American University of Beirut
Department of Electrical and Computer Engineering
EECE 210 - Electric Circuits
Quiz 2
Closed Book - No Programmable Calculators - 90 minutes

April 17, 2015

Name: _____

ID:_____

Solve the following problems;
Provide your answers on the attached Scantron card;
This question sheet must be returned with the Scantron card;
There is No penalty;
Mark with a *pencil* your LAST NAME, your First name Initial (FI) and your Middle name Initial (MI);
Mark your AUB ID Number in the box titled "ID NUMBER";
Write the name of your course instructor on the Scantron card;
Use a pencil for marking your answers ;
When using an eraser, make sure that you have erased well.

This exam has 9 pages.

Course Instructors: L. Hamandi, S. Khaddaj, Y. Nasser, and R. Jabr.

1. In the circuit shown in Fig. 1, $I_S = 3$ A and each of the resistances is equal to 5 Ω. Find I_X.

   (a) 0.25 A
   (b) 0.5 A
   (c) 0.75 A
   (d) 1 A
   (e) None of the above

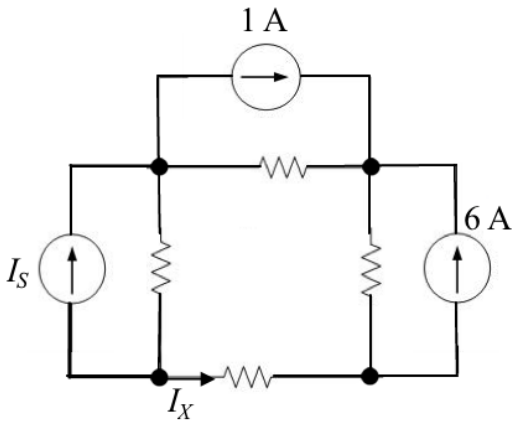

Fig. 1: Circuit for Problem 1

2. If $R = 30$ Ω in the circuit shown in Fig. 2, find the Thévenin voltage between terminals a,b.

   (a) 10 V
   (b) 20 V
   (c) 30 V
   (d) 40 V
   (e) None of the above

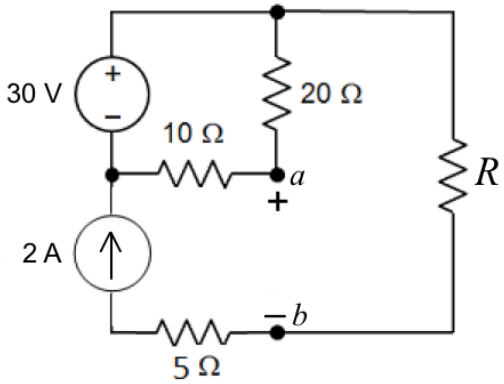

Fig. 2: Circuit for Problem 2

3. If $I_S = 5$ A in the circuit shown in Fig. 3, find the Thévenin voltage between terminals a,b.

   (a) 18 V
   (b) 12 V
   (c) 14 V
   (d) 16 V
   (e) None of the above

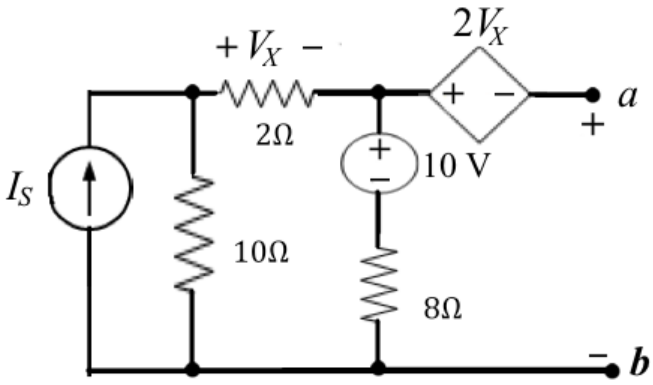

Fig. 3: Circuit of Problem 3

4. In the circuit shown in Fig. 4, $R_a = 3\ \Omega$. Find the value of R_L that results in maximum power being transferred to R_L.

