NET1LAB Hybrid Class (202&208)   **Dr. Charles Kim**
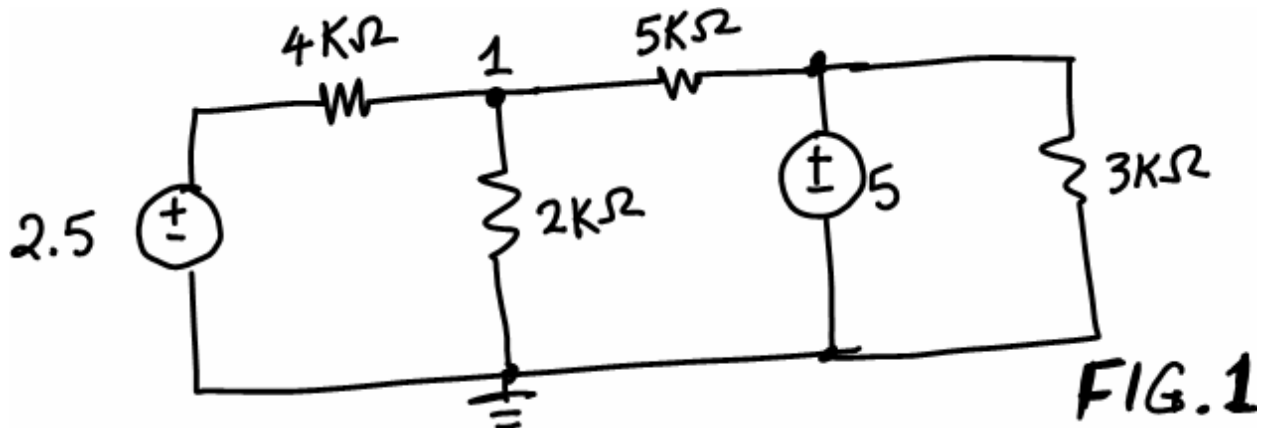
Mobile Studio (MS)-04 - Node Voltage and Superposition Theorem

1. Node voltage
   A node voltage is a voltage between a node and the ground (reference point).   Consider the
circuit below (FIG. 1) for the discussion of node voltage method. Mind you that node voltage
method (or "nodal analysis") is KCL in disguise.

FIG.1

   As in the circuit below (FIG. 2), since the voltage at node 2 is known, we may need only an
equation at node 1. It is the same KCL equation, but with form of [voltage across]/[resistance]
instead of [current].

