Index Number: 11/ENG/

- ANSWER ALL QUESTIONS
- SECTION A: SHADE THE ANSWER TO ALL QUESTIONS IN
- ANSWER SECTION B IN THE ANSWER BOOK
- BOOLEAN ALGEBRA THEOREMS ARE PROVIDED IN THE

1. Digital circuits play a very important role in today's electronic systems
employed in almost every facet of electronics, excluding:
   a) Control instrumentation
   b) Communication
   c) Computing
   d) Amplification of weak signals

2. A logic gate is:
   a) A special type of amplifier circuit designed to amplifier volta
      corresponding to binary 1's and 0's
   b) A special type of amplifier circuit designed to amplifier curre
      corresponding to binary 1's and 0's
   c) A special type of voltage amplifier circuit designed to perform
      corresponding to binary 1's and 0's
   d) A special type of amplifier circuit designed to accept and pro
      signals corresponding to binary 1's and 0's

3. Which of the following statements does NOT describe an advantage
technology?

d) In digital system... that the circuitry used to ge...

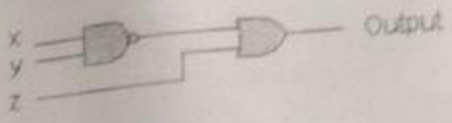
e) None of the above

A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

4. What type of logic gate is this?

a) 3 Inputs OR
b) 3 Inputs AND
c) 3 Inputs NOR
d) 3 Inputs NAND
e) none of the above

5. What function is implemented by the circuit shown



a) $\bar{x}.\bar{y}+z$
b) $(\bar{x}+\bar{y})z$
c) $\bar{x}.\bar{y}.z$
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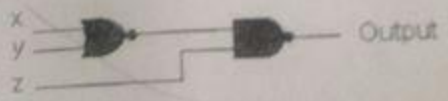

a) $x+y+z$
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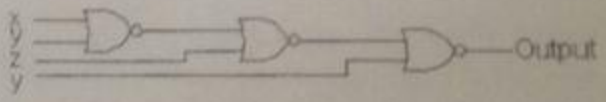
7. What function is implemented by the circuit shown



a) $xz+y$
b) $\bar{x}.z+\bar{y}$
c) $\bar{x}.\bar{y}+\bar{y}.\bar{z}$
d) $\bar{x}.\bar{y}+\bar{y}.z$

8. Use Boolean algebra to simplify the logic function $A + (\bar{A}.B)$

(a) $A.B + \bar{A}$

valuations for input switches A, B and C that generate a 1 at the output: (A=1, B=1, C=0), (A=1, B=0, C=1), (A=0, B=1, C=1),

i. Complete the truth table
ii. Write the Boolean expression
iii. Draw the Logic circuit

A	B	C	output
0	0	0	
1	1	0	
1	0	1	
0	1	1	

F. K AMPONG

Appendix A

Single-Variable Theorems

1a. $x \cdot 0 = 0$

1b. $x + 1 = 1$

2a. $x \cdot 1 = x$

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...onics II

Index number..... 6225111 .....

March 2014

TIME : 1 Hr

Answer all questions
Answer section A on the question paper and section B in your answer booklet.
(Find attached: Appendix A - list of Boolean algebra theorems)
Section A [10 Marks]

1. Digital circuits play a very important role in today's electronic systems. They are employed in almost every facet of electronics, excluding,
   a) Control Instrumentation
   b) Communication
   c) Computing
   d) Amplification of weak signals
   e) None of the above

2. A logic gate is:
   a) A special type of amplifier circuit designed to amplifier voltage signals corresponding to binary 1's and 0's.
   b) A special type of amplifier circuit designed to amplifier current signals corresponding to binary 1's and 0's.
   c) A special type of voltage amplifier circuit designed to generate voltage signals corresponding to binary 1's and 0's.
   d) A special type of amplifier circuit designed to accept and generate voltage signals corresponding to binary 1's and 0's.
   e) None of the above

3. Which of the following statements about a logic gate is false?
   a) Gate circuits are most commonly represented in a schematic by their own unique symbols rather than by their constituent transistors and resistors.
   b) Logic circuits provide solution to a problem. They implement functions that are needed to carry out specific tasks
   c) Within the framework of a computer, logic circuits do not provide complete capability for execution of programs and processing of data.

