電路學(EE2210)第一次期中考

2012年10月31日
時間：2 小時
Close Book

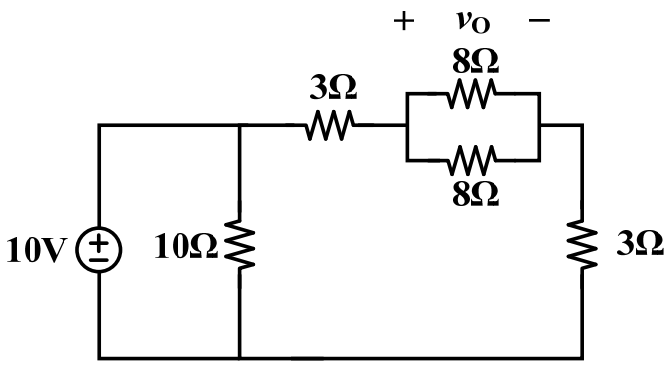
學號：_____

姓名：_____

- There are 12 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.
- 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!

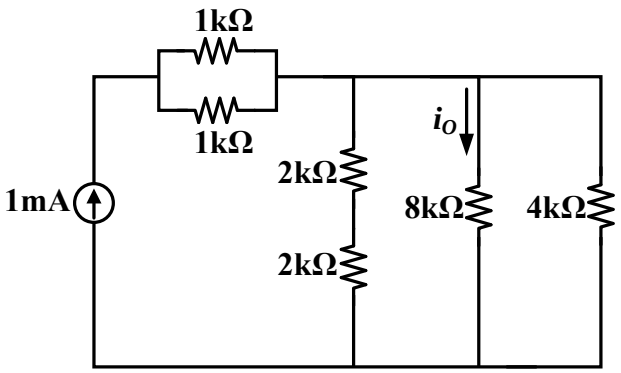
1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.
Total Grade				

1. Determine the indicated branch voltage v_O. (4%)



v_O = _____

2. Determine the indicated branch current i_O. (4%)

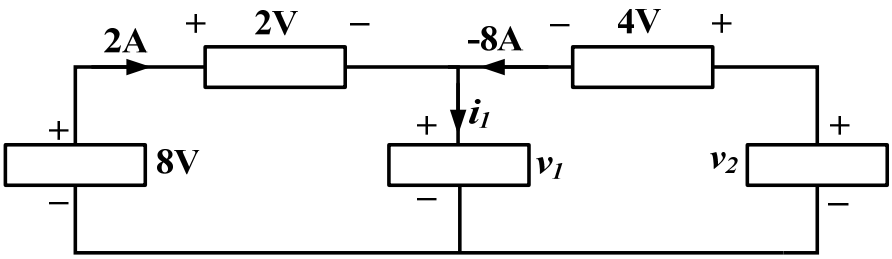


i_O = _____

3. A battery, which can be modelled by a Thévenin equivalent circuit, has an open circuit voltage of 2 volts. When a 500Ω resistor is connected to the battery, the terminal voltage drops to 1 volt. How much power is dissipated ($\boldsymbol{P_{disp}}$) in the Thévenin equivalent resistance of the battery under this condition? (4%)

