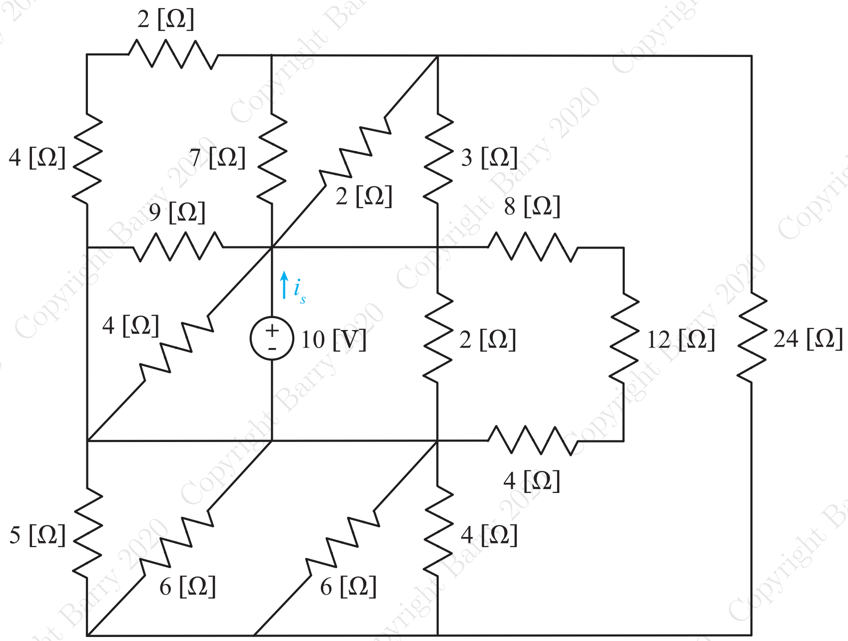
MEMS 0031 - Electrical Circuits
Quiz #2
Assigned: May 29st, 2020
Due: May 31st, 2020, 9:00 pm

Name: ______________________________

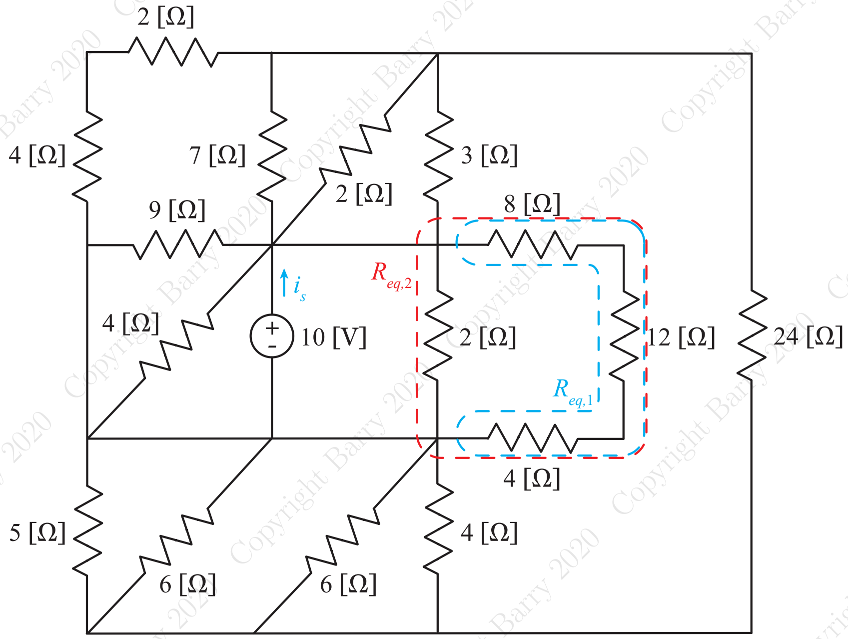
Problem #1

Using series and parallel resistors, determine the source current i_s. Note: KVL and KCL are not needed. The use of KVL and KCL will result in your answer being marked incorrect.



