Digital Electronics Circuits lab
Lab Experiment:6
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AIM:To design a circuit to add two 4-bit numbers (current and previous input) input from the ASCII keypad and display the sum output as

a) 5-bit binary representation using LEDs
b) Decimal representation using 7seg display

ICs used:-

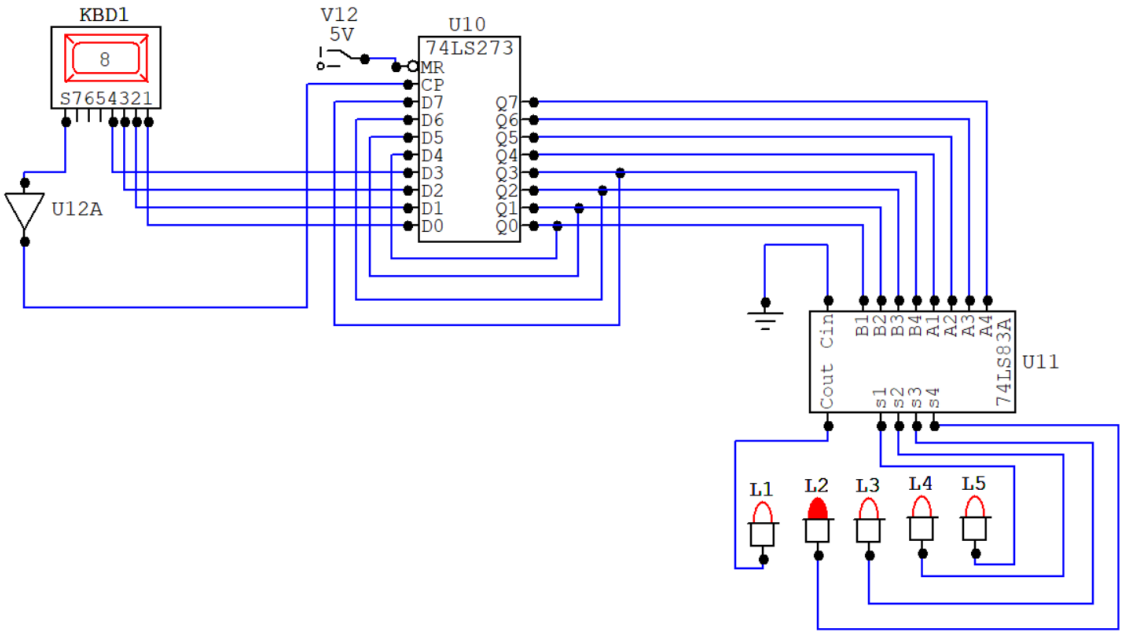
74LS83-2 quantity
74LS157-1 quantity
74LS47-2 quantity
ASCII Keypad
74LS273

Buffer/Driver:-4050

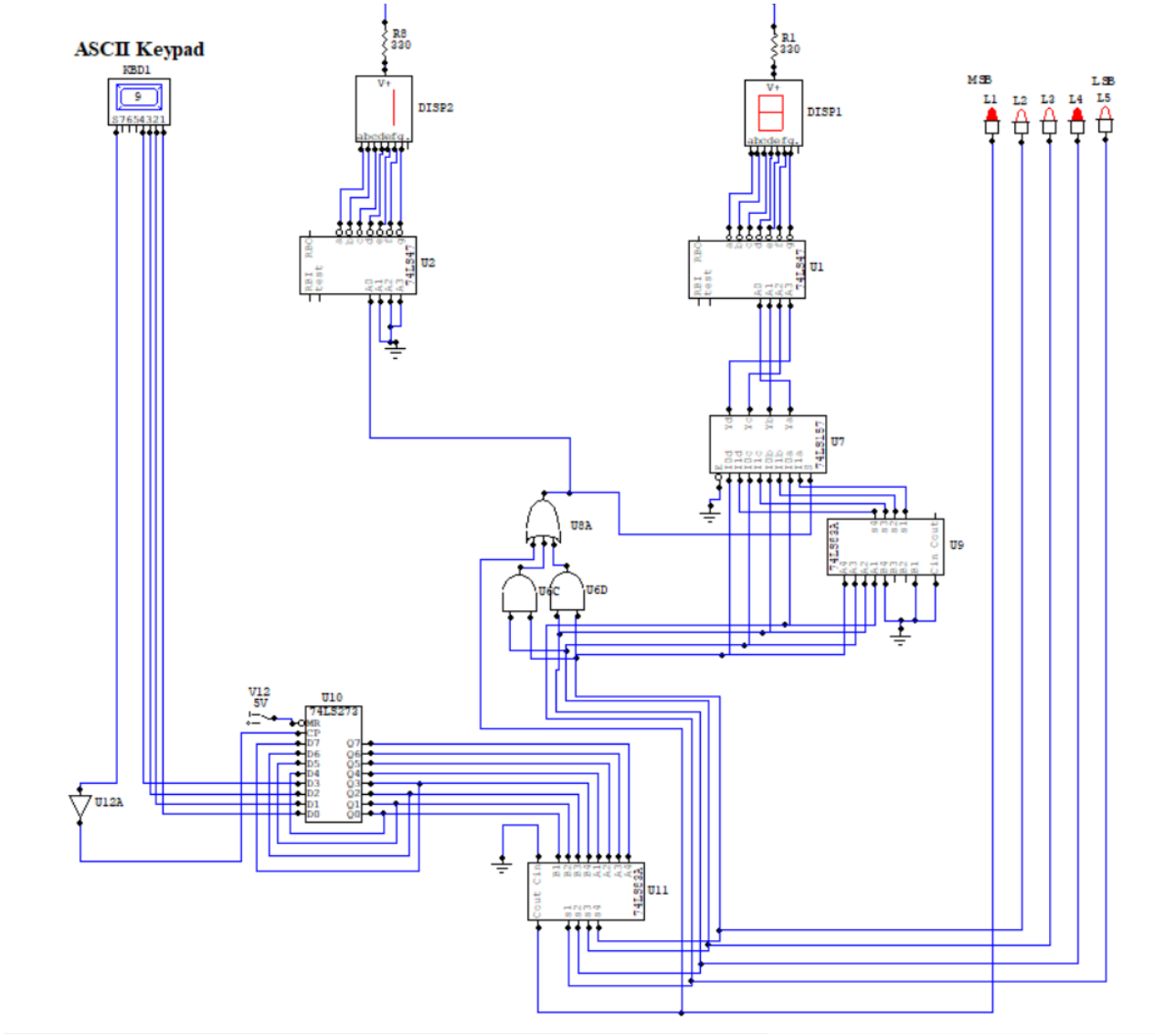
Components used:- 7-seg display, Logic Gates,ASCII Keypad,logic displays

