CLASS : S.E. 5 E &TC **SUBJECT : DC**

EXPT. NO. : 2 **Roll No.: 22119**

DATE:17th September, 2020

TITLE : STUDY OF DEMULTIPLEXER / DECODER.

PRE-REQUISTITES FOR EXPT. : Definition of Demultiplexer/ Decoder, Implementation and operation of DEMUX/ Decoder using logic gates, Operation of Demultiplexer / Decoder IC-74LS138.(Refer Data-Sheet)

OBJECTIVE :

1. Verification of function table of IC-74LS138.
2. Design & Implement full adder circuit using IC-74LS138.
3. Design & Implement full subtractor circuit using IC-74LS138.
4. Design & Implement 3-bit Binary to Gray code converter-using IC-74LS138.
5. Design & Implement 3-bit Gray to Binary code converter-using IC-74LS138
6. Design & Implement following logical expression using IC-74LS138.

$$F1\ (A,B,C) = \Sigma_M (0,1,2,3)$$
$$F2\ (A,B,C) = \Sigma_M (2,3,4,5)$$
$$F3\ (A,B,C) = \Sigma_M (4,5,6,7)$$

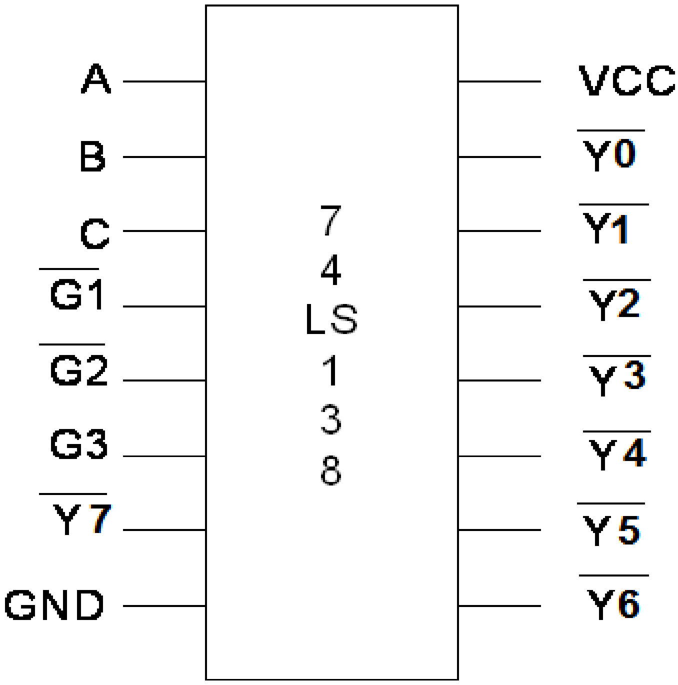
APPARATUS :

Digital-Board, GP-4Patch-Cords, IC-74LS138, IC-74LS32, IC-74LS00 / IC-74LS04.

THEORY :

De-Multiplexer/Decoder is a combinational logic device, which has one input & many output, one output can be selected according to select input. IC-74LS138 is 3 to 8 Line Decoder/Demultiplexer. It is a 16-pin dual packaged IC, which has three enable pins (2-STROBE Active Low and one Active High). IC-74LS138 produces complementary output. i.e. the output of 74LS138 is Active Low. We can design any combinational circuits using IC-74LS138. DEMUX/Decoder performs reverse operation to that of Multiplexer.

PIN Diagram :



