電路學(10410EE221002)第一次期中考

2015年10月28日
時間：2 小時
Close Book

學號：________________________________

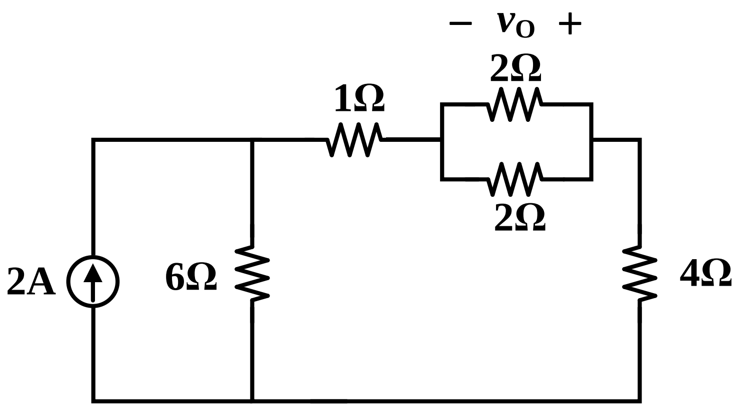
姓名：________________________________

- 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:

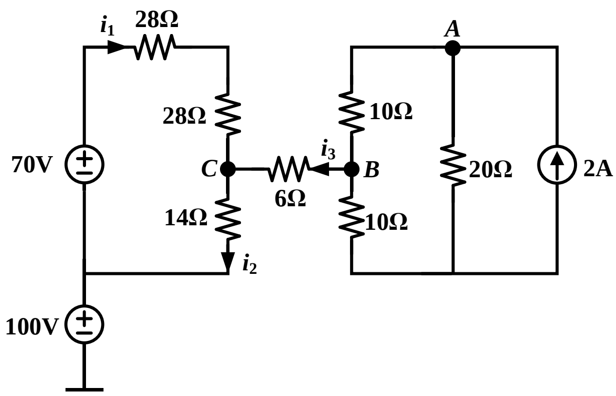
1.	**2.**	**3.**	**4.**	**5.**
6.	**7.**	**8.**	**9.**	**10.**
Total Grade:				

1. Determine the indicated branch voltage v_O. (10%)



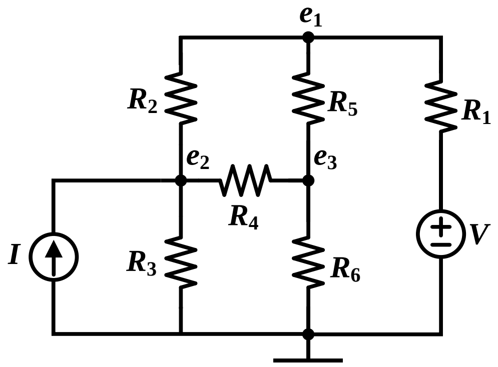
v_O = _______________

2. Find the voltage at node C with respect to the ground node. (10%)



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*.) (10%)



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} =________________________,

