March 25, 2006

COMPUTER ENGINEERING DEPARTMENT

COE 202

FUNDAMENTALS OF COMPUTER ENGINEERING

Major Exam I

Second Semester (052)

Time: 7:30-9:30 PM

Student Name : ____

Student ID. : ____

Question	Max Points	Score
Q1	25	
Q2	18	
Q3	12	
Q4	20	
Q5	25	
Total	100	

Dr. Aiman El-Maleh

[25 Points]

(Q1) Indicate whether the following is true or false, and if it is false **correct** it:

(1) (True, False) The hexadecimal number $(421)_{16}$ is equal to the octal number $(841)_8$.

(2) (True, False) The binary number $(1110.0111)_2$ is equal to $(14.875)_{10}$, $(E.7)_{16}$ and $(16.7)_8$.

(3) (True, False) The 16`s complement of the hexadecimal number $(B120)_{16}$ is $(4EE0)_{16}$ while the 15`s complement is $(4ED0)_{16}$.

(4) (True, False) Assuming 6-bit representation of numbers, the binary number 111010 is equal to +58 in sign-magnitude representation, -5 in 1`s complement representation, and -4 in 2`s complement representation.

(5) (True, False) The decimal number 2048 can be represented as an unsigned number in 11 bits.

(6) (True, False) Assuming 5-bit 1`s complement representation of numbers, then 11011+01001 is equal to 00101.

(7) (True, False) Assuming 6-bit 2's complement representation, the range of numbers that can be represented is -63 to +63.

(8) (True, False) Assuming 8-bit 2`s complement representation of numbers, then E6+9A produces overflow i.e. it produces incorrect result.

(9) (True, False) The result of the following addition operation $(AA)_{16} + (13)_{16}$ is $(123)_{16}$.

(10) (True, False) The result of the following unsigned multiplication operation $(A15)_{16} * (8)_{16}$ is $(50A8)_{16}$.

[18 Points]

(Q2) Prove the identity of each of the following Boolean functions using algebraic manipulation. Start with the left-hand side expression and derive from it the right-hand side expression. ***Clearly indicate the postulates and theorems used***.

(i) (a + b)(a` + c)(b + c) = a`b + ac

(ii) { [b` + (a + c)` + a`(c`+d)][d` + b`c`] }` = b (a + c) + d (b + c)

[12 Points]

(Q3) Given the function F(A, B, C)= A + B` C

(i) Determine the minterms of the function F and express it as an algebraic sum of minterms.

(ii) Determine the maxterms of the function F and express it as an algebraic product of maxterms.

[20 Points]

(Q4) Consider the function F(A, B, C) = Π M(3, 5).

(i) Simplify the function into a minimal sum-of-products expression.

(ii) Simplify the function into a minimal product-of-sums expression.

(iii) Implement the function using only **2-input NAND** gates and **Inverters**, with minimal number of gates. Draw the circuit diagram for your implementation.

(iv) Implement the function using only **2-input NOR** gates and **Inverters**, with minimal number of gates. Draw the circuit diagram for your implementation.

[25 Points]

(Q5) Simplify the following Boolean functions **F** together with the don`t care conditions **d,** into minimal sum-of-products expressions. Identify all the *prime implicants* and the *essential prime implicants*.

(i) F(A, B, C, D)=Σ m(0, 6, 7, 9, 11, 13, 15), d(A, B, C, D)=Σ m(2, 5, 8, 10)

AB \ CD	00	01	11	10
00	1	0	0	X
01	0	X	1	1
11	0	1	1	0
10	X	1	1	X

(ii) F(A, B, C, D, E) =Σ m(0, 1, 2, 3, 4, 6, 10, 11, 14, 17, 18, 21, 22, 25, 26, 27, 29, 30)

A=0

BC \ DE	00	01	11	10
00	1	1	1	1
01	1	0	0	1
11	0	0	0	1
10	0	0	1	1

A=1

BC \ DE	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	0	1	0	1
10	0	1	1	1