C10

Binary Adders: 74HC283

CHAPTER ASSIGNMENT

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from the Guru Jazzy chapter page and *Circuits with Tinkercad* (INEX), for classroom use.

Labs

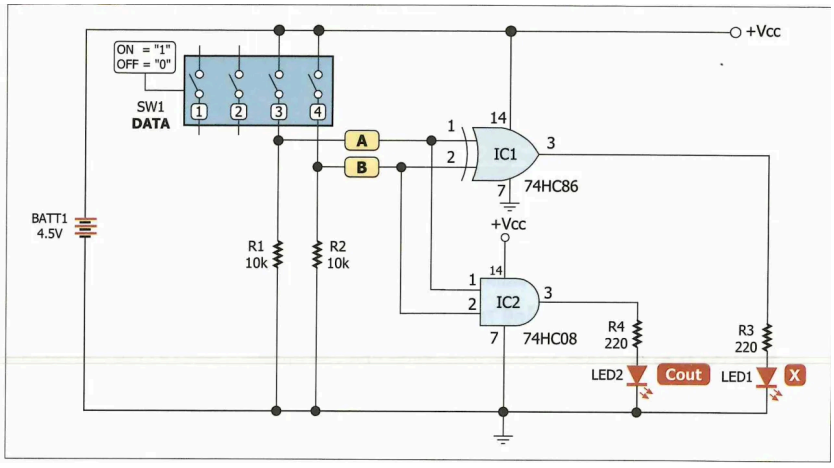
10.1 Add two bits

1. Build Fig 10-4 in Tinkercad, as in Fig 10-5.

2. Set inputs A and B with DIP switch SW1 (positions 3 and 4) and watch the two output LEDs, X and Cout.

3. Build it with real parts and repeat step 2.

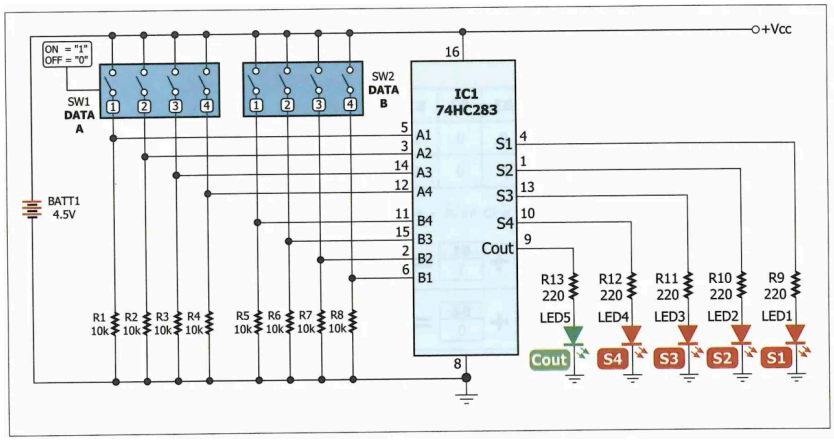
In this circuit, sliding a switch **ON** gives logic “1” and **OFF** gives “0”. It is the simplest way to see how binary addition works.



10.2 Add two 4-bit numbers

1. Build Fig 10-7 in Tinkercad, as in Fig 10-8. Set both 4-way DIP switches to choose two binary numbers to add, and watch the 5 LEDs: 4 red for the sum and 1 green for the carry.

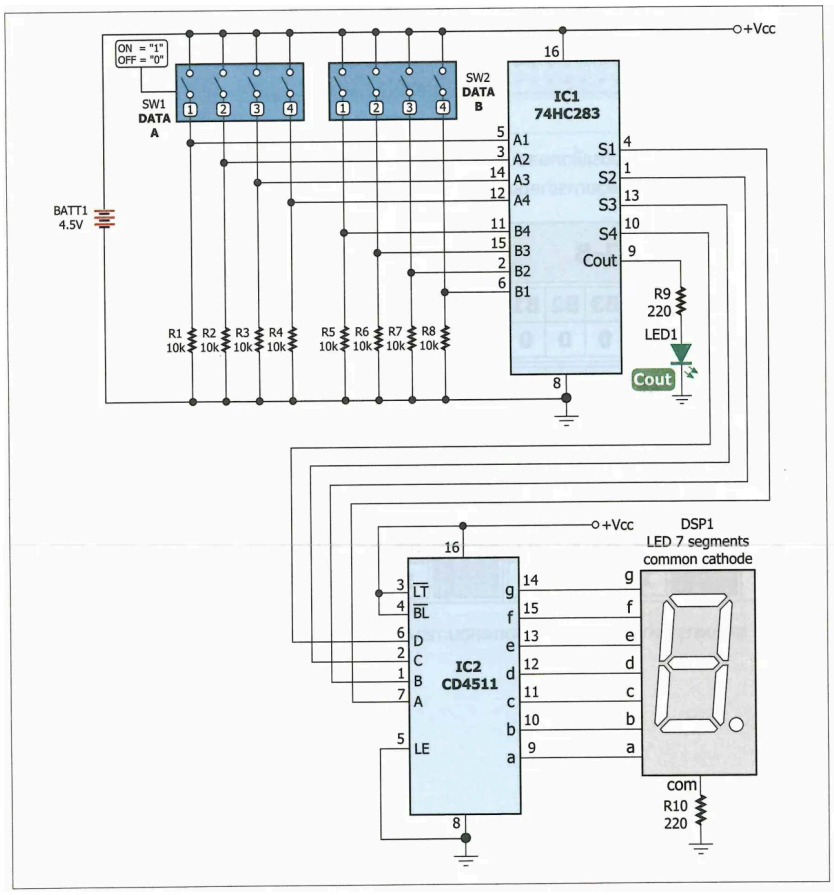
2. Build it with real parts and repeat step 1. Remember ON = “1”. Make a table like Fig 10-9: fill in A and B, simulate in Tinkercad, and compare with the real circuit. If they don’t match, check your wiring.