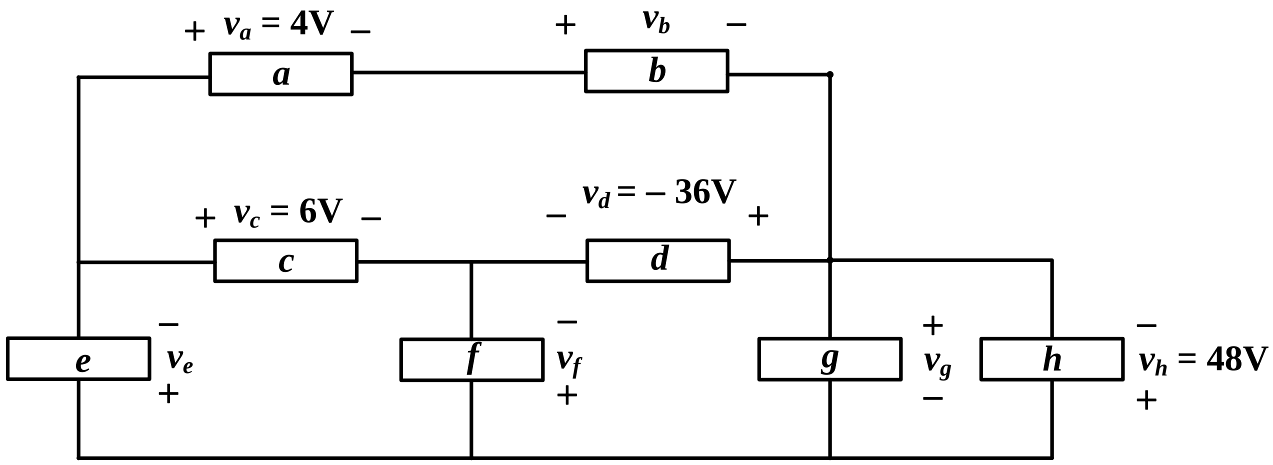
S_1 = G_1V, S_2 = I, S_3 =________________________.

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 = 1A, for element *e* is i_e = 3A, for element *f* is i_f = 4A, and for element *g* is i_g = –12A. By using the KVL and KCL, please find

(i) the voltages of element *e* and *f* (v_e and v_f), (4%)

(ii) the currents of element *d* and *h* (i_d and i_h), (4%)

(iii) the power of element *h* (p_h). (2%)

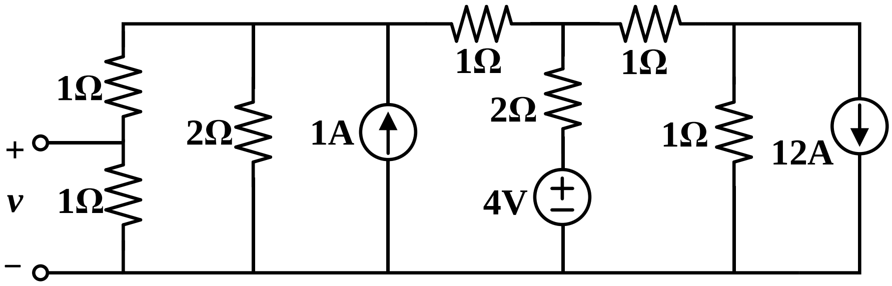


(i) v_e =____________________, v_f =____________________,

(ii) i_d =____________________, i_h =____________________,

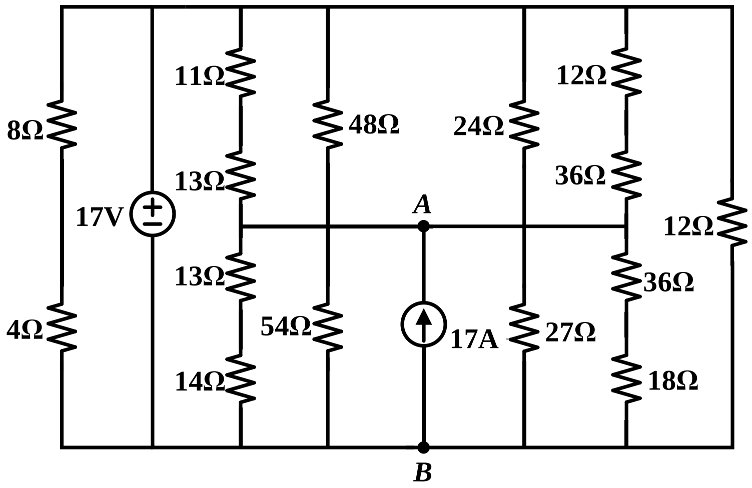
(iii) p_h =____________________.

