

ECE 211 Test #1

Summer - 2026. Calculators, Matlab, & Bison Academy allowed

Chegg, ChatGPT, AI not allowed.

Individual Effort (i.e. giving or receiving help from others not allowed)

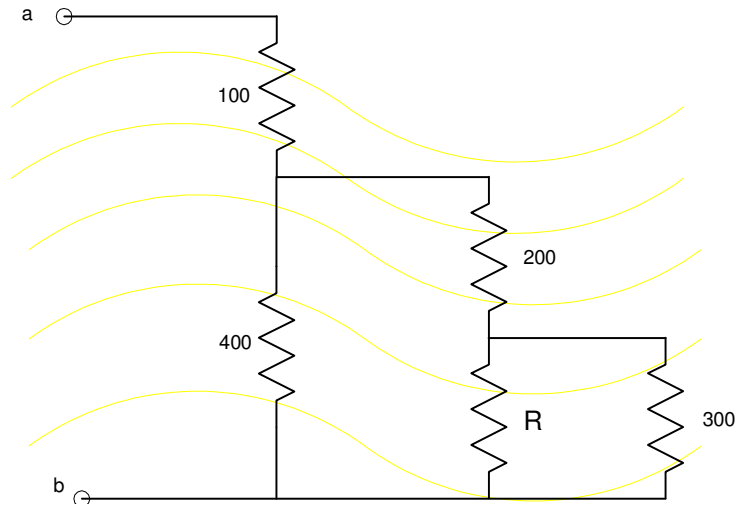
Resistors in Series and Parallel

Let R be your birthday

- Example: May 14th results in $R = 1414$ Ohms

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

R $900 + 100 * (\text{birth month}) + (\text{birth date})$
1414 Ohms
R_{ab}
311.2075



Using Matlab as a calculator

```
>> R1 = 1 / (1/1414 + 1/300)
```

```
R1 = 247.4912
```

```
>> R2 = R1 + 200
```

```
R2 = 447.4912
```

```
>> R3 = 1 / (1/400 + 1/R2)
```

```
R3 = 211.2075
```

```
>> Rab = R3 + 100
```

```
Rab = 311.2075
```

```
>>
```

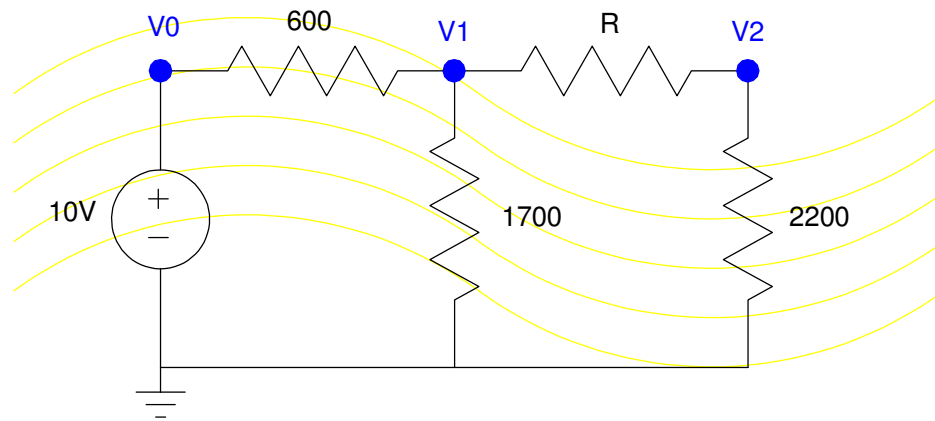
Voltage Division

Let R be determined by your birthdate

- $R = 900 + 100 * (\text{month}) + (\text{day})$
- May 14th gives $R = 1414$ Ohms

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

- Please show your work to get full credit



R $900 + 100 * (\text{month}) + (\text{day})$	V1	V2
1414 Ohms	6.5834 V	4.0076 V

Solving using Matlab as a calculator

```
>> R1 = 2200 + 1414  
  
R1 =      3614  
  
>> R2 = 1 / (1/1700 + 1/R1)  
  
R2 = 1.1562e+003  
  
>> V1 = R2 / (R2 + 600) * 10  
  
V1 =      6.5834  
  
>> V2 = 2200 / (2200 + 1414) * V1  
  
V2 =      4.0076  
  
>>
```

