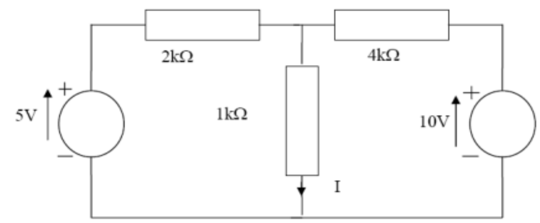
Q- Consider the circuit in fig bellow with two ideal voltage sources. Calculate the current I in the 1 kΩ resister using the superposition theorem.



The superposition theorem states that "total current in any part of a linear circuit equals the algebraic sum of the currents produced by each source separately"

If the battery of 10 V is short circuited then the parallel combination of 1KΩ and 4 KΩ is in series with 2 KΩ resistance and hence equivalent resistance of the circuit will be

$$R = 2 + \frac{4*1}{4+1} = 2.8\ K\Omega$$

The current in the circuit will be

I = 5/2.8K = 1.786 mA

This current will be distributed in the resistances of 1KΩ and 4 kΩ in the ratio of 4:1 and hence the current in 1 KΩ resistor will be

I_1 = 1.786 (4/5) = 1.428 mA

Now if the battery of 5 V is short circuited then the parallel combination of 1KΩ and 2 KΩ is in series with 4 KΩ resistance and hence equivalent resistance of the circuit will be

$$R' = 4 + \frac{2*1}{2+1} = 4.67\ K\Omega$$

The current in the circuit will be

I' = 10/4.667K = 2.143 mA

This current will be distributed in the resistances of 1KΩ and 2 kΩ in the ratio of 2:1 and hence the current in 1 KΩ resistor will be

I_2 = 2.143 (2/3) = 1.428 mA

Hence the total current in 1KΩ resistance will be

I = $I_1 + I_2$ = 1.428 + 1.428 = 2.856 mA

(can be done easily using Kirchhoff's law)