

College of Industrial Technology
King Mongkut's University of Technology North Bangkok

เลขที่นั่งสอบ

Final Examination of Semester 1

Year: 2012

Subject: 341151 Electric Circuits I

Section: 5-6

Date: 5 October 2012

Time: 08.00-10.00

Name: _____ ID: _____ Field of Study: _____

Instructions:

1. Cheating will result in failure of all classes registered for the current semester. Students who are caught cheating will also be denied registering for the following semester.
 2. No documents are allowed to be taken out of the examination room.
 3. Text books are NOT allowed.
 4. Dictionaries and a calculator are allowed.
 5. No documents are allowed to be taken out of the examination room.
 6. No any electronic communication devices allow in the exam room.
 7. The examination has 10 pages (including this page), 3 parts (55 questions) and a total score of 110 points.
 8. Write all your answers on this exam and answers sheet.
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Part 1 (20 points) True/False

Instruction: Mark "True" or "False" for the following questions in **the provided answer sheet**.

1. When using the superposition theorem, each ideal voltage source must be replaced by an open circuit.
2. Thevenin's theorem permits the reduction of any two-terminal linear dc network to one having a single voltage source and series resistance.
3. For nodal analysis, Kirchhoff's current law is used.
4. Super mesh is happened if there is current source in branch.
5. Additional equation from KVL is needed in super mesh circuit.
6. Variables in nodal analysis in the form of electric current.
7. For any physical network, the value of E_{th} can be determined experimentally by measuring the short-circuit voltage across the load terminals.
8. Capacitance is directly proportional to the area of the plates and inversely proportional to the distance between the plates.
9. The total capacitance of several capacitors connected in parallel equals the sum of the individual capacitances.
10. Short circuit between terminals is equivalent to zero voltage.
11. An ideal inductor looks like a short circuit to dc current.
12. The total inductance of several coils in series equals the sum of the individual inductances.
13. An ideal current source has an infinite resistance in series with it.
14. A wattmeter is an instrument used to measure energy.
15. The efficiency of a system is the ratio of the power output divided by the power input.
16. Voltage sources cannot be placed in parallel if they are the same polarity.
17. The current supplied by an ideal source is independent on the load.
18. R_N from Norton theorem is same as R_{Th} from Thevenin theorem.
19. An ideal voltage source has zero internal resistance and an ideal current source has infinite internal resistance.
20. A load will receive maximum power from a linear bilateral dc network when its total resistive value is exactly equal to the Norton resistance of the network as "seen" by the load.

Part 1 (60 points) Multiple choices

Instruction: Mark the correct answer for the following questions in the provided answer sheet.

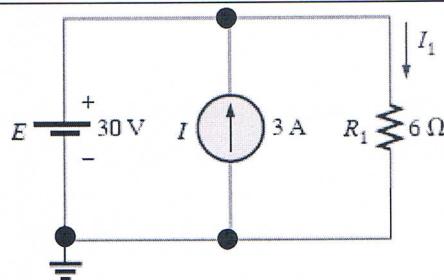


Figure 1.

1. See Figure 1. What is the current at R_1 ?

(A) 2 A (B) 3 A (C) 5 A (D) 8 A

2. See Figure 1. What is the current from voltage source ?

(A) 2 A (B) 3 A (C) 5 A (D) 8 A

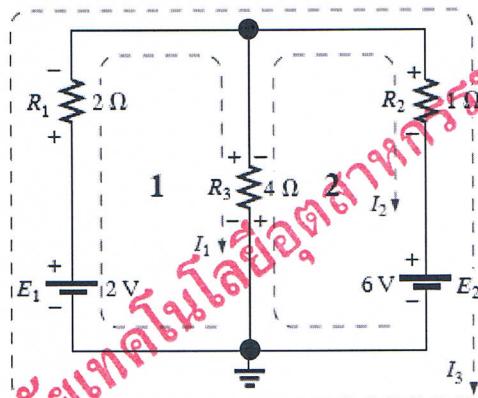


Figure 2.

3. See Figure 2. Which of the following terms describes the voltage across the $4\ \Omega$ resistor when using the mesh analysis (general) approach?

(A) $(4\ \Omega)I_1$ (B) $(4\ \Omega)I_2$
 (C) $(4\ \Omega)(I_1 - I_2)$ (D) $(4\ \Omega)(I_1 + I_2)$

4. See Figure 2. Which statement is true if the loop current I_2 is found to be a negative number?

(A) The nodal analysis approach should have been used, not the mesh analysis approach.
 (B) The determinant used to compute the current is equal to zero.
 (C) The 6 V battery and $1\ \Omega$ resistor should have been converted to a current source.
 (D) The original direction assumed for I_2 is wrong.