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   b) Logic circuits provide solution to a problem. They implement functions that are needed to carry out specific tasks
   c) Within the framework of a computer, logic circuits do not provide complete capability for execution of programs and processing of data.

d) In digital systems, the convenient feature of using ON/OFF voltage levels is that the circuitry used to generate, manipulate and store them is very simple
e) None of the above

4. What type of logic gate is this?

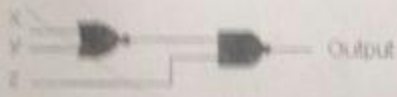
X	Y	Z	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

a) 3 Inputs OR
b) 3 Inputs AND
c) 3 Inputs NOR
d) 3 Inputs NAND
e) none of the above

5. What function is implemented by the circuit shown

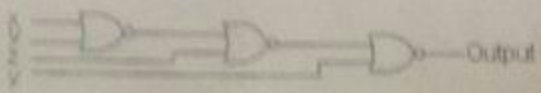
a) $\bar{x}\bar{y} + z$
b) $(\bar{x} + \bar{y})z$
c) $\bar{x}\bar{y}z$
d) $\bar{x} + \bar{y} + z$

6. What function is implemented by the circuit shown



a) $x + y + z$
b) $x + y + \bar{z}$
c) $\bar{x}\bar{y}z$
d) $\bar{x} + \bar{y} + \bar{z}$

What function is implemented by the circuit shown



a) $xz + y$
b) $\bar{x}z + \bar{y}$
c) $\bar{x}\bar{y} + \bar{y}\bar{z}$
d) $\bar{x}\bar{y} + \bar{y}z$

Use Boolean algebra to simplify the logic function $A + (\bar{A}\ B)$

(a) $A.B + \bar{A}$

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e) None of the above

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X	Y	Z	X
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1	0	0	0
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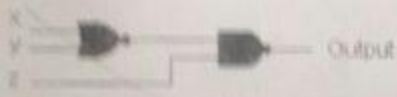

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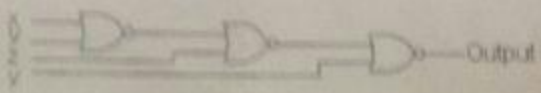

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(a) $A.B + \bar{A}$

10. Simplify the expression $\overline{\overline{A}+C(B+\overline{D})}+\overline{A}$

(a) $A\overline{C}+B\overline{D}$

(b) $\overline{A}C+B\overline{D}$

(c) $AC+\overline{B}\overline{D}$

(d) $A\overline{C}+\overline{B}\overline{D}$

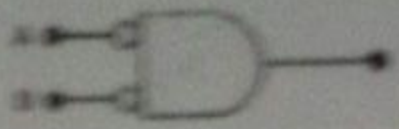

Figure 1

11. Figure 1 is the alternate logic gate representation for a .....

(a) NOR

(b) AND

(c) NOT

(d) NAND

SECTION B THEORY: ANSWER THIS SECTION IN YOUR A BOOKLETS

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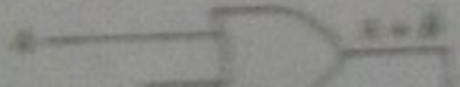
I. Write down the Boolean expression

II. Simplify the Boolean expression

III. Draw the simplified circuit



4. A standard way of representing the behavior of logic circuits is to use
(a) Boolean algebra
(b) Boolean algebra theorems and axioms
(c) Universal gates
(d) Truth tables

5. The output of an AND gate with three inputs, A, B, and C, is HIGH when
(a) A = 1, B = 1, C = 0
(b) A = 0, B = 0, C = 0
(c) A = 1, B = 1, C = 1
(d) A = 1, B = 0, C = 1

A	B	C
0	0	0
0	0	1

6. If a 3-input NOR gate has eight input possibilities, how many of those possibilities will result in a HIGH output?

(a) 1

(b) 2

(c) 7

(d) 8

7. Use Boolean algebra to simplify the logic function $A + (\bar{A} \cdot B)$

(a) $A \cdot B + \bar{A}$

(b) $A + B$

(c) $\bar{A} + A$

(d) $\bar{A} \cdot A$

8. Use Boolean algebra to simplify the logic function $A \cdot (B + \bar{B} \cdot C)$.

(a) $A \cdot (B + C)$

(b) $A + \bar{B}$

(c) $A \cdot C + B$

(d) $A + B \cdot C$

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(b) $A + B$
(c) $\bar{A} + A$
(d) $\bar{A} \cdot A$

