Name: _____ (please print)

Signature: _____

ECE 2201 – Quiz #5
November 19, 2019

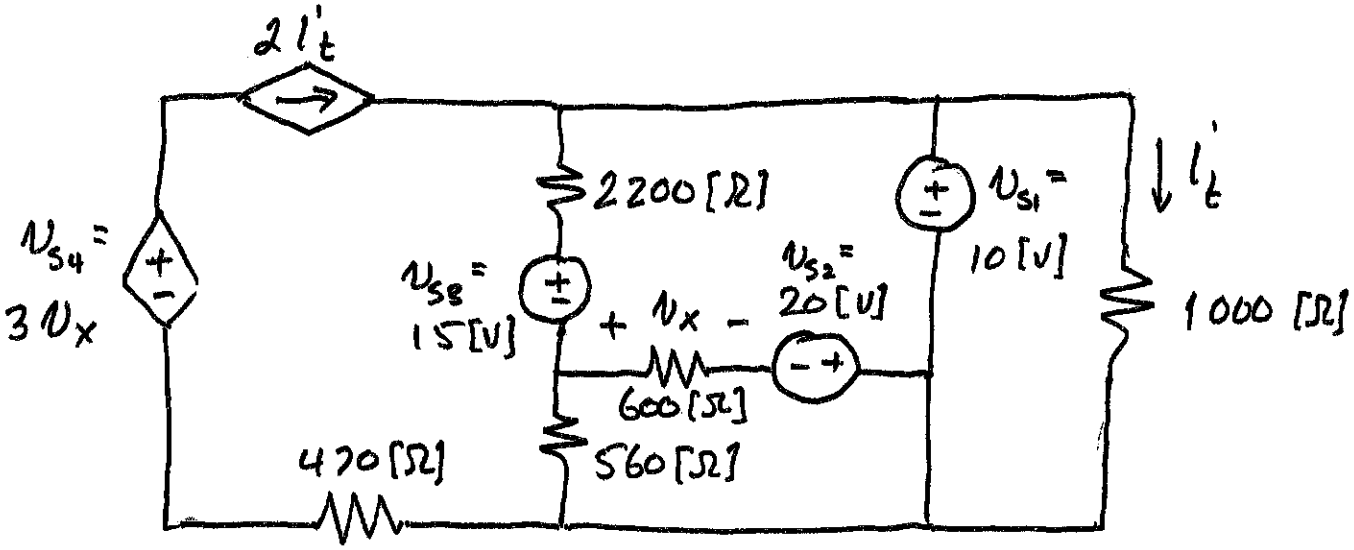
Keep this quiz closed and face up until you are told to begin.