   (a) 15 Ω
   (b) 16 Ω
   (c) 17 Ω
   (d) 18 Ω
   (e) None of the above

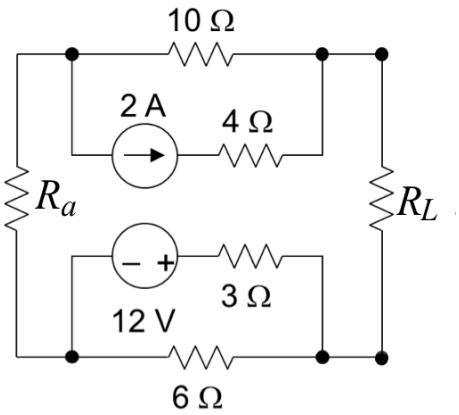

Fig. 4: Circuit of Problem 4

5. If $V_S = 120$ V in the circuit shown in Fig. 5, find the maximum power that can be delivered to R_L.

   (a) 329.14 W
   (b) 302.29 W
   (c) 228.57 W
   (d) 96.57 W
   (e) None of the above

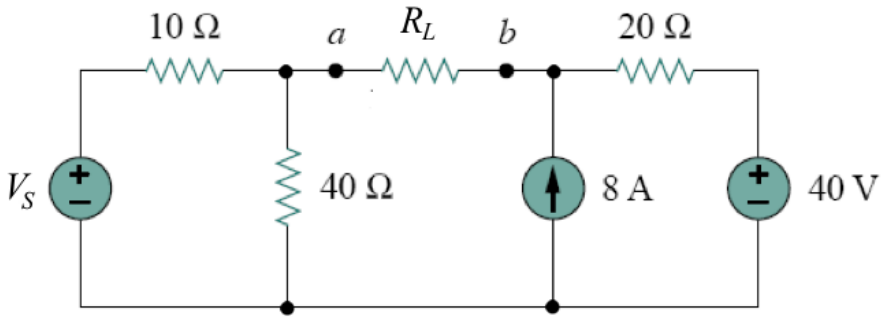

Fig. 5: Circuit of Problem 5

6. In the circuit shown in Fig. 6, $V_T = 120$ V. Find the component of I_S resulting from the V_T voltage source acting alone, with all the other voltage and current sources deactivated.

   (a) 1 A
   (b) 2 A
   (c) 3 A
   (d) 4 A
   (e) None of the above

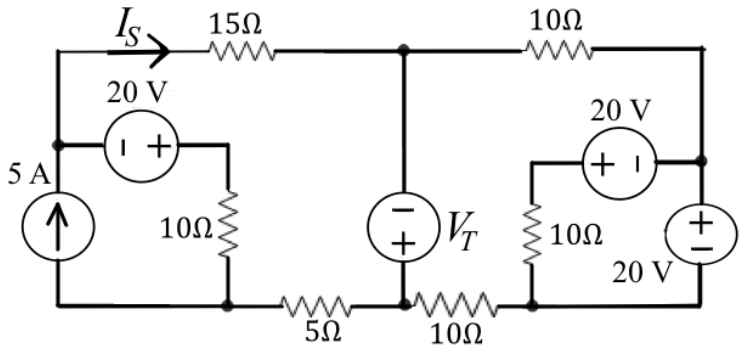

Fig. 6: Circuit of Problem 6

7. In the circuit shown in Fig. 7, $V_{CC} = 2.5$ V. Find the maximum value of R_X that can be used such that the op-amp operates in its linear region.