Thee 8, 12 and 4 [Ω] resistors are in series, yielding an equivalent of $R_{eq,1}$ =24 [Ω]. This equivalence is in parallel with the 2 [Ω] resistor, yielding an equivalence of

$$R_{eq,2} = \frac{(24\,[\Omega])(2\,[\Omega])}{(24+2)\,[\Omega]} = 24/13\,[\Omega]$$

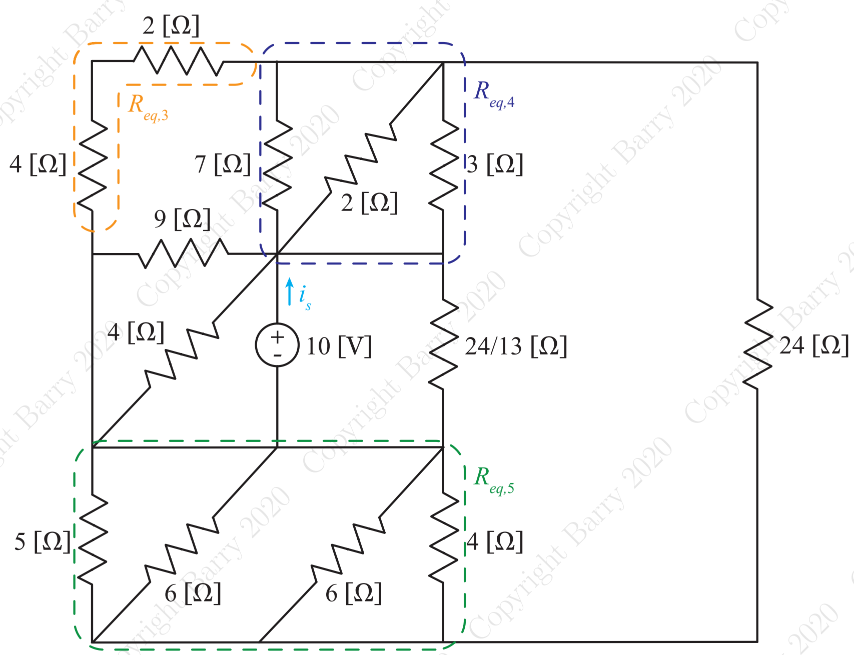


The 2 and 4 [Ω] resistors are in series, yielding an equivalent of $R_{eq,3}$ =6 [Ω]. The 7, 2 and 3 [Ω] resistors are in parallel, yielding an equivalent resistance of

$$R_{eq,4} = \left(\frac{1}{7\,[\Omega]} + \frac{1}{2\,[\Omega]} + \frac{1}{3\,[\Omega]}\right)^{-1} = 42/41\,[\Omega]$$

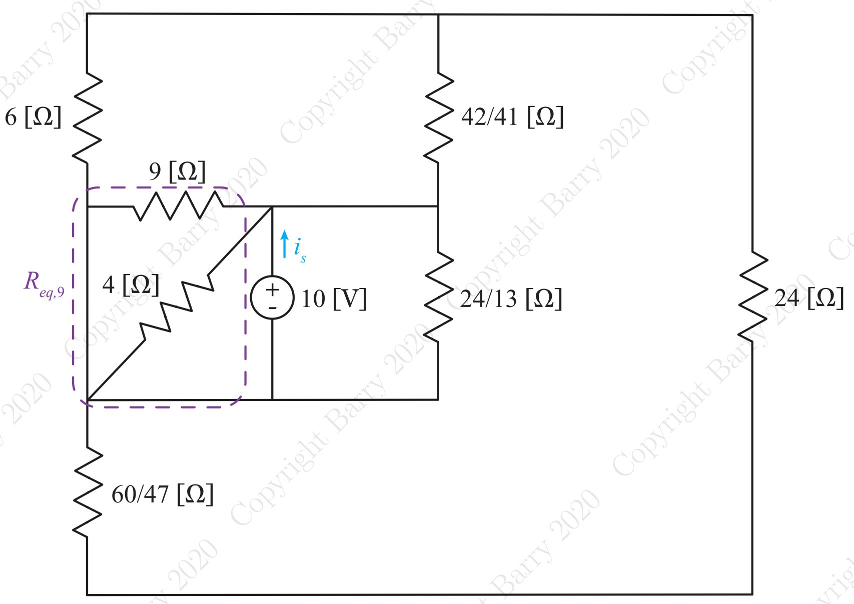
The 5, 6, 6, and 4 [Ω] resistors are in parallel, yielding an equivalent resistance of

$$R_{eq,5} = \left(\frac{1}{5\,[\Omega]} + \frac{1}{6\,[\Omega]} + \frac{1}{6\,[\Omega]} + \frac{1}{4\,[\Omega]}\right)^{-1} = 60/47\,[\Omega]$$