5. Find *v* of the following network by superposition. (10%)



v = ______________________________

6. **Determine** the values of R_1, R_2 and R_3 so that the entire circuit below is equivalent to the simpler circuit shown below for the purpose of creating the Thévenin equivalent of the below circuit when viewed from its port labeled A-B. **Find** the Thévenin equivalent of the circuit when viewed from A-B port. (10%)



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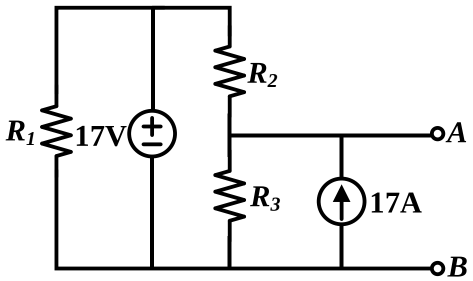

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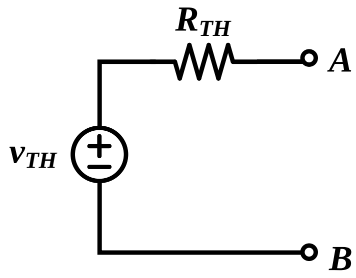
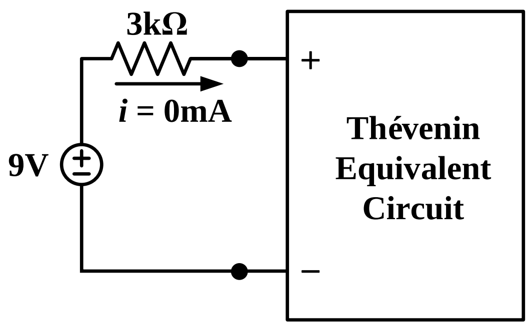


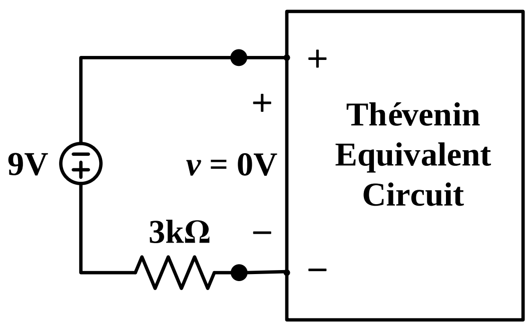
R_1 = ________________, R_2 = ________________, R_3 = ________________

v_{TH} = ________________________, R_{TH} = ________________________

7. Two experiments are performed on a Thévenin equivalent circuit as shown in (a) and (b). For (a), the terminal current is measured and zero current (i = 0 mA) is found. For (b), the external testing circuit is flipped, the terminal voltage of the Thévenin equivalent circuit is measured and zero voltage (v = 0 mA) is found. Find the Thévenin equivalent voltage (v_{TH}) and resistance (R_{TH}). (10%)



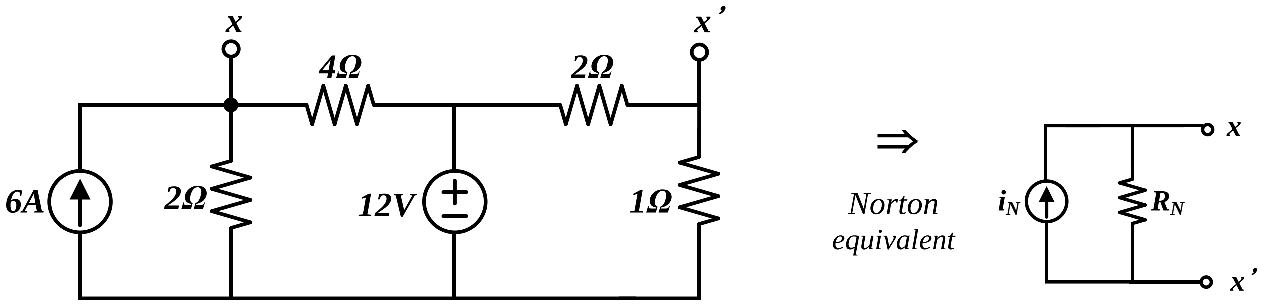
(a)



