LEHIGH UNIVERSITY

DEPT. OF ELECTRICAL & COMPUTER ENGINEERING

ECE 081 – PRINCIPLES OF ELECTRICAL ENGINEERING

FALL 2010

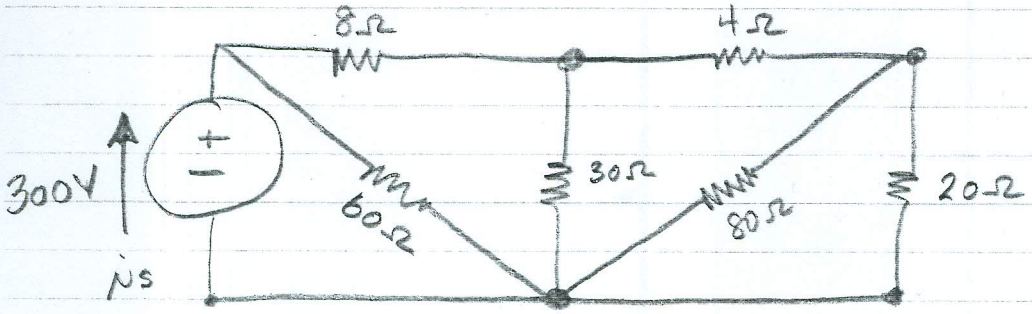
MIDTERM EXAMINATION

WEDNESDAY 20 OCTOBER 2010

Problem #1

(15)

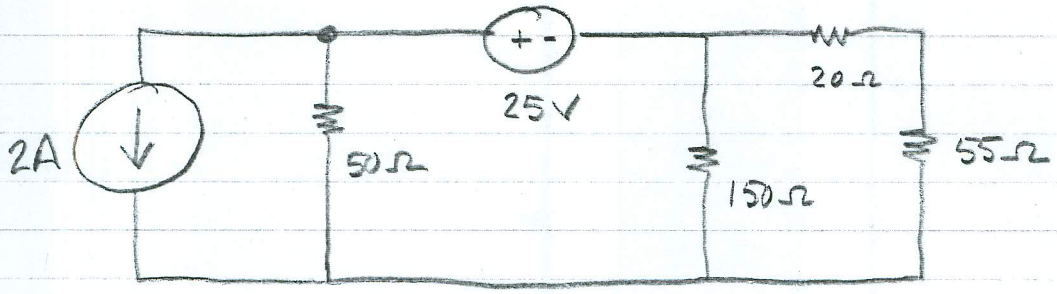
For the circuit shown, find i_s and the power dissipated by the 30 Ω resistor.



PROBLEM #2

(25)

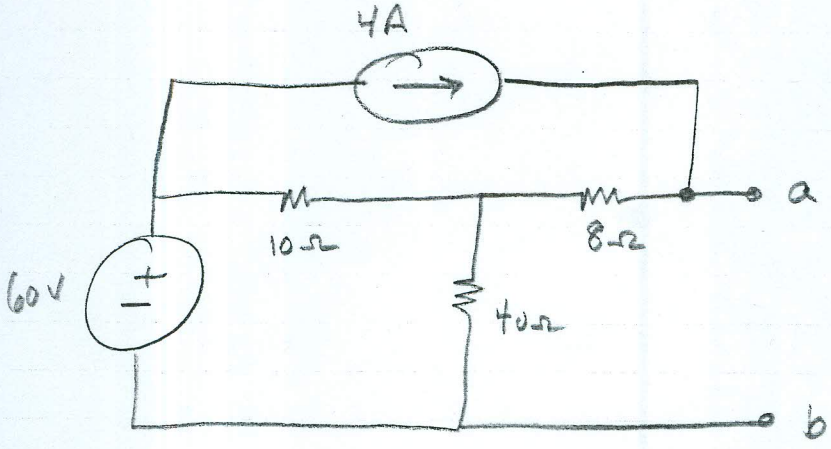
FOR THE CIRCUIT SHOWN, FIND THE POWER DELIVERED BY THE 2A CURRENT SOURCE.



