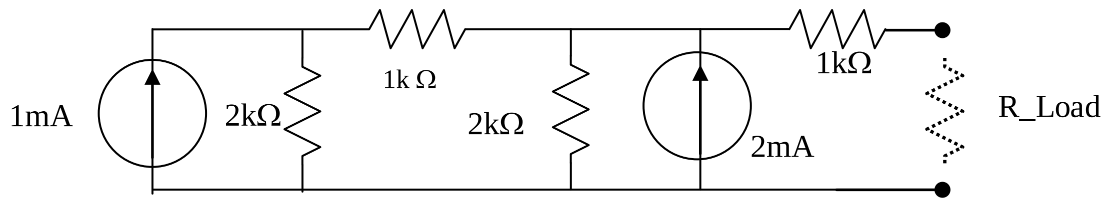
**EEE 202, TEST 2,** **NAME:__SOLUTIONS_____**

2 Problems, 30', Closed Book&Notes, 1 sheet of formulae allowed

**Problem 1.** Determine the Thevenin Equivalent for the circuit below (without the load).




$R_{TH}$ can be found directly as the equivalent resistance with the current sources replaced by opens. Thus, $R_{TH} = (2k + 1k)||2k + 1k = 2.2k\Omega$

$V_{OC}$ can be computed by nodal/loop analysis, e.g., the loop equations are

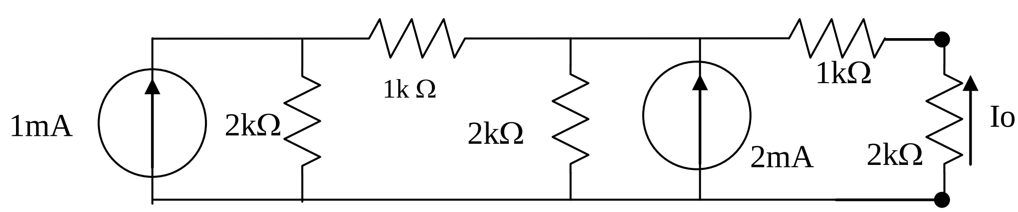
$$I_1 = 1m$$
$$2k(I_2 - I_1) + 1kI_2 + 2k(I_2 - I_3) = 0$$
$$I_3 = -2m$$

It now follows that $I_2 = -\frac{2}{5}mA$. Performing KVL on the path of 2k, 1k, resistances we find

$$V_{OC} = 2k(I_2 - I_3) = \frac{16}{5} = 3.2V$$

Alternatively, one could apply source transformation to the first source, combine the resistances in series and then find the Norton equivalent of the left part of the circuit. Then the current sources can be simply added and the final Thevenin equivalent can be found by another source transformation.

**Problem 2.** Use Superposition to compute the current Io in the circuit below.




We need to compute $I_{01}, I_{02}$ for the two circuits where each of the sources is set to zero. When the 1mA source is used, two successive source transformations convert the circuit into a current division with a 2/3mA source and three resistances 3k, 2k, 3k in parallel. Using the current division formula $I_{01} = -\frac{2}{3}m\frac{\frac{1}{3k}}{\frac{1}{3k}+\frac{1}{3k}+\frac{1}{2k}} = -\frac{4}{21}mA$. (Here it is important to preserve the 2k resistance in order to compute the corresponding current). When the 2mA source is used, we have again a current division problem with a 3k, 2k, and 3k resistances. Thus, $I_{02} = -2m\frac{\frac{1}{3k}}{\frac{1}{3k}+\frac{1}{3k}+\frac{1}{2k}} = -\frac{4}{7}mA$ and $I_0 = I_{01} + I_{02} = -\frac{16}{21}m = 0.76mA$.