國立彰化師範大學 97 學年度碩士班招生考試試題

系所：電子工程學系碩士班　　組別：乙組　　科目：邏輯設計

☆☆請在答案紙上作答☆☆　　

1. The inputs of *A, B* and *C, D* represent the binary numbers in the range 0:3. Show a truth table such that *w, x, y,* and *z* represent a binary number in the range 0:15 that equals to the magnitude of the multiplication product of the two inputs. 10%

2. Show the decimal equivalent of the binary number 10010101 that is interpreted as
   (a) Unsigned binary 5%
   (b) Signed binary (2's complement) 5%

3. Prove whether the following Boolean functions of *f* and *h* are equal or not. 10%
   $f(x, y, z) = xz' + x'z + yz$ and $h(x, y, z) = (x + z)(x' + y + z')$

4. Simplify each of following expressions using only the axioms of Boolean algebra:
   (a) $f(a, b, c, d) = ab + bcd + ab'c' + abd + bc + a'bc$ 5%

   (b) $g(A, B, C, D) = (A + B)(B' + C)(A + C + D)(A + B + D')(A + C + D')$ 5%

5. Referring to the function $f(w, x, y, z) = (w' + x)(y + z)(w' + y)(x + y' + z)$
   (a) Derive the SOP (Sum of Product) and POS (Product of Sum) canonical forms. 5%
   (b) Using NOR gates to implement the function *f*. 5%

6. Using the Karnaugh map method to find the minimum Sum-of-Product expressions for

   (a) $F(a,b,c,d) = \sum_m (3,4,9,13,14,15) + \sum_d (2,5,10,12)$ 5%

   (b) $g(w, x, y, z) = w'yz + xy'z + wy + wxy'z' + wz + xyz'$ 5%

7. Using the 8-to-1 and 4-to-1 multiplexers to implement the following functions.
   (a) $f(a, b, c, d) = b'c'd' + bd + a'cd$ 5%
   (b) $F(x, y, z) = \prod_M(0, 2, 4)$ 5%

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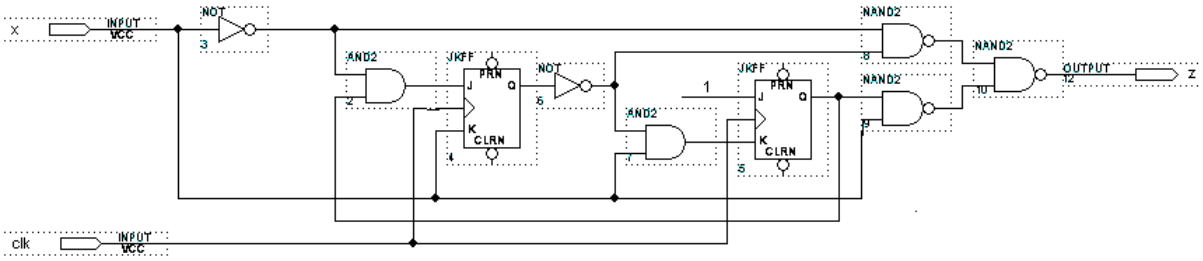
8. Derive the *next state equation*, *output function*, and *state diagram* of the following sequential circuit. 10%



9. Reduce the following system to one with the minimum number of states? 10%

A.

C.S.	N.S. X=0	N.S. x=1	z
A	C	A	1
B	F	A	1
C	A	E	0
D	C	B	1
E	D	D	1
F	B	E	0

B.

C.S.	N.S. X=0	N.S. x=1	Z X=0	Z x=1
A	A	E	0	0
B	F	D	0	1
C	A	C	0	0
D	F	D	0	1
E	C	E	0	0
F	A	C	0	0

10. Referring to the following state diagram to design the sequential logic circuit using T-type flip-flops. 10%