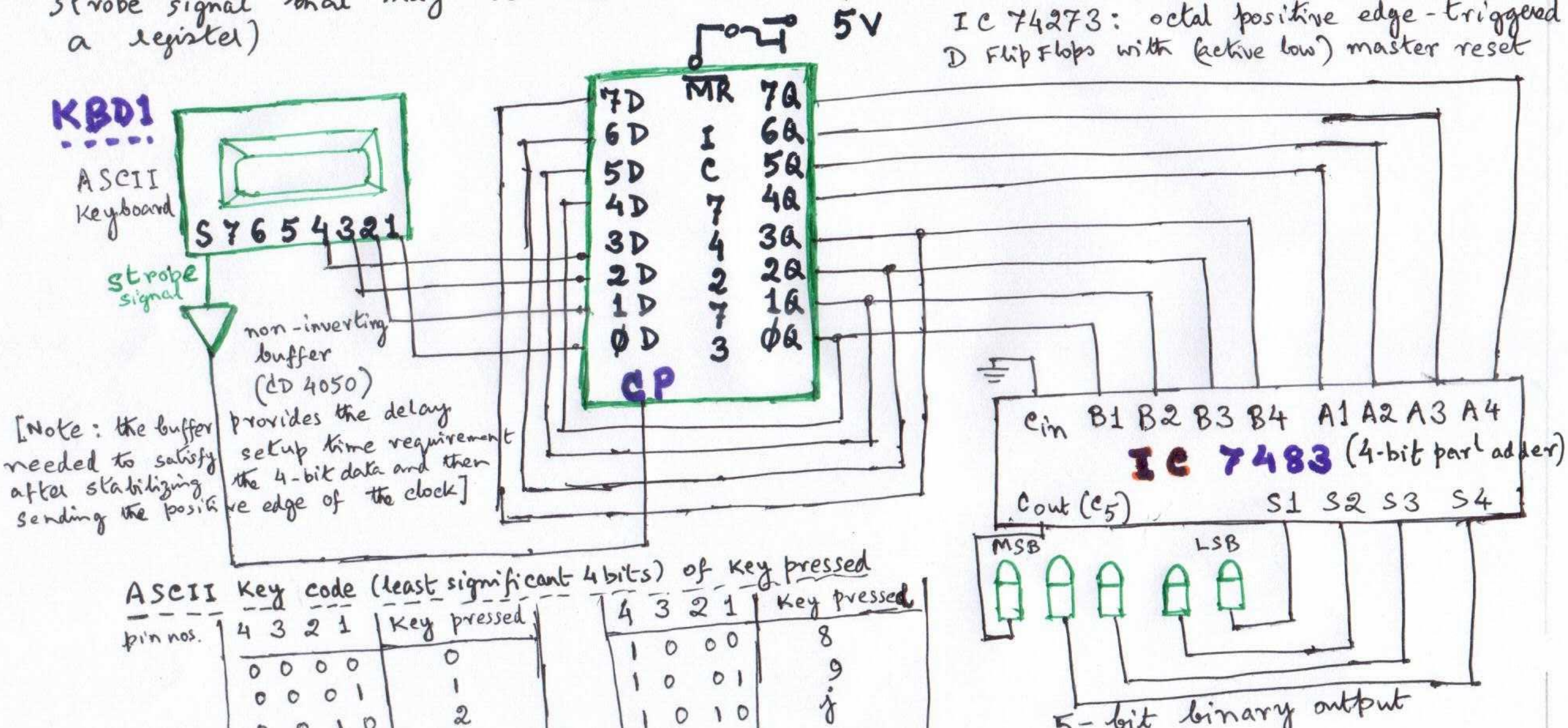
07/10/2020

Experiment to Add two 4-bit numbers input from ASCII Keypad and display the sum output on five logic display elements.

(N.B. we use ASCII Keypad (and not hex Keypad as is done in actual hardware experiment) as in Circuit Maker Software, every ASCII keypress is accompanied with a positive strobe signal that may be used to store (the four lowermost bits of) the keycode in a register)



ASCII Key code (least significant 4 bits) of Key pressed

pin nos. 4	3	2	1	Key pressed	4	3	2	1	Key pressed
0	0	0	0	0	1	0	0	0	8
0	0	0	1	1	1	0	0	1	9
0	0	1	0	2	1	0	1	0	j
0	0	1	1	3	1	0	1	1	k
0	1	0	0	4	1	1	0	0	l
0	1	0	1	5	1	1	0	1	m
0	1	1	0	6	1	1	1	0	n
0	1	1	1	7	1	1	1	1	o

EC 39003 Digital Circuits Lab

Steps:- 1) Place ASCII Keypad in the circuit by Device Selection:
Switches (major device class) → Digital (minor device class) → Ascii Key (device symbol)

2) Place IC74273 as:- Digital by Number (major) → 742xx (minor) → 74273 (device symbol)

3) Place IC7483 (4 bit parallel adder) as:- Digital by Number (major) → 74xx (minor) → 7483 (device symbol)

4) Place/select non-inverting buffer as:- Digital by Function (major) → Buff/Driver (minor) → 4050 (device symbol)

5) choose display lamp (LED) as:- Displays (major) → Digital (minor) → logic display (device symbol)

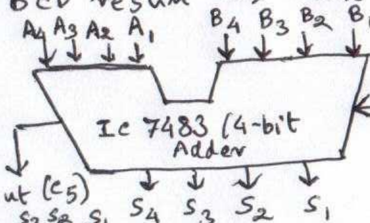
NB: Choose gate symbol for 'digital' simulation mode in top horizontal menu bar.

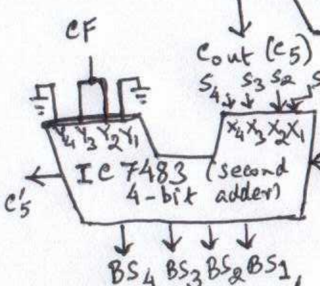
Sub-experiment: Input two BCD numbers (0–9) + (0–9) and display valid BCD result

Steps:-
1> add the two 4-bit BCD numbers using ordinary binary addition.
2> if the sum is ≤ 9, it is in proper BCD form and no correction is needed.
3> if the sum of the BCD digits is > 9, a correction factor (CF) of 0110 should be added to that sum, to produce the proper BCD result → this produces a carry to be propagated and added to the next decimal position.

Nine cases where sum > 1001 are given below:-

C_5	S_4	S_3	S_2	S_1	Decimal number
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18



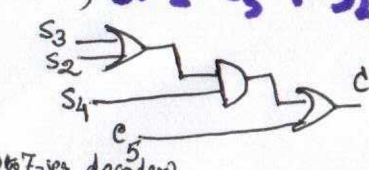


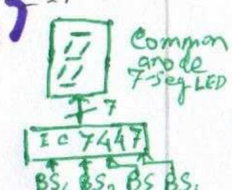
to a common-anode 7-seg. display via 7447 (BCD to 7-seg decoder)

Range of five-bit number
$C_5 S_4 S_3 S_2 S_1$: 00000 to 10010 (as 1001 + 1001 = 10010)

Note: CF should be '1' for following conditions:
(a) if $C_5 = 1$ (sum > 15 – last three cases in table)
(b) if $S_4 = 1$ and either $S_3 = 1$ or $S_2 = 1$ or both $S_3 = S_2 = 1$ (first six cases)

That is, $CF = C_5 + S_4 . (S_3 + S_2)$





Select common anode 7-seg. LED as :- Displays (major) → 7-seg. LED (minor) → CA 7-seg (Device Symbol)