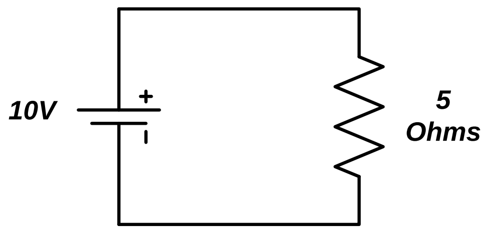
Homework # 1 – Due: 30 January 2020
ECET 3000 – Electrical Principles **Name** ______________________________
(Print Name – Last Name First)

Instructions – Complete the following problems and place your final answers in the blanks provided. Be sure to show ***all*** of the work required to obtain the final solutions. You may complete this assignment in the space provided after each problem statement on this handout as long as you write neatly and that your work is well organized.

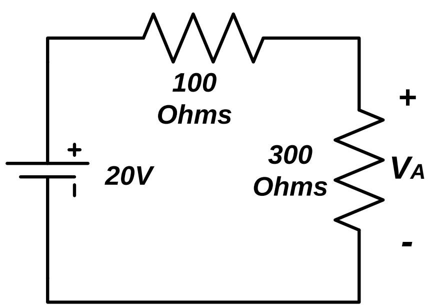
Problem #1) Determine the current (**I**) through the resistor and the electrical power (**P**) consumed by the resistor. Draw the direction of current flow on the circuit diagram using an arrow labeled with a capital "**I**".



I = ______________________ **(A)**

P = ______________________ **(W)**

Problem #2) Determine the current (**I**), the voltage (**V_A**) across the 300Ω resistor, the total power (**P_S**) produced by the source, and the power (**P_R**) consumed by the 300Ω resistor in the following circuit. Also, show the direction of current flow on the circuit diagram by means of an arrow labeled with a capital "**I**".



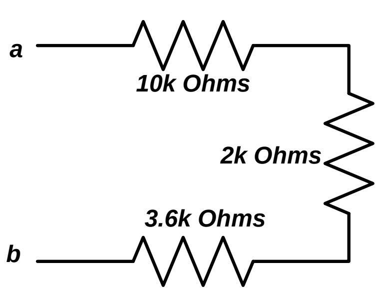
I = ______________________ **(mA)**

V_A = ______________________ **(V)**

P_S = ______________________ **(W)**

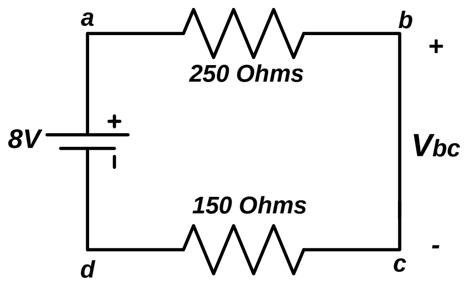
P_R = ______________________ **(W)**

Problem #3) Determine the equivalent resistance between terminals "a" and "b" in the following circuit.



R_{eq} = ______________________ **(kΩ)**

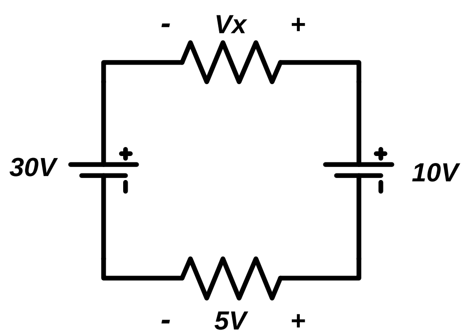
Problem #4) Determine the current flowing in the following circuit in mA and the voltage $\mathbf{V_{bc}}$ as shown in volts. Also, show the direction of current flow on the circuit diagram by means of an arrow labeled with a capital "**I**".



I = ________________________ **(mA)**

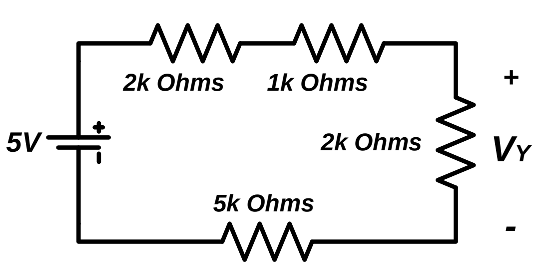
$\mathbf{V_{bc}}$ = ________________________ **(V)**

Problem #5) Determine the voltage $\mathbf{V_x}$ as shown in the following circuit ***using Kirchhoff's Voltage Law***.



$\mathbf{V_x}$ = ________________________ **(V)**

Problem #6) Determine the voltage $\mathbf{V_Y}$ as shown in the following circuit ***using the voltage divider rule***, as well as the total power ($\mathbf{P_S}$) produced by the source.