8. Use Boolean algebra to simplify the logic function $A(B + \bar{B}C)$
(a) $A(B + C)$
(b) $A + \bar{B}$
(c) $A \cdot C + B$
(d) $A + BC$

Index Number: 113513

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   c) A special type of voltage amplifier circuit designed to generate corresponding to binary 1's and 0's
   d) A special type of amplifier circuit designed to accept and produce signals corresponding to binary 1's and 0's

3. Which of the following statements does NOT describe an advantage of technology?

(d) $\bar{A}$

7. Use Boolean algebra to simplify the logic function $A + (\bar{A}.B)$

(a) $A.B + \bar{A}\bar{B}$

(b) $A + B$

(c) $\bar{A} + A$

(d) $\bar{A}.A$

8. Use Boolean algebra to simplify the logic function $A.B + \bar{B}.C$

(a) $A.(B + C)$

(b) $A + \bar{B}$

(c) $A.C + B$

(d) $A + B.C$

9. Simplify the logic function $F = (B + A).(B + C)$

(a) $B + A.C$

(b) $B.A + B$

(c) $(A + B).B.C$

(d) $C + A.B$

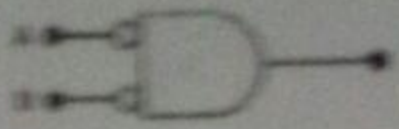
10. Simplify the expression $\overline{\overline{A+C}(B+\overline{D})}+F$

(a) $A\overline{C}+B\overline{D}$

(b) $\overline{A}C+BD$

(c) $AC+\overline{B}\overline{D}$

(d) $A\overline{C}+\overline{B}D$



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(c) NOT

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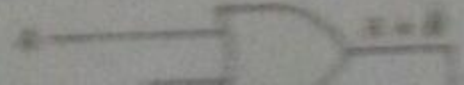

$AB + B + B'$

$B(A + 1 + 1)$

$B + 1$

Appendix

$B(A + 1)$

$B \cdot 1 + B$

$AB + B$

Single-Variable Theorems

1a. $x \cdot 0 = 0$

1b. $x + 1 = 1$

2a. $x \cdot 1 = x$

2b. $x + 0 = x$

3a. $x \cdot x = x$

3b. $x + x = x$

4a. $x \cdot \bar{x} = x$

4b. $x + \bar{x} = 1$

5. $\bar{\bar{x}} = x$

Two- and Three-Variable Properties

1a. $x \cdot y = y \cdot x$ — Cumulative

1b. $x + y = y + x$

2a. $x \cdot (y \cdot z) = (x \cdot y) \cdot z$ — Associative

2b. $x + (y + z) = (x + y) + z$

3a. $x \cdot (y + z) = x \cdot y + x \cdot z$ — Distributive

3b. $x + y \cdot z = (x + y) \cdot (x + z)$

4a. $x + x \cdot y = x$ — Absorption

4b. $x \cdot (x + y) = x$

5a. $x \cdot y + x \cdot \bar{y} = x$ — Combining

5b. $(x + y) \cdot (x + \bar{y}) = x$

6a. $\overline{x \cdot y} = \bar{x} + \bar{y}$ — DeMorgan's The

6b. $\overline{x + y} = \bar{x} \cdot \bar{y}$

7a. $x + \bar{x} \cdot y = x + y$

7b. $x \cdot (\bar{x} + y) = x \cdot y$

8a. $x \cdot y + y \cdot z + \bar{x} \cdot z = x \cdot y + \bar{x} \cdot z$ — Co

8b. $(x + y) \cdot (y + z) \cdot (\bar{x} + z) = (x + y) \cdot (\bar{x} + z)$

4. A standard way of representing the behavior of logic circuits is to use
(a) Boolean algebra
(b) Boolean algebra theorems and axioms
(c) Universal gates
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5. The output of an AND gate with three inputs, A, B, and C, is HIGH when
(a) A = 1, B = 1, C = 0
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(d) A = 1, B = 0, C = 1

A	B	1
0	0	0
0	0	1

6. If a 3-input NOR gate has eight input possibilities, how many of those possibilities will result in a HIGH output?

(a) 1

(b) 2

(c) 7

(d) 8

7. Use Boolean algebra to simplify the logic function $A + (\bar{A}B)$

(a) $AB + \bar{A}$

(b) $A + B$

(c) $\bar{A} + A$

(d) $\bar{A}A$

$A + (\bar{A}B)$

$A + B$

8. Use Boolean algebra to simplify the logic function $A(B + \bar{B}C)$.

(a) $A(B + C)$

(b) $A + \bar{B}$

(c) $AC + B$

(d) $A + BC$

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(a) Boolean algebra
(b) Boolean algebra theorems and axioms
(c) Universal gates
(d) Truth tables