FIG.2
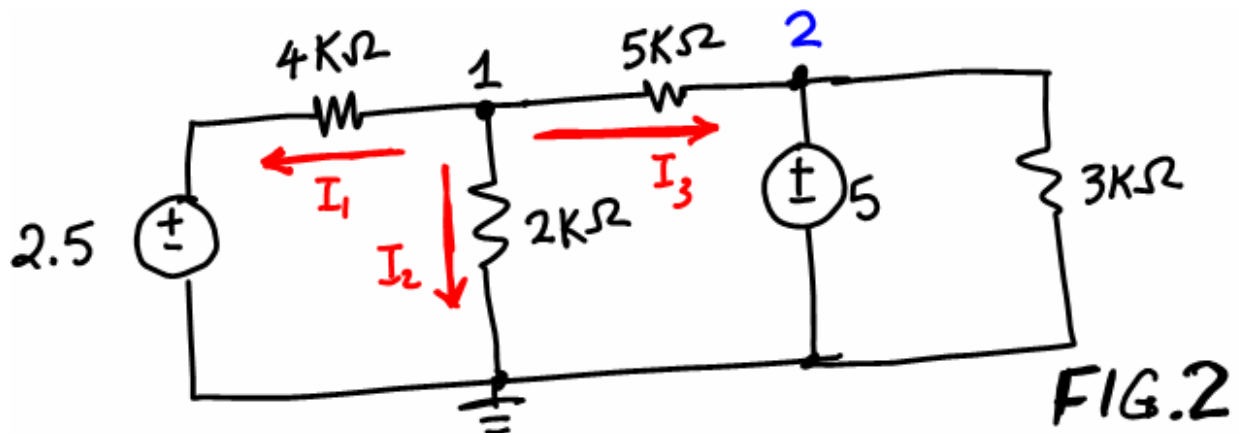
$$I_1 + I_2 + I_3 = 0 \quad (KCL\ form)$$
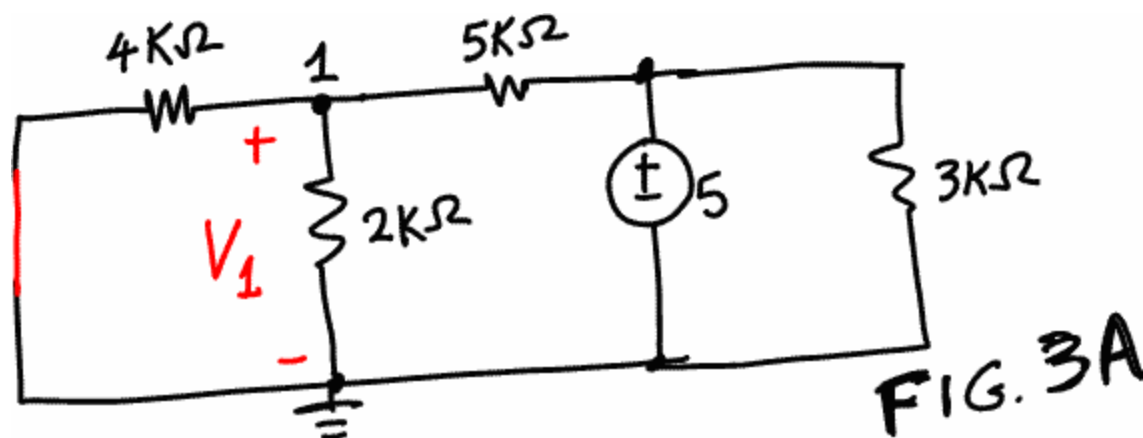
_____ (Node Voltage form)

2. Superposition Theorem

Superposition is to add the contribution of each independent source planning in a circuit. In other words, find a voltage (or current) with only an independent source presence while all others deactivated, then do the same thing for each of the other independent sources, and then add them all for the final result. Let's have FIG.3 as our example case. In the two voltage source circuit, we are asked to find voltage V1, a node voltage.
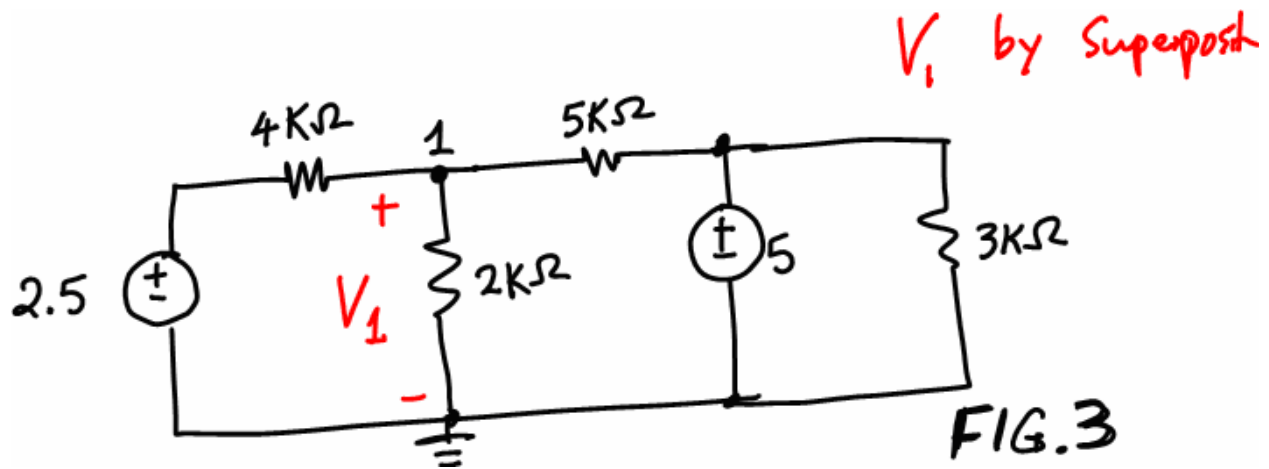
FIG.3

Since there are two independent sources, we consider one source at a time.
For 5V alone (with 2.5V source deactivated), we have the following circuit (FIG.3A). From the circuit we find the voltage V1 due only to 5 V source.