   (a) 15 Ω
   (b) 30 Ω
   (c) 45 Ω
   (d) 60 Ω
   (e) None of the above

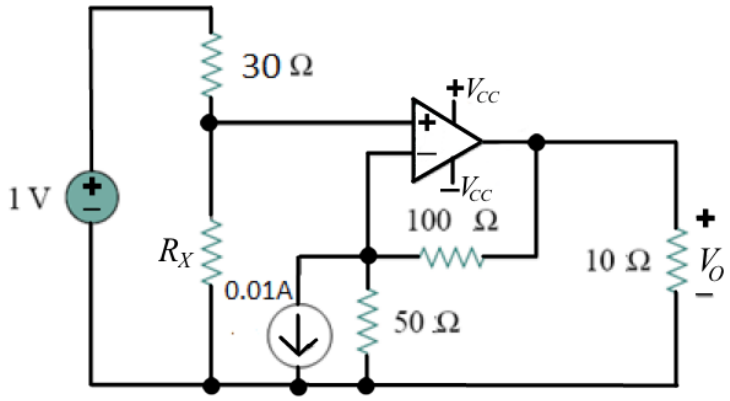

Fig. 7: Circuit of Problem 7

8. Each op-amp shown in Fig. 8 is operating in the linear region, and each of the resistances is equal to 10 Ω. If $V_S = 6$ V and $V_T = 24$ V, find the current I_O.

   (a) 0.5 A
   (b) 0.6 A
   (c) 0.7 A
   (d) 0.8 A
   (e) None of the above

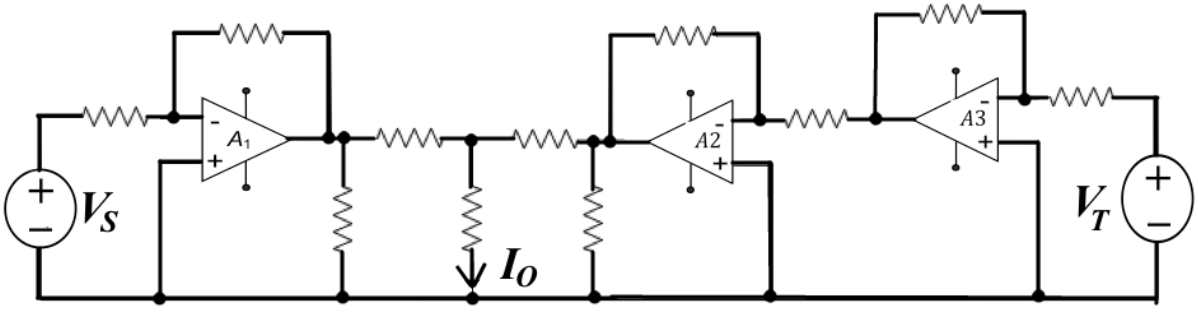

Fig. 8: Circuit of Problem 8

9. The op-amp shown in Fig. 9 is operating in the linear region. $V_{SRC} = 1$ V, $R_1 = 4$ kΩ, $R_2 = 40$ kΩ, $R_3 = 4$ kΩ, and $R_L = 10$ kΩ. Find I_L.

