



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 3

EEE412- DIGITAL ELECTRONICS 1A

FINAL EXAMINATION – PENSTER 1, 2014

DAY/DATE: Wednesday 12/03/2014 TIME:0900AM – 1110AM

INSTRUCTIONS TO STUDENTS

- 1. You are allowed 10 minutes Extra reading time during which you are NOT to write.*
- 2. Begin each answer on a fresh page and use both sides of the sheet.*
- 3. Write your candidate-number at the top of each attached sheet*
- 4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string*
- 5. For all sheets of paper on which rough/draft work has been done, cross each one through and attach these to your answer script.*
- 6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
- 7. ATTEMPT ALL QUESTIONS.*
- 8. Show all workings where necessary.*
- 9. Do not use programmable calculators, especially the ones that does the conversions of number systems.*
- 10. ALWAYS CHECK YOUR ANSWER SCRIPT BEFORE YOU SUBMIT IT!*

- 1) The decimal equivalent of the following binary number 1011_2 is:
A) 11_{10}
B) 15_{10}
C) 10_{10}
D) 35_{10}
- 2) An analogue instrument for measuring Voltage, Current & Resistance is called a
A) analogue multi-meter
B) cathode ray oscilloscope
C) logic probe
D) digital multi-meter
- 3) The Boolean expression for a three-input AND gate is:
A) $A + B + C$
B) ABC
C) $AB + C$
D) $A + B$
- 4) Identify which Logic Gate the following Truth Table is for:

- A) AND GATE
- B) NOR GATE
- C) EX-OR GATE
- D) EX-NOR GATE

INPUTS		OUTPUT
A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

- 5) A common 7-bit code used to represent numbers, letters, punctuation marks, and control characters is known by the acronym
A) ASCII
B) Gray
C) Parity
D) EBCDIC
- 6) The sum of $100000_2 + 011100_2$ equals
A) 110011_2
B) 100001_2
C) 110100_2
D) 111100_2
- 7) Which flip-flop has Set & Reset inputs beside the clock input?
A) JK flip flop
B) SR flip flop
C) D flip flop
D) T flip flop

8) Applying DeMorgan's theorem to the expression $\overline{A \cdot B \cdot C}$ will get _____.

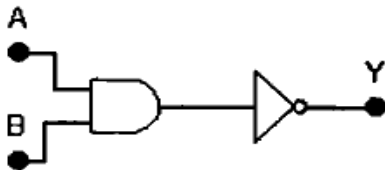
- A) $\overline{A} + \overline{B} + \overline{C}$
- B) $A(B + C)$
- C) $\overline{A + B + C}$
- D) $\overline{A} \cdot \overline{B} \cdot \overline{C}$

9) From the truth table below, determine the standard SOP expression.

Inputs			Output
A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

- A) $\overline{A} \overline{B} \overline{C} + A B C + \overline{A} B C$
- B) $A \overline{B} C + \overline{A} B C + A \overline{B} C$
- C) $A B C + A B C + A B C$
- D) $\overline{A} \overline{B} C + \overline{A} B C + A B \overline{C}$

10) This combination of gates will generate the _____ logic function.



- A) AND gate
- B) OR gate
- C) Ex-OR gate
- D) NAND gate

11) If a 3-input OR gate has eight input possibilities, how many of those possibilities will result in a HIGH output?

- A) 1
- B) 7
- C) 2
- D) 8

12) Which of the following statements does NOT describe an advantage of digital technology?

- A) Information storage is easy.
- B) The operation can be programmed.
- C) The circuits are less affected by noise.
- D) The values may vary over a continuous range.

13) Convert hexadecimal value C1 to binary.

- A) 11000001
- B) 1000111
- C) 111000100
- D) 111000001

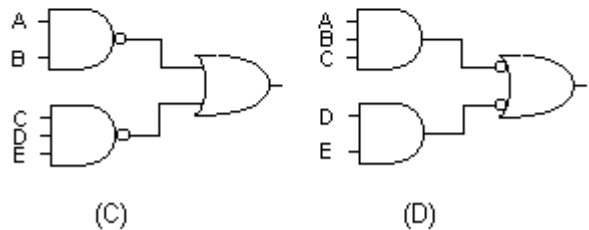
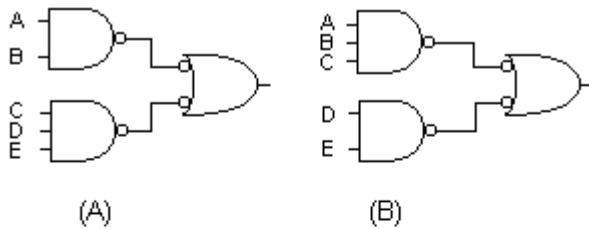
14) The binary number for octal 44_8 is _____.

