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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FLD20403**
SUBJECT TITLE	:	**DIGITAL SYSTEM**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**2.00 PM – 5.00 PM (3 HOURS)**
DATE	:	**30 DECEMBER 2014**

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answers should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) questions only.**
6. **Answer all questions inEnglish.**

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIX.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) Convert 1011011101_2 to hexadecimal and decimal (4 marks)

(b) Convert the octal number $(36.065)_8$ to binary and hexadecimal (4 marks)

(c) Perform the following operations by using an 8-bit, 2's

i. $-29_{10} + (-43_{10})$ (4 marks)

ii. $-66_{10} - (-75_{10})$ (4 marks)

(d) The $110\ 0101_2 + 1110\ 1000_2$ is an 8-bit, 2's complement number.

Perform the operation. Convert the answer to decimals. (4 marks)

(e) Add the following decimals numbers in BCD, and verify the answer in decimals

$39_{10} + 69_{10}$ (4 marks)

(f) Add the following Hexadecimal number. Show your work.

$DA1_{16} - 2E4_{16}$ (2 marks)

Question 2

Simplify the following Boolean expressions using the De'Morgan theorems and/or Boolean algebra.

(a) $M = \overline{A}C + \overline{A}\,\overline{C}\,D + ABC + AB\overline{C}\,D$ (4 marks)

(b) $Q = \overline{A\overline{B} + \overline{C}\,D + EF}$ (4 marks)

Question 3

Based on the logic circuit of Figure 1:

(a) Determine the Boolean expression for the output Y (4 marks)

(b) Simplify the expression determined in (a) using the De'Morgan theorems and/or Boolean algebra. (4 marks)

(c) Draw the simplified circuit of expression (b) (4 marks)

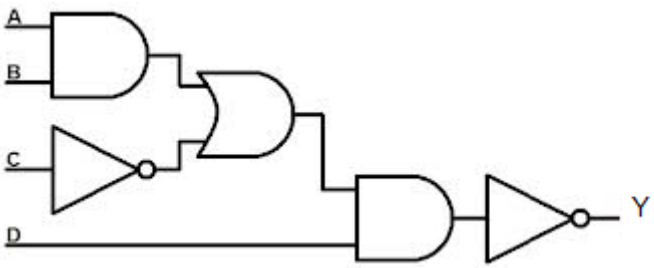

Figure 1

Question 4

Implement the following Boolean expression with a 4 x 1 multiplexer

$J(A,B,C,D) = \sum_m (0,1,3,4,8,9,15)$

(a) Tabulate the truth table (8 marks)

(b) Draw the circuit (6 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions
Please use the answer booklet provided.

Question 5

Implement the truth table of Table 1 given below using any basic logic gate and:

(a) A single 3-to-8 Decoder and any simple logic gate (7 marks)
(b) A single 8-to-1 Multiplexer and any simple logic gate (7 marks)
(c) A single 4-to-1 Multiplexer and any simple logic gate (6 marks)

Table 1

Input			Output
a	**b**	**c**	**Y**
0	0	0	1
0	0	1	0
0	1	0	X
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	X
1	1	1	1

Question 6

(a) Figure 2 shows a 3-bit synchronous counter using JK flip flop.

i. Derive the input equations for each flip-flop. (3 marks)

ii. Determine the MOD number of the counter. (3 marks)

iii. Draw the state table and state diagram for the circuit (6 marks)

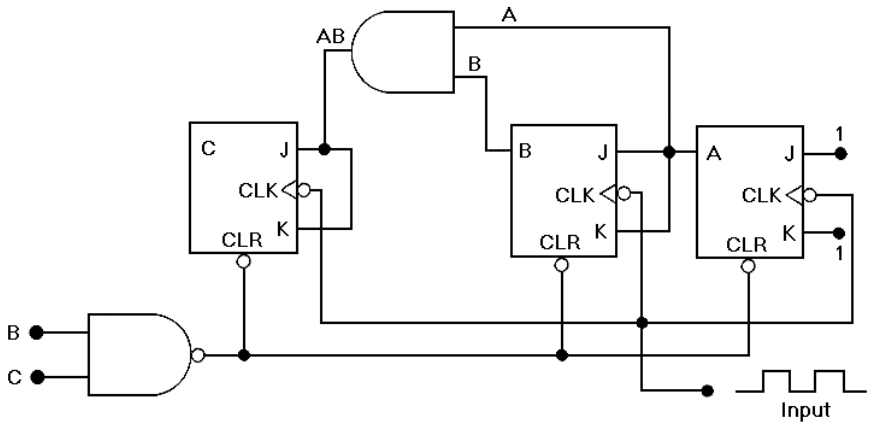

Figure 2

(b) How many FFs are required for the MOD-60 counter? (2 marks)

(c) Construct a MOD-10 counter that will count from 0000 through 1001 (6 marks)

Question 7

Design a combinational circuit that converts a 4-bit gray code to a 4-bit binary number.

(a) Tabulate its truth table (8 marks)

(b) Simplify the expression using K-map (7 marks)

(c) Implement the circuit using exclusive-OR gates (5 marks)

END OF QUESTION PAPER

APPENDIX

Boolean algebra and De Morgan's theorems

1. $X \bullet 0 = 0$
2. $X \bullet 1 = X$
3. $X \bullet X = X$
4. $X \bullet \overline{X} = 0$
5. $X + 0 = X$
6. $X + 1 = 1$
7. $X + X = X$
8. $X + \overline{X} = 1$
9. $X + Y = Y + X$
10. $X \bullet Y = Y \bullet X$
11. $X + (Y + Z) = (X + Y) + Z = X + Y + Z$
12. $X(YZ) = (XY)Z = XYZ$

13a. $X(Y + Z) = XY + XZ$

13b. $(W + X)(Y + Z) = WY + XY + WZ + XZ$

14. $X + XY = X$
15. $X + \overline{X}Y = X + Y$
16. $\overline{X + Y} = \overline{X}\,\overline{Y}$
17. $\overline{XY} = \overline{X} + \overline{Y}$
18. $\overline{\overline{A}} = A$