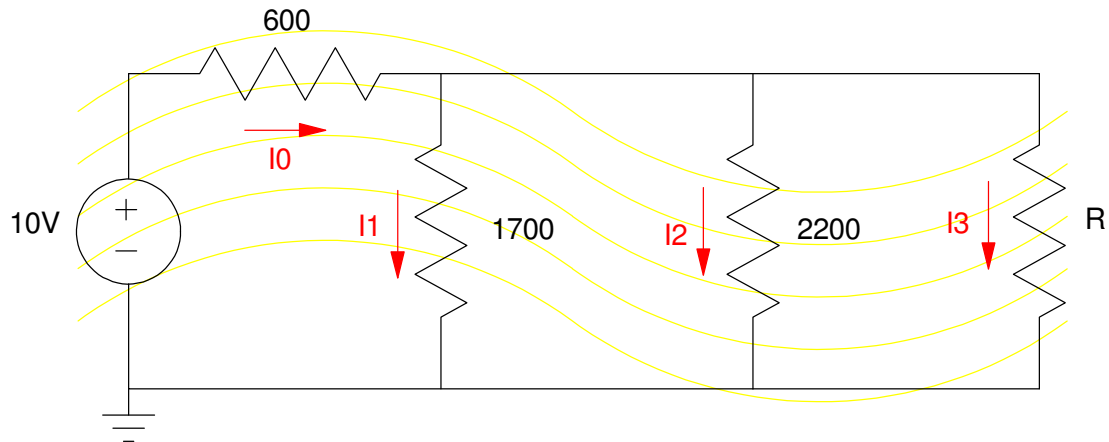
Current Division

Let R be determined by your birthdate

- $R = 900 + 100 * (\text{month}) + (\text{day})$
- May 14th gives $R = 1414 \text{ Ohms}$

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

- Please show your work to get full credit



R $900 + 100 * (\text{mo}) + (\text{day})$	I_0	I_1	I_2	I_3
1414 Ohms	8.5366 mA	2.8694 mA	2.2173 mA	3.4498 mA

Solving using Matlab as a calculator

```
>> Rnet = 1 / (1/1700 + 1/2200 + 1/1414)
```

```
Rnet = 571.4304
```

```
>> I0 = 10 / (600 + Rnet)
```

```
I0 = 0.0085
```

```
>> % switch to mA
```

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

```
I0 = 8.5366
```

```
>> I1 = ( 1/1700 ) / (1/1700 + 1/2200 + 1/1414) * I0
```

```
I1 = 2.8694
```

```
>> I2 = ( 1/2200 ) / (1/1700 + 1/2200 + 1/1414) * I0
```

```
I2 = 2.2173
```

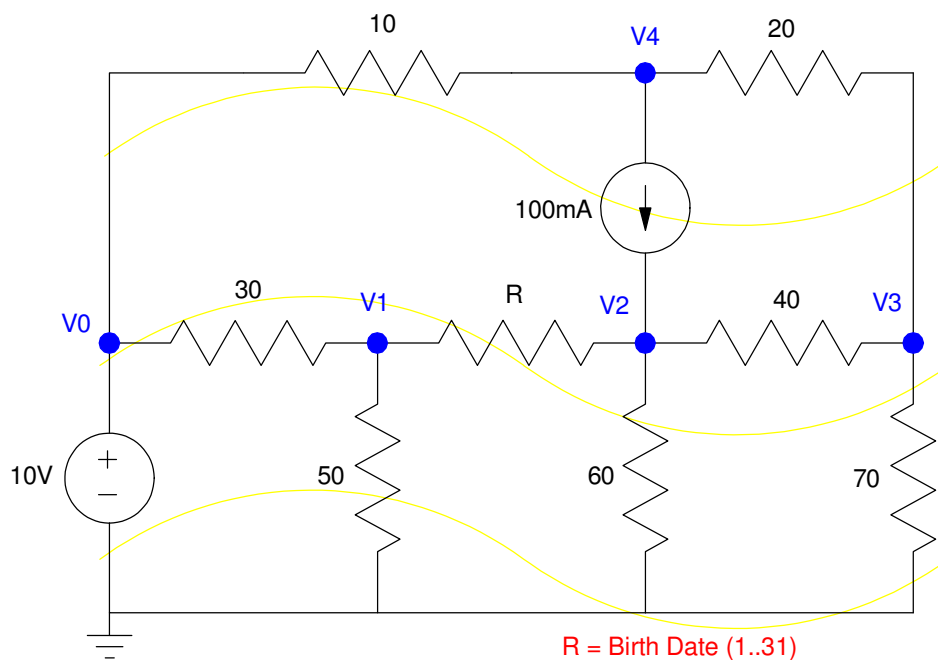
```
>> I3 = ( 1/1414 ) / (1/1700 + 1/2200 + 1/1414) * I0
```

```
I3 = 3.4498
```

Voltage Nodes

Let R be your birth date (1..31). Write voltage node equations that would allow you to solve for five unknowns

- {V0, V1, V2, V3, V4}
- You don't need to solve (just write five equations for five unknowns)