- A) 100010
- B) 100101
- C) 110101
- D) 100100

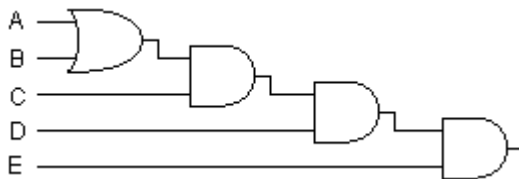
15) A decimal 11_{10} in BCD is _____.

- A) 00001011
- B) 00001100
- C) 00010001
- D) 00010010

16) Implementing the expression $ABC + DE$ using NAND logic, we get:



17) Derive the Boolean expression for the logic circuit shown below:



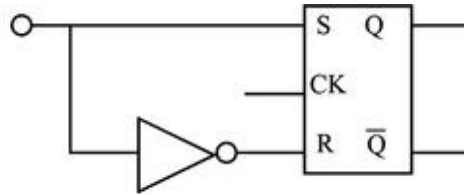
- A) $[C(A+B)\overline{D}+E]$
- B) $ABCDE$
- C) $C(A+B)DE$
- D) $[[C(A + B)]C] \overline{E}$

18) A 4-bit counter will count from binary 0000 to _____.

- A) 1111
- B) 1000
- C) 0011
- D) 1110

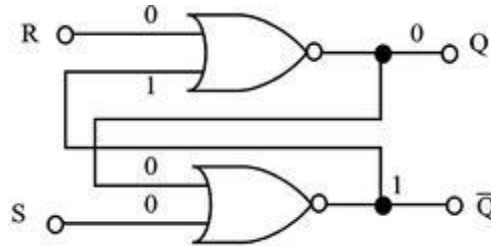
19) Identify the type of Flip Flop the Logic Gate circuit represents:

- A) MS flip flop
- B) SR flip flop
- C) T flip flop
- D) D flip flop



20) Identify the type of Flip Flop the Logic Gate circuit represents:

- A) D Flip Flop
- B) SR Flip Flop
- C) MS Flip Flop
- D) JK Flip Flop



A. WRITE TRUE OR FALSE**(5 MARKS)**

1. The job of a latch can be performed by a D-flip-flop.
2. To form an excess-3 coded number, decimal 3 is added to the decimal number and this is converted to its 4-bit binary code.
3. An 8-bit grouping of binary digits is called a nibble.
4. Electronic devices that can be programmed and have alphanumeric displays probably contain digital circuitry.
5. The Boolean expression $AB + BC + Y$ is in the Product of the Sum form.

B. FILL IN THE BLANKS**(5 MARKS)**

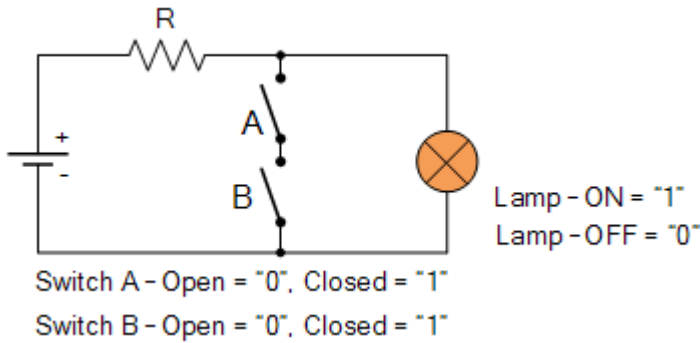
10, D, 1, 16, two states, octal, 4, B, hexadecimal, 8, toggle, reset, 0, octal, binary, 9
--

1. The number of possible input combinations for a 3-input gate is _____.
2. The Boolean expression $B + BC$ is equal to _____.
3. A decade counter will count through to decimal _____.
4. Assume a J-K flip-flop has 1s on the J and K inputs. The next clock pulse will cause the output to _____.
5. The _____ number system has a base of sixteen.

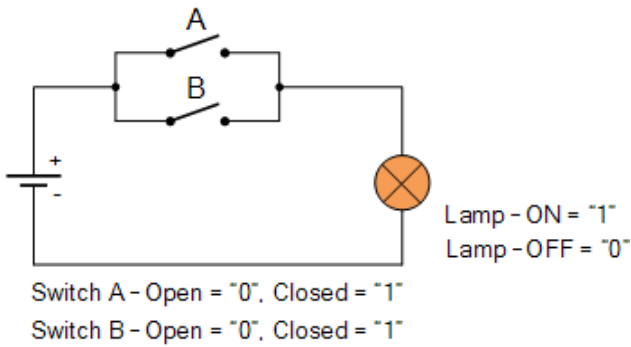
a) Determine what equivalent logic gate function are represented by the following circuit diagram.