5. See Figure 2. If nodal analysis were to be used to solve for unknown voltages in this circuit, how many nodes would be needed (including the reference node)?

(A) 1 (B) 2 (C) 3 (D) 4

6. See Figure 2. The equation obtained from performing mesh analysis on mesh #1 is:

(A) $2V - 2I_1 - 4(I_1 - I_2) = 0$ (B) $2V + 2I_1 + 4(I_1 - I_2) = 0$
 (C) $2V + 2I_1 - 4(I_1 - I_2) = 0$ (D) $2V - 2I_1 + 4(I_1 - I_2) = 0$

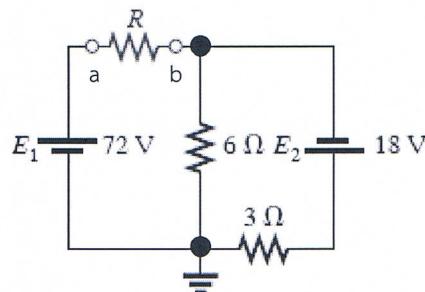


Figure 3.

7. See Figure 3. What is the Thevenin resistance at the terminal a-b (after moving R out)?
 (A) 1 Ω (B) 2 Ω (C) 3 Ω (D) 9 Ω

8. See Figure 3. What is the Thevenin voltage at the terminals ?
 (A) 90 V (B) 54 V (C) 60 V (D) 84 V

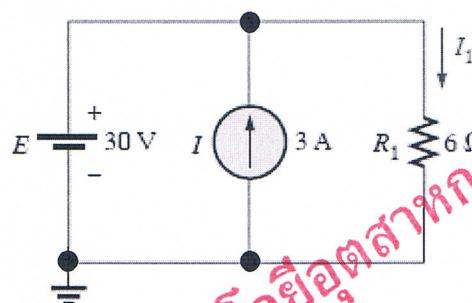


Figure 4.

9. See Figure 4. Using the superposition theorem, what is the portion of the current through the 6 Ω resistor caused by the 30 V battery?
 (A) 3 A (B) 4 A (C) 5 A (D) 8 A

10. Thevenin's theorem states that you can replace a bilateral dc network with an equivalent circuit consisting of _____.
 (A) a voltage source and a series resistor.
 (B) a current source and a series resistor.
 (C) a current source and a parallel resistor.
 (D) a voltage source and a parallel resistor.

11. Thevenin's theorem states that the Thevenin voltage is equal to _____.
 (A) open circuit voltage at the network terminals.
 (B) short circuit voltage at the network terminals.
 (C) open circuit current at the network terminals.
 (D) short circuit current at the network terminals.

12. Current sources may be placed in series if they are _____.
 (A) identical (B) different
 (C) the same in polarity (D) different in polarity

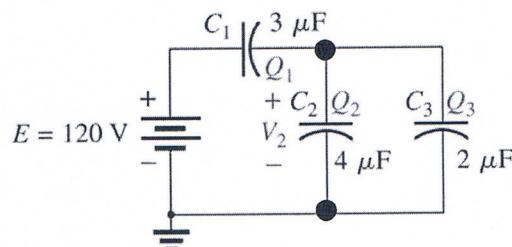


Figure 5.

13. See Figure 5. What is the total capacitance C_T ?

- (A) $2.5 \mu\text{F}$ (B) $4.33 \mu\text{F}$ (C) $6 \mu\text{F}$ (D) $9 \mu\text{F}$

14. What is a dielectric?

- (A) A conductive plate in a capacitor
 (B) A measurement of capacitance
 (C) A charged particle
 (D) An insulator between two metal plates in a capacitor

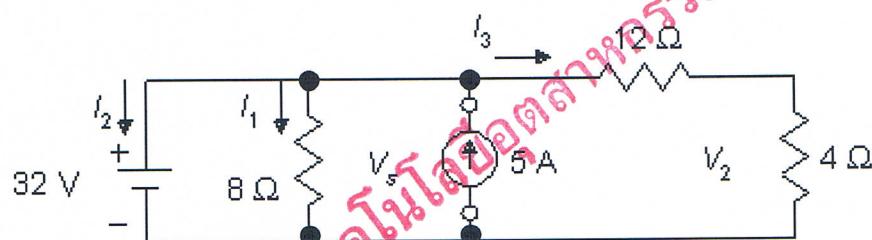


Figure 6.

