交換電路與邏輯設計期中考　　範圍：Chap. 1-8

.2000/11/10, 3:10-4:50pm

1. (10%) In this problem, we consider number systems and conversion. Convert the following numbers from the given base to the base indicated.

(a) $(11010.110)_2$ to decimal, octal, and hexadecimal. (3%)

(b) $(3DA9.DD)_{16}$ to binary, decimal, and octal. (4%)

(c) $(372.16)_8$ to binary, decimal, and hexadecimal. (3%)

2. (10%) In this problem, we consider the simplification of Boolean expressions. Use the laws and theorems of Boolean algebra to simplify the following expressions and state the law or theorem used.

(a) (A'+B)CD'+(A'+B)'CD' (3%)

(b) (B'+A+C)(CD+E+AF')+(CD+AF'−E) (4%)

(c) (U'+VW)(X'Y+Z)'+(X'Y+Z) (3%)

3. (10%) In this problem, we consider the input and output for a 3-input logic gate circuit. Assume that the input and output voltages for the 3-input logic gate circuit is shown by the following table with volt unit

(a) Translate this table to a truth table using positive logic (+8V is a logic 1, and -8V is a logic 0). What logic function does the 3-input gate realize? (5%)

(b) Translate this table to a truth table using negative logic (-8V is a logic 1, and −8V is a logic 0). What logic function does the 3-input gate realize? (5%)

e_1	e_2	e_3	e_0
+8	+8	+8	+8
+8	+8	-8	+8
+8	-8	+8	-8
+8	-8	-8	+8
-8	+8	+8	+8
-8	+8	-8	−8
-8	-8	+8	+8
-8	-8	-8	-8

4. (12%) Simplify each of the following expressions:

(a) A'BCD+A'BC'D+B'EF+CDE'G+A'DEF+A'B'EF (reduce to a sum of three terms) (6%)

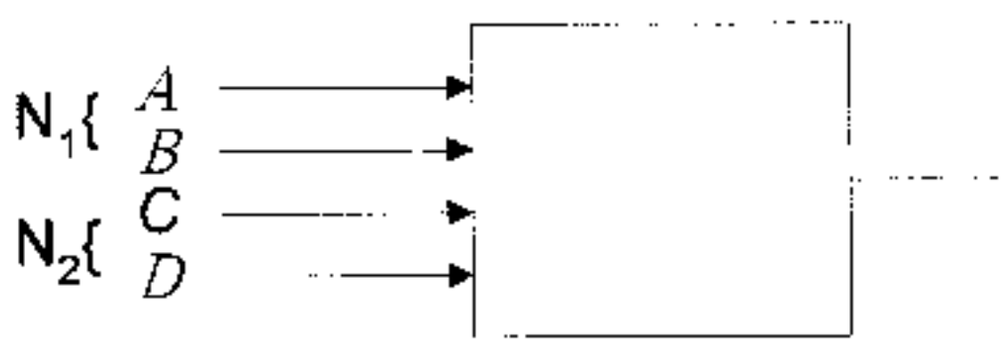
(b) $w'x'y' + w'xz' + [(x + y + w'z)(x' + z' + wy')]'$ (reduce to a sum of three terms) (6%)

5. (14%)A switching network has four inputs as shown below. A and B represent the first and second bits of a binary number N_1. C and D represent the first and second bits of a binary number N_2. The output of the network is to be 1 only if the product $N_1 \times N_2$ is less than or equal to 12.

(a) Find the minterm expansion for F. (7%)

(b) Find the maxterm expansion for F. (7%)

Express each answer in both decimal notation and algebraic form.



6. (4%) What are the purposes of introducing min-term and max-term expansions?

7. (18%) f(a,b,c,d) = ∑m(0,1,5,8,12,13,15) + d(2,7,11)

(a) Find the minimum sum-of-products (SOP) expression of f(a,b,c,d) using Karnaugh map. (4%)

(b) Find the minimum product-of-sums (POS) expression of f(a,b,c,d) using Karnaugh map. (4%)

(c) Realize f(a,b,c,d) using two-level OR-AND network with minimum number of gates. Assume that a, a', b, b', c, c', d, d' are available in the inputs. (5%)

(d) Use **only** NAND gates to realize f(a,b,c,d). There is no constraint on the number of inputs for the NAND gates. (5%)

8. (8%) f(a,b,c,d) = ∑m(0,1,5,7,9,14,15)

(a) Find all of the prime implicants of f(a,b,c,d). (4%)

(b) Find all of the essential prime implicants of f(a,b,c,d). (4%)

9. (14%) Given F = ab'd' + a'b + a'd + cd

(a) Use the Karnaugh map to find the minterm expansion (*or so-called* list of minterm expression, $F = \sum m(1,3,6,..15)$) for F. (4%)

(b) Find the minimum SOP expression for F. (4%)

(c) Suppose that the cases of (a,b,c,d) = (0,0,0,0) and (1,1,1,1) never occur in the inputs. Find the minimum SOP expression for F. (6%)