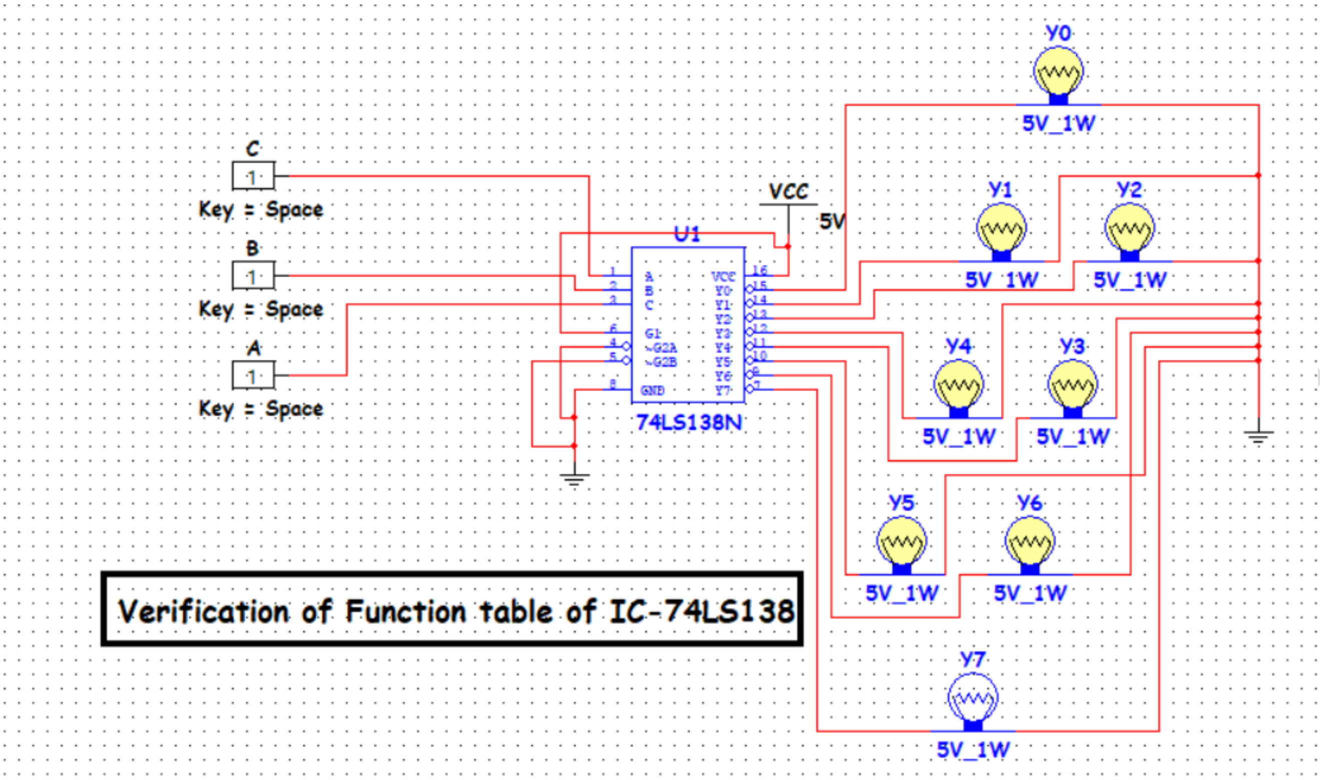
PROCEDURE :

1. Verify operation of IC 74138.
2. Design and implement 3 / 4 variables function using decoder and Verify its Truth Table.
3. Design and implement the logic diagram of Full adder / Subtractor circuit and Verify its Truth Table.
4. Design and implement 3-bit code converter circuit and Verify its Truth Table.

1) Verification of Function Table (IC-74LS138):

Select I/P						Active Low Output							
G1	G2	G3	A	B	C	$\overline{Y_0}$	$\overline{Y_1}$	$\overline{Y_2}$	$\overline{Y_3}$	$\overline{Y_4}$	$\overline{Y_5}$	$\overline{Y_6}$	$\overline{Y_7}$
0	0	1	0	0	0	0	1	1	1	1	1	1	1
0	0	1	0	0	1	1	0	1	1	1	1	1	1
0	0	1	0	1	0	1	1	0	1	1	1	1	1
0	0	1	0	1	1	1	1	1	0	1	1	1	1
0	0	1	1	0	0	1	1	1	1	0	1	1	1
0	0	1	1	0	1	1	1	1	1	1	0	1	1
0	0	1	1	1	0	1	1	1	1	1	1	0	1
0	0	1	1	1	1	1	1	1	1	1	1	1	0

Logic Diagram: (Verification of IC-74LS138)



