



FIJI NATIONAL UNIVERSITY

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, 2013

DAY/DATE: \ TIME: ROOM: as per timetable.

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 100011_2 is:
 A) 11_{10}
 B) 15_{10}
 C) 10_{10}
 D) 35_{10}
- 2) A digital 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 OR 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	0
0	1	1
1	0	1
1	1	0

- 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 one input 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 $\overline{A+B+C}$, we get _____.

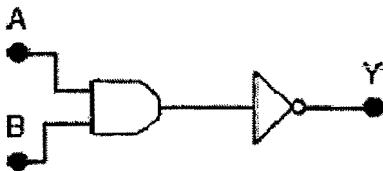
- A) $\overline{A} + \overline{B} + \overline{C}$
- B) $A(B + C)$
- C) $\overline{A+B+C}$
- D) $\overline{A} \cdot \overline{B} \cdot \overline{C}$

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

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

- 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 AND 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 1C1 to binary.

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

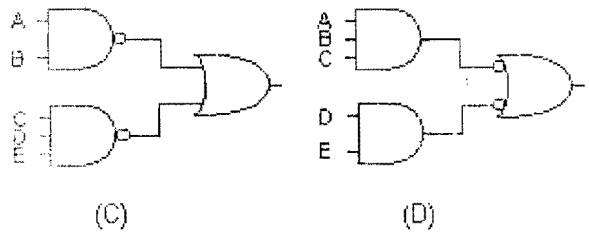
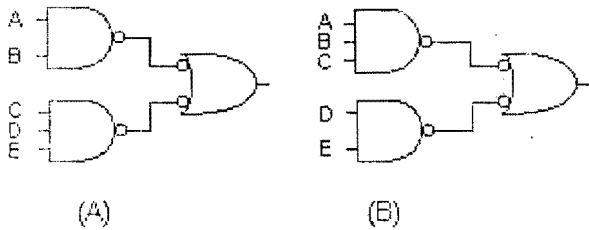
14) The binary number for octal 65_8 is _____.

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

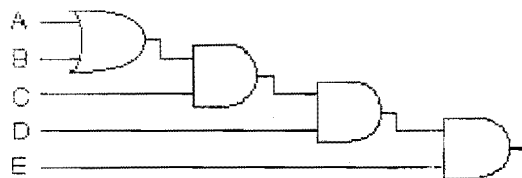
15) A decimal 11_{10} in BCD is _____.

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

16) Implementing the expression $AB + CDE$ using NAND logic, we get:



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



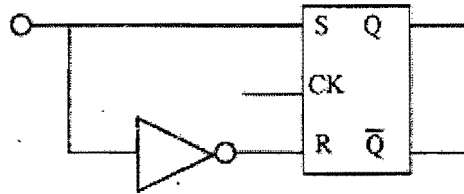
- A) $[C(A+B)\overline{D}+E]$
- B) ABCDE
- C) $C(A+B)DE$
- D) $[[C(A+B)]C]\overline{E}$

18) A 3-bit counter will count from binary 000 to _____.

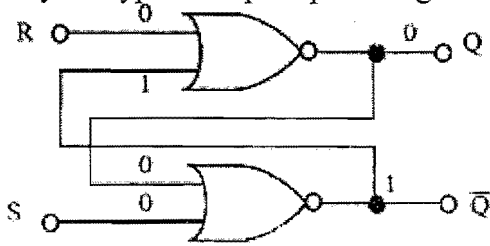
- A) 101
- B) 100
- C) 001
- D) 111

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:



Cross-connected NOR Gates

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

A. WRITE TRUE OR FALSE

(5 MARKS)

- I) The job of a latch can be performed by a D-flip-flop.
- II) 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.
- III) An 8-bit grouping of binary digits is called a byte.
- IV) Electronic devices that can be programmed and have alphanumeric displays probably contain digital circuitry.
- V) The Boolean expression $AB + BC + Y$ is in sum-of-products form.

