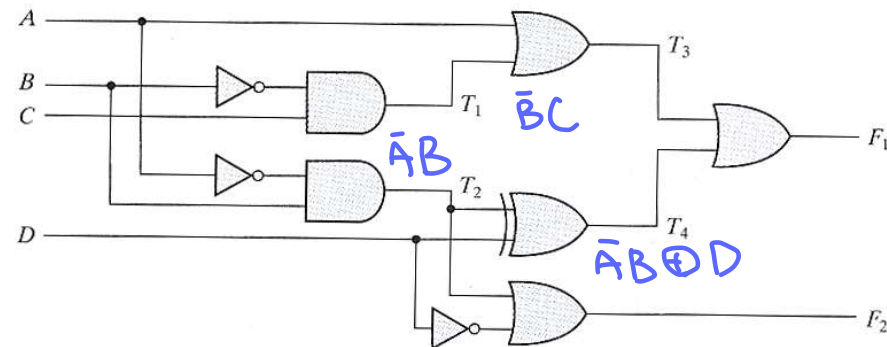


Homework #5

- 4.1 ✓ Consider the combinational circuit

Truth Table



Derive the Boolean expressions for T_1 through T_4 . Evaluate the outputs F_1 and F_2 as a function of the four inputs.

- 4.4 ✓ Design a combinational circuit with three inputs and one output.
 (a)* The output is 1 when the binary value of the inputs is less than 3 and greater than 6. The output is 0 otherwise. 012 7

- 4.8 ✓ Design a code converter that converts a decimal digit from
 (a)* The 8, 4, -2, -1 code to BCD.

- 4.14* ✓ Assume that the exclusive-OR gate has a propagation delay of 10 ns and that the AND or OR gates have a propagation delay of 5 ns. What is the total propagation delay time in the four-bit adder of Fig. 4.12?

- 4.18 ✓ Design a combinational circuit that generates the 9's complement of a
 (a)* BCD digit.

0 ↔ 9
 1 ↔ 8
 2 ↔ 7
 1-22

4.1(1) $T_1 = B'C$

$T_2 = A'B$

$T_3 = A + T_1 = A + B'C$

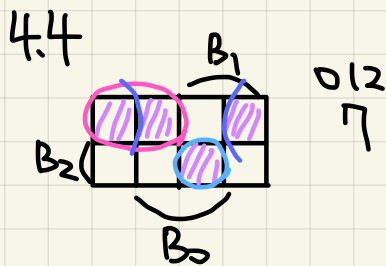
$T_4 = T_2 \oplus D$

$= T_2'D + T_2D'$

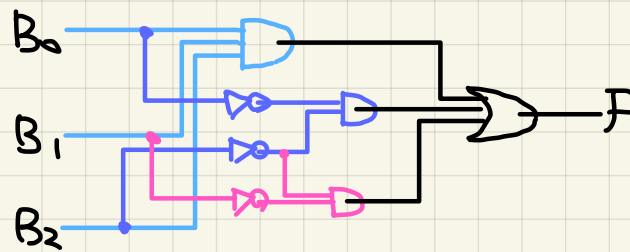
$= (A+B')D + A'BD'$

(2) $F_1 = T_3 + T_4 = \underbrace{A+B'C}_{T_3} + \underbrace{(A+B')D + A'BD'}_{T_4}$

