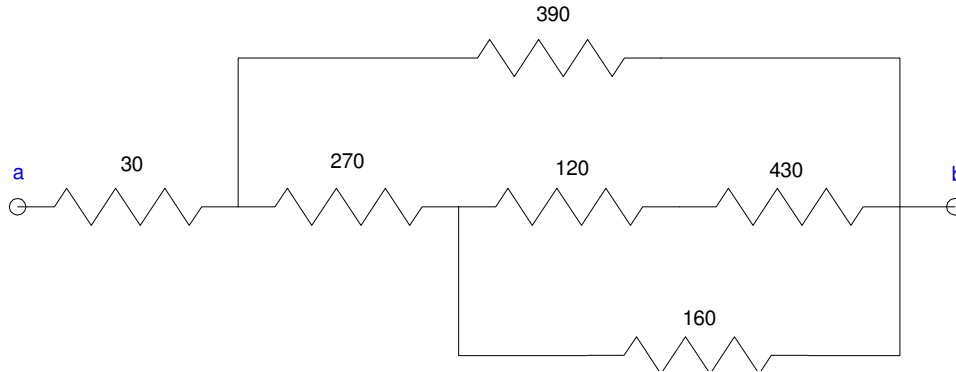


ECE 211 Test #1b

Resistors in Series and Parallel

Find the resistance R_{ab} . Please show your work to get full credit.



Using Matlab

```
>> R1 = 120 + 430
```

```
R1 = 550
```

```
>> R2 = 1 / (1/R1 + 1/160)
```

```
R2 = 123.9437
```

```
>> R3 = R2 + 270
```

```
R3 = 393.9437
```

```
>> R4 = 1 / (1/R3 + 1/390)
```

```
R4 = 195.9810
```

```
>> Rab = R4 + 30
```

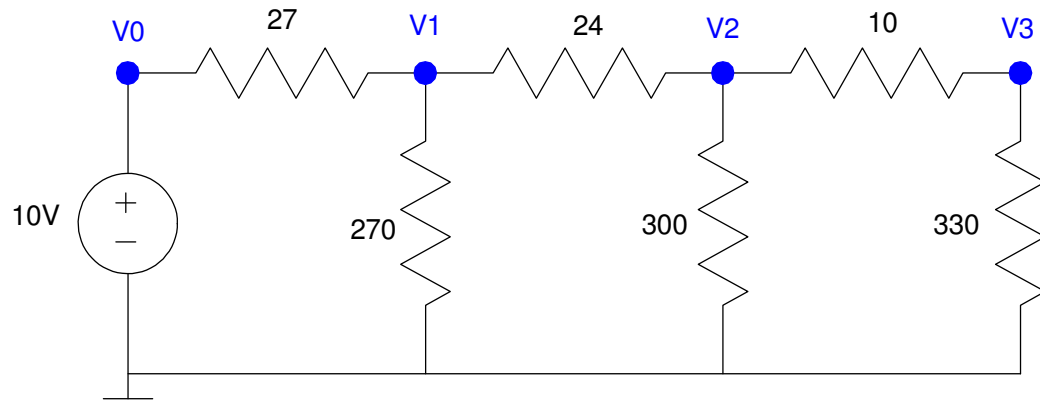
```
Rab = 225.9810
```

```
>>
```

Voltage Division

Use voltage division to find the voltages {V1 and V2}

- Please show your work to get full credit



```
>> R3 = 330;  
>> R2 = 1 / (1/300 + 1/(R3+10))
```

```
R2 = 159.3750
```

```
>> R1 = 1 / (1/270 + 1/(R2+24))
```

```
R1 = 109.2060
```

```
>> V0 = 10
```

```
V0 = 10.0000
```

```
>> V1 = R1 / (R1 + 27)*V0
```

```
V1 = 8.0177
```

```
>> V2 = R2 / (R2 + 24)*V1
```

```
V2 = 6.9684
```

```
>> V3 = R3 / (R3 + 10)*V2
```