1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

_____/25

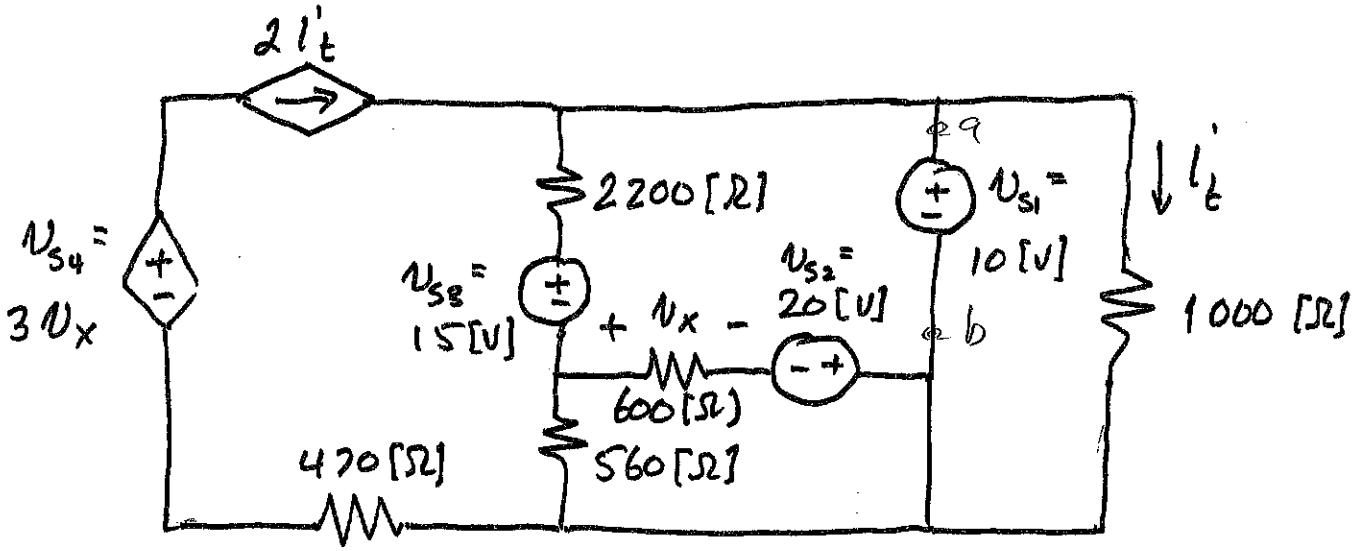
Room for extra work

For the circuit below, find the Norton equivalent seen by the voltage source v_{S1}.



Room for extra work

For the circuit below, find the Norton equivalent seen by the voltage source v_{S1}.



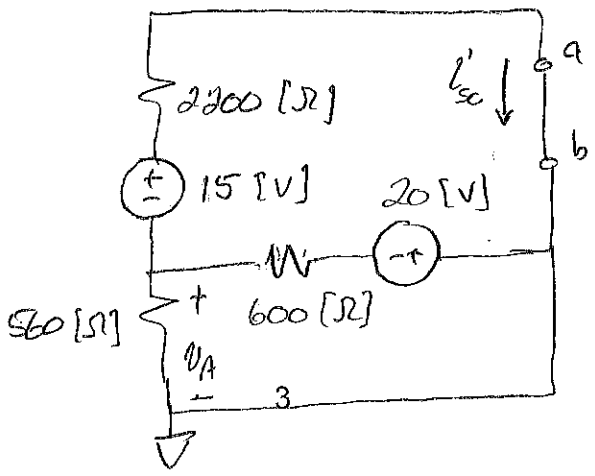
We need two of • open-circuit voltage, • short-circuit current, and • test source, we apply these at the terminals of v_{S1} after removing v_{S1}. We labeled the terminals a, b.

We will use all three methods here, but it seems clear that short-circuit current will simplify things because $i'_t \to 0$ and dependent current source $2 \cdot i'_t \to$ open-circuit. Also, test source allows us to deactivate v_{S2} and v_{S3}. Open-circuit voltage will be a bit harder to do.

Short-circuit current:

$i'_t \to 0$

$2i'_t \to 0$



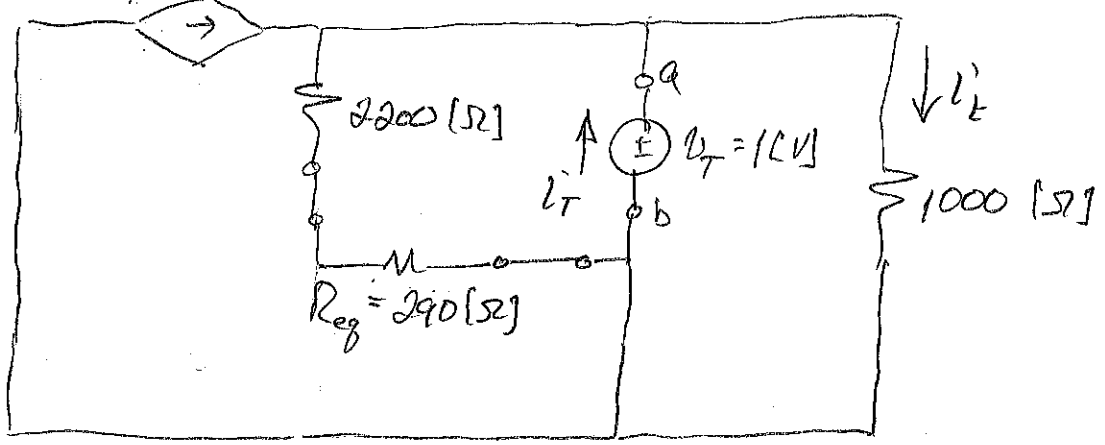
Note i'_{sc} polarity from a → b.