Start with the easy one

$$V_0 = 10$$

Write the voltage node equations for equations 2..5

$$\left(\frac{V_1 - V_0}{30} \right) + \left(\frac{V_1}{50} \right) + \left(\frac{V_1}{R} \right) = 0$$

$$\left(\frac{V_2 - V_1}{R} \right) + \left(\frac{V_2}{60} \right) + \left(\frac{V_2 - V_3}{40} \right) - 100mA = 0$$

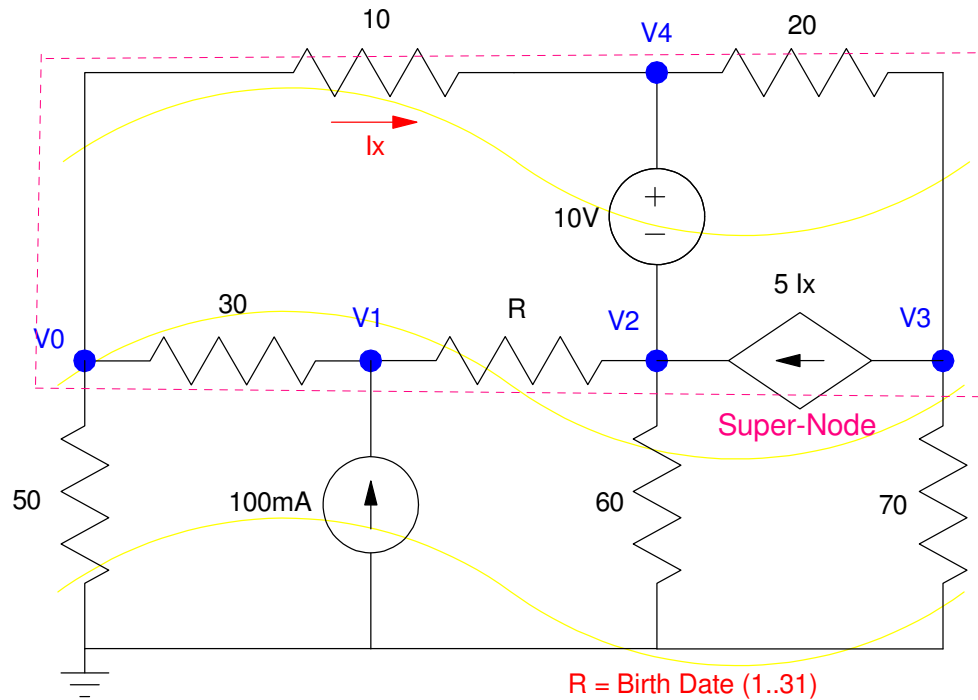
$$\left(\frac{V_3 - V_2}{40} \right) + \left(\frac{V_3}{70} \right) + \left(\frac{V_3 - V_4}{20} \right) = 0$$

$$\left(\frac{V_4 - V_0}{10} \right) + 100mA + \left(\frac{V_4 - V_3}{20} \right) = 0$$

Super Nodes

Let R be your birth date (1..31). Write voltage node equations that would allow you to solve for six unknowns

- {V0, V1, V2, V3, V4, Ix}
- You don't need to solve (just write five equations for five unknowns)



Start with the easy equations

$$I_x = \left(\frac{V_0 - V_4}{10} \right)$$

$$V_4 - V_2 = 10$$

Write the voltage node equations

$$\left(\frac{V_0 - V_1}{30} \right) + \left(\frac{V_0}{50} \right) + I_x = 0$$

$$\left(\frac{V_1 - V_0}{30} \right) - 100mA + \left(\frac{V_1 - V_2}{R} \right) = 0$$

$$\left(\frac{V_3}{70} \right) - 5I_x + \left(\frac{V_3 - V_4}{20} \right) = 0$$

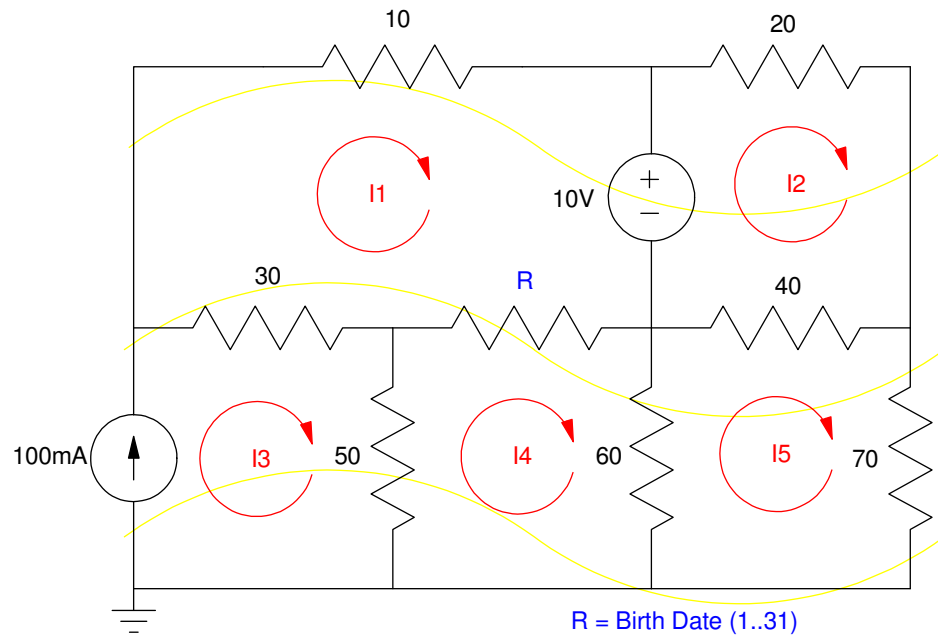
One more equation is needed. The 60 Ohm resistor hasn't been accounted for. Define a super-node to include it

