

國立臺灣科技大學 108 學年度碩士班招生試題

系所組別：電子工程系碩士班甲組
 科目：數位邏輯設計與資料結構

(總分為 100 分)

1. (10%) Please answer the following short questions.

- (a) What's the difference between the Flip-Flop and the Latch? (2%)
 (b) What are the setup-time and hold-time of a Flip-Flop? (2%)
 (c) What's the difference between the Moore and Mealy model FSM? (2%)
 (d) What's the main difference between a combinational logic and a sequential logic? (2%)
 (e) Convert the $(185)_{10}$ to unsigned binary format and convert the 2's complement $(110101)_2$ to decimal format. (2%)

2. (20%) Given a Boolean function $F(A, B, C, D) = \Sigma(1, 3, 4, 9, 14, 15)$, we can construct following function table:

| ABCD | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| F | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

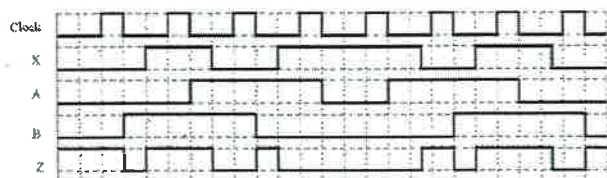
Please design this circuit (draw the circuit diagram) with input variables A, B, C, D and output variable F using

- (a) One 8-to-1 Multiplexer and one NAND gate. (10%)
 (b) One 4-to-1 Multiplexer and three NOR gates (10%)

3. (10%) Please answer the following two questions:

- (a) Draw the circuit diagram of function $f = (a + b')(a' + c + d)(b + d')$ using only NOR gates. (5%)
 (b) Convert the function $f = (w + x' + z)(w' + y + z')(x + y + z)$ to SOP (Sum of Product) form. (5%)

4. (10%) A state machine has one input, X, one output Z, and two positive-triggered D-type flip-flops with outputs A and B. The timing diagram for this circuit is shown as follows, please complete the state diagram for this circuit.



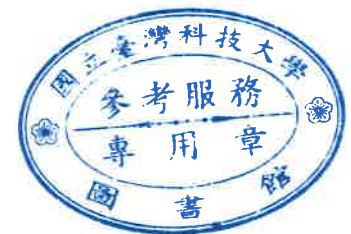
00

01

10

11

label: state Input / output



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- (10%)
5. In computer systems, the main memory can be regarded as a one-dimensional array. Nevertheless, in C or other high-level programming languages, a two-dimensional or higher-dimensional array is often used. How would you implement (represent) a two-dimensional array with a one-dimensional array in such computer systems? (10%)
- (30%)
6. Stacks are a data structure widely used in computer systems. For example, a stack is used to pass arguments from one function to another in C-language programs.
- (a) Explain what is a stack. (5%)
 - (b) Define the two basic operations of stacks. (5%)
 - (c) How would you implement a stack with an array? (10%)
 - (d) How would you implement a stack with a linked list? (10%)
- (10%)
7. A queue is a kind of data structure. In practice, it can be either an ordinary queue or a priority queue.
- (a) What is a queue? Define it. (5%)
 - (b) What is a priority queue? Define it. (5%)