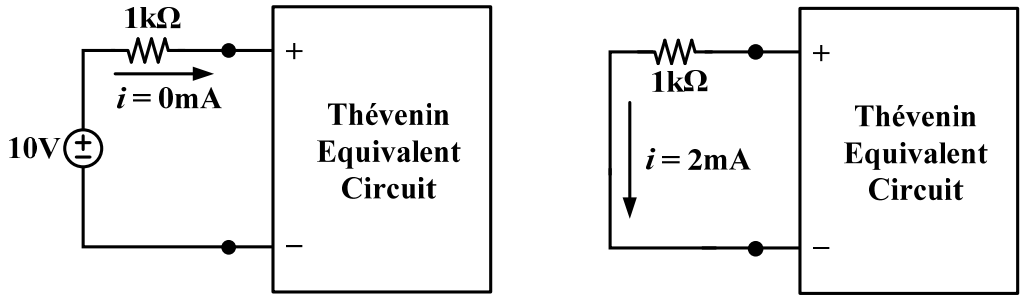
P_{disp} = _____

4. Find the branch voltage v_1, v_2 and the branch current i_1. (9%)



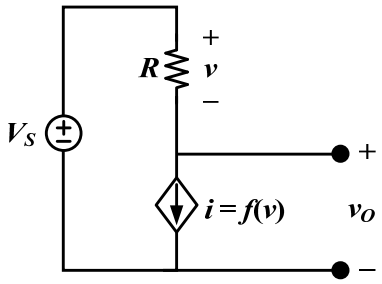
$\boldsymbol{v_1}$ = _____, $\boldsymbol{v_2}$ = _____, $\boldsymbol{i_1}$ = _____

5. The current i is measured in two experiments which are performed on a Thévenin equivalent circuit as shown. What is the Thévenin equivalent resistance $\boldsymbol{R_{TH}}$? (5%)



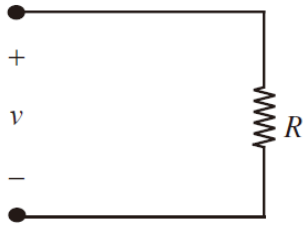
$\boldsymbol{R_{TH}}$ = _____

6. Determine the voltage v_O across the voltage-dependent current source shown in the circuit in the following figure when $i = f(v) = Kv^2$. (4%)



$\boldsymbol{v_o}$ = _____

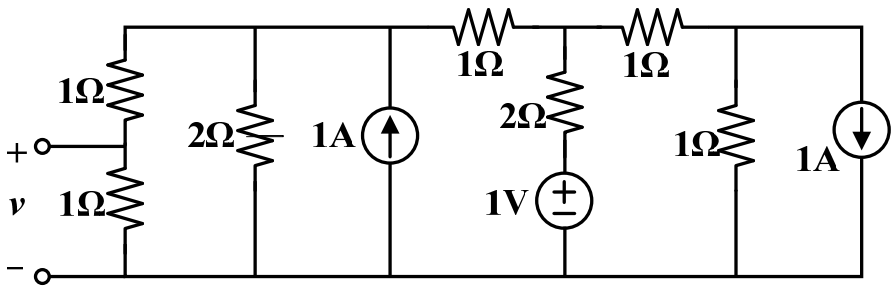
7. (a) In the circuit as shown, R is a linear resistor and $v = V_{DC}$ a constant voltage (called DC). What is the power dissipated (P_{disp}) in the resistor, in terms of R and V_{DC}? (3%)(b) For the same circuit, $v = V_{AC}\cos\omega t$, a sinusoidal time varying voltage (called AC) with peak amplitude V_{AC} and angular frequency ω, in radians/sec. What is the average power dissipated ($\overline{P}_{disp}$) in R? (3%)(c) What is the relationship between V_{DC} and V_{AC} when the average power in R is the same for both voltage sources? (3%)