FIG.3A

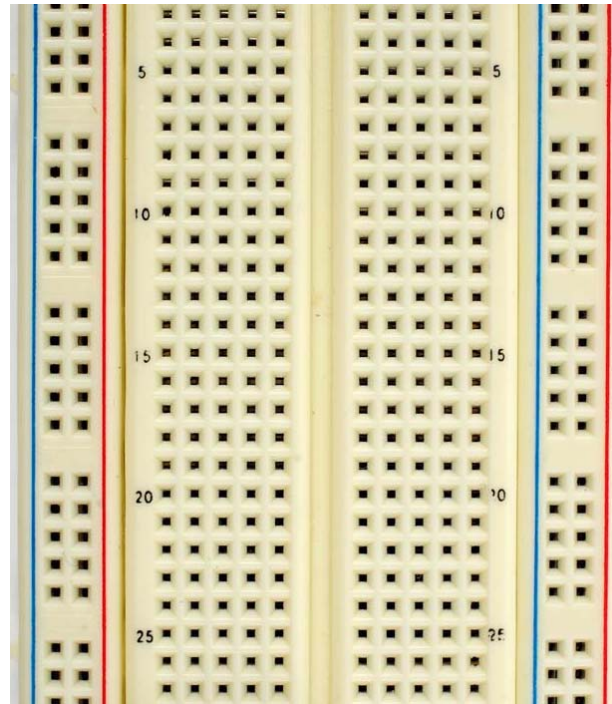Similarly, we find voltage V1 due only to 2.5V source (with 5V source deactivated.)
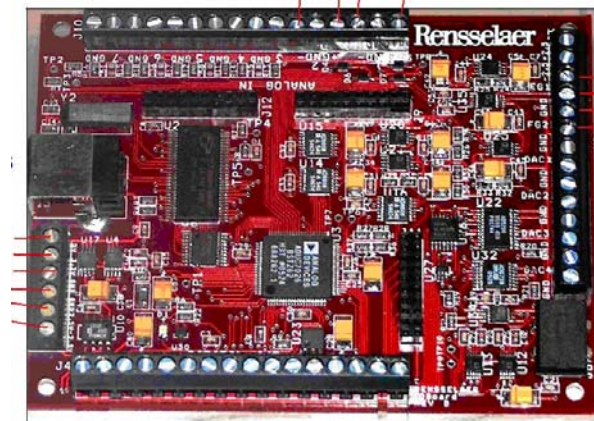The final answer is the sum of two V1's due each to 2.5V and 5V source, respectively.

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MS-04   Pre-Lab   **NAME:**_____