15. Find the current I_2 from Figure 6.

- (A) -1.5 A (B) -1 A (C) 1.5 A (D) 1 A

16. Find the voltage V_s in Figure 6.

- (A) 28 V (B) 34 V (C) 30 V (D) 32 V

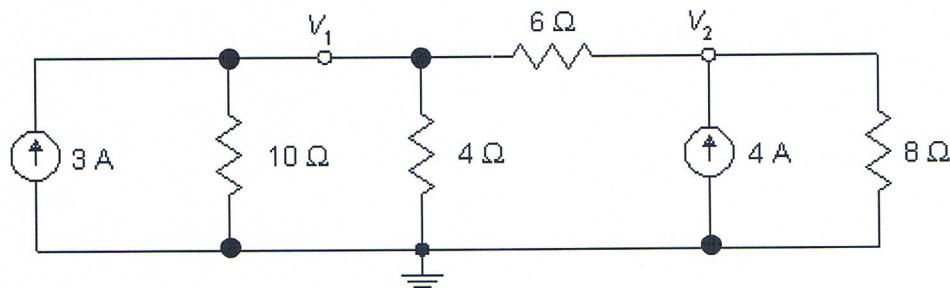


Figure 7.

17. Using the circuit in Figure 7, find V_1 .

- (A) 12.54 V (B) 14.44 V (C) 13.62 V (D) 11.45 V

18. Find V_2 from the circuit of Figure 7.

- (A) -20.9 V (B) 20.9 V (C) -18.3 V (D) 18.3 V

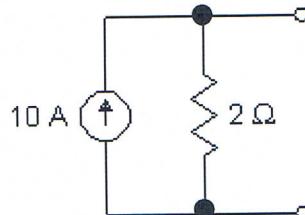
19. An ideal current source has _____ source resistance.

- (A) infinity (B) zero
 (C) small (D) large

20. A load will receive maximum power from a linear bilateral dc network when its total resistive value is _____ the Thévenin resistance of the network as "seen" by the load.

- (A) exactly equal to
- (B) less than
- (C) about the same as
- (D) larger than

21. Convert the current source to a voltage source.



- (A) 20 V and 20 Ω
- (B) 2 V and 2 Ω
- (C) 20 V and 2 Ω
- (D) 2 V and 20 Ω

22. The star (Y) and the delta (Δ) configurations often appear in a circuit as _____.

- (A) opposites of each other
- (B) duals of each other
- (C) neither series nor parallel
- (D) both series and parallel

23. The most obvious advantage of the superposition theorem is that _____ advanced mathematical techniques.

- (A) it makes it harder to use
- (B) it makes it easier to use
- (C) it does not require
- (D) it requires

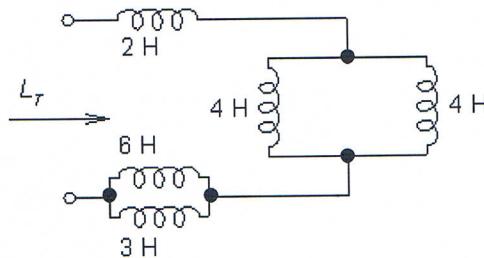
24. E_{th} is the _____ voltage looking back into the two-terminal network.

- (A) short circuit
- (B) load
- (C) fully loaded
- (D) open circuit

25. A capacitor has a capacitance of 1 farad if 1 _____ of charge is deposited on the plates by a potential difference of 1 volt across the plates.

- (A) particle
- (B) amp
- (C) atom
- (D) coulomb

26. Find the total inductance.

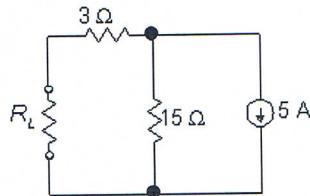


- (A) 4.5 H
- (B) 3 H
- (C) 1.25 H
- (D) 6 H

27. For loads connected directly to a dc-voltage supply, maximum power will be delivered to the load when the _____ is equal to the internal resistance of the source.