Circuit:Digital circuits for displaying the addition of two 4-bit numbers which are given from the ASCII keypad.

(a)



(b)



This is the continuation of the experiment 5,where the difference lies only in giving the input values.

Observation:

- When we set master reset(MR) port to low in IC 74273 then this setting will erase all the values which are stored at the output terminals of the flip flops.

ASCII keycode(least significant 4-bits) of key pressed:-

key pressed	4	3	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
j	1	0	1	0
k	1	0	1	1
l	1	1	0	0
m	1	1	0	1
n	1	1	1	0
o	1	1	1	1

Result:-

- When we two numbers say from ascii keypad,then the 2 7-segment displays show its value and the logic displays will display the number in binary form(when light blinks then its logic 1,if not then its logic 0)
- For example if we gave j,9 from the ascii in that order then
  - ★ The 7segment display will show 19
  - ★ The logic displays will display 10011
- When we first set master reset to low then all values which are there before will be erased and the we give first j then 9 from the keypad,below is the working of ICLS273: $D_{3\text{-}0}$ -> $Q_{3\text{-}0}$ -> $D_{7\text{-}4}$ -> $Q_{7\text{-}4}$

Input No.	Ascii input	D3	D2	D1	D0	D7	D6	D5	D4	Q3	Q2	Q1	Q0	Q7	Q6	Q5	Q4
1	j	1	0	1	0	0	0	0	0	**1**	**0**	**1**	**0**	0	0	0	0
2	9	1	0	0	1	**1**	**0**	**1**	**0**	1	0	0	1	1	0	1	0

Discussion:-

- We use ASCII keypad,every ASCII keypress is accompanied with a positive strobe signal that may be used to store (the 4-lowermost bits of key entered)the keycode in the register.
- We take the 4-bit input from the ascii keypad and this will be fed to the 8-bit register IC-74273(D_3-D_0) which contains octal positive edge-triggered D-Flip Flops with active low master reset.
- The output(4-bit)(O_3-O_0) from the register will be fed as input to the other remaining terminals(D_7-D_4) of the same register which will store the value for the next cycle.
- When we enter another ascii from the keypad the previous value will be stored at O_7-O_4 and the present value will be stored at O_3-O_0.
- The buffer provides the delay needed to satisfy the setup time requirement after stabilising the 4-bit data and then sending the positive edge of the clock.

➔ Task 1:

- The two outputs are connected to the adder which is connected to 5 Logic Displayers which glow corresponding to the set bit. (L1 - MSB and L5- LSB).

➔ Task 2:

- The two outputs are connected to the adder:added values will come out from the adder output(S_1-S_4 of U11).
- Displaying the numbers in 7-segment display:
  - We have to display only the BCD input for the 7-segment display.i.e,0 to 9 only.
  - To determine whether the output of adder is greater than 9 or not.
    - We use the boolean expression $\mathbf{C_{out} + S_4.(S_3+S_2)}$,this expression gives a high level when the adder output is greater than 9.
  - So we come across two cases where the output of the adder is less than 9 or greater than 9.
    - If the number is less than 9 we just simply give that output from adder to IC-7447 as input.
    - If the number is greater than 9 we add 6 to the output of the adder using another IC-7483(adder),the output from this adder is fed as input to IC-7447.

- The nibble multiplexer(IC-74157) is used to determine whether which of the two above outputs to be feed as input for the IC-7447,the select of nibble will be high when the adder output is greater than 9.so,this nibble acts as a between the two process mentioned.

➢ At last we feed the 4-bit output which comes from the nibble multiplexer(IC-74157) as input for the IC-7447,this takes care of which digit to be displayed at units place.

➢ For deciding the digit at ten’s place we use the previous boolean expression.