HW2

1. Convert F and G to the other canonical form and standard forms of sum of products and product of sums. (10%)
   $F(a,b,c) = \sum(0,1,3,4,7)$
   $G(w,x,y,z) = \Pi(1,3,5,8,9,11,13,15)$
2. Simplify the following Boolean expressions (do not use K-map) to a minimum number of literals as less as possible. After simplification, draw the logic diagrams of the circuits that implement the original and simplified expressions, respectively. (10%)

   (a) (x+y′z′)(w+xy′),

   (b) w'x′y+wyz+wx′z′+x′yz.

3. Use DeMorgan's theorem to remove the complement outside the braces. (12%)

   (a) ((x+w′)′+w′y′z+(x+z)′(x+y))′,

   (b) (x(yz′+y′z)′+wy(y′+x′z))′,

   (c) (x+y)′+z′(x′+z)′,

   (d) (xy′+z)′(w+y′z).

4. Reformulate the function F=x′+x(x′+y)(y′+z) using (15%)

   (a) AND, OR, and inverter (NOT) gates,

   (b) AND and inverter (NOT) gates,

   (c) OR and inverter (NOT) gates.

5. For the function $F(w,x,y,z) = \prod(2,3,4,5,6,7,9,11,14)$
   (a) Obtain its truth table, (3%)
   (b) Express F in sum-of-minterms and product-of-maxterms forms, (6%)
   (c) Draw the logic diagram of F, (5%)
   (d) Use Boolean algebra to simplify the function F to a new function G, with minimum number of literals, (5%)
   (e) Obtain the truth table of G and compare it with that of F, (5%)
   (f) Draw the logic diagram of G and compare the number of literals of F and G. (5%)

6. For the Gray code sequence of 16 code words ($g_3g_2g_1g_0$), use a 4-bit binary code ($b_3b_2b_1b_0$) as inputs
   (a) Derive the related truth table, (6%)
   (b) Find the logic functions for each g_i. (8%)

7. Write the Boolean functions with one canonical form (f_1 and f_2) and draw the logic diagrams of the circuit whose outputs are defined by the truth table. (10%)

a	b	c	f_1	f_2
0	0	0	0	1
0	0	1	1	1
0	1	0	1	0
0	1	1	0	0

1	0	0	1	1
1	0	1	1	0
1	1	0	0	0
1	1	1	1	1