(b)

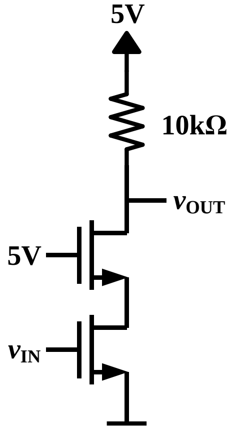
v_{TH} = ______________________, R_{TH} = ______________________

8. Find the Norton equivalent of the circuit for the terminals marked $x\,x'$. (10%)



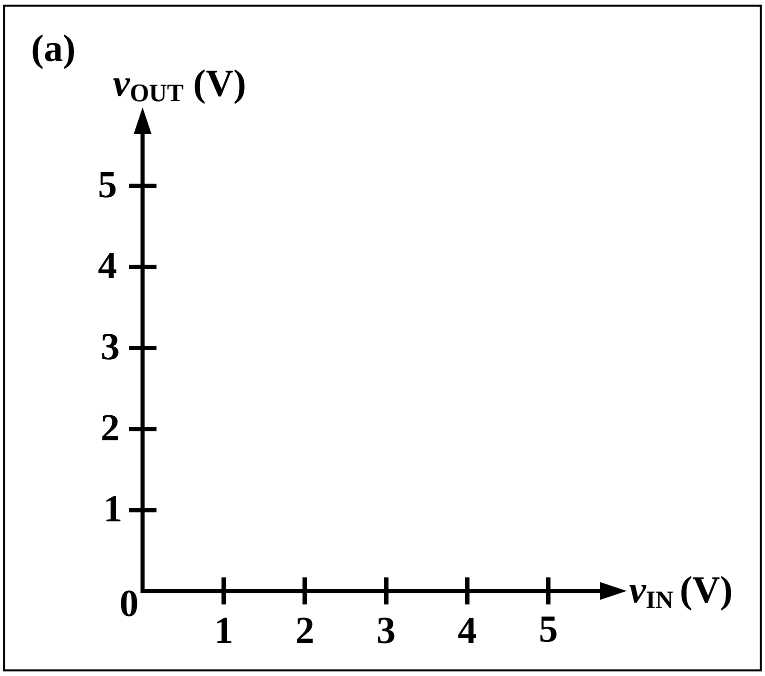
i_N = ______________________________________, R_N =______________________________________.

9. (a) Draw the voltage transfer characteristics for the NAND 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%)



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

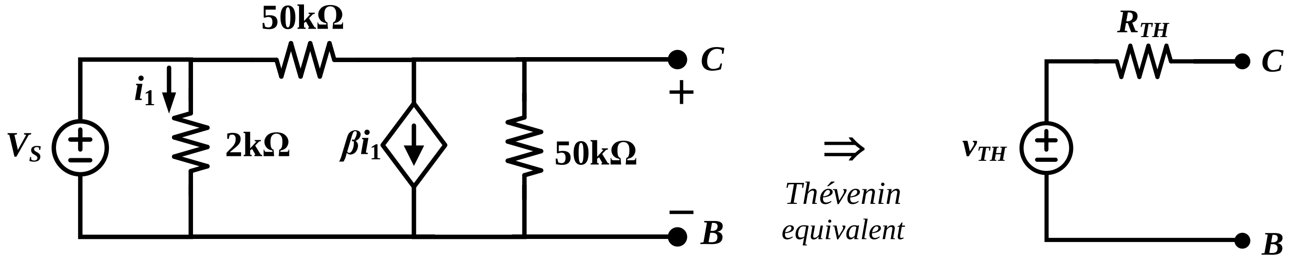
Static Discipline: $V_{OL} = 1$ V $V_{OH} = 4$ V
$V_{IL} = 1.5$ V $V_{IH} = 3.5$ V



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

Answer: ____.

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



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