Homework1

1. Finish the reading of Chapter 1, 2, 3.

2. Finish the reading of Chapter 1, 2, 3. The first generation PC uses the Intel 8088 with 29,000 transistors. Approximately how many transistors are in the Intel Core i7 (Quad) CPU? Approximately how many transistors are in the Xilinx Virtex-7 FPGA?

i7四核--13亿、 Xilinx V7--68亿

3. Convert the following numbers to 12-bit signed binary numbers.

a) $135_{10} = 128_{10} + 7_{10} = 1000\ 0000_2 + 0111_2 = 0000\ 1000\ 0111_2$

b) $-135_{10} = 1000\ 1000\ 0111_2(\text{原码}) = 1111\ 0111\ 1000_2(\text{反码})$
$= 1111\ 0111\ 1001_2(\text{补码})$

c) $35F_{16} = 0011\ 0101\ 1111_2$

d) -576_{10}
$576_{10} = 512_{10} + 64_{10} = 10\ 0000\ 0000_2 + 0100\ 0000_2 = 0010\ 0100\ 0000_2$
$-576_{10} = 1010\ 0100\ 0000_2(\text{原码}) = 1101\ 1011\ 1111_2(\text{反码})$
$= 1101\ 1100\ 0000_2(\text{补码})$

4.完成下列8位无符号二进制数的计算，并给出相应的十进制数。

a) $1010\ 1010_2 + 0011\ 1011_2 = 1110\ 0101_2$
$$= 128+64+32+4+1 = 229$$

b) $0011\ 1101_2 + 0111\ 0100_2 = 1011\ 0001_2$
$$= 128+32+16+1 = 177$$

c) $1110\ 0011_2 + 1111\ 0011_2 = 1\ 1101\ 0110_2$
$$= 256+128+64+16+4+2 = 470$$

d) $1100\ 0111_2 + 1001\ 0110_2 = 1\ 0101\ 1101_2$
$$= 256+64+16+8+4+1 = 349$$

5. Derive the truth table for the function
$F(x,y,z) = [(x+y') + (xz)'] (xy' + y'z)$

x	y	z	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

6. Derive the truth table and equation for the following circuit. Do not simplify the equation.

F=((x'z')'(w'xy')'(wyz')')'
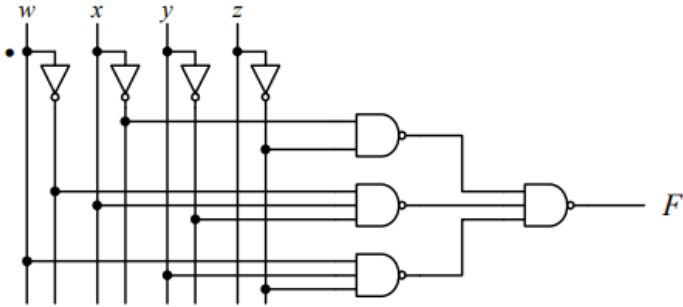
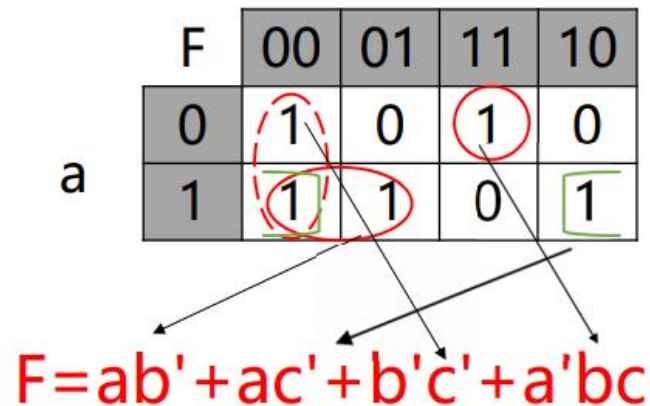| w	x	y	z	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0

w	x	y	z	F
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

7. Derive the Boolean function for the following truth table, and simplify it by using Karnaugh Maps.

a	b	c	F
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

$F=a'b'c'+a'bc+ab'c'+ab'c+abc'$

bc

F	00	01	11	10
a 0	1	0	1	0
1	1	1	0	1

$F=ab'+ac'+b'c'+a'bc$

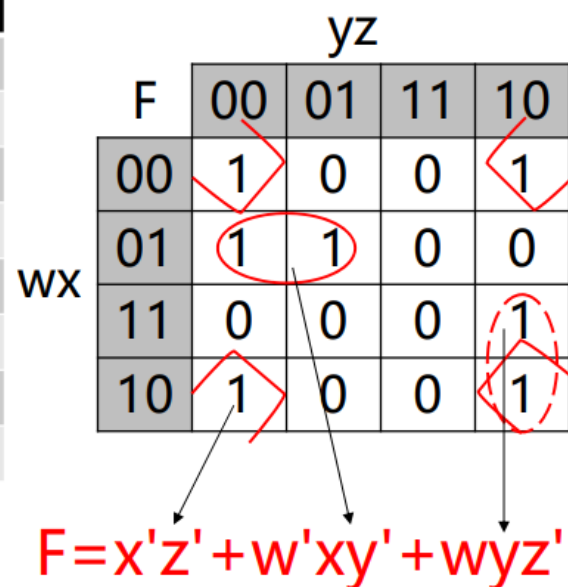# 8. Derive the Boolean function for the following truth table, and simplify it by using Karnaugh Maps.