   (a) 1.75 mA

   (b) 2.375 mA

   (c) 3 mA

   (d) 4.25 mA

   (e) None of the above

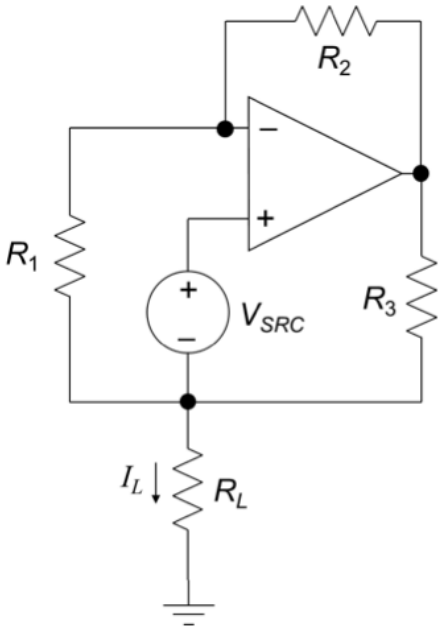

Fig. 9: Circuit of Problem 9

10. If $C = 11$ μF in the network shown in Fig. 10, find the equivalent capacitance with respect to the terminals a, b.

    (a) 0.8 μF

    (b) 2 μF

    (c) 2.4 μF

    (d) 3 μF

    (e) None of the above

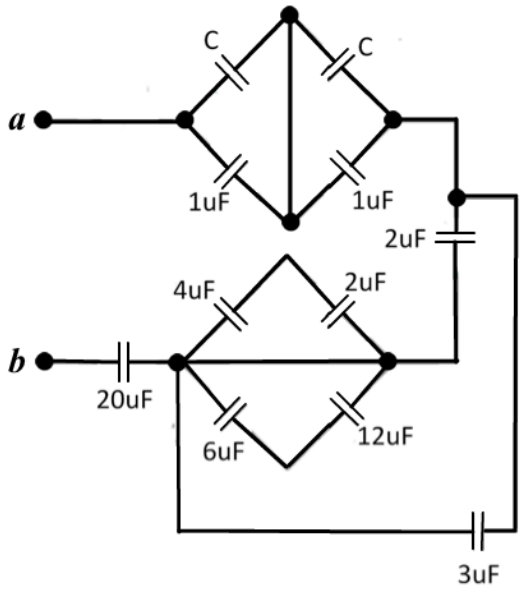

Fig. 10: Circuit of Problem 10

11. In the circuit shown in Fig. 11, $L_1 = 4$ H, $L_2 = 4$ H, and $M = 2$ H. Write the mesh-current equation around mesh 2 (corresponding to mesh-current i_2).

    (a) $6(di_1/dt) - 13(di_2/dt) - 14i_2 = 0$
    (b) $6(di_1/dt) - 12(di_2/dt) - 14i_2 = 0$
    (c) $6(di_1/dt) - 11(di_2/dt) - 14i_2 = 0$
    (d) $6(di_1/dt) - 10(di_2/dt) - 14i_2 = 0$
    (e) None of the above

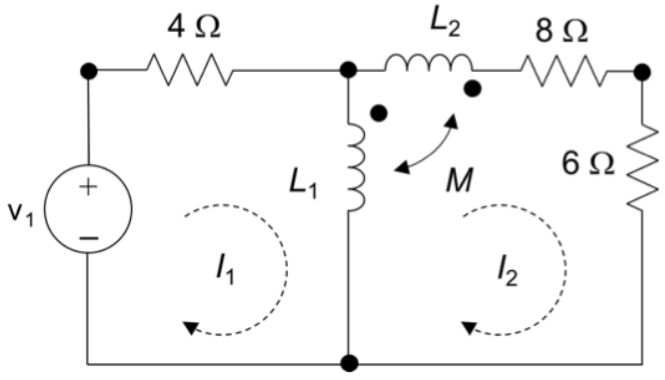

Fig. 11: Circuit of Problem 11

12. In the circuit shown in Fig. 12, $V_S = 75$ V. The switch has been closed for a long time, and is opened at t = 0. How much energy is delivered to the 5 Ω resistor in the time interval interval $0 \leq t < \infty$?

(a) 0.3 J

(b) 1.2 J

(c) 2.7 J

(d) 4.8 J

(e) None of the above

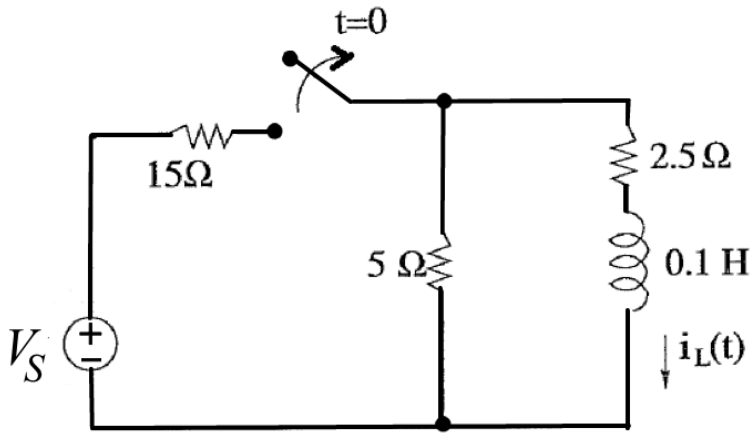

Fig. 12: Circuit of Problem 12

13. In the circuit shown in Fig. 13, the initial currents in inductors L_1 and L_2 (10 A upward and 4 A downward) have been established by sources not shown. The switch is opened at $t = 0$. Find the value of $i_2(t)$ at $t = 0.82$ s.