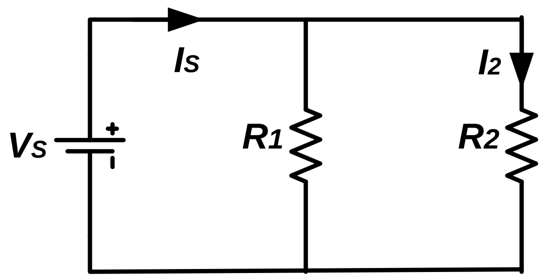
$\mathbf{V_Y}$ = ________________________ **(V)**

$\mathbf{P_S}$ = ________________________ **(mW)**

Problem #7) Given the following circuit having the component values:

$I_S = 400$ mA, $R_1 = 10\ \Omega$, $R_2 = 15\ \Omega$,

Determine the current (**I_2**) in resistor R_2 as shown in the figure ***using the current divider method***.



I_2 = ______________________ **(mA)**

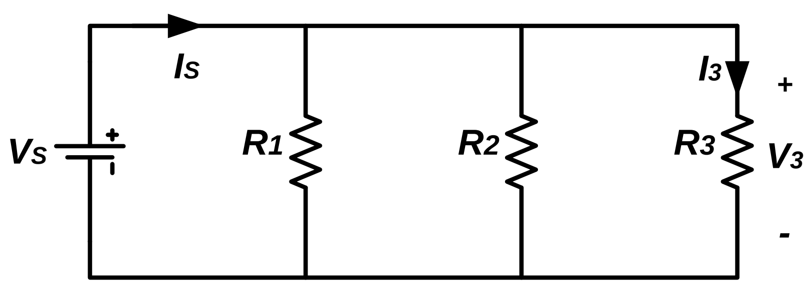
Problem #8) Given the same circuit as in problem #7, if the resistor R_2 is removed from the circuit while leaving the wires that were originally connected to R_2 open-circuited, determine the new current **I_2**.

I_2 = ______________________ **(mA)**

Problem #9) Given the following circuit having the component values:

$V_S = 24$ volts, $R_1 = 300\ \Omega$, $R_2 = 80\ \Omega$, $R_3 = 200\ \Omega$,

Determine the total equivalent (parallel) resistance "seen" by the source (**R_{eq}**), the source current (**I_S**), and the voltage rise (**V_3**) across and the current (**I_3**) in resistor R_3 as shown in the figure.



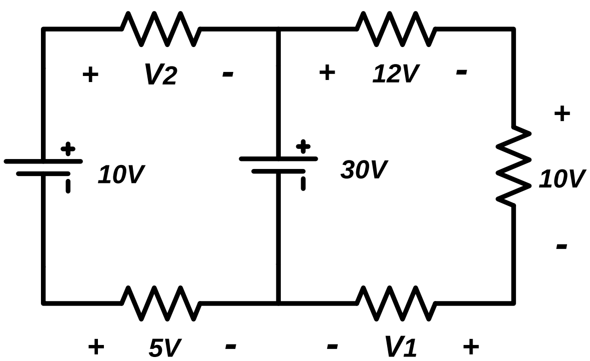
R_{eq} = ______________________ **(Ω)**

I_S = ______________________ **(A)**

V_3 = ______________________ **(V)**

I_3 = ______________________ **(A)**

Problem #10) Determine the voltages $\mathbf{V_1}$ and $\mathbf{V_2}$ in the following circuit ***using Kirchhoff's Voltage Law***.



$\mathbf{V_1}$ = ______________________ **(V)**

$\mathbf{V_2}$ = ______________________ **(V)**

Problem #15) Given a 75 Watt, 120 Volt incandescent light bulb used in a lamp;

a) Determine the **resistance of the light bulb**.

b) If the lamp is used an average of 8 hours a day, determine the **yearly cost** of using the lamp assuming that the cost per kW·h is ten cents.

c) If the light bulb is replaced with a 22 Watt, 120 Volt compact fluorescent light bulb, determine the **amount of money saved annually** if the lamp is still used for 8 hours a day.

R = ______________________ **(Ω)**

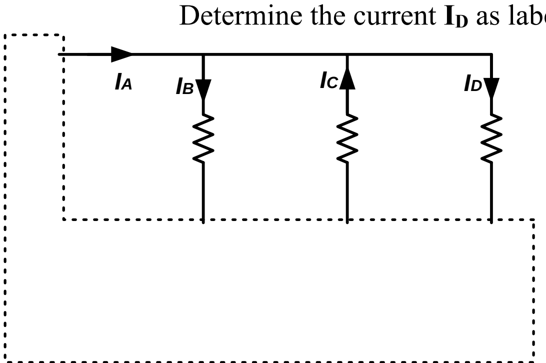
Yearly Cost = $__________________

Annual Savings = $__________________

Problem #16) Given the following potion of a circuit having current values of:

I_A = 500 mA, I_B = 1200 mA, I_C = 400 mA (in the directions that they are labeled),

Determine the current $\mathbf{I_D}$ as labeled ***using Kirchhoff's Current Law***.