$F_2 = T_2 + D = A'B + D'$



$F = B_2'B_1' + B_2'B_0' + B_0B_1B_2$



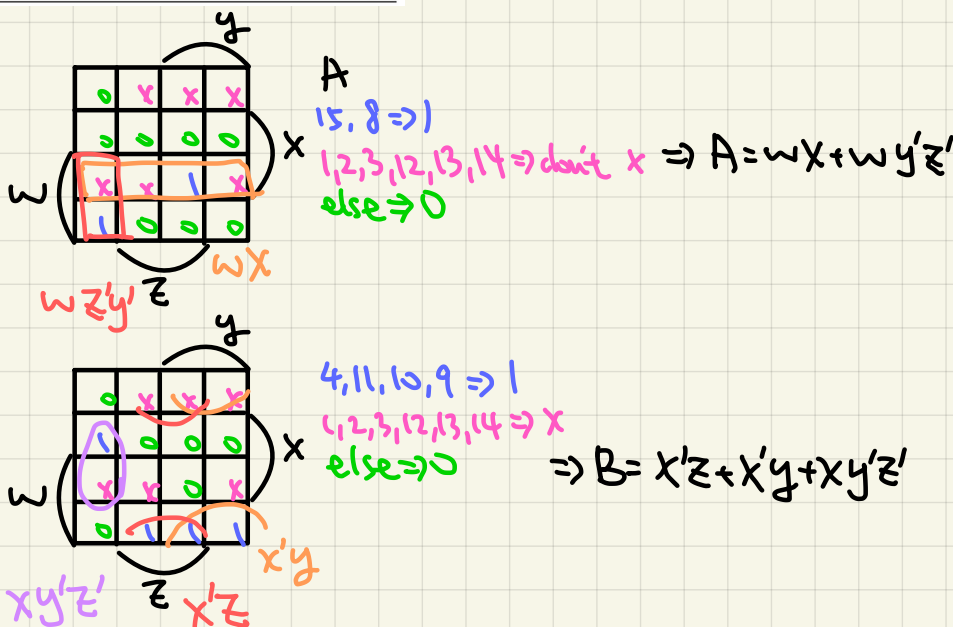
4.8

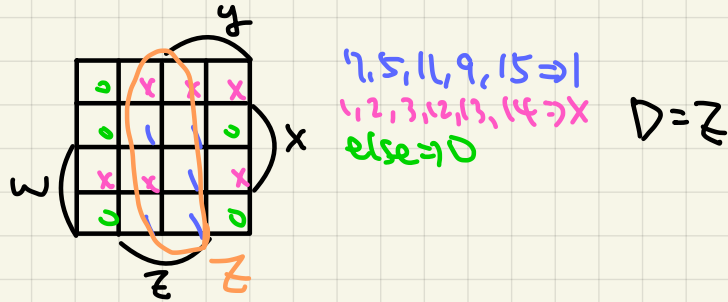
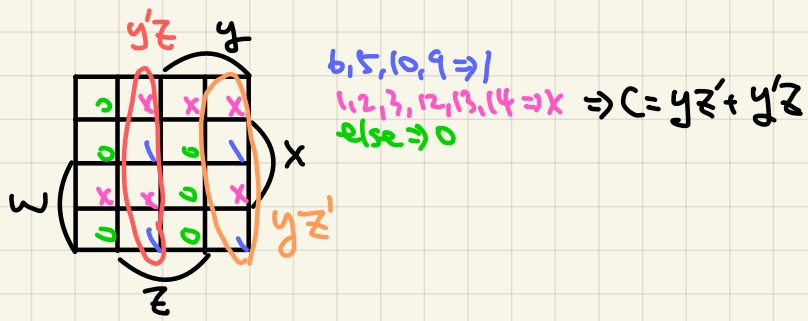
Table 1.5
Four Different Binary Codes for the Decimal Digits

Decimal Digit	BCD 8421	2421	Excess-3	+/- weights
0	0000	0000	0011	0000 0
1	0001	0001	0100	0111 7
2	0010	0010	0101	0110 6
3	0011	0011	0110	0101 5
4	0100	0100	0111	0100 4
5	0101	0101	1000	1011 3
6	0110	1100	1001	1010 2
7	0111	1101	1010	1001 1
8	1000	1110	1011	1000 0
9	1001	1111	1100	1111 15

