國立中山大學九十七學年度第二學期資工系數位系統期中考試

學號：　　姓名：

一、選擇與是非題（每題 4 分，20 分）

(　　) 1. 對於 Boolean *n*-cube 而言，下列何者錯誤？ ① represent a Boolean function of *n* variables ② each vertex represents a minterm ③ each *m*-subcube of 1-minterms represents a product of $n-m$ literals ④ each *m*-subcube represents $2m$ minterms。

(　　) 2. 給一個 truth table，使用 map method 進行 Boolean simplification 包含以下四個步驟：❶Generate map ❷Find minimal cover ❸Select essential prime implicants ❹Determine prime implicants，實行順序為①❶❸❹❷ ②❶❹❸❷ ③❶❹❷❸ ④❶❷❸❹。

(　　) 3. 關於 XOR 以及 XNOR，何者錯誤？ ① $x \oplus y = (x \odot y)'$ ② $x \oplus y' = (y \oplus x)'$ ③ $x \oplus 1 = x'$ ④ $x \oplus x' = 0$。

(　　) 4. A prime implicant is a subcube not contained in any other prime implicant.

(　　) 5. 對於 three-bit message x, y, z 而言，假如 parity bit $P = x \oplus y \oplus z$ 且 parity check $C = x \oplus y \oplus z \oplus P$，則 $C = 1$ 代表奇數個資料位元發生錯誤。

二、問答題（80 分）

1. Prove by algebraic manipulation that the following expressions are equivalent.
$xy+xz+yz = (x+y)(x+z)(y+z)$　(6%)

2. Derive the sum-of-minterms and the product-of-maxterms canonical forms for Boolean function $F(w, x, y, z) = (w+x+y'+z)(w'+x'+z)(y+z)$. Find the standard sum-of-products of this Boolean function.　(10%)

3. (1) Using the map method to find the standard sum-of-products and product-of-sums forms of Boolean function $F(w, x, y, z) = w'y'z'+x\,y'z+wyz+x'yz'+wxyz$.　(12%)
(2) Using the map method to find the standard sum-of-products of Boolean function $F(v, w, x, y, z) = \sum m(0, 1, 3, 7, 8, 9, 11, 14, 15, 16, 17, 19, 24, 25, 27, 30)$.　(12%)

4. (1) Convert the function $F(x, y, z) = xy'z' + x'yz' + x'y'z + xyz$ into three-input NAND gates.　(10%)
(2) Convert the function $F(x, y, z) = xy + xz + yz$ into two-input NOR gates.　(10%)

5. Using the tabulation method, find all the prime implicants, all the essential prime implicants, and all the minimal covers for Boolean function $F(w, x, y, z) = \sum m(0, 1, 5, 6, 8, 9, 12, 13, 14)$.　(20%)

Group ID	Subcube Minterms	Subcube value				Subcube Covered
		w	*x*	*y*	*z*	
G_0	(0)	0	0	0	0	
G_1	(1)	0	0	0	1	
	(8)	1	0	0	0	
G_2	(5)	0	1	0	1	
	(6)	0	1	1	0	
	(9)	1	0	0	1	
	(12)	1	1	0	0	
G_3	(13)	1	1	0	1	
	(14)	1	1	1	0	

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		w	*x*	*y*	*z*	

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		w	*x*	*y*	*z*	

Prime Implicant Name	Prime Implicant Expression	Implicant Minterms	Function Minterms								
			0	1	5	6	8	9	12	13	14