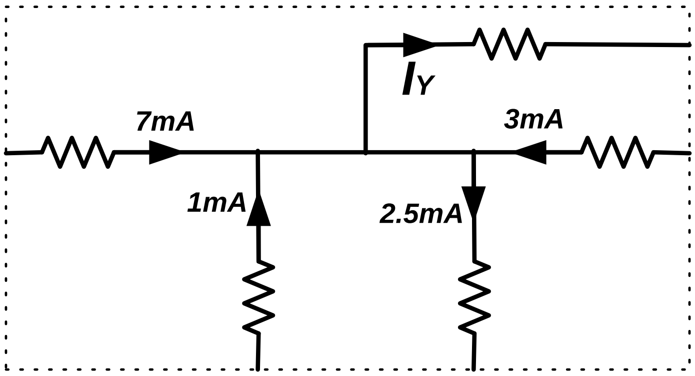


$\mathbf{I_D}$ = ______________________ **(mA)**

Problem #17) Given the exact same figure and current values as defined in problem #16, if the direction of the current I_D within the circuit diagram is reversed such that it is defined in the "upward direction", Determine the ***new value*** of $\mathbf{I_D}$.

$\mathbf{I_D}$ = ______________________ **(mA)**

Problem #18) Determine the current $\mathbf{I_Y}$ as labeled using Kirchhoff's Current Law.



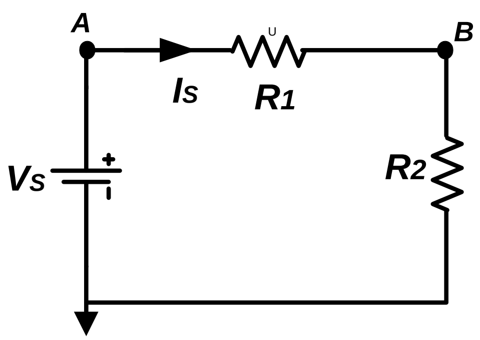
$\mathbf{I_Y}$ = ______________________ **(mA)**

Problem #20) Given the following circuit having the component values:

V_S = 50 volts, R_1 = 25 Ω, R_2 = 50 Ω,

a) Determine the node voltages $\mathbf{V_A}$ and $\mathbf{V_B}$ in the circuit as well as the source current $\mathbf{I_S}$.

b) If the resistor R_2 is removed from the circuit and replaced by an idea wire (short-circuit), determine the new values for $\mathbf{V_A}$, $\mathbf{V_B}$, and $\mathbf{I_S}$.



a) $\mathbf{V_A}$ = ______________________ **(V)**

$\mathbf{V_B}$ = ______________________ **(V)**

$\mathbf{I_S}$ = ______________________ **(A)**

b) $\mathbf{V_A}$ = ______________________ **(V)**

$\mathbf{V_B}$ = ______________________ **(V)**

$\mathbf{I_S}$ = ______________________ **(A)**

Problem T/F) Specify whether each of the statements are **TRUE** or **FALSE**.

___________ The ***series equivalent resistance*** of multiple resistors in series will always be greater than the resistance of any of the individual resistors.

___________ ***Kirchhoff's Voltage Law*** states that the sum of voltages across a set of series-connected resistors will always equal zero.

___________ The ***parallel equivalent resistance*** of multiple resistors in parallel will always be greater than the resistance of any of the individual resistors.

___________ An ***ideal switch*** in the ***"off"*** position appears to be an "***open-circuit***".

___________ Within a circuit, ***parallel resistors*** must have the same current flowing through all of them.

___________ If two resistors having the same resistance value are in ***parallel*** with each other in an active circuit then the two resistors will have the same magnitude currents flowing through them.

___________ According to ***Kirchhoff's Current Law***, if all of the currents for a given node are defined in a direction such that they are all "entering" the node, then the sum of these currents must be zero.

___________ Given a set of ***parallel resistors***, if additional resistors are added to the parallel combination then the total equivalent resistance will decrease.

___________ Given a circuit containing a single voltage source and one or more resistors, ***"current"*** will flow ***"out of" the positive terminal*** of the voltage source.

___________ There is never a potential difference (voltage) across an ***idea wire***.

___________ If two resistors are connected in ***series*** with each other in an active circuit then the two resistors will have the same magnitude currents flowing through them.

___________ The ***direction of the voltage rise*** across a resistor will always be opposite compared to the direction of current flowing through the resistor.

___________ Any two elements within a circuit that are connected across the same two nodes are said to be in ***parallel*** with each other.

Answers:			
	#1) 2, 20	**#2) 50, 15, 1, 0.75**	**#3) 15.6k**
	#4) 20, 0	**#5) -15**	**#6) 1, 2.5**
	#7) 160	**#8) 0**	**#9) 48, 0.5, 24, 0.12**
	#10) 8, -15	**#15) 192, $21.90, $15.48**	**#16) -300**
	#17) +300	**#18) 8.5m**	**#20) 50, 33.3, 0.667, 50, 0, 2**

True/False) T, F, F, T, F, T, T, T, T, T, T, T, T