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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FLB23043**
SUBJECT TITLE	:	**DIGITAL SYSTEM**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**3.00 PM – 6.00 PM (3 HOURS)**
DATE	:	**09 JANUARY 2015**

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 in English.**

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) Perform the Octal multiplication on 237_8+ $63_{8.}$ Then perform the following on the answer obtained. (6 marks)
   i. Convert it to binary
   ii. Divide it with 10101_2

(b) Subtract using the 2's complement binary subtraction: - 50_{10} - 60_{10} (4 marks)

(c) Calculate $C2A_{16}$ – $A8D_{16.}$ Convert the answer in decimal (4 marks)

Question 2

For the sentence below:

"The alarm will ring if the alarm switch is turned on, and the door is not closed, or it is after 8 pm and the window is not closed".

(a) Represent its equivalent SOP expression (4 marks)

(b) Simplify the expression using Karnaugh map (6 marks)

(c) Produce the truth table for the simplified expression in (b) (4 marks)

(d) Draw the logic circuit for (b) using NOR gates only (4 marks)

Question 3

(a) Simplify the following Boolean expression using De Morgan's theorem and/or Boolean algebra. Draw its simplified circuit.

$$M = \overline{(a+b)(\overline{a}+\overline{b})}$$ (6 marks)

(b) Simplify the following Boolean expression, in sum-of-products form, using K-map. Draw its simplified circuit

$$F(w,x,y,z) = \sum_m (0,2,3,5,6,7,8,9) \quad + \quad D(10,11,12,13,14,15)$$ (8 marks)

(c) Produce the truth table of the following Boolean expression. Draw its simplified circuit.

$$I = (p+\overline{q}+r)(p+\overline{q}+\overline{r})(\overline{p}+q+r)(\overline{p}+\overline{q}+\overline{r})$$ (6 marks)

Question 4

Figure 1 shows two 4X1 multiplexer implemented as full adder. Determine the outputs functions A and B as sums of minterms. You may use any process to determine the result, but show your work.

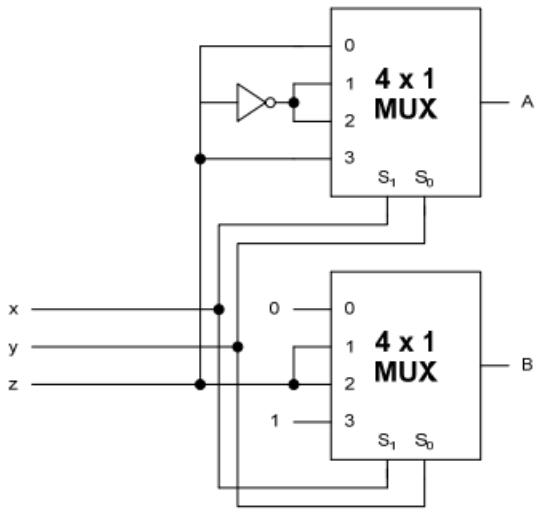

Figure 1

(8 marks)

SECTION B (Total: 60 marks)

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

Question 5

Design a synchronous counter using JK flip-flop with sequence as shown in the state diagram of Figure 2. The design should include the following:

(a) Excitation table (5marks)
(b) Karnaugh map (10 marks)
(c) Circuit diagram (5 marks)

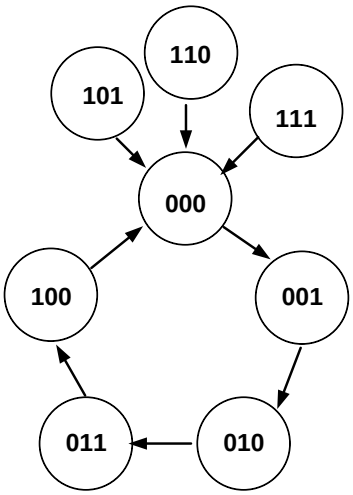

Figure 2

Question 6

Design a magnitude comparator circuit for 2-bit binary numbers A=A1A0 and B=B1B0. The outputs are F, G, and H, where F is 1 if A>B, G is 1 if A=B, and H is 1 if A<B.

(a) Fill in its truth table for the three output of the comparator (12 marks)

(b) Determine the output functions as sum of minterms (8 marks)

Question 7

(a) Design a MOD- 6 up asynchronous counter using JK flip-flop with NGT clock. The design should include the following:

i. Counting sequence (3 marks)

ii. Circuit diagram. (7 marks)

iii. Output expressions at each flip-flop (3 marks)

(b) Construct a 2-to-4-line decoder by using a 1-to-4 demultiplexer. Use block diagrams.

(7 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. $\overline{\overline{A}} = A$