(a) P_{disp}= _____, **(b)** $\overline{P}_{disp}$ = _____,

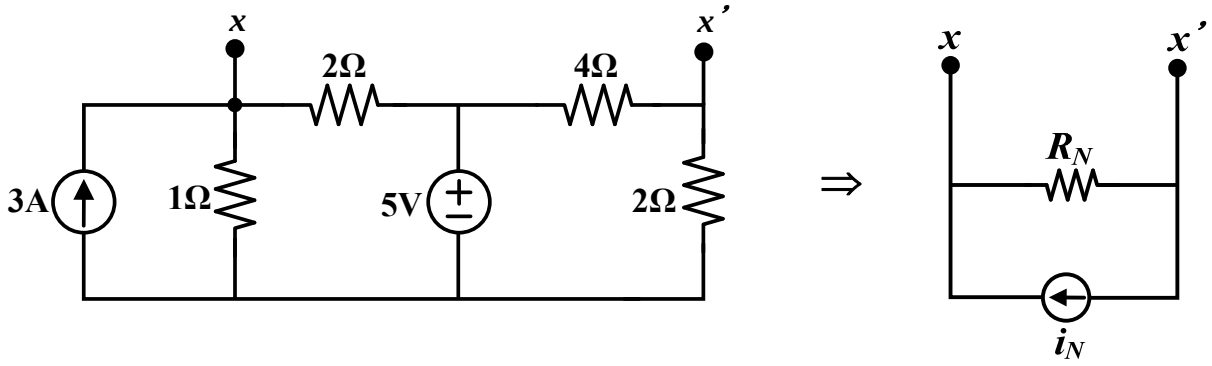
(c) Relationship: _____

8. Find v of the following network by superposition (No credit will be given for other methods). (4%)



v = _____

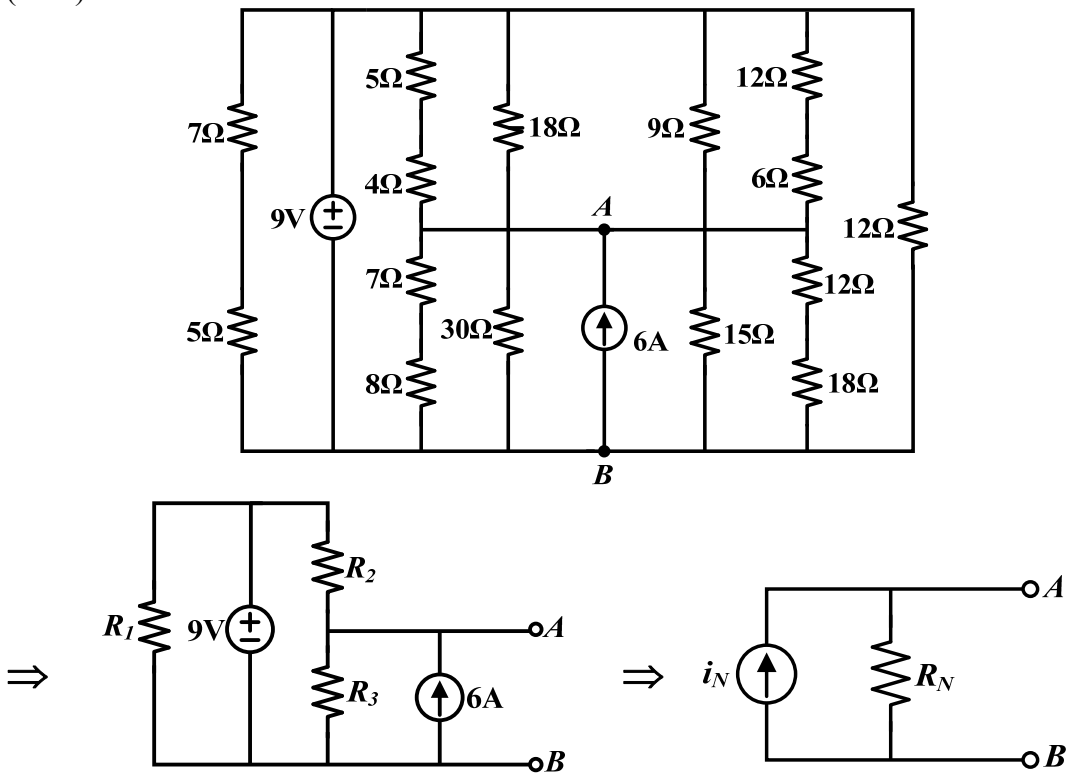
9. Find the Norton equivalent at the terminals marked *xx'* in the circuit. (8%)



i_N = _____, R_N = _____

10. **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 Norton equivalent of the below circuit when