8 4 2 1
w x y z
8 4 2 1
A B C D

↓ 對應列的 bit



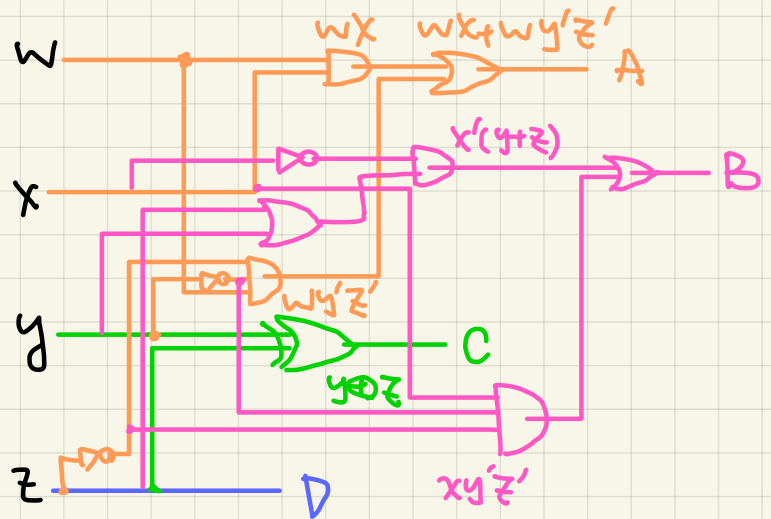


All in all, $A = wx + wyz'$

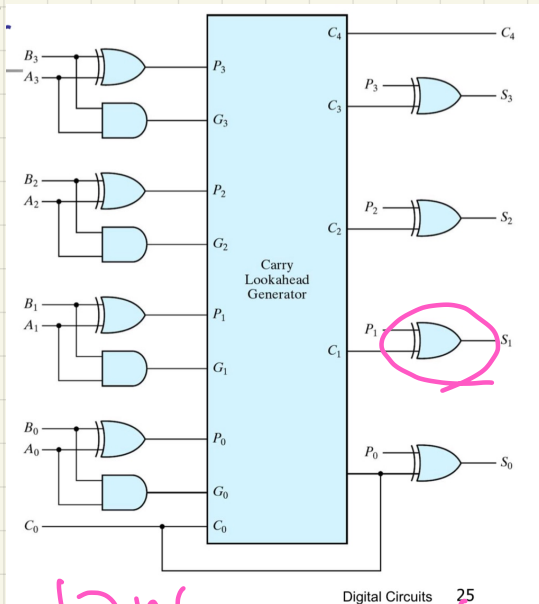
$$B = x'z + x'y + xy'z'$$

$$C = yz' + yz = y \oplus z$$

$$D = z$$



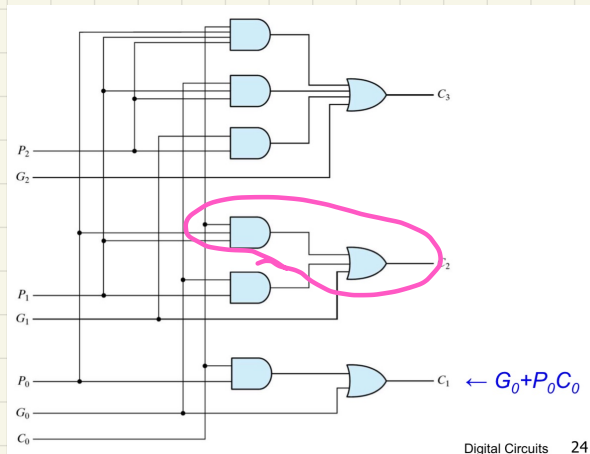
4.14



10 ns

10 ns

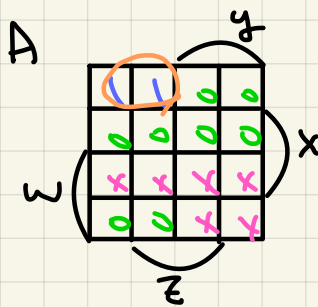
total = 30 ns



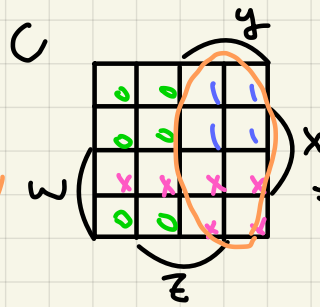
5 + 5 = 10 ns

4.18

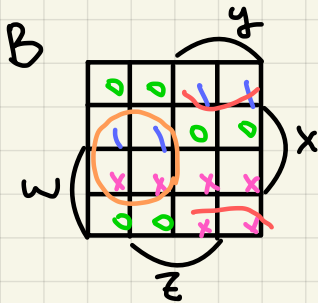
	BCD				q'			
	w	x	y	z	A	B	C	D
0	0	0	0	0	1	0	0	1
1	0	0	0	1	1	0	0	0
2	0	0	1	0	0	1	1	1
3	0	0	1	1	0	1	1	0
4	0	1	0	0	0	1	0	1
5	0	1	0	1	0	1	0	0
6	0	1	1	0	0	0	1	1
7	0	1	1	1	0	0	1	0
8	1	0	0	0	0	0	0	1
9	1	0	0	1	0	0	0	0



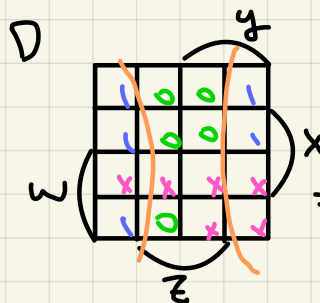
0,1 \Rightarrow 1
 10 ~ 15 \Rightarrow X
 else \Rightarrow 0
 $\Rightarrow A = w'x'y'$



2,3,6,7 \Rightarrow 1
 10 ~ 15 \Rightarrow X
 else \Rightarrow 0
 $\Rightarrow C = y$



2,3,4,5 \Rightarrow 1
 10 ~ 15 \Rightarrow X
 else \Rightarrow 0
 $\Rightarrow B = xy' + x'y$



0,2,4,6,8 \Rightarrow 1
 10 ~ 15 \Rightarrow X
 else \Rightarrow 0
 $\Rightarrow D = z'$

All in all, $A = w'x'y'$ $C = y$

$B = xy' + x'y$ $D = z'$
 $= x \oplus y$