5. The output of an AND gate with three inputs, A, B, and C, is HIGH
(a) $X = 1, B = 1, C = 0$
(b) $A = 1, B = 1, C = 1$
(c) $A = 1, B = 1, C = 1$
(d) $A = 1, B = 1, C = 1$

A	B	C
0	0	x
0	0	

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(a) $A.B + \bar{A}$
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$A + (\bar{A} B)$
$A + B$

8. Use Boolean algebra to simplify the logic function $A.B + \bar{B}$
(a) $A.(B + C)$
(b) $A + \bar{B}$
(c) $A.(C + B)$
(d) $A + B + C$

$A \cdot B + \bar{B} C$

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(c) $A.C + B$
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10. Simplify the expression $(\bar{A} + C)(B + \bar{D}) + \bar{A}$

(a) $A\bar{C} + B\bar{D}$
(b) $\bar{A}C + B\bar{D}$
(c) $A\bar{C} + B\bar{D}$
(d) $A\bar{C} + B\bar{D}$

Figure 1

11. Figure 1 is the alternate logic gate representation for a .....
(a) NOR
(b) AND
(c) NOT
(d) NAND

SECTION B THEORY: ANSWER THIS SECTION IN YOUR A BOOKLETS

12. For the circuit in figure 2 perform the following

i. Write down the Boolean expression
ii. Simplify the Boolean expression
iii. Draw the simplified circuit

(b) A + B
(c) $\bar{A}$ + A
(d) $\bar{A}$.A

9. Use Boolean algebra to simplify the logic function A.(B + $\bar{B}$.C).
(a) A.(B + C)
(b) A + $\bar{B}$
(c) A.C + B
(d) A + B.C

10. Simplify the logic function F = (B+A).(B+C).
(a) B+A.C
(b) B.A+B
(c) (A+B).(B.C)
(d) C+A.B

SECTION B [10 MARKS]

ANSWER ALL QUESTIONS FROM THIS SECTION IN YOUR ANSWER BOOKS

11. Draw the Logic circuit that would be used to implement the following Boolean equations

a) P = (AC + BC)(A + C)
b) R = BC + D + AD
c) S = B(A + C) + AC + D

12.

INPUT			OUTPUT
C	B	A	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Let us assume that we are designing a simple electronic lock. The lock will open only when certain switches are activated. A 1 at the output will open the lock. There are three

valuations for input switches A, B and C that generate a 1 at the output: (A=1, B=1, C=0), (A=1, B=0, C=1), (A=0, B=1, C=1),

i. Complete the truth table
ii. Write the Boolean expression
iii. Draw the Logic circuit

A	B	C	output
0	0	0	
1	1	0	
1	0	1	
0	1	1	

F. K AMPONG

Appendix A

Single-Variable Theorems

1a. $x \cdot 0 = 0$

1b. $x + 1 = 1$

2a. $x \cdot 1 = x$

d) In digital systems, the convenient feature of using ON/OFF voltage levels is that the circuitry used to generate, manipulate and store them is very simple
e) None of the above

4. What type of logic gate is this?

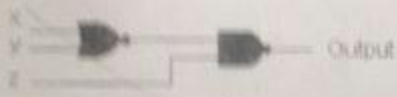
X	Y	Z	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

a) 3 Inputs OR
b) 3 Inputs AND
c) 3 Inputs NOR
d) 3 Inputs NAND
e) none of the above

5. What function is implemented by the circuit shown

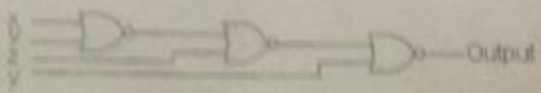
a) $\bar{x}\bar{y} + z$
b) $(\bar{x} + \bar{y})z$
c) $\bar{x}\bar{y}z$
d) $\bar{x} + \bar{y} + z$

6. What function is implemented by the circuit shown



a) $x + y + z$
b) $x + y + \bar{z}$
c) $\bar{x}\bar{y}z$
d) $\bar{x} + \bar{y} + \bar{z}$

What function is implemented by the circuit shown



a) $xz + y$
b) $\bar{x}z + \bar{y}$
c) $\bar{x}\bar{y} + \bar{y}\bar{z}$
d) $\bar{x}\bar{y} + \bar{y}z$

Use Boolean algebra to simplify the logic function $A + (\bar{A}\ B)$

(a) $A.B + \bar{A}$

...onics II

Index number..... 6225111 .....