B. FILL IN THE BLANKS

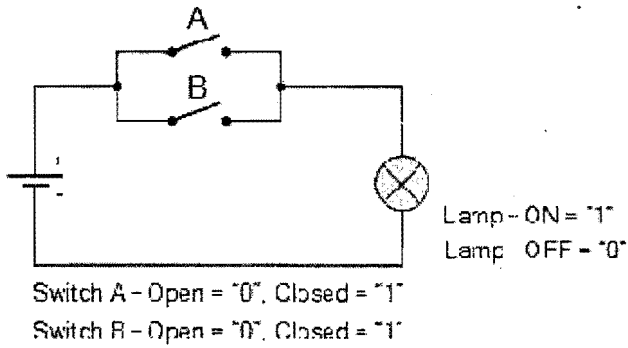
(5 MARKS)

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

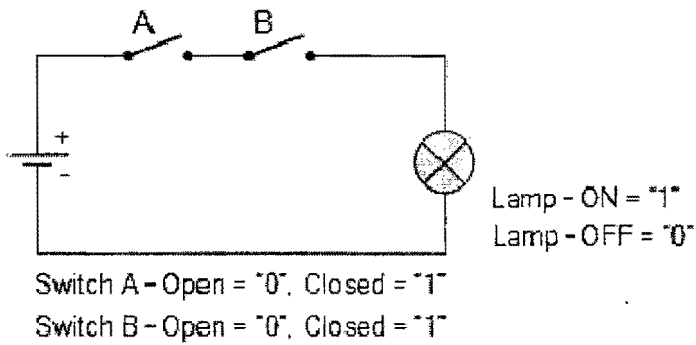
- I) The number of possible input combinations for a 3-input gate is _____.
- II) The Boolean expression $B + BC$ is equal to _____.
- III) A decade counter will count through decimal _____.
- IV) Assume a J-K flip-flop has 1s on the J and K inputs. The next clock pulse will cause the output to _____.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

a) Determine what equivalent logic gate function are represented by the following circuit diagram. **(3 marks)**

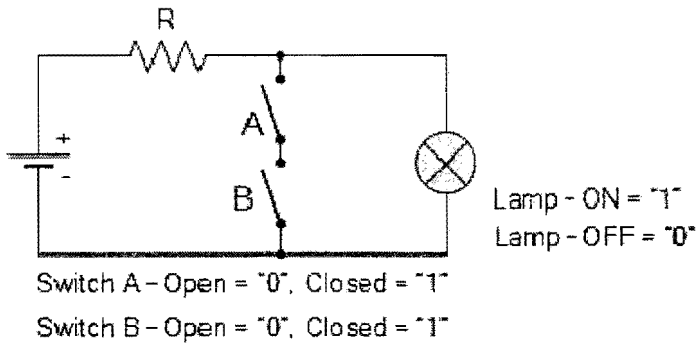
i)



ii)



iii)

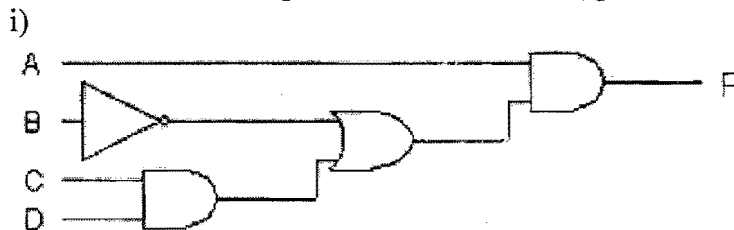


b) Convert the following hexadecimal number to decimal notation. Show the necessary working.

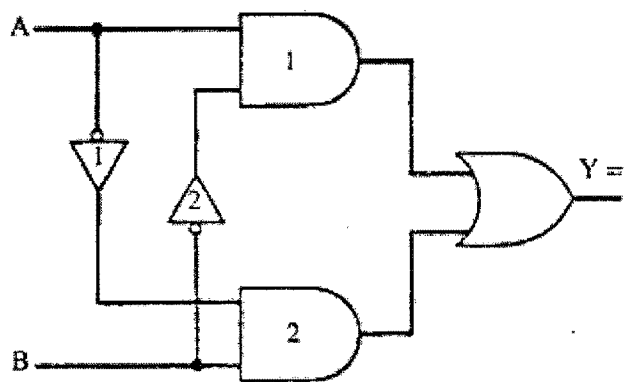
i) BC **(2 marks)**

ii) 45 **(2 marks)**

c) Write the Boolean expression for the following circuits: **(4 marks)**



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