***University of California at Berkeley***
***College of Engineering***
***Dept. of Electrical Engineering and Computer Sciences***

# *EECS 40 Midterm I*

Spring 1999 Prof. Roger T. Howe February 24, 1999

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***Name:*** _____ ***Student ID*** _____
Last, First

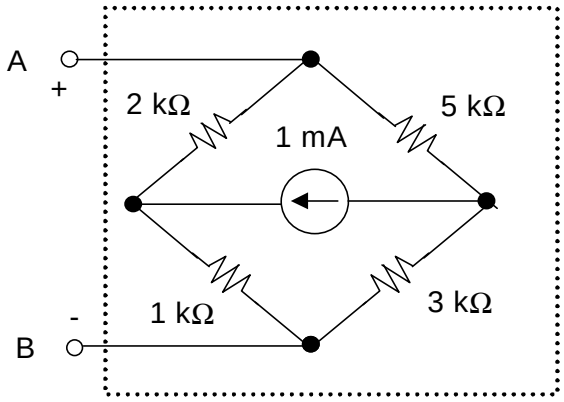
***Guidelines***

1. Closed book and notes; one 8.5" x 11" page (both sides) of your own notes is allowed.
2. You may use a calculator.
3. Do not unstaple the exam.
4. Show *all your work and reasoning on the exam* in order to receive full or partial credit.

***Score***

| Problem | Points Possible | Score |
|---|---|---|
| 1 | 16 | |
| 2 | 17 | |
| 3 | 17 | |
| Total | 50 | |

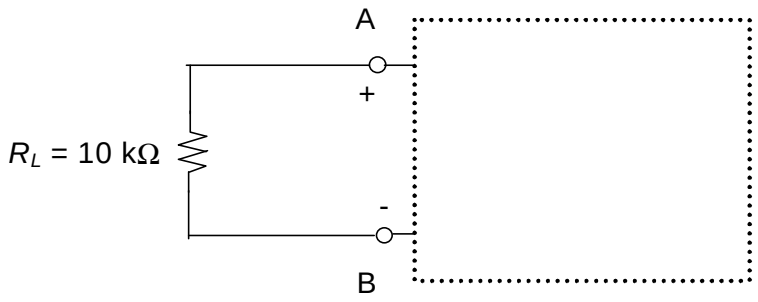
1. Equivalent Circuits [16 points]




(a) [4 pts.] Find the Thevenin equivalent voltage between A and B.

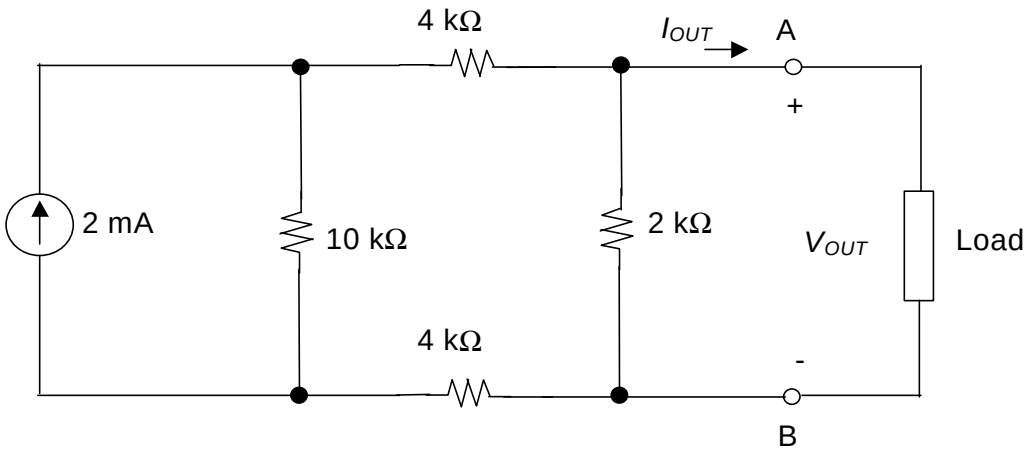
(b) [4 pts.] Find the Thevenin equivalent resistance $R_{TH}$ between terminals A and B.

(c) [4 pts.] The circuit in the dotted box is connected to a 10 kΩ load resistor, as shown below. Find the numerical value of $V_{AB}$.
*Note*: if you couldn't solve parts (a) and (b), you can assume without loss of credit that $V_{TH}$ = 2.8 V and $R_{TH}$ = 5.5 kΩ. Of course, these are not the correct answers to parts (a) and (b).



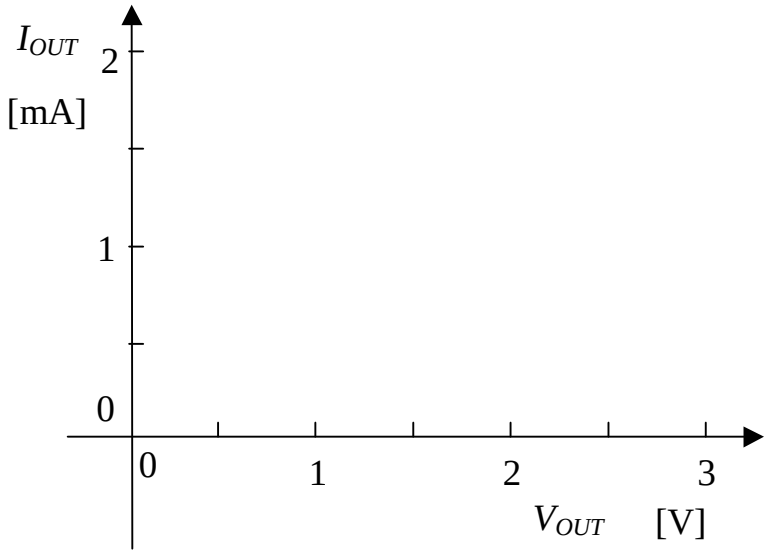

(d) [4 pts.] For the circuit in part (c), what is the numerical value of the power *released* from the circuit inside the dotted box, in Watts? You can use the default from part (c), if you were unable to solve the earlier parts.