$$\left(\frac{V_0}{50} \right) - 100mA + \left(\frac{V_2}{60} \right) + \left(\frac{V_3}{70} \right) = 0$$

Current Loops

Let R be your birth date (1..31). Write current loop equations that would allow you to solve for five unknowns

- $\{I_1, I_2, I_3, I_4, I_5\}$
- You don't need to solve (just write five equations for five unknowns)



$$I_3 = 100mA$$

$$10(I_1) + 10 + R(I_1 - I_4) + 30(I_1 - I_3) = 0$$

$$-10 + 20(I_2) + 40(I_2 - I_5) = 0$$

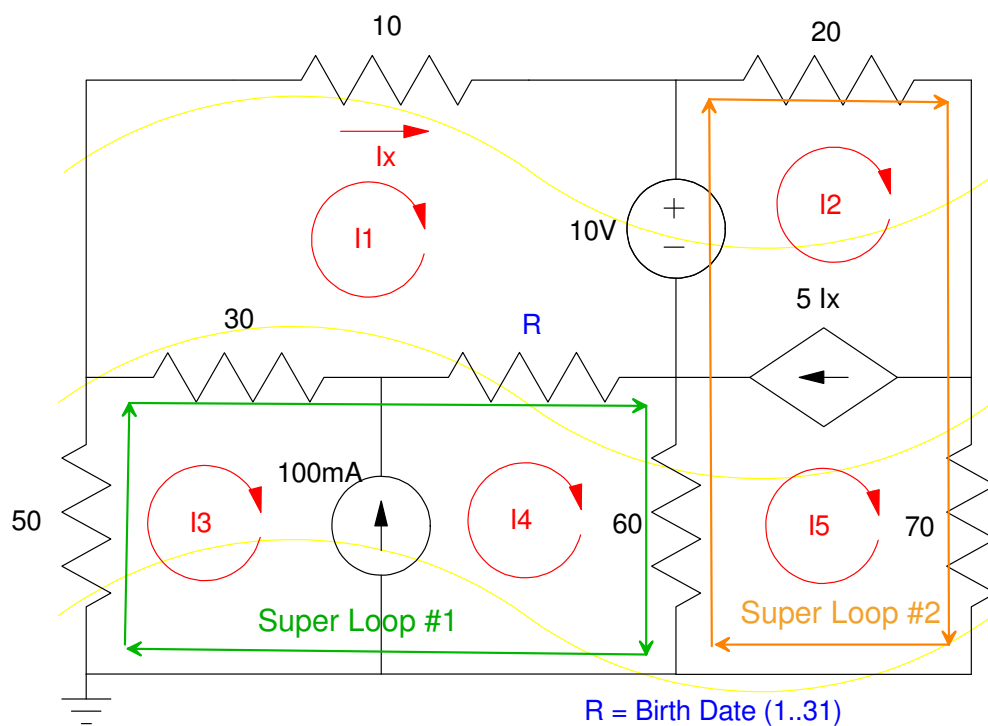
$$50(I_4 - I_3) + R(I_4 - I_1) + 60(I_4 - I_5) = 0$$

$$60(I_5 - I_4) + 40(I_5 - I_2) + 70(I_5) = 0$$

Super Loops

Let R be your birth date (1..31). Write current loop equations that would allow you to solve for six unknowns

- $\{I_1, I_2, I_3, I_4, I_5, I_x\}$
- You don't need to solve (just write five equations for five unknowns)



Start with the easy ones

$$I_x = I_1$$

$$5I_x = I_2 - I_5$$

$$I_4 - I_3 = 100mA$$

Write the loop equations around I_1

$$10(I_1) + 10 + R(I_1 - I_4) + 30(I_1 - I_3) = 0$$

Super Loop #1

$$50(I_3) + 30(I_3 - I_1) + R(I_4 - I_1) + 60(I_4 - I_5) = 0$$

Super Loop #2

$$60(I_5 - I_4) - 10 + 20(I_2) + 70(I_5) = 0$$