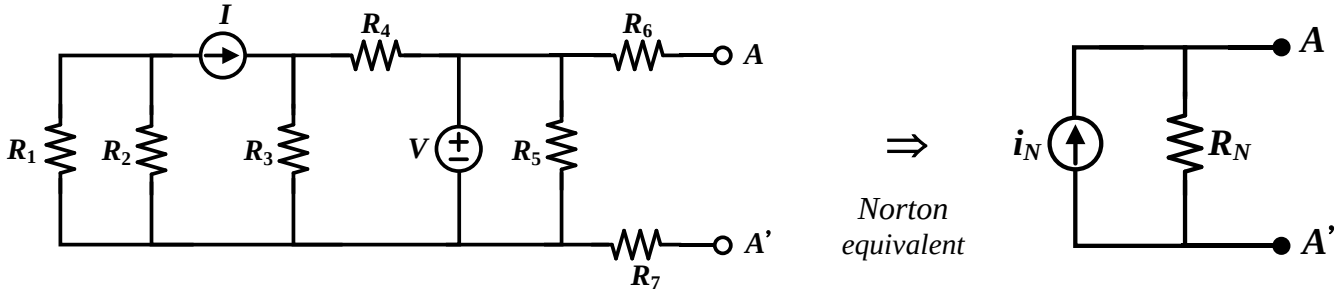
v_e = _____.

7. Find the current *i* of the following network by superposition. (7%)



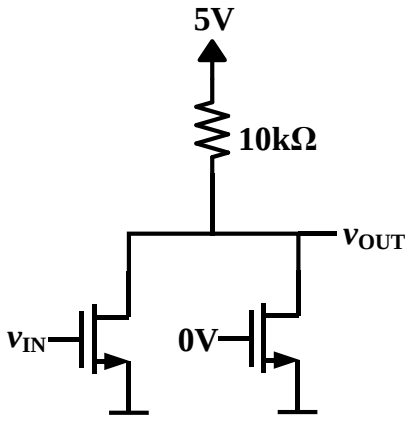
i = _____.

8. Find the Norton equivalent of the circuit for the terminals marked *AA*'. (10%)



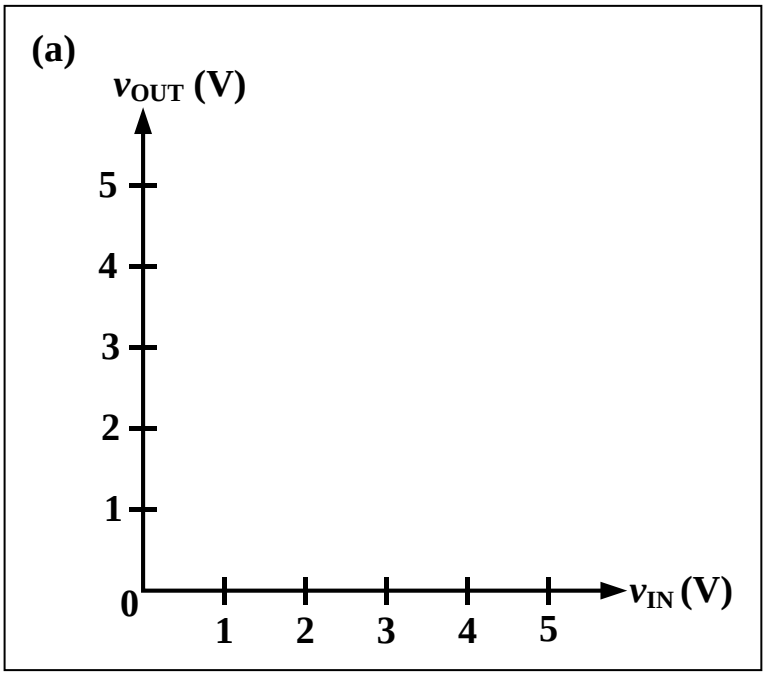
i_N = _____, R_N =_____.

9. (a) Draw the voltage transfer characteristics for the NOR gate circuit shown. (5%)
   (b) Can this gate be operated in a digital system characterized by a static discipline with the voltage thresholds below? **Explain**. (5%)
   (c) Compute the worst-case power ($p_{worst\text{-}case}$) consumed by this NOR gate. (5%)



For both MOSFET: V_T = 2.1 V
R_{on} = 2 kΩ

Static Discipline: V_{OL} = 1 V V_{OH} = 4 V
V_{IL} = 2 V V_{IH} = 3 V

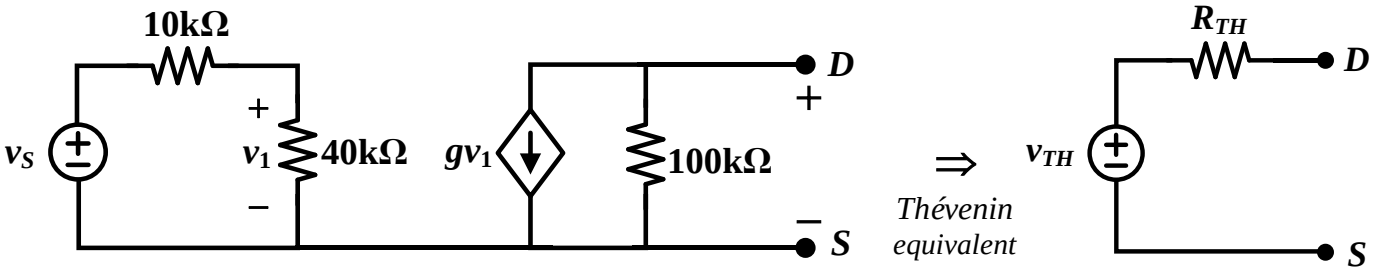


(b) Can this gate be operated in a digital system characterized by the a static discipline? **Explain**.

Answer: _____.

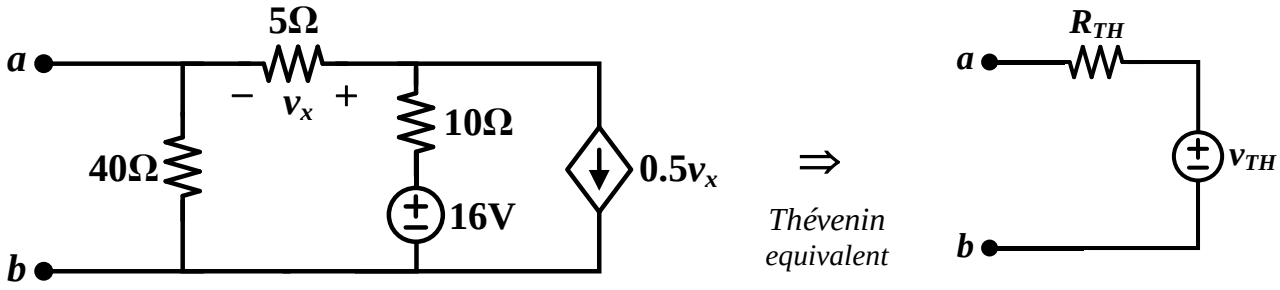
(c) $p_{worst\text{-}case}$ = _____.

10. Find the Thévenin equivalent for the network at the terminals *DS*. (8%)



v_{TH} = _____, R_{TH} =_____.

11. Find the Thévenin equivalent paramaters, v_{TH} and R_{TH}, for the port *ab* of the network shown in the following figure. (8%)



v_{TH} = _____, R_{TH} =_____.