Problem #3

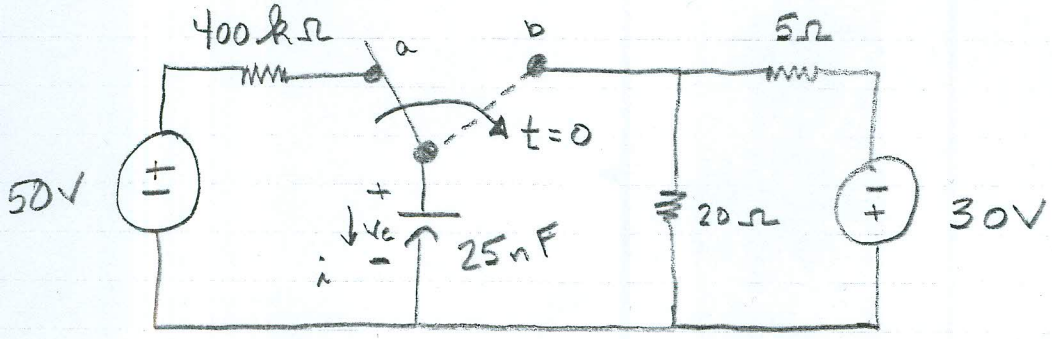
(25)

For the Circuit Shown, Find the N.T Subcircuits with Respect to the Terminals a-b.



PROBLEM #4 (25)

FOR THE CIRCUIT SHOWN, FIND:
$v_c(t)$ FOR $t \geq 0$ AND $i_c(t)$ $t \geq 0$.
NOTE: BE EXTRA CAREFUL OF SIGNS!!



NOTE: At $t=0$ switch flips from a → b

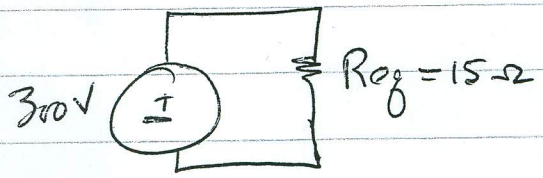
Problem #5

(10)

You have a collection of only 10Ω and 50Ω resistors. You need a circuit whose $R_{eq} = 87.5\,\Omega$. Design a circuit that will accomplish this with the minimum number of resistors.

EXAM SOLUTIONS

#1



$$i_s = \frac{300V}{15\Omega} = 20A$$

Starting From Left Hand End:

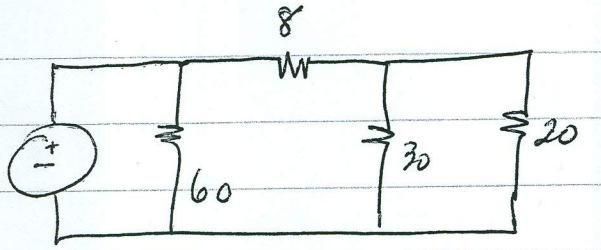
$80 // 20 = 16$

$4 S. 16 = 20$

$30 // 20 = 12$

$8 S. 12 = 20$

$60 // 20 = 15 = R_{eq}$

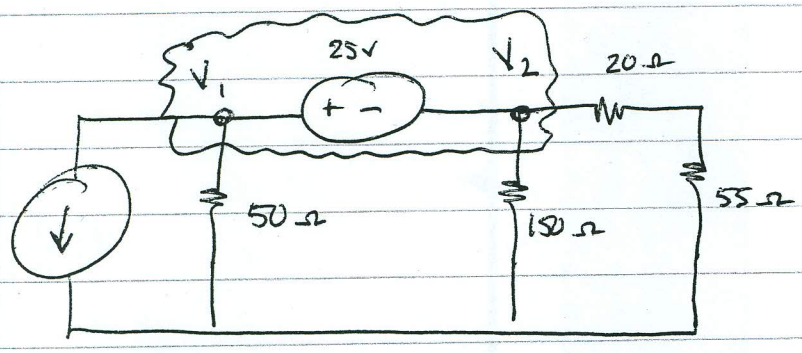


$$i_{8\Omega} = \frac{60}{80}(20) = 15A$$

$$i_{30} = \frac{20}{50}(15) = 6A$$

$$P = I^2R = (6)^2(30) = 1080W$$

#2



NOTE: $V_{\downarrow} = V_{50\Omega}$ (// Elements)

NOTE:

$V_1 - (+-) - V_2$

FORM SUPERNODE

NODE: $\frac{V_1}{50} + \frac{V_2}{150} + \frac{V_2}{75} + 2 = 0$

CONTINUITY: $V_1 = V_2 + 25$

SOLVING: $V_1 = -37.5V$

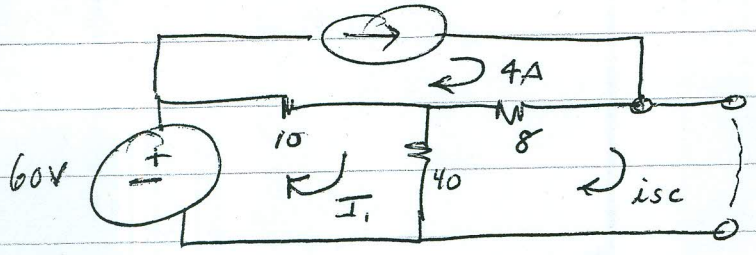
Hence: $P_{\downarrow} = (I)(V)$

$= (2)(-37.5)$

$= -75W$

(DELIVERED)

#3 Zero Out Sources: $R_{TH} = 8\Omega + (10 \,//\, 40) = 16\Omega$

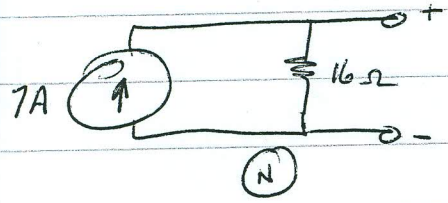


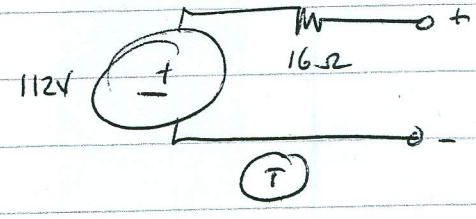
I_1: $10(I_1 - 4) + 40(I_1 - i_{sc}) - 60 = 0$

i_{sc}: $40(i_{sc} - I_1) + 8(i_{sc} - 4) = 0$

$i_{sc} = 7A = I_N$

$V_{oc} = (R_T)(I_N) = 112V$





#4 $v(0) = 50V$ (Note: With SS and OC No Current Flows through 400kΩ)

$v(\infty) = \frac{20}{25}(-30) = -24V$ (Note: Sign is - DUE to ± Polarity)

$R_{TH} = 5 \,//\, 20 = 4\Omega \quad \tau = R_{TH} C = 0.1\mu s \Rightarrow \frac{1}{\tau} = 10^7$

$v_c(t) = v(\infty) + [v(0) - v(\infty)]e^{-t/\tau}$

$v_c(t) = -24 + 74e^{-10^7 t}$

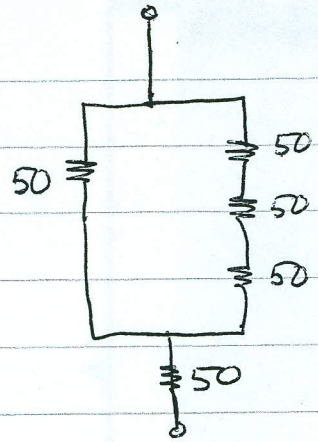
$i_c(t) = C\frac{dv_c}{dt} = 25 \times 10^{-9}(10^{-7})(74e^{-10^7 t})$

$i_c(t) = -18.5e^{-10^7 t}$

Note: It is Much More Difficult to Solve the Problem if You Look @ $i_c(0^-)$, $i_c(0^+)$ etc. Remember Dfns.!!

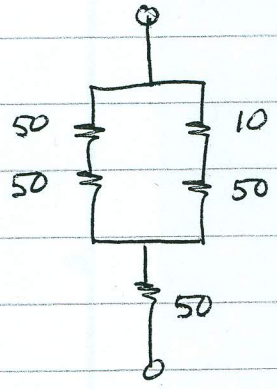
#5

BEST:



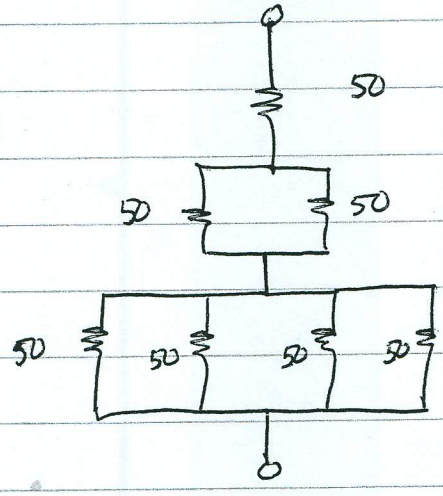
(5) RESISTORS

BEST:



(5) RESISTORS

STANDARD (Acceptable):



(7) RESISTORS

NOTE: There Are Several Other (7) Resistor Combinations!