10.3 Add and display

1. Build Fig 10-10 in Tinkercad, as in Fig 10-11, using one more 400-point breadboard.

2. Set both 4-way DIP switches to choose the two numbers, and watch the 7-segment display and the green carry LED. ON = "1". Make a table first, as in 10.4 (Fig 10-12).



Activity: Beyond 4 bits

1 On paper, add 0110 + 0111 one column at a time, writing each carry. Check with the widget.

2 In the 1-bit adder (Fig 10-4), add a third input as Cin. Which extra gates do you need to make a full adder (Fig 10-2)?

3. Chain two 74HC283s (Cout of the first to Cin of the second) to make an 8-bit adder. How big a sum can it show?

4. In 10.5 the display goes blank for sums 10–15. How could you show a carry-correct decimal answer? (Hint: look up “BCD adder”.)

Practice (Figs 10-9 and 10-12 of the book)

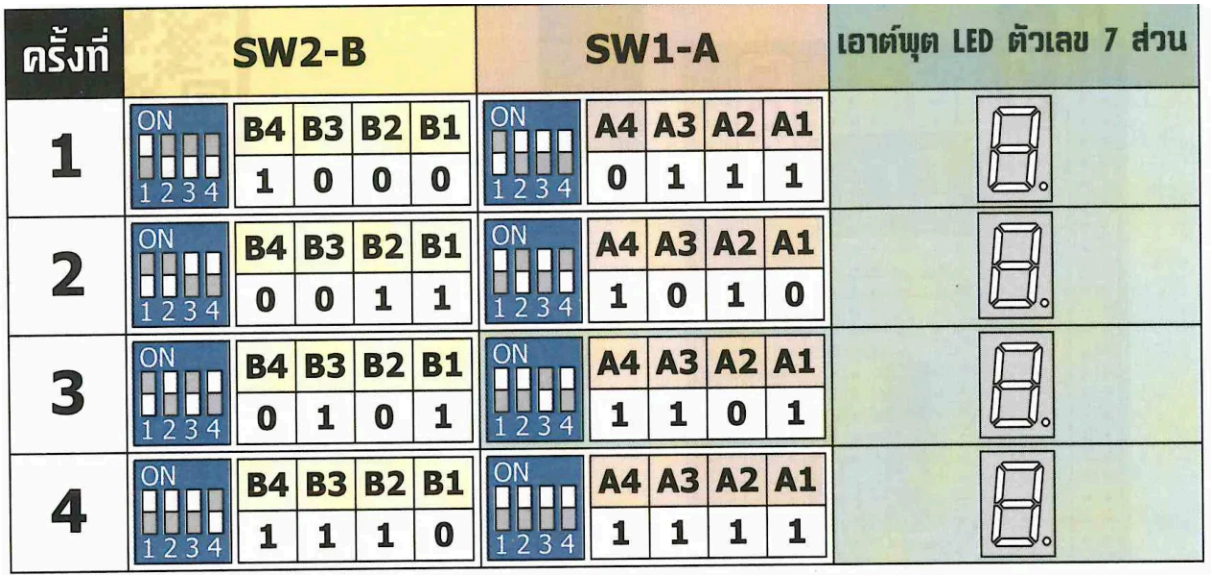
P1 Practice · Fig 10-9

Work out each row, then check with Tinkercad.

Try	B4 B3 B2 B1	A4 A3 A2 A1	Your Cout S4 S3 S2 S1
1	1000	0111	
2	0011	1010	
3	0101	1101	
4	1110	1111	

P2 Practice · Fig 10-12

Same inputs as Fig 10-9. What will the display and the carry LED show? Remember the CD4511 only shows 0–9.



Chapter quiz

1 In binary, what is 1 + 1?

A. 1 B. 2 C. 0, carry 1 D. 1, carry 1

2 Which gates make a half adder?

A	B	C	D
XOR for the sum, AND for the carry	OR for the sum, NOT for the carry	NAND only	Two NOR gates

3 What does a full adder add that a half adder cannot?

A	B	C	D
A fourth input	A carry in (Cin) from the previous column	Subtraction	A clock

4 In a full adder, A = 1, B = 0, Cin = 1. What are X and Cout?

A. X = 0, Cout = 1 B. X = 1, Cout = 0 C. X = 1, Cout = 1 D. X = 0, Cout = 0

5 Which two ICs build the 1-bit adder in 10.2?

A. 74HC00 and 74HC02 B. 74HC86 and 74HC08 C. 74HC93 and CD4511 D. 74HC283 and 74HC75

6 With the 74HC283, Cin = 0, A = 1010 (10) and B = 1001 (9). What is the result?

A. Cout = 0, S = 1001 B. Cout = 1, S = 0011 C. Cout = 1, S = 0100 D. Cout = 0, S = 1111

7 What does Cout of the 74HC283 let you do?

A	B	C	D
Reset the IC	Pass the carry to another 74HC283 to add more than 4 bits	Light the 7-segment display	Power the IC

8 In 10.5, the sum is 1101 (13). What does the CD4511 display show?

A. 13 B. d C. 3 D. Nothing — it is blank

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/tinkercad/chapter-10-binary-adder/