國立高雄大學　資訊工程學系　九十七學年度 第二學期

數位系統導論　　**平時考（二） 考試範圍： Chap. 2**

1. (20%) Express the following function in sum of minterms and product of maxterms.

   $F(A,B,C,D) = B'D + A'D + BD$

Ans :

$$F = \Sigma(1,3,5,7,9,11,13,15) = \Pi(0,2,4,6,8,10,12,14)$$

2. (20%) Convert the following to the other canonical form:

   (a) $F(x,y,z) = \sum(2,5,6)$

   (b) $F(A,B,C,D) = \prod(0,1,2,3,4,6,12)$

Ans :

(a)

$$F(x,y,z) = \Sigma(2,5,6) = \Pi(0,1,3,4,7)$$

(b)

F(A, B, C, D)=$\prod(0,1,2,3,4,6,12) = \sum(5,7,8,9,10,11,13,14,15)$

3. (15%) Simply the following Boolean expression to a minimum number of literals. (Don't use K-map)

   (a) $ABC + A'B + ABC'$

   (b) $(x+y)'(x'+y')$

   (c) $xy + x'z + yz$

Ans :

(a) $ABC + A'B + ABC' = AB + A'B = B$

(b) $(x+y)'(x'+y') = x'y'(x'+y') = x'y'$

(d) xy + x'z + yz
= xy + x'z + yz(x+x')
= xy + x'z + yzx + yzx'
= xy(1+z) + x'z(1+y)
= xy +x'z

4. (30%) Draw logic diagrams of the circuits that implement the original and simplified expression in Problem 3.

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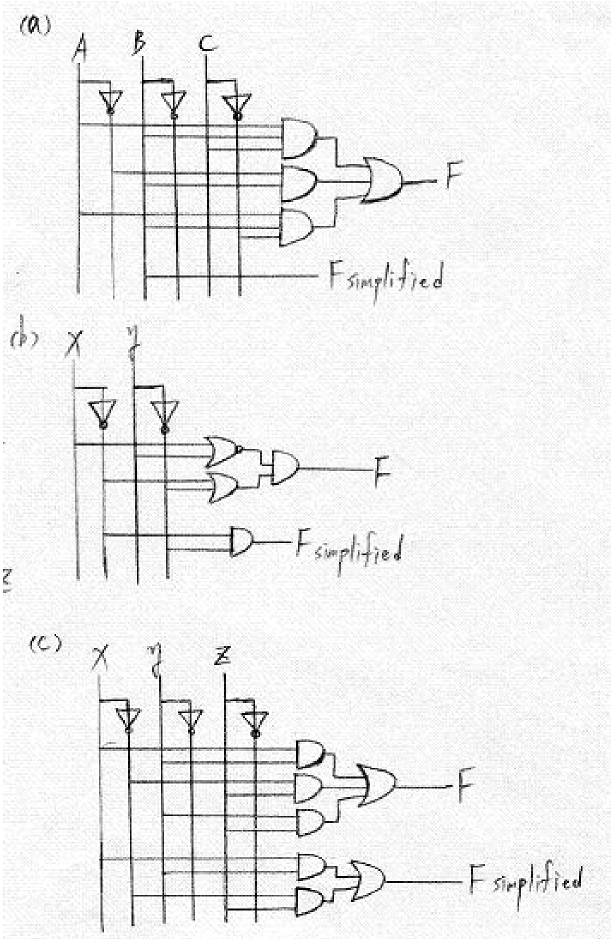
Ans :



5. (15%) Explain that what is Boolean algebra?

Ans :

A set of elements B and two binary operators + and ·

1. Closure w.r.t. the operator + (·)
   - $x, y \in$ B $\rightarrow$ $x+y \in$ B
2. An identity element w.r.t. + (·)
   - $0+x = x+0 = x$
   - $1 \cdot x = x \cdot 1 = x$
3. Commutative w.r.t. + (·)
   - $x+y = y+x$
   - $x \cdot y = y \cdot x$
4. · is distributive over +: $x \cdot (y+z)=(x \cdot y)+(x \cdot z)$

   + is distributive over · : $x+(y \cdot z)=(x+y) \cdot (x+z)$
5. $\forall$ $x \in$ B, $\exists$ $x' \in$ B (complement of x) such that $x+x'=1$ and $x \cdot x'=0$
6. $\exists$ at least two elements $x, y \in$ B such that $x \neq y$