EE 302, Introduction to Electrical and Computer Engineering

Dr. Archie Holmes, Jr.

Exam #3

Name: _____

SSN: _____

Please remember….

- **Read the entire exam before starting**
- **If you feel you need more information than is given, please ask!!!**
- **Show all work for credit!!!**
- **Relax!!!**

This exam contains 10 pages and 6 problems along with some extra credit questions
Give units to all answers where applicable

Problem #1	_____
Problem #2	_____
Problem #3	_____
Problem #4	_____
Problem #5	_____
Problem #6	_____
Bonus (Extra Credit)	_____
Total	_____

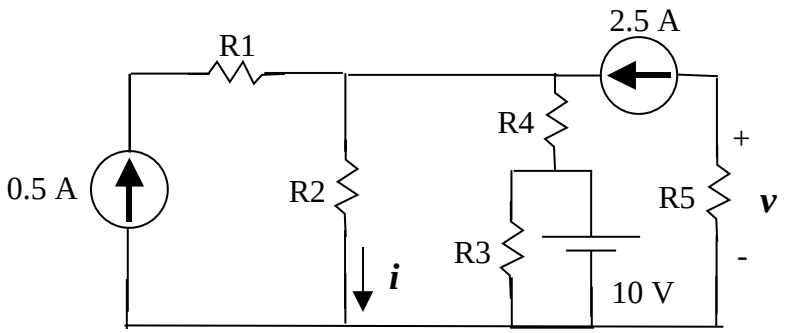
This information will be provided when I return the exam

Class Average = _____

Standard Deviation = _____

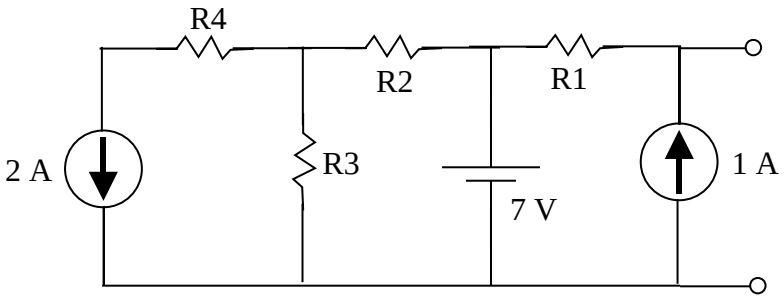
PROBLEM #1. SUPERPOSITION (16 POINTS)

Solve for the two unknowns, ***i*** and ***v***, using the reference directions provided via superposition. Assume the following values for the resistors: R1 = 8Ω, R2 = 10Ω, R3 = 200Ω, R4 = 40Ω, and R5 = 12Ω.



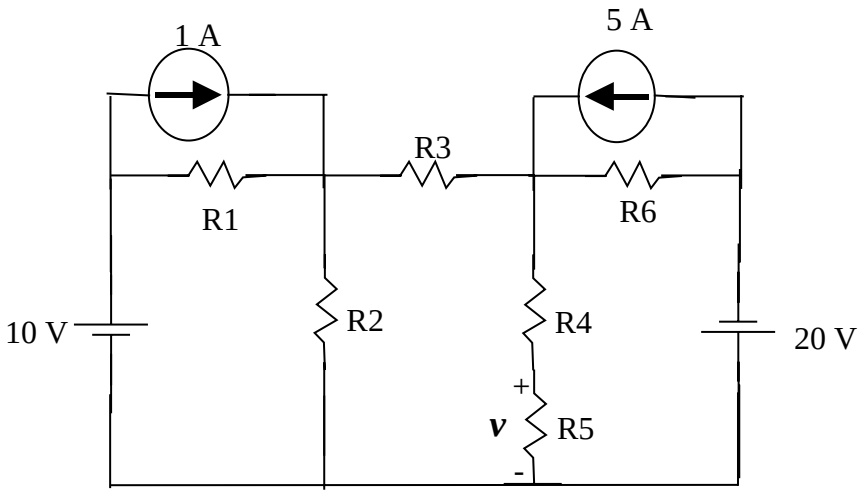
PROBLEM #2. THEVENIN AND NORTON EQUIVALENT CIRCUITS (16 POINTS)

Calculate the Thevenin and Norton equivalent circuits for the circuit below. You must show all work for the calculation of both equivalent circuits (i.e., **DO NOT** use $V_{TH}=I_N R_{TH}$ for one of the circuits). Assume the following values for the resistors: R1 = 100Ω, R2 = 20Ω, R3 = 50Ω, and R4 = 500Ω.