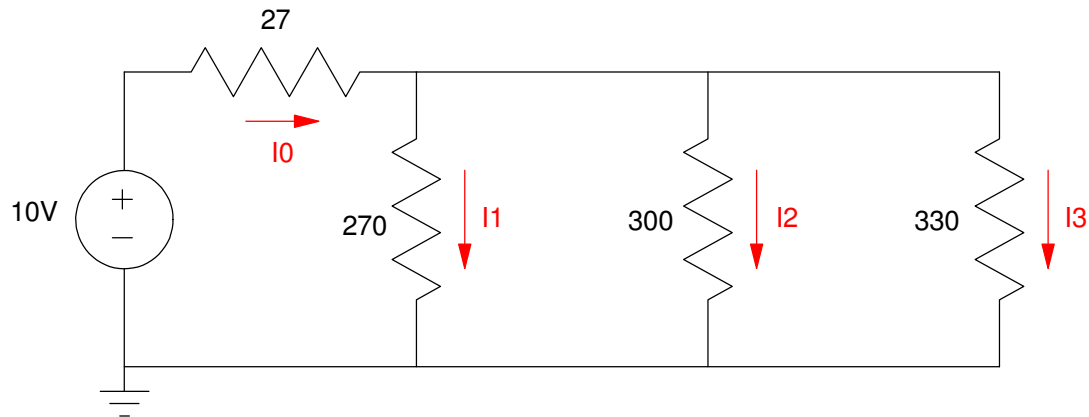
```
V3 = 6.7634
```

```
>>
```

Current Division

Use current division to find the currents $\{I_0, I_1, I_2, I_3\}$

- Please show your work to get full credit



Using Matlab

```
>> Rnet = 1 / (1/270 + 1/300 + 1/330)
```

```
Rnet = 99.3311
```

```
>> I0 = 10 / (27 + Rnet)
```

```
I0 = 0.0792
```

```
>> % Convert to mA
```

```
>> I0 = I0 * 1000
```

```
I0 = 79.1571 mA
```

```
>> I1 = (1/270) / (1/270 + 1/300 + 1/330) * I0
```

```
I1 = 29.1213 mA
```

```
>> I2 = (1/300) / (1/270 + 1/300 + 1/330) * I0
```

```
I2 = 26.2092 mA
```

```
>> I3 = (1/330) / (1/270 + 1/300 + 1/330) * I0
```

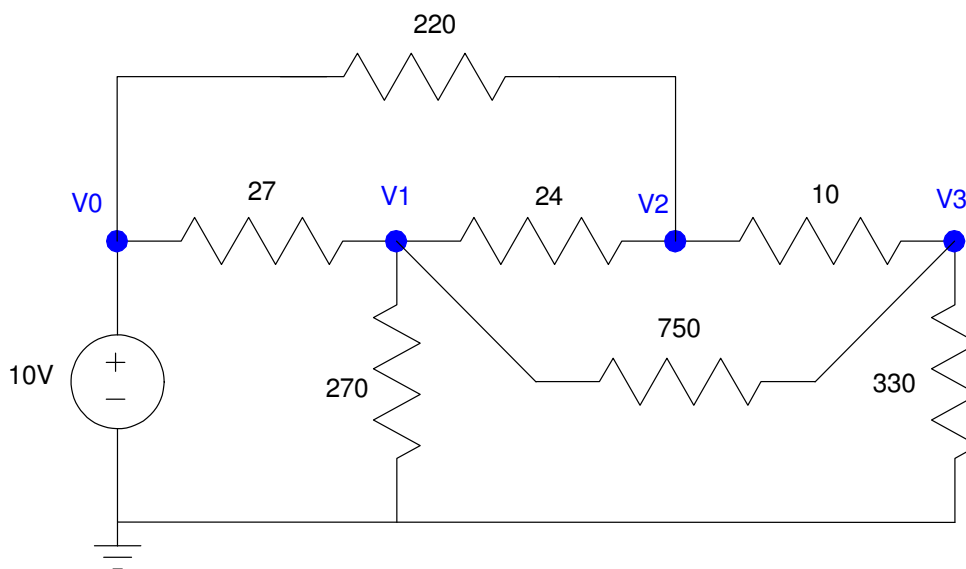
```
I3 = 23.8265 mA
```

```
>>
```

Voltage Nodes

Write voltage node equations for this circuit

- You don't need to solve (just write four equations for four unknowns)



Node V0

$$V_0 = 10$$

Node V1

$$\left(\frac{V_1 - V_0}{27} \right) + \left(\frac{V_1}{270} \right) + \left(\frac{V_1 - V_2}{24} \right) + \left(\frac{V_1 - V_3}{750} \right) = 0$$