$$F=w'x'y'z'+w'x'yz'+w'xy'z'+w'xy'z+wx'y'z'+wx'yz'+wxyz'$$

w	x	y	z	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0

w	x	y	z	F
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

yz

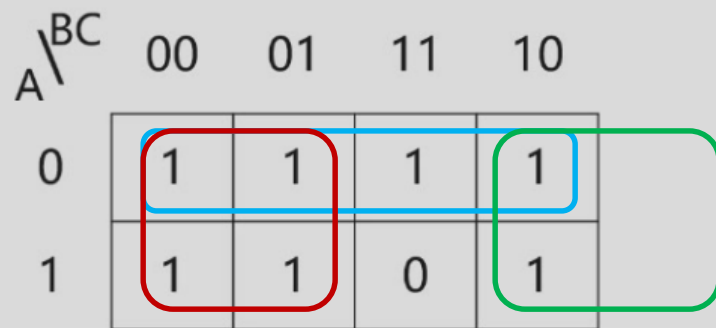| F	00	01	11	10
00	1	0	0	1
01	1	1	0	0
11	0	0	0	1
10	1	0	0	1

wx

$$F=x'z'+w'xy'+wyz'$$

Week 2
课堂练习

1.利用卡诺图化简 $\overline{B}\overline{C} + A\overline{B} + AB\overline{C} + \overline{A}BC\overline{D} + \overline{A}BC\overline{D} + A\overline{B}CD$

B'C'+AB'+AC'

2.利用卡诺图化简 $\overline{A} + A\overline{B} + AB\overline{C}$

A\BC	00	01	11	10
0	1	1	1	1
1	1	1	0	1

A'+B'+C'

3.十进制数99用二进制数表示的结果有 7 比特。

思路1：将$(99)_{10}$用二进制数表示，$(99)_{10} = (1100011)_2$

思路2：6bit无符号二进制能表示的十进制数值范围是$0 \sim 2^6-1$即$0 \sim 63$，7bit

无符号二进制能表示的十进制数值范围是$0 \sim 2^7-1$即$0 \sim 127$。

Table 1.1
Powers of Two

n	2^n	n	2^n	n	2^n
0	1	8	256	16	65,536
1	2	9	512	17	131,072
2	4	10	1,024 (1K)	18	262,144
3	8	11	2,048	19	524,288
4	16	12	4,096 (4K)	20	1,048,576 (1M)
5	32	13	8,192	21	2,097,152
6	64	14	16,384	22	4,194,304
7	128	15	32,768	23	8,388,608

4.异或运算满足 ABC （同学们仅对C选项存在问题，则以C选项为例提供思路）

A.交换律，即$A \oplus B = B \oplus A$

B.结合律，即$(A \oplus B) \oplus C = A \oplus (B \oplus C) = A \oplus B \oplus C$

C.分配律，即$A \cdot (B \oplus C) = (A \cdot B) \oplus (A \cdot C)$

思路1：直接列出真值表比较

A	B	C	$A \cdot (B \oplus C)$	$(A \cdot B) \oplus (A \cdot C)$
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

思路2：分析表达式为1（或为0）的条件是否一致（实质上也是列真值表）

A·(B⊕C)=1的条件：A=1且B⊕C=1

(A·B)⊕(A·C)=1的条件：A=1且B⊕C=1

思路3：将表达式用与、或、非来表示

由A⊕B=AB′+A′B

有A·(B⊕C)=A·(BC′+B′C)=ABC′+AB′C

和(A·B)⊕(A·C)=(AB)(AC)′+(AB)′AC=AB(A′+C′)+(A′+B′)AC=ABC′+AB′C

Week 3
课堂练习

1. 使用一个二选一数据选择器，实现F=AB的 "与" 门功能
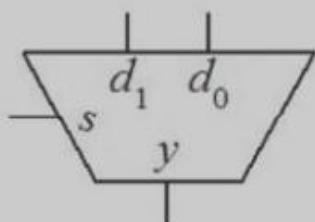
$$y = d0 \cdot s' + d1 \cdot s$$
$$F = AB = 0 \cdot B' + AB = 0 \cdot A' + BA$$
$$= BB' + AB = AA' + BA$$

s	d1	d0	y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

d0=0/B d1=A s=B
或者
d0=0/A d1=B s=A

2. 使用一个二选一数据选择器和一个非门，实现F=A和B的
异或运算

s	d1	d0	y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1
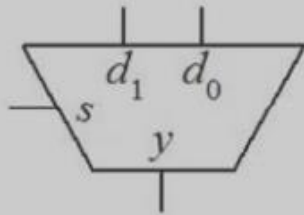
$y = d0s' + d1s$
$F = AB' + A'B = BA' + B'A$

d0=A d1=A' s=B
或者
d0=B d1=B' s=A

3. 使用一个二选一数据选择器，实现F=A'
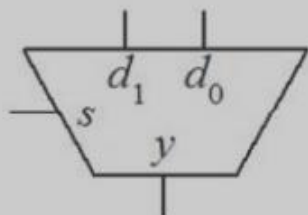
$y=d0s'+d1s$
$F=A'=1A'+0A$

d0=1 d1=0 s=A

s	d1	d0	y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

4. 使用一个二选一数据选择器，实现或运算F=A+B

$$y=d_0 s'+d_1 s$$
$$F=A+B=AB'+B=BA'+A$$

s	d1	d0	y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

d0=A d1=B/1 s=B
或者
d0=B d1=A/1 s=A

Y		B
	0	1
A 0	0	1
1	1	1

Y		B
	0	1
A 0	0	1
1	1	1