2. Current-Voltage Characteristics [17 points]

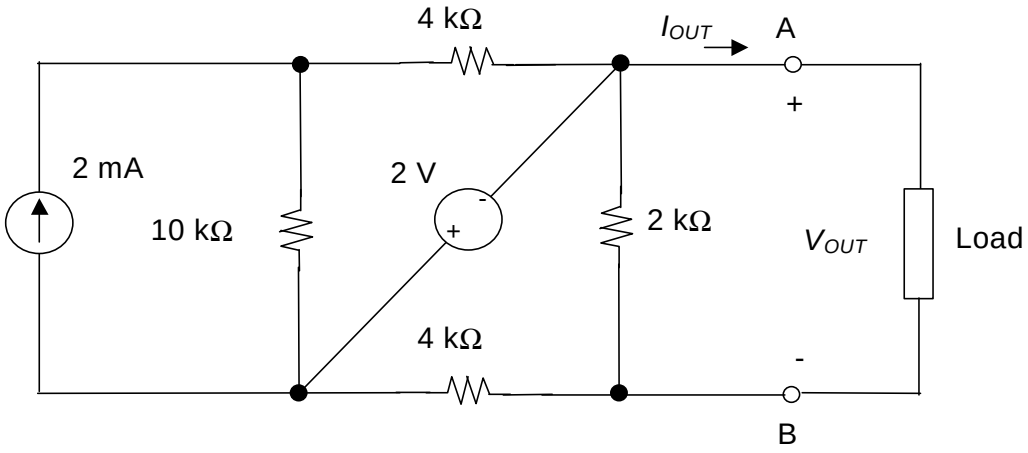



(a) [4 pts.] Find the numerical value of the short-circuit current $I_{OUT} = I_{SC}$, when $V_{AB} = 0$ V.

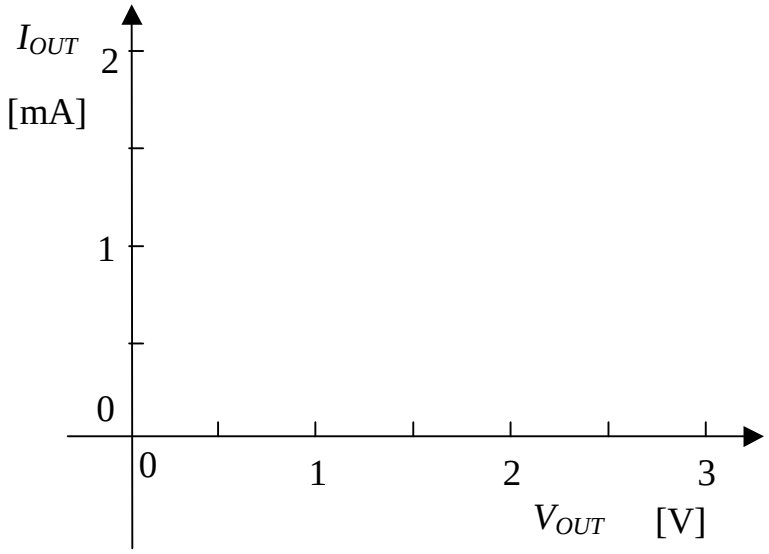
(b) [4 pts.] Plot the output current $I_{OUT}$ versus the output voltage $V_{OUT}$ on the graph below



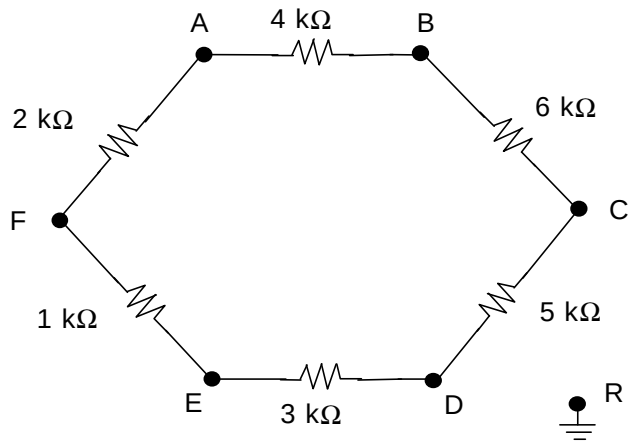
(c) [4 pts.] The circuit in parts (a) and (b) is modified by the addition of a 2 V voltage source, as shown below. Find the numerical value of the open-circuit voltage $V_{oc}$.




(d) [5 pts.] Plot the output current $I_{OUT}$ versus the output voltage $V_{OUT}$ for the modified circuit on the graph below.



3. Linear Resistive Networks [17 points]




(a) [4 pts.] For this part, we connect a 5 V voltage source between node F and node D, with the + side of the source at node D. Nodes B, C, D, and E are connected to the reference node R. Find the voltage $V_A$ at node A.

(b) [4 pts.] Repeat part (a) with only node C connected to the reference node R.

(c) [4 pts.] For this part, the voltage source is removed and a 5 mA current source replaces the 6 kΩ resistor between nodes B and C. The "arrowhead" end of the current source points toward node B. Only node D is connected to the reference node for this part. Find the voltage $V_F$.

(d) [5 pts.] Repeat part (c), but keep the 6 kΩ resistor connected between nodes B and C for this part.