題號： 424

科目：邏輯設計

節次： 7

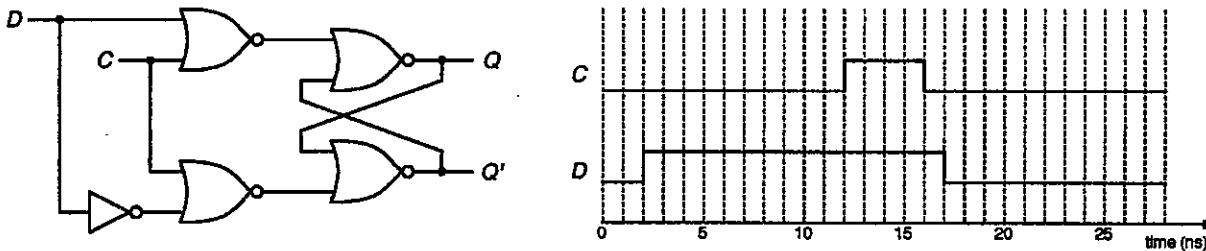國立臺灣大學106學年度碩士班招生考試試題

題號：424

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※ 注意：全部題目均請作答於試卷內之「非選擇題作答區」，請標明題號依序作答。

Problem 1 (20%)

Consider the gated D-latch and the timing diagram of C and D below. Show the timing diagram of Q and Q' (for up to 30 ns) assuming that (1) $Q = 0$ at time 0, and (2) the gate delay is 2 ns for the NOR gate and 1 ns for the inverter.

Problem 2 (20%)

Show the state transition graph of a Moore system whose output is 1 iff three consecutive 0 inputs occurred more recently than three consecutive 1 inputs. A sample input/output trace is given below. Note that you must use the implication table method to reduce the number of states.
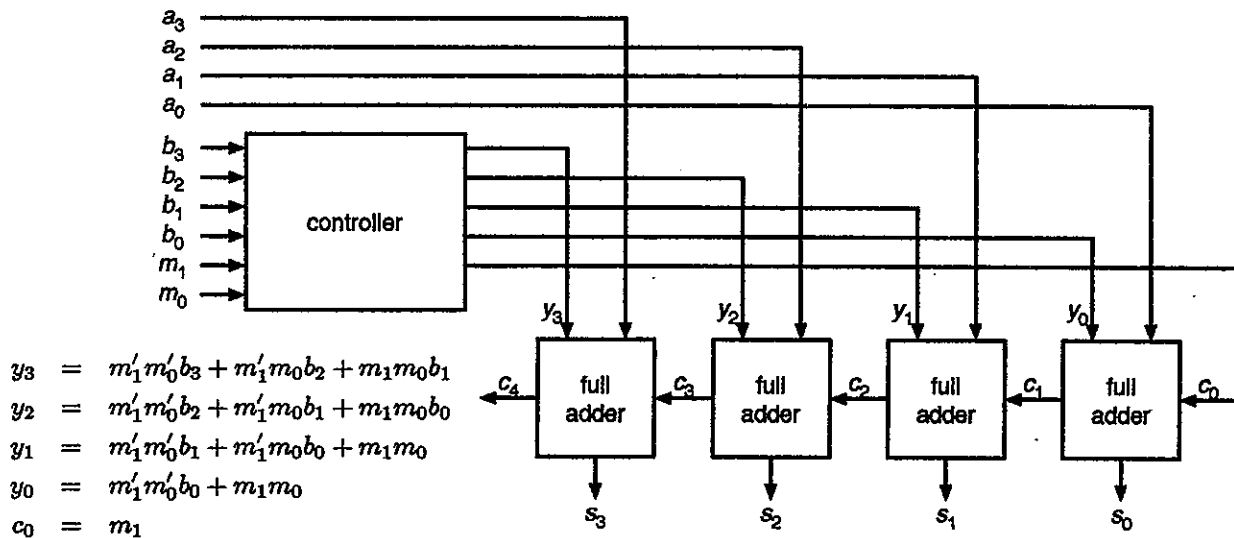
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x 1 1 1 0 0 1 0 1 1 1 0 0 1 0 0 0 0 1 1 1 1 0 1
z ? ? ? 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0
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Problem 3 (20%)

Using one synchronous 3-bit binary counter with a synchronous clear input, one 3-bit adder, and some extra logic, design a counter that counts the sequence 1, 3, 5, 7, 9.

Problem 4 (20%)

Consider the ALU below where $A = a_3a_2a_1a_0$, $B = b_3b_2b_1b_0$, and $M = m_1m_0$. What functions (in terms of A and B) does it perform with respect to $M = 00, 01, 10,$ and 11?

$$y_3 = m_1'm_0'b_3 + m_1'm_0b_2 + m_1m_0b_1$$
$$y_2 = m_1'm_0'b_2 + m_1'm_0b_1 + m_1m_0b_0$$
$$y_1 = m_1'm_0'b_1 + m_1'm_0b_0 + m_1m_0$$
$$y_0 = m_1'm_0'b_0 + m_1m_0$$
$$c_0 = m_1$$

Problem 5 (20%)

Consider the equation $F(a,b) = (abc + a'b)'$.

1. Use algebraic manipulation to convert F to the sum of product form. You must show the theorems you use in each step to receive full credits. (8%)
2. Implement F by means of an 8-to-1 multiplexer. (6%)
3. Implement F by means of a 3-to-8 decoder. (6%)

試題隨卷繳回