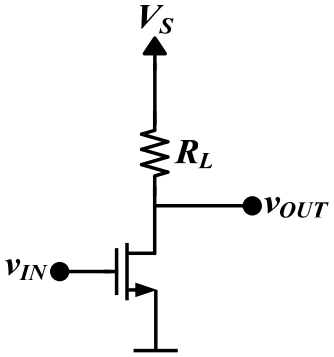
viewed from its port labeled A-B. **Find** the Norton equivalent of the circuit when viewed from A-B port. (15%)



R_1 = _____, R_2 = _____, R_3 = _____

i_N = _____, R_N = _____

11. Compute the worst-case power consumed by the inverter as shown. The MOSFET has a threshold voltage V_T = 2 V. Assume that V_S = 5 V and R_L = 10 kΩ . Model the MOSFET using its switch-resistor model, and assume that the on-state resistance of the MOSFET is R_{ON} = 1 kΩ. (4%)

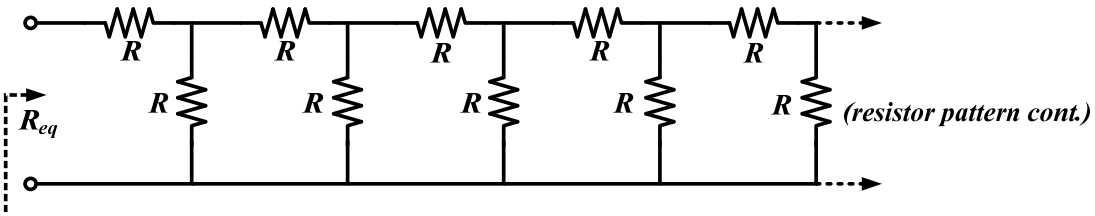


$P_{worst\ case}$ = _____

12. A logic gate obeys a static discipline with the following voltage levels: V_{IH} = 3.5 V, V_{OH} = 4.3 V, V_{IL} = 1.5 V, and V_{OL} = 0.9 V. (a) What range of voltages will be treated as invalid under this discipline? (b) What are its noise margins? (9%)

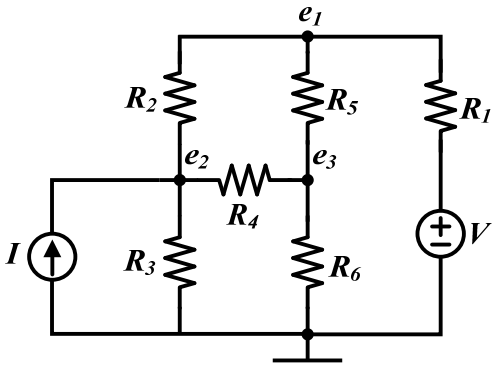
Invalid Range = _____ Noise Margin 1= _____ Noise Margin 0= _____

13. Find the equivalent resistance R_{eq} between the indicated terminals. (4%)



R_{eq} = _____

14. 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. (*Do not solve the equations*.) (12%)



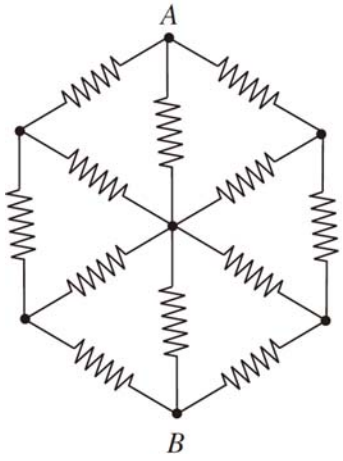
Node equations:

At node e_1: _____

At node e_2: _____

At node e_3: _____

15. Find the voltage drop v_{AB} between the indicated terminals. Assume that all of the resistors have a value of 1kΩ, and that 10mA flows into node A and out of node B. (5%)



v_{AB} = _____