Node V2

$$\left(\frac{V_2 - V_0}{220} \right) + \left(\frac{V_2 - V_1}{24} \right) + \left(\frac{V_2 - V_3}{10} \right) = 0$$

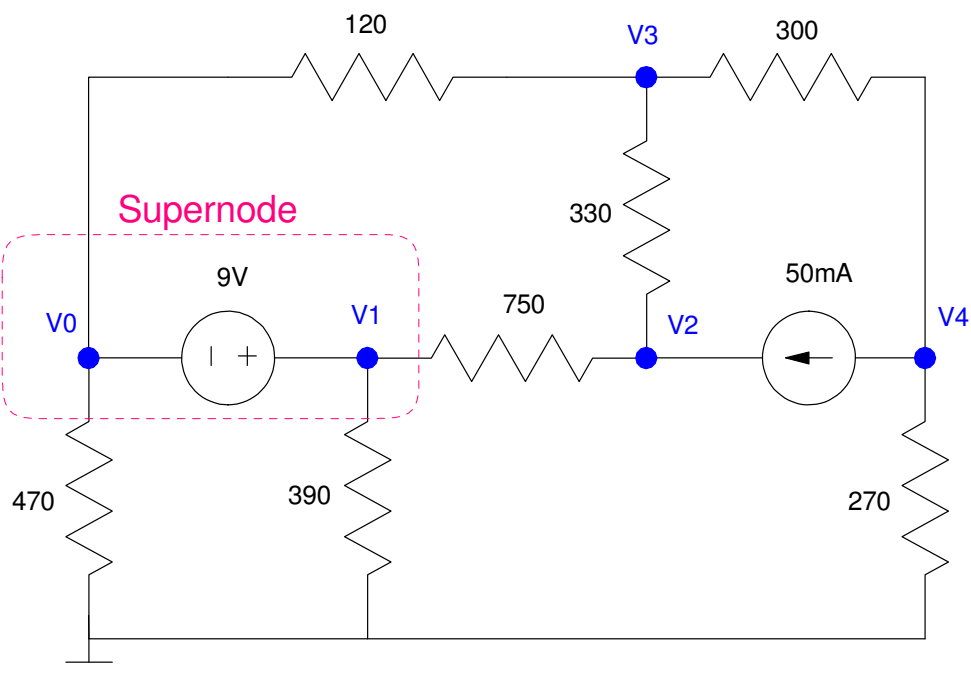
Node V3

$$\left(\frac{V_3 - V_1}{750} \right) + \left(\frac{V_3 - V_2}{10} \right) + \left(\frac{V_3}{330} \right) = 0$$

Super Nodes

Write voltage node equations the following circuit

- You don't need to solve (just write five equations for five unknowns)



Voltage Source

$$V_1 - V_0 = 9$$

Node V2

$$\left(\frac{V_2 - V_1}{750} \right) + \left(\frac{V_2 - V_3}{330} \right) - 50mA = 0$$

Node V3

$$\left(\frac{V_3 - V_0}{120} \right) + \left(\frac{V_3 - V_2}{330} \right) + \left(\frac{V_3 - V_4}{300} \right) = 0$$

Node V4

$$\left(\frac{V_4 - V_3}{300} \right) + 50mA + \left(\frac{V_4}{270} \right) = 0$$

