Pre-lab 3
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Prelab –

Read Lab 3 before beginning the calculations for the prelab. Bold items must be turned in as part of your written prelab.

1. Refer to the circuit in Figure 3.3. **Solve for the voltage across the 1kΩ resistor using superposition.** Make sure to solve for the following 3 cases: Only V1 present, only V2 present, and both V1 and V2 present. **Fill out the column corresponding to Part D in Table 3.1. Show all steps to receive full credit.**
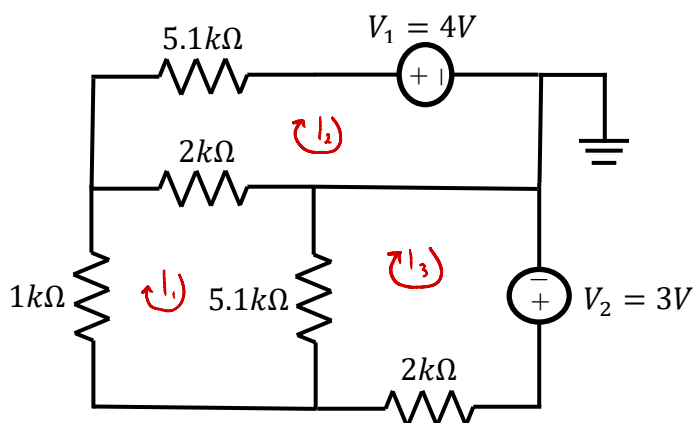

Figure 3.3

2. Simulate the circuit in Figure 3.3 in SPICE. **Print your schematic with all voltages and currents displayed to hand in to your TA.** You can test the superposition principle by running 2 more simulations: one with V_1 replaced with a short and one with V_2 replaced with a short. You do not need to print all of the schematics to turn in. However, you should run the simulations and fill out the entries in Table 3.1. Keep a copy of your results to use when you prepare your lab report.

3. Simulate the circuit in Figure 3.4. You will want to use part 1N4148 for the diode in SPICE. **Print the schematic with voltages and currents displayed to hand in to your TA.** Again, test the superposition principle by running 2 more simulations: first with V_1 replaced with a short and second with V_2 replaced with a short. You do not need to print all of the schematics to turn in. Finish filling out Table 3.1.

Both V_1 & V_2 Present

#1 $\quad 1 \cdot I_1 + 2(I_1 - I_2) + 5.1(I_1 - I_3) = 0$
$\quad = I_1 + 2I_1 - 2I_2 + 5.1I_1 - 5.1I_3 = 0$
$\quad = 8.1I_1 - 2I_2 - 5.1I_3 = 0$

#2 $\quad 2(I_2 - I_1) + 5.1(I_2) + 4 = 0$
$\quad = 2I_2 - 2I_1 + 5.1I_2 + 4 = 0$
$\quad = -2I_1 + 7.1I_2 = 4$

#3 $\quad = -3 + 2I_3 + 5.1(I_3 - I_1) = 0$
$\quad = -5.1I_1 + 7.1I_3 = 3$

$I_1 = 0.2655$
$I_2 = -0.4886$
$I_3 = 0.6132$

V_1 Present

$8.1I_1 - 2I_2 - 5.1I_3 = 0$ ——①
$-2I_1 + 7.1I_2 = -4$ ←—— 2
$-5.1I_1 + 7.1I_3 = 0$ ←——③

$I_1 = -0.291 \quad I_2 = -0.6453 \quad , I_3 = -0.2090$

V_2 Present

$8.1I_1 - 2I_2 - 5.1I_3 = 0$
$-2I_1 + 7.1I_2 = 0$
$-5.1I_1 + 7.1I_3 = 3$

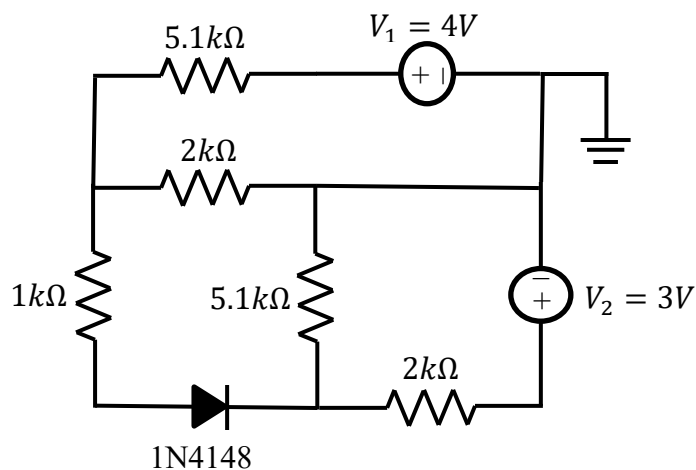$I_1 = 0.5564, \quad I_2 = 0.156, \quad I_3 = 0.822$

Figure 3.4

Table 3.1: Include this table, will all entries completed, to hand in as part of your prelab.

V_L (voltage over the 1kΩ resistor)	Calculation Part D (No diode)	PSPICE Part E (No diode)	PSPICE Part F (with diode)
1. V_1 & V_2 Present	0.2654	0.2655	0.2908
2. V_1 only	-0.2909	-6.291	-0.2908
3. V_2 only	0.5564	0.556	0.5562
4. Add line 2 & 3	0.2655	6.265	0.84
5. % difference between line 1 and line 4	0.04%	0.038%	0.034%

For which columns does the superposition principal hold?

SAVE YOUR SPICE SIMULATIONS AND CALCULATIONS! You will need some of the values in your lab report!