Room for extra work

KVM: $\frac{v_A}{560} + \frac{v_A + 20}{600} + \frac{v_A + 15}{2200} = 0$ $\quad v_A = -10.2777\ [V]$

$$i'_{sc} = \frac{v_A + 15}{2200} = 2.1468\ [mA] = i'_N$$

test-source: $2i'_t$



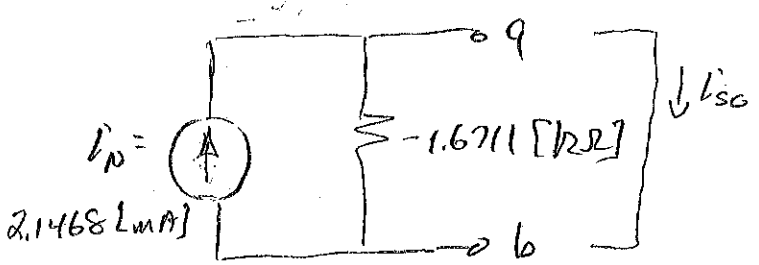
v_{sc} & 420 [Ω] are in series with a current source ⇒

$R_{eq} = 600 // 560 = 290\ [\Omega]$ $\quad i'_t = v_T/1000$

$$i'_T = \frac{v_T}{1000} - 2\frac{v_T}{1000} + \frac{v_T}{2200+290} = v_T(-5.9839 \times 10^{-4})$$

$$R_N = \frac{v_T}{i'_T} = -1.6711\ [k\Omega]$$

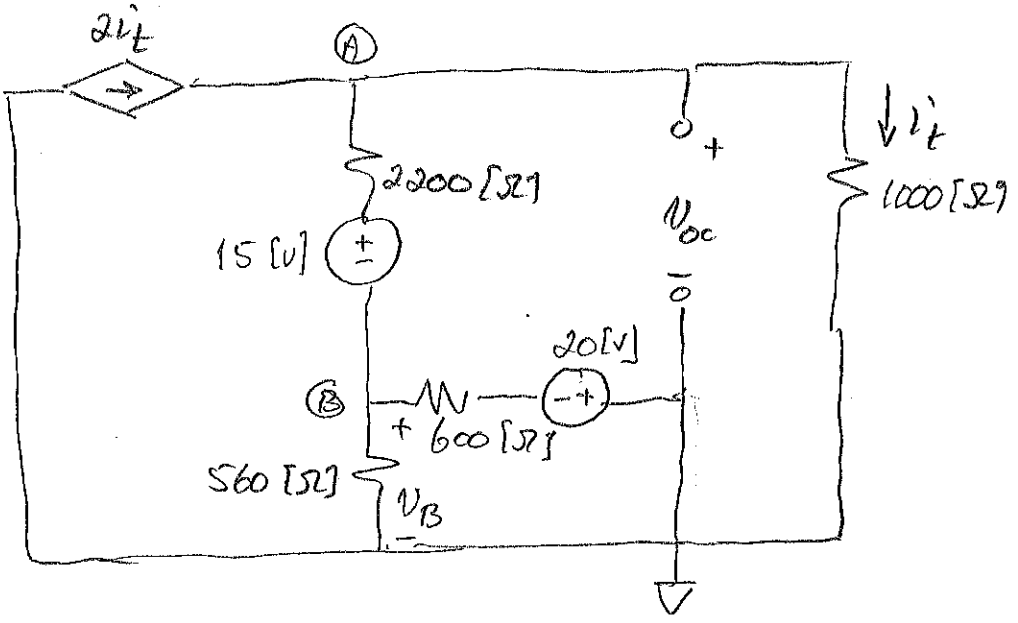
So...



v_{oc}

$i'_N = i'_{sc}$ runs a → b.

Room for extra work



Note that v_{oc} is a node-voltage at (A)

$$-2i_t' + \frac{v_{oc} - v_B - 15}{2200} + i_t' = 0 \qquad i_t' = \frac{v_{oc}}{1000}$$

$$\frac{v_B}{560} + \frac{v_B + 20}{600} + \frac{v_B - v_{oc} + 15}{2200} = 0$$

$i_t' = -3.588$ [mA] $\quad v_{oc} = -3.588$ [V] $\quad v_B = -10.694$ [V]

If we had found i_{sc}' and v_{oc}, we would have

$$R_N = \frac{v_{oc}}{i_{sc}'} = \frac{-3.588 [V]}{2.1468 [mA]} = -1.671 [k\Omega]$$

If we had found R_N and v_{oc}, we would have

$$i_{sc}' = \frac{v_{oc}}{R_N} = \frac{-3.588 [V]}{-1.671 [k\Omega]} = 2.147 [mA]$$

So this all checks out!