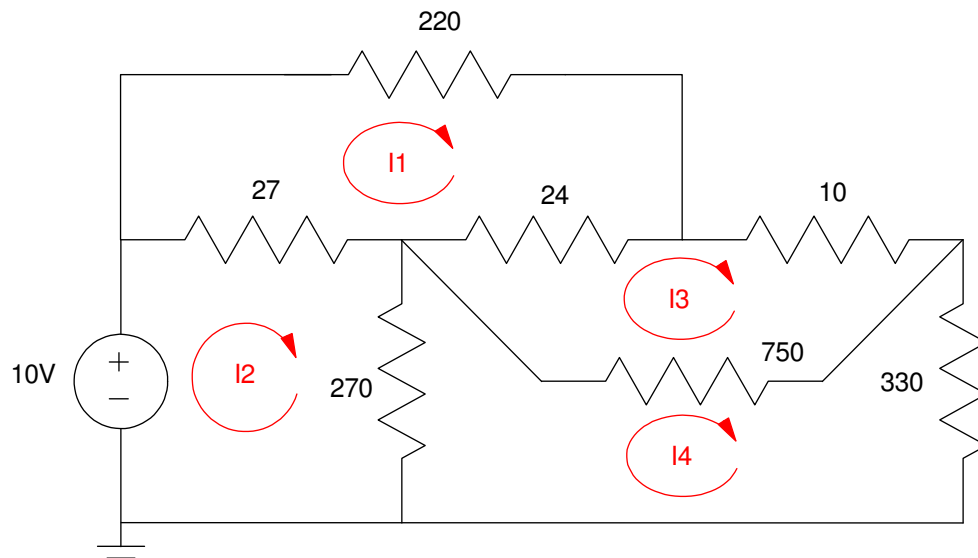
Supernode

$$\left(\frac{V_0}{470} \right) + \left(\frac{V_0 - V_3}{120} \right) + \left(\frac{V_1}{390} \right) + \left(\frac{V_1 - V_2}{750} \right) = 0$$

Current Loops

Write current loop equations for the following circuit

- You don't need to solve (just write four equations for four unknowns)



Loop I1

$$220(I_1) + 24(I_1 - I_3) + 27(I_1 - I_2) = 0$$

Loop I2

$$-10 + 27(I_2 - I_1) + 270(I_2 - I_4) = 0$$

Loop I3

$$24(I_3 - I_1) + 10(I_3) + 750(I_3 - I_4) = 0$$

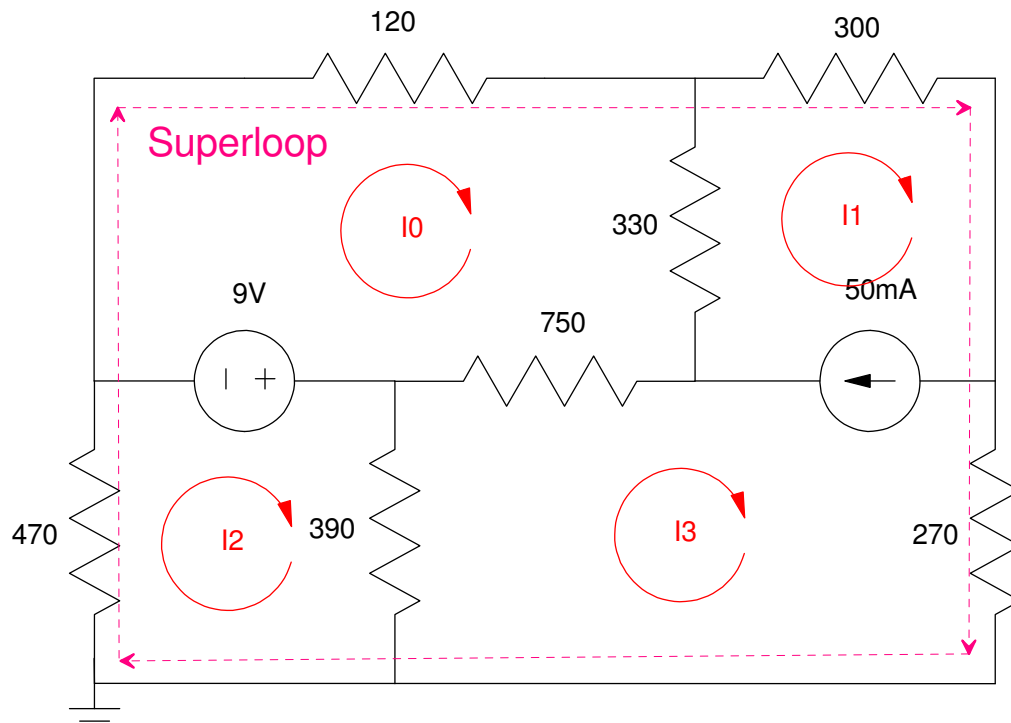
Loop I4

$$270(I_4 - I_2) + 750(I_4 - I_3) + 330(I_4) = 0$$

Super Loops

Write current loop equations for the following circuit

- You don't need to solve (just write four equations for four unknowns)



Current Source

$$I_1 - I_3 = 50mA$$

Loop I0

$$120(I_0) + 330(I_0 - I_1) + 750(I_0 - I_3) + 9 = 0$$

Loop I2

$$470(I_2) - 9 + 390(I_2 - I_3) = 0$$

Superloop

$$470(I_2) + 120(I_0) + 300(I_1) + 270(I_3) = 0$$