(3 marks)

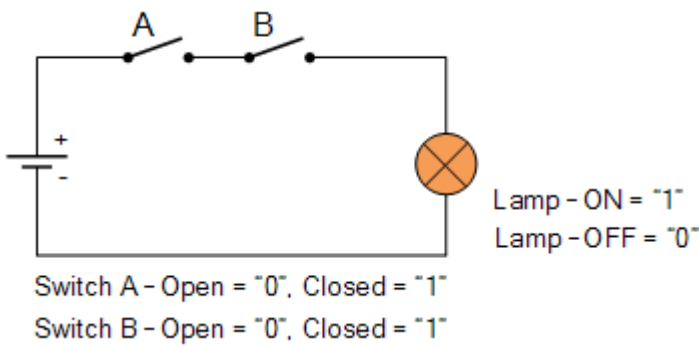
i)



ii)



iii)



b) Convert the following hexadecimal number to decimal notation. Show the necessary working.

i) BBC

(2 marks)

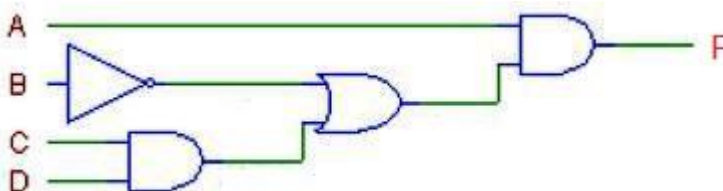
ii) 445

(2 marks)

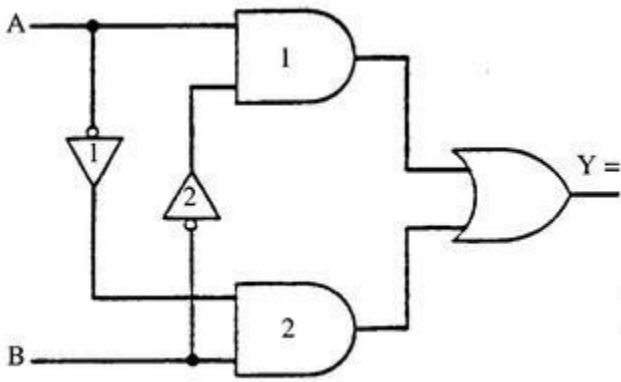
c) Write the Boolean expression for the following circuits:

(4 marks)

i)



ii)



d) Show that $(A+B) \cdot (A+C) = A+B.C$ using Boolean algebra. **(3 marks)**

e) For the Boolean algebra shown below: simplify using K map. **(4 marks)**

$$F = \bar{A}\bar{B}CD + \bar{A}BCD + A\bar{B}CD + AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D} + ABCD$$

f) Three switches A, B, C control a device. The device must operate if A is on and B is on but C is off or if A is off B is on and C is on or if A is on B is off and C is on. Under all other conditions the device must not operate. Take Q as the output.

i) Draw the truth table **(4 marks)**

ii) Write the Boolean expression **(2 marks)**

g) Apply DeMorgan's theorems to each of the following expressions:

i) $Q = \overline{A + B + C}$ **(2 marks)**

ii) $P = \overline{A B + \bar{A} \bar{B}}$ **(3 marks)**

h) Express the Gray Code for the decimal number 47. **(3 marks)**

i) Express the following decimal numbers in excess-3 code: **(3 marks)**

i) 821

ii) 6243

- a) Draw the logic symbols of the following: **(4 marks)**
 i) D-FF
 ii) JK-FF
 iii) T-FF
 iv) SR-FF
- b) What happens to the clock inputs in a synchronous counter? **(2 marks)**
- c) Draw a three-bit asynchronous binary counter circuit and its timing diagram for one cycle. **(8 marks)**
- d) i) Name the flip flop used in Debounced circuits. **(1 mark)**
 ii) What are the J and K inputs to make the flip flop avoid the invalid states. **(1 mark)**
 iii) If the flip-flop is triggered on the 0-1 transition; name the type of clock input. **(1 mark)**
 iv) What are formed when flip-flops are interconnected. **(1 mark)**
 v) If a flip-flop triggers on the H-to-L transition of the clock pulse it is called a _____ triggered device. **(1 mark)**
- e) Decode the following numbers expressed in 8421 code:
 i) 0111 1000 0101 **(2 marks)**
 ii) 1001 1001 0001 0101 **(2 marks)**
- f) For the edge triggered S-R flip flop complete the table below: **(6 marks)**

Inputs		Outputs		Comments
S	R	Q	Q'	
0	0			
0	1			
1	0			
1	1			

- g) What are the two of the most common types of shift register counters? **(2 marks)**
- h) What is the difference between a counter and a shift register? **(4 marks)**



THE END