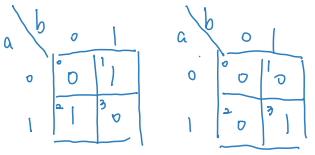
Week 5

① half adder

a	b	sum	carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1



sum

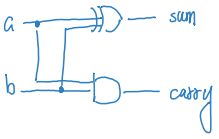
carry

$a\bar{b} + \bar{a}b$

$a \oplus b$

ab

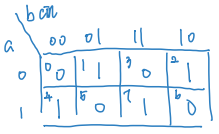
$a \cdot b$



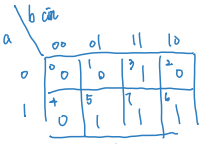
→ half adder.

② full adder

a	b	c_{in}	sum	cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1



sum



cout

$\bar{a}\bar{b}c_{in} + \bar{a}b\bar{c_{in}} + a\bar{b}\bar{c_{in}} + abc_{in}$

$= c_{in}(\bar{a}\bar{b} + ab) + \bar{c_{in}}(\bar{a}b + a\bar{b})$

$= c_{in} \cdot \overline{(a \oplus b)} + \bar{c_{in}}(a \oplus b)$

$= (a \oplus b) \oplus c_{in}$

$b\,c_{in} + a\,c_{in} + ab$

$= (a \cdot b) + ((a \oplus b) \cdot c_{in})$

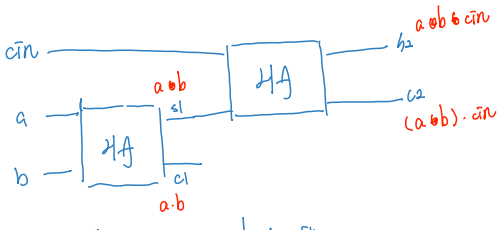
括弧 複雜，不括弧

拆解 full adder 的 2 個 half adder

① 

$sum = a \oplus b \oplus c_{in}$ → complete

$carry = (a \cdot b) + ((a \oplus b) \cdot c_{in})$ → complete

② 

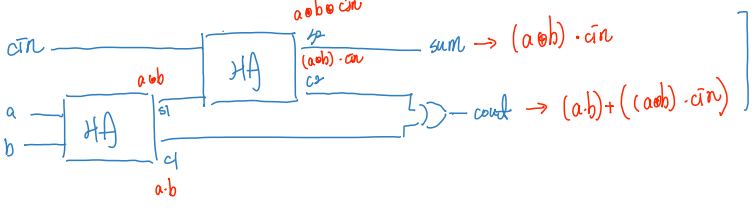
$sum = a \oplus b \oplus c_{in}$ → complete

$carry = (a \cdot b) + ((a \oplus b) \cdot c_{in})$ → complete

可以這樣 $sum = a \oplus b \oplus c_{in}$

s1

跟 cin XOR 的話 HA 有辦法算所以拿 HA 試試看.

③ 

all complete.

Week 11

1 Hz ⇒ 每秒 1 個週期

50MHz ⇒ 50×10^6 Hz ⇒ 每秒 50×10^6 個週期

50MHz ⇒ $\frac{1}{50\times10^6}$ s/次 (週期)

$\frac{1}{50\times10^6} = \frac{1}{5\times10^7} = 0.2\times10^{-7} = 2\times10^{-8} = 20\times10^{-9} = 20$ ns.

20 ns/次 → 1 s/次

Time Expire ⇒ 每 0.5 秒的週期數

$\frac{50\times10^6}{2} = 25\times10^6$ 次.

有 frequency divier 就是將 N Hz → 1 Hz.

N Hz → N 次/秒

有 Time Expire 為每 0.5 秒的週期數

次 $\frac{N}{2}$ 次/0.5 秒

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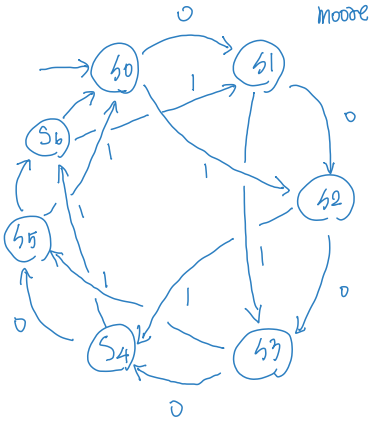
week 12.



moore finite state machine.