March 2014

TIME : 1 Hr

Answer all questions
Answer section A on the question paper and section B in your answer booklet.
(Find attached: Appendix A - list of Boolean algebra theorems)
Section A [10 Marks]

1. Digital circuits play a very important role in today's electronic systems. They are employed in almost every facet of electronics, excluding,
   a) Control Instrumentation
   b) Communication
   c) Computing
   d) Amplification of weak signals
   e) None of the above

2. A logic gate is:
   a) A special type of amplifier circuit designed to amplifier voltage signals corresponding to binary 1's and 0's.
   b) A special type of amplifier circuit designed to amplifier current signals corresponding to binary 1's and 0's.
   c) A special type of voltage amplifier circuit designed to generate voltage signals corresponding to binary 1's and 0's.
   d) A special type of amplifier circuit designed to accept and generate voltage signals corresponding to binary 1's and 0's.
   e) None of the above

3. Which of the following statements about a logic gate is false?
   a) Gate circuits are most commonly represented in a schematic by their own unique symbols rather than by their constituent transistors and resistors.
   b) Logic circuits provide solution to a problem. They implement functions that are needed to carry out specific tasks
   c) Within the framework of a computer, logic circuits do not provide complete capability for execution of programs and processing of data.

(b) A + B
(c) $\bar{A}$ + A
(d) $\bar{A}$.A

9. Use Boolean algebra to simplify the logic function A.(B + $\bar{B}$.C).
(a) A.(B + C)
(b) A + $\bar{B}$
(c) A.C + B
(d) A + B.C

10. Simplify the logic function F = (B+A).(B+C).
(a) B+A.C
(b) B.A+B
(c) (A+B).(B.C)
(d) C+A.B

SECTION B [10 MARKS]

ANSWER ALL QUESTIONS FROM THIS SECTION IN YOUR ANSWER BOOKS

11. Draw the Logic circuit that would be used to implement the following Boolean equations

a) P = (AC + BC)(A + C)
b) R = BC + D + AD
c) S = B(A + C) + AC + D

12.

INPUT			OUTPUT
C	B	A	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Let us assume that we are designing a simple electronic lock. The lock will open only when certain switches are activated. A 1 at the output will open the lock. There are three

d) In digital system... that the circuitry used to ge...

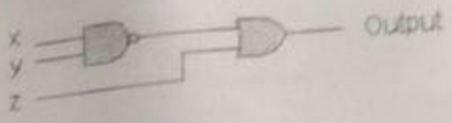
e) None of the above

A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

4. What type of logic gate is this?

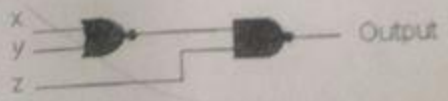
a) 3 Inputs OR
b) 3 Inputs AND
c) 3 Inputs NOR
d) 3 Inputs NAND
e) none of the above

5. What function is implemented by the circuit shown



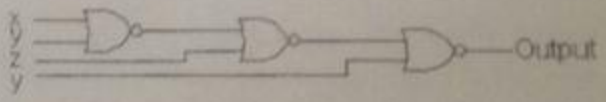
a) $\bar{x}.\bar{y}+z$
b) $(\bar{x}+\bar{y})z$
c) $\bar{x}.\bar{y}.z$
d) $\bar{x}+\bar{y}+z$

6. What function is implemented by the circuit shown



a) $x+y+z$
b) $x+y+\bar{z}$
c) $\bar{x}.\bar{y}.z$
d) $\bar{x}+\bar{y}+\bar{z}$

7. What function is implemented by the circuit shown



a) $xz+y$
b) $\bar{x}.z+\bar{y}$
c) $\bar{x}.\bar{y}+\bar{y}.\bar{z}$
d) $\bar{x}.\bar{y}+\bar{y}.z$

8. Use Boolean algebra to simplify the logic function $A + (\bar{A}.B)$

(a) $A.B + \bar{A}$