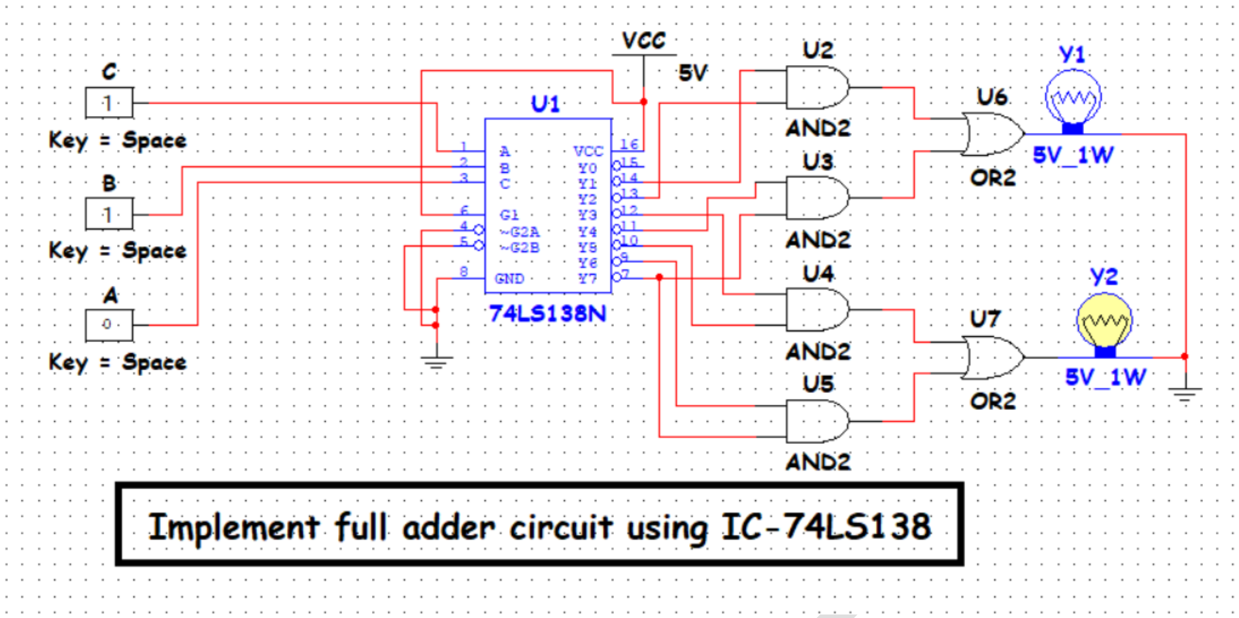
2) Design of full adder using IC 74LS138

TRUTH -TABLE:

Select I/P			Output	
			Sum	Carry
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= $\Sigma_m (1,2,4,7)$
Carry= $\Sigma_m (3,5,6,7)$

Logic Diagram:

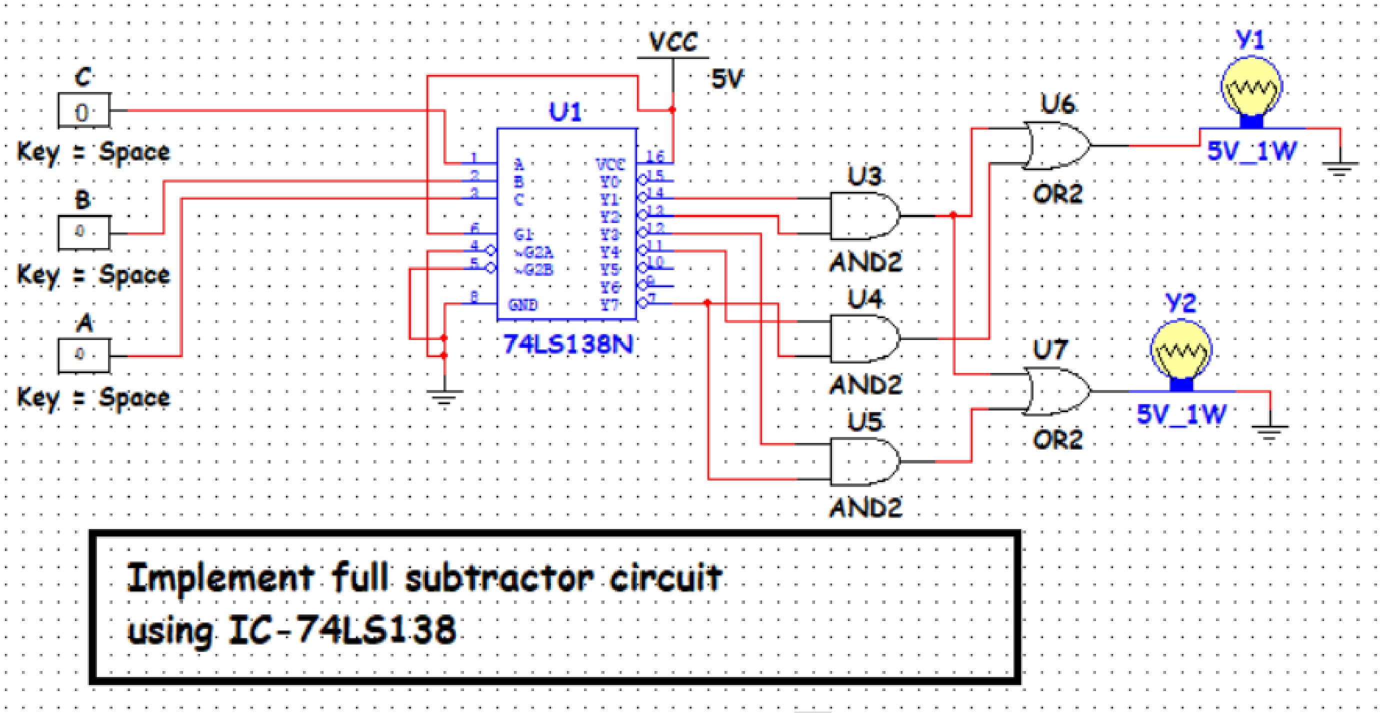


3) Full- Subtractor Circuit using IC74LS138

Select I/P			Output	
			DIFF	BORROW
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Difference $=\sum m\ (1,2,4,7)$
Barrow $=\sum m\ (1,2,3,7)$

Logic Diagram:

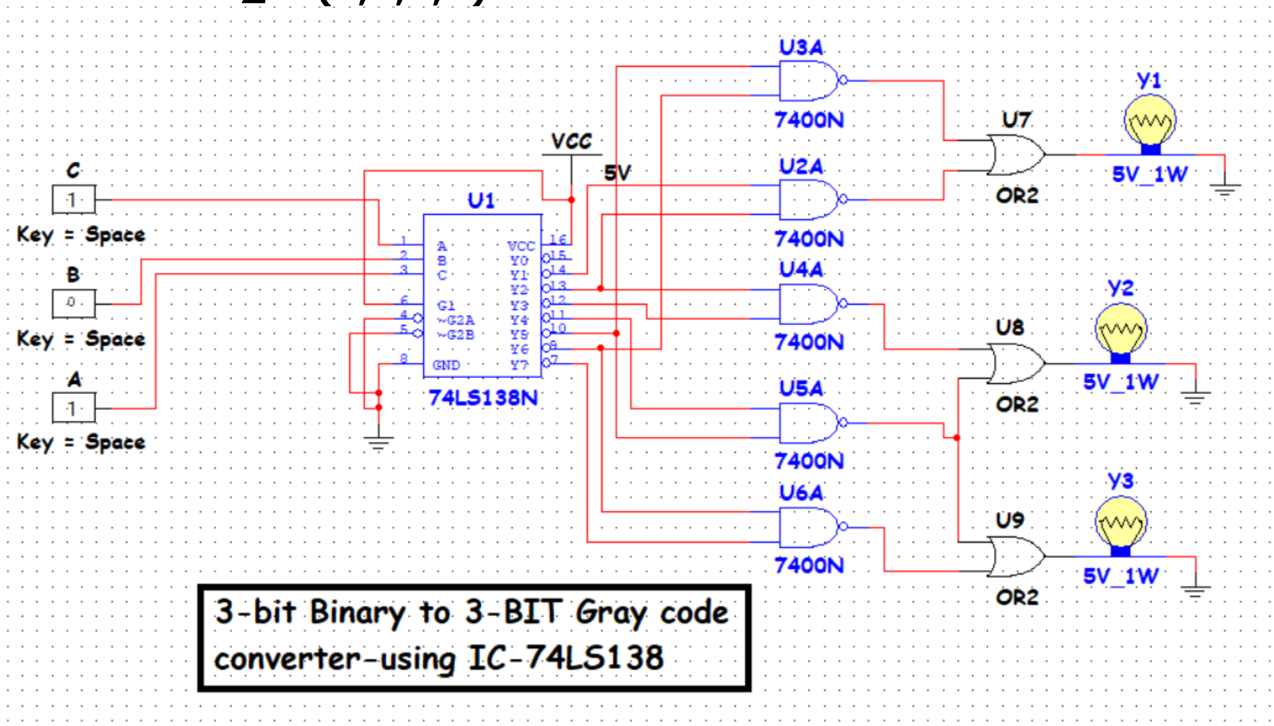


4) 3-bit Binary to 3-bit Gray code Converter:

Binary			Gray		
B2	B1	B0	G2	G1	G0
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	1	1
0	1	1	0	1	0
1	0	0	1	1	0
1	0	1	1	1	1
1	1	0	1	0	1
1	1	1	1	0	0

$=\sum m\,(4,5,6,7)$

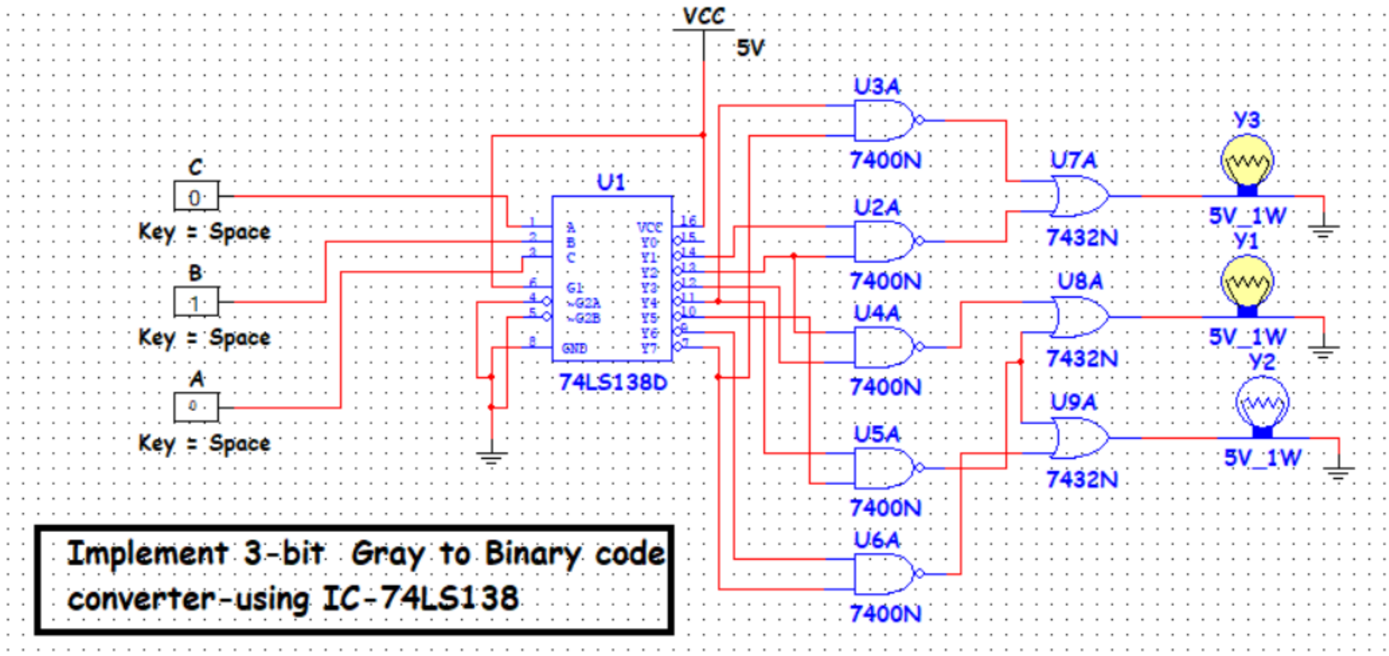
=∑m (2,3,4,5)
=∑m (1,2,5,6)



5) Logic Diagram: (3-bit Gray code To 3-bit Binary code Converter)

Gray			Binary		
G2	**G1**	**G0**	**B2**	**B1**	**B0**
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	1	1
0	1	1	0	1	0
1	0	0	1	1	1
1	0	1	1	1	0
1	1	0	1	0	0
1	1	1	1	0	1

=∑m (4,5,6,7)
=∑m (2,3,4,5)
=∑m (1,2,4,7)