- (A) total resistance
- (B) Norton resistance
- (C) load resistance
- (D) Thévenin resistance

28. Find the Norton equivalent of the circuit used in Figure below.

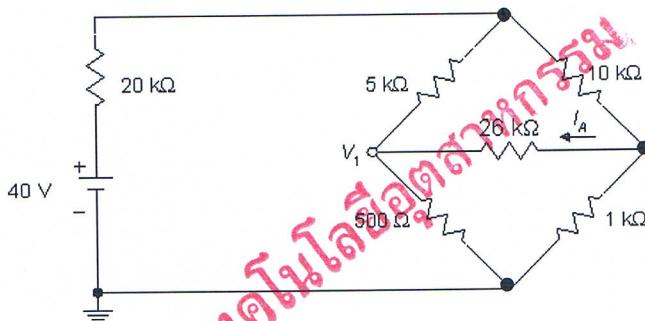


- (A) 21.2Ω and 0.53 A
 (B) 22.3Ω and 760 mA
 (C) 22.3Ω and 5.3 A
 (D) 21.2Ω and 590 mA

29. In the Norton equivalent circuit of Problem 28, find the power delivered to the load resistor if it is 4Ω .

- (A) 53.4 W
 (B) 46.5 W
 (C) 4.65 W
 (D) 5.34 W

30. Determine the current I_A .

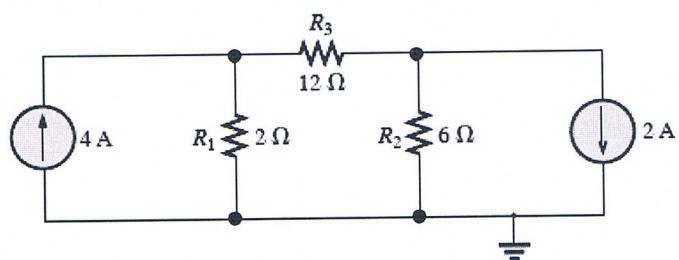


- (A) 1.2 mA
 (B) 0 A
 (C) $1.2 \mu\text{A}$
 (D) 2 mA

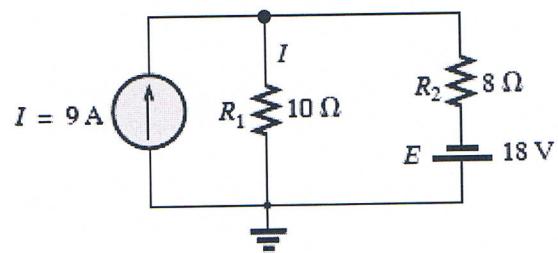
Part 3 (30 points) Calculation

Instruction: Show the mathematical expression and answers of following problems.

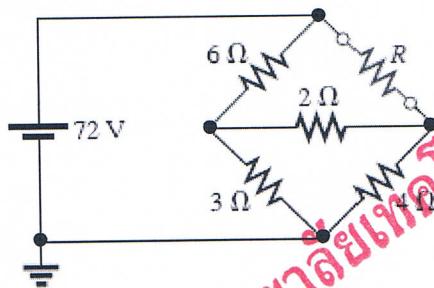
1. Using the nodal analysis approach, determine the nodal voltages V_{R1} and V_{R2} for the networks of figure below.



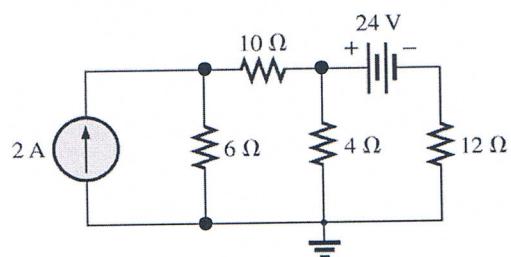
2. Using superposition, find the current I through the 10-resistor for each of the networks of figure below.



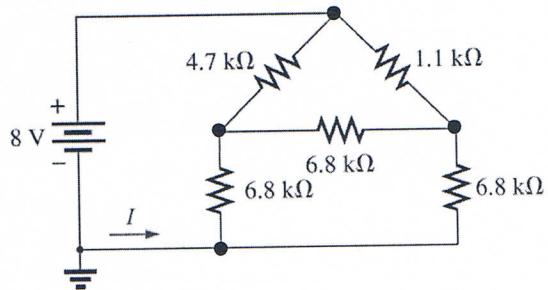
3. Find the Thévenin equivalent circuit for the network below.



4. Use supernode approach to determine the nodal voltages for the network below.



5. Convert the Δ of $6.8 \text{ k}\Omega$ resistors in network below to a Y configuration and find the current I.



วิทยาลัยเทคโนโลยีจุฬาภรณ์ราชวิถี

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Asst. Prof. Dr. Titipong Lertwiriyaprapa

Answer Sheet

เลขที่นั่งสอบ

Name: _____ ID: _____

Subject: 341151 Electric Circuits I

Part 1Part 2

	True	False
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