(a) −5.00 A

(b) −4.80 A

(c) −4.60 A

(d) −4.40 A

(e) None of the above

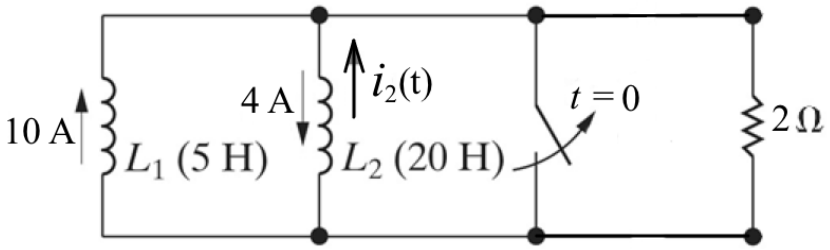

Fig. 13: Circuit of Problem 13

14. In the circuit shown in Fig. 14, $V_S = 180$ V. The two switches operate simultaneously. Switch 1 ($SW1$) has been in position a and switch 2 ($SW2$) has been in position c for a long time. At $t = 0$, $SW1$ moves to position b and $SW2$ moves to position d. Find $V_o(0^+)$.

(a) 10 V

(b) 20 V

(c) 30 V

(d) 40 V

(e) None of the above

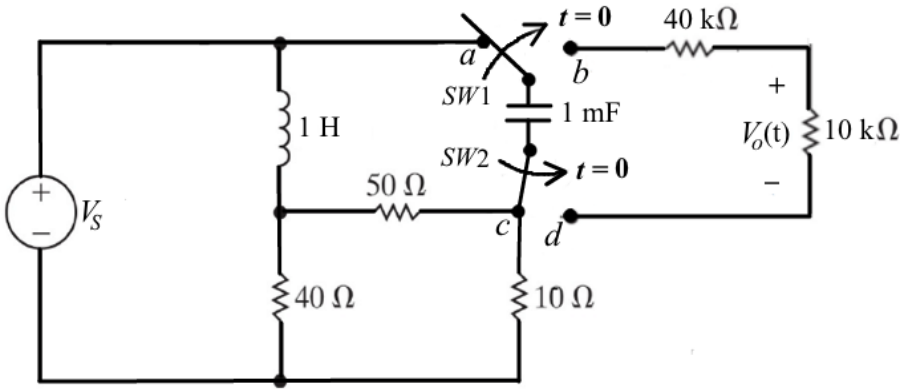

Fig. 14: Circuit of Problem 14

15. In the circuit shown in Fig. 15, the initial capacitor voltages are $v_1(0) = 10$ V and $v_2(0) = 5$ V. Find the value of $v_2(t)$ as $t \to \infty$.

(a) 9 V

(b) 13 V

(c) 17 V

(d) 21 V

(e) None of the above

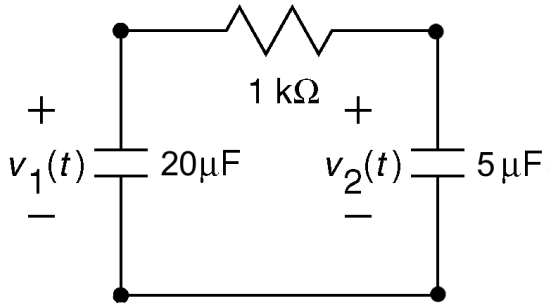

Fig. 15: Circuit of Problem 15