113 EE06

國立臺北科技大學 113 學年度碩士班招生考試

系所組別：2151 電機工程系碩士班戊組

第一節　數位邏輯設計　試題（選考）

注意事項：

1. 本試題共七題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、(15%) Assume $X_1 = -11_7$, $X_2 = D_{16}$, and $X_3 = 23_4$. The negative number is represented in 2's complement.

（一）Convert X_1, X_2, and X_3 to 6-bit binary numbers with the most significant bit representing the sign. (5%)

（二）Work on the arithmetical operation: $X_1 + X_3 - X_2$ in binary. Indicate whether overflow occurs. (10%)

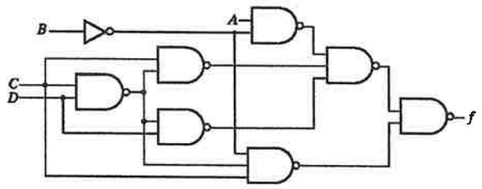
二、(20%) Simplify the following expressions to the minimal sum of products. Only individual variables should be complemented.

（一）$b'c'd' + bcd + acd' + a'b'c + a'bc'd$ (5%)

（二）$F(V, W, X, Y, Z) = \Pi M(0, 3, 6, 9, 11, 19, 20, 24, 25, 26, 27, 28, 29, 30) \cdot \Pi D(1, 2, 12, 13)$ (5%)

（三）$(A + C' + F' + G)(A + C' + F + G)(A + B + C' + D' + G)(A + C + E + G)(A' + B + G)(B + C' + F + G)$ (10%)

三、(10%) Realizes f ′ of the following circuit containing only NOR gates (Only individual variables should be complemented)

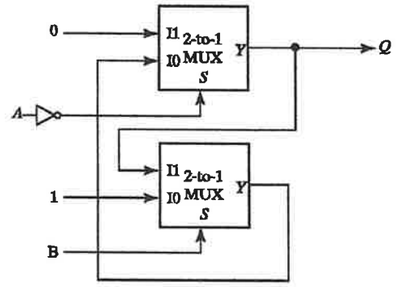


四、(10%) Find a minimum two-level, multiple-output SOP circuits to realize the following functions. Use a PLA to implement the minimum SOP circuits. Specify the PLA table only.

$$f_1(a, b, c, d) = \Sigma m(3, 4, 6, 9, 11)$$
$$f_2(a, b, c, d) = \Sigma m(2, 4, 8, 10, 11, 12)$$
$$f_3(a, b, c, d) = \Sigma m(3, 6, 7, 10, 11)$$

五、(10%) (一) Construct a state table for the following circuit and identify the stable states of the circuit. (5%)

（二）Derive a Boolean algebra equation for the next value of the output Q^+ in terms of Q, A and B. (5%)



六、(20%) An *M-N* flip-flop works as follows:

If $MN = 00$, the next state of the flip-flop is 0.

If $MN = 01$, the next state of the flip-flop is the same as the present state.

If $MN = 10$, the next state of the flip-flop is the complement of the present state.

If $MN = 11$, the next state of the flip-flop is 1.

（一）Give the characteristic (next-state) equation for this flip-flop. (5%)

（二）Design a 3-bit counter by using *M-N* flip-flops which counts in the sequence as follows. (10%)

$CBA = 000, 001, 011, 111, 101, 100,$ (repeat) $000, \ldots$

（三）What will happen if the counter of *CBA* is started in state 010? (5%)

七、(15%) (一) Is the following circuit a Mealy or Moore state machine? (5%)

（二）Use T flip-flops to construct the following state machine. (10%)