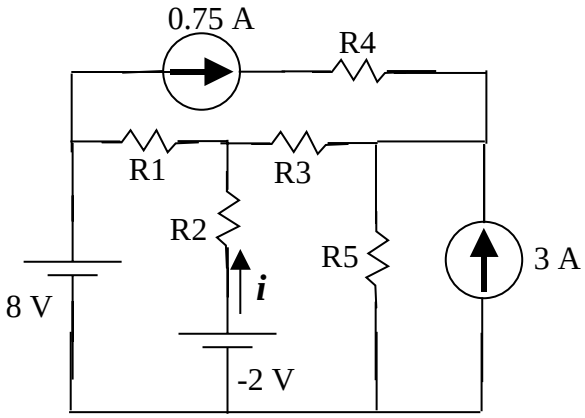
PROBLEM #3. NODAL ANALYSIS (16 POINTS)

Use nodal analysis to solve for ***v*** using the reference directions provided. Use the following values for the resistors: R1=500Ω, R2=200Ω, R3=250Ω, R4=250Ω, R5=750 Ω, and R6=100 Ω.. *Note*: 75-80% of the credit will be given for the correct set-up for solving this problem. Make sure you label the circuit **clearly**.



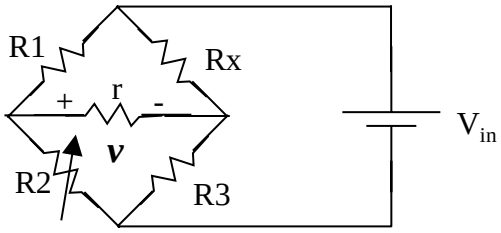
PROBLEM #4. LOOP ANALYSIS (16 POINTS)

Use loop current analysis to solve for ***i*** as shown in the circuit below. Use the following values for the resistors: R1=10Ω, R=20Ω, R3=2.5Ω, R4=50Ω, and R5=7.5Ω. *Note*: 75-80% of the credit will be given for the correct set-up for solving this problem. Make sure you label the circuit **clearly**.



PROBLEM #5. GENERAL CIRCUIT ANALYSIS (16 POINTS)

The circuit below represents a Wheatstone bridge circuit. This circuit is traditionally used to accurately measure an unknown resistance (in our case Rx) in terms of very accurately known resistors (R1, R2, and R3). The procedure which is typically used is that the value of one of the resistors (such as R2) is changed until the voltage across resistor *r* (which has a value not equal to zero) goes to zero. At this point, the Wheatstone bridge circuit is considered to be 'balanced' and Rx can be determined.

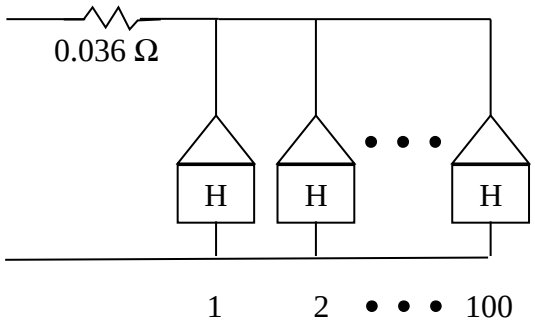


a) Under the condition of the Wheatstone bridge being 'balanced', write an expression for ***v*** in terms of V_{in}, *R1, R2, R3, and Rx*. Use any method of analysis you chose.

b) The unknown resistor value can be expressed in terms of R1, R2, and R3 when the voltage *v* goes to zero. Use the result of (a) to calculate a value for Rx given that R1 = 2Ω, R2 = 5 Ω, and R3 = 20 Ω.

PROBLEM #6. SUBDIVISION DESIGN II (20 POINTS)

You are an electrical engineer who has been brought in to solve a problem for the Holmes Construction Company. They are in the process of finishing a 100-home subdivision in SW Austin. Each house requires 3000 W of power at a constant voltage of 120 V at all times. The following circuit below represents the electrical layout of the subdivision without the power plant:



a) The power plant that was chosen for this subdivision has a voltage of 210 V and a short-circuit current of 21 kA. When this power plant was connected to the subdivision, the houses did not have enough power. Use any circuit analysis technique to explain to the owner of the company why this is occurring.

b) To rectify the situation, you propose the following solution: you need to use power plant for the subdivision which is impedance matched to the **entire** subdivision (i.e., all 100 houses). Provide a circuit model for the proposed power plant. Make sure that your model solves the original problem(s) in part (a).

c) As you go to the owner with the proposed power plant circuit model, you are told that -- for cost reasons -- you cannot tear down the old power plant. Instead you must add another power plant in parallel with the first one in order to meet your conditions in part (b). Provide the voltage and short-circuit current for this additional power plant.

EXTRA CREDIT (4 POINTS)

In about 17 months we will once again elect a new president. AS OF TODAY, which 5 of the 9 people listed below have OFFICIALLY announced that they will run for this office. Place a checkmark in the appropriate box.

Name	YES	No
Gov. George Bush		
Vice President Al Gore		
Elizabeth Dole		
Sen. John McCain		
Pat Buchannan		
House Minority Leader Dick Gephardt		
Bill Bradley		
Steve Forbes		
Rev. Jesse Jackson		