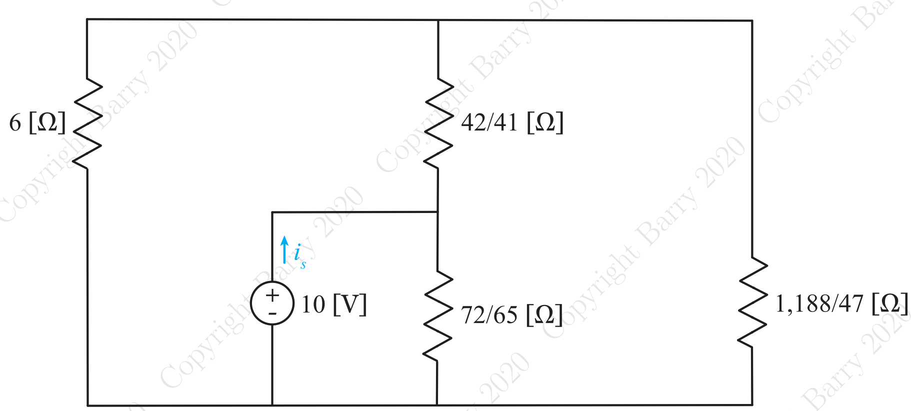
The 9 and 4 [Ω] resistor are in parallel, yielding an equivalence of

$$R_{eq,9} = \frac{(9\,[\Omega])(4\,[\Omega])}{(9+4)\,[\Omega]} = 36/13\,[\Omega]$$



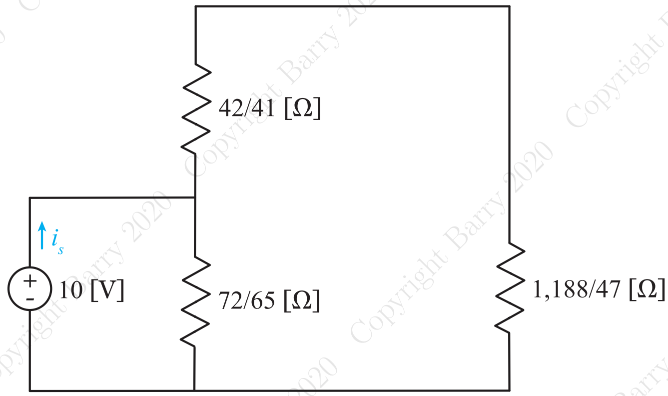
We recognize the 60/47 and 24 [Ω] resistors are in series, which yields and equivalence of $R_{eq,10}$ =1,188/47 [Ω]. We also recognize the 36/13 and 24/13 [Ω] resistors exist in parallel, yielding an equivalence of

$$R_{eq,11} = \frac{(36/13\,[\Omega])(24/13\,[\Omega])}{(36/13 + 24/13)\,[\Omega]} = 72/65\,[\Omega]$$



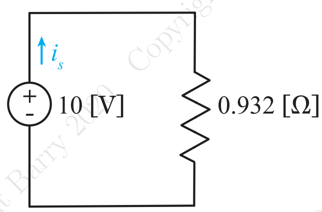
The 6 and 1,188/47 [Ω] resistors are in parallel, yielding an equivalence of

$$R_{eq,12} = \frac{(6\,[\Omega])(1,188/47\,[\Omega])}{(6 + 1,188/47)\,[\Omega]} = 1,188/245\,[\Omega]$$



The 42/41 and 1,188/245 [Ω] resistors are in series, with an equivalent resistance of $R_{eq,13}$ =58,998/10,045 [Ω]. This equivalence is in parallel with the 72/65 [Ω] resistor, which yields an equivalence of

$$R_{eq,14} = \frac{(42/41\,[\Omega])(58,998/10,045\,[\Omega])}{(42/41 + 58,998/10,045)\,[\Omega]} \approx 0.932\,[\Omega]$$



Thus, the source current is

$$i = \frac{10\,[\text{V}]}{0.932\,[\Omega]} = 10.73\,[\text{A}]$$