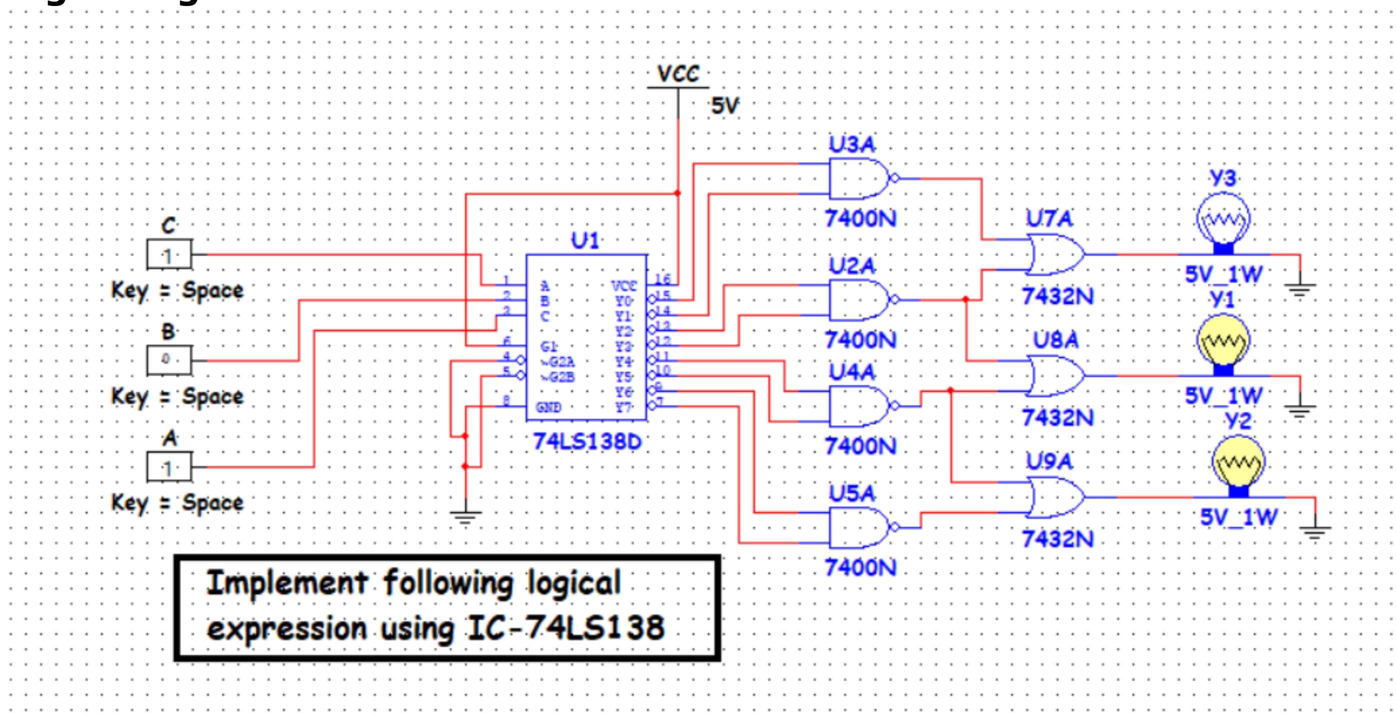


6).Design & Implement following logical expression using IC-74LS138.

F1 (A,B,C) = Σ_M (0,1,2,3)
F2 (A,B,C) = Σ_M (2,3,4,5)
F3 (A,B,C) = Σ_M (4,5,6,7)

Select I/P			Output		
A	B	C	F1	F2	F3
0	0	0	1	0	0
0	0	1	1	0	0
0	1	0	1	1	0
0	1	1	1	1	0
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	0	0	1
1	1	1	0	0	1

Logic Diagram:



CONCLUSION :

1)Function table of IC74LS138 verified

2)successfully designed and implemented full adder circuit with IC74LS138

3)successfully designed and implemented full subtractor circuit with IC74LS138

4)Sucessfully designed and implemented 3bit binary to 3bit Gray code converter using IC74LS138

5) Sucessfully designed and implemented 3bit gray to 3bit binary Code converter

6)successfully designed and implemented given logical expressions Using IC74LS138

REFFRENCE:

1) : R.P. Jain , "Modern digital electronics" , 3rd edition
2) : A. Anand Kumar, "Fundamentals of digital circuits" 1st edition

Subject teacher Sign with Date Remark