1. Implement the circuit of FIG.1 using the Instrumentation board and the breadboard.

2. In the circuit of FIG. 2, write node voltage equation(s) AND find the current I_1. Show your work.

3. In the circuit FIG.3A, find the V_1 due to only 5V source. Show you work.

4. From the circuit FIG.3, draw a circuit which has only 2.5 V source, with 5V source deactivated. Then, find the V_1 due only to 2.5V source.
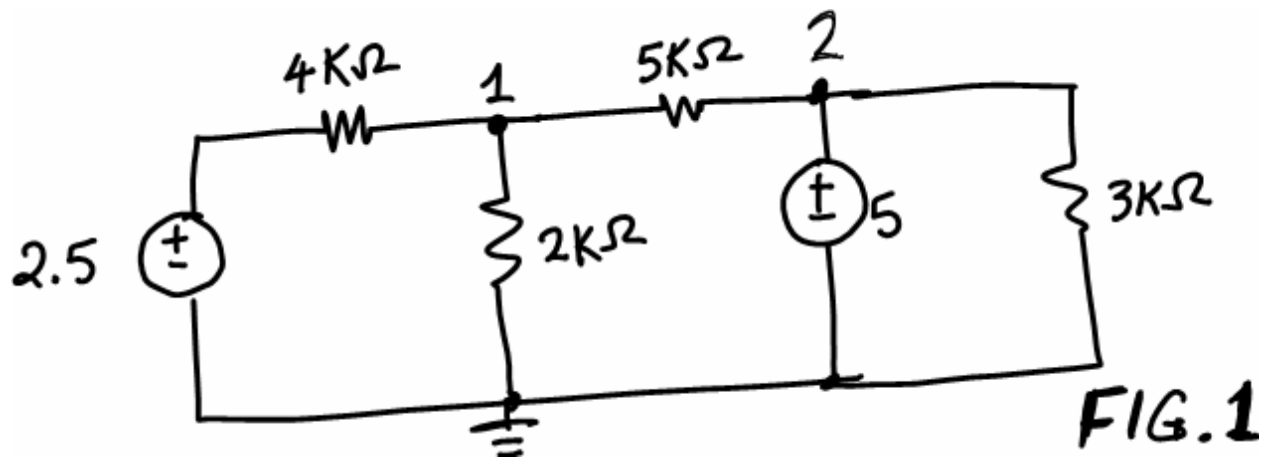
5. Add the result of 4 and 5 above to find the V_1 of the circuit FIG.3.

**Mobile Studio (MS) 04 – Node Voltage and Superposition Theorem**

PROCEDURE

A. Node Voltage Method

1. Implement the following circuit on the breadboard and measure node voltages at node 1 and node 2, V_1 and V_2.

FIG.1

2. Measure the voltages across 4K, 2K, and 5K, as their polarities shown in the figure shown below. Then calculate the current I_1, I_2, and I_3 from the measured voltages.


FIG.2
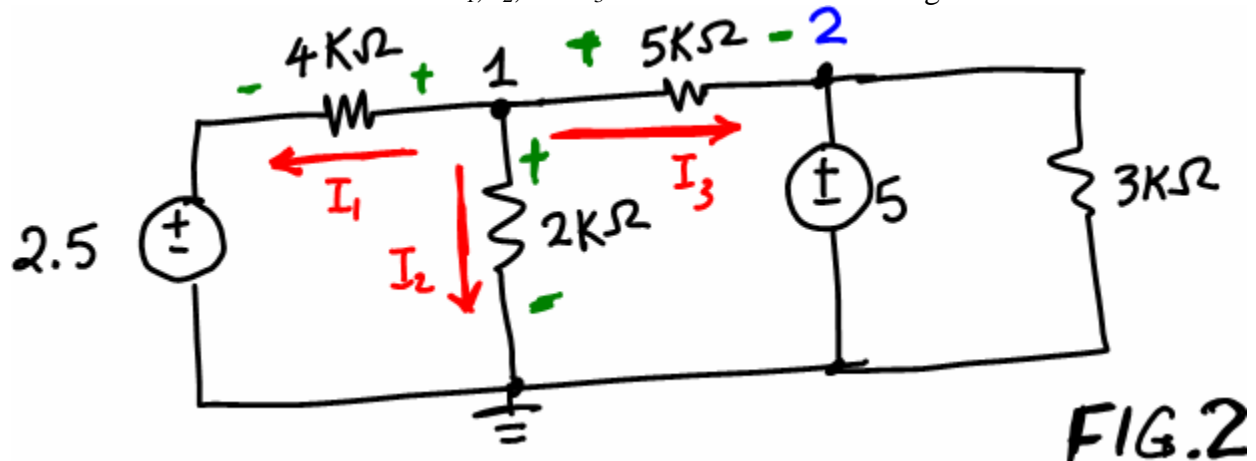
  (a) Is the sum of all three currents zero?
  (b) Write your node voltage equation at node 1 and compare with the result of (a).

  3. By calculating the current through 3K, find the current flowing through the 5V source.

B. Superposition Theorem

4. For the circuit FIG.1, keep only 5V source. (To deactivate 2.5V source, take the 2.5V source out first. Then, replace it by wire to make a short circuit). Then measure the voltage V_1.

FIG. 3A
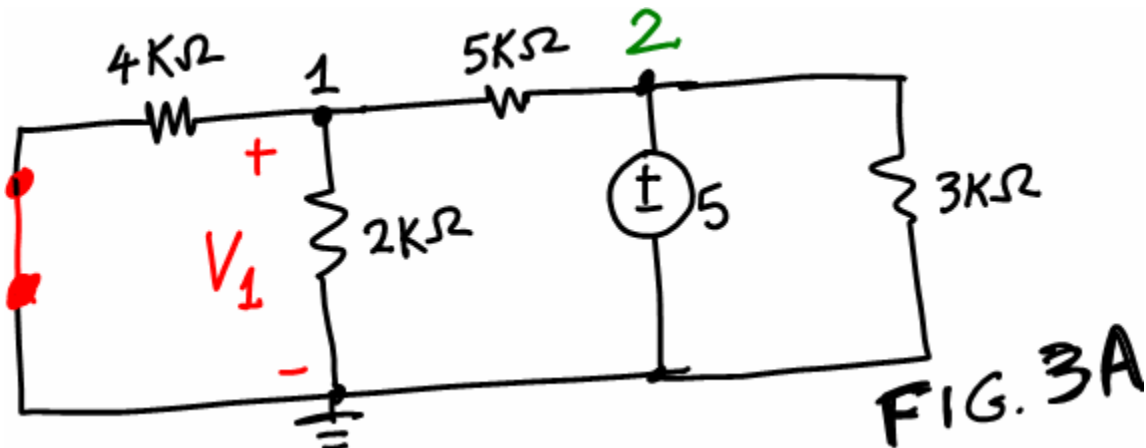
5. 1. For the circuit FIG.1, keep only 2.5V source. (To deactivate 5V source, take the 5V source out first. Then, replace it by wire to make a short circuit). Then measure the voltage V_1.

FIG. 3B
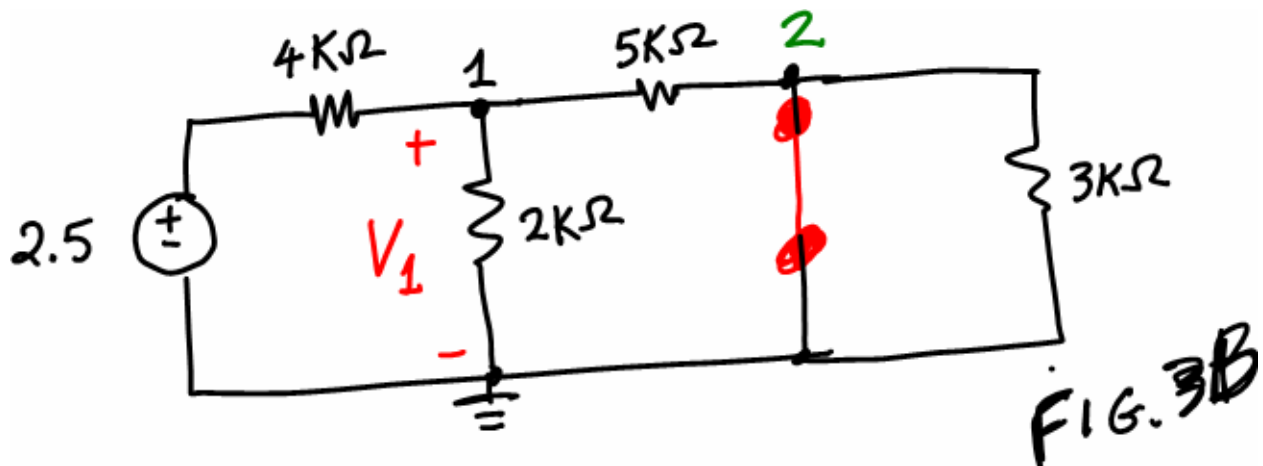
6. Add the results of 4 and 5 above. Is the sum the same as the node voltage V1 measure in the step 1 above.

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REPORT

Name:_____   ID#:_____   Group#:_____

1. Discussion on Node Voltage Method

2. Discussion on Superposition Theorem