Department of Electrical Engineering

UET, Lahore

Digital Systems Laboratory

Lab # 7(a)

Decoders: Construction, Operation and Application

Objective:

In this lab you will:

- Verify the operation of 74LS139 Dual 2 to 4 active low output decoder digital IC.
- Construct large decoders from small decoder units.
- Implement Boolean functions using a decoder.

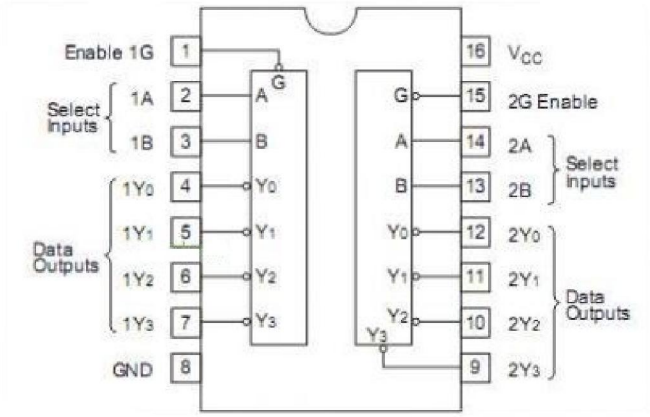
Theoretical Background:

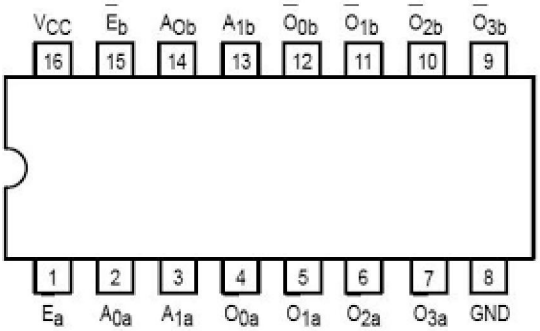
Discrete quantities of information are represented in digital systems by binary codes. A binary code of n bits is capable of representing up to 2^n distinct elements of coded information. A decoder is a combinational circuit that converts binary information from n input lines to a maximum of 2^n unique output lines. If the n-bit coded information has unused combinations, the decoder may have fewer than 2^n outputs. The purpose of decoder is to generate the 2^n (or fewer) min terms of n input variables. Each combination of inputs will assert a unique output. For details, study the article 4.9 from 'Digital Design, with an introduction to Verilog HDL', 5th edition, by M. Morris Mano and Michael D. Ciletti

Apparatus:

74LS139 Dual 2x4 active low output decoder digital IC.

The pin configuration of 74LS139 is given below:





It is an active low output IC with a pair of 2 to 4 decoders. IC chip has a 2 active low enable inputs, one for each decoder. Truth table of this IC is shown on right.

Truth Table

Inputs			Outputs			
$\overline{E}$	A_0	A_1	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

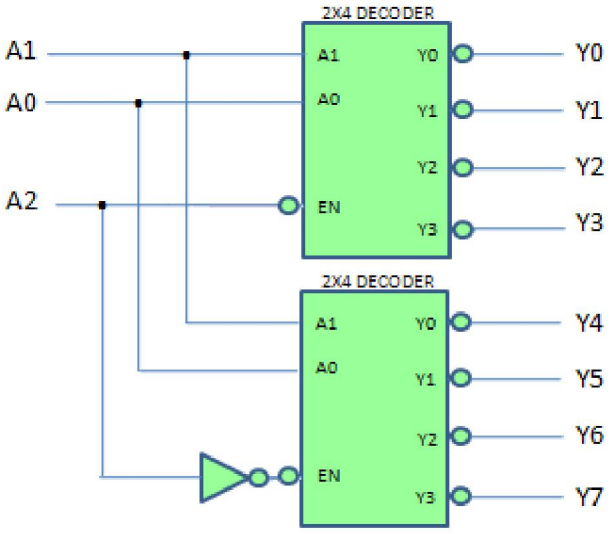
H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

Lab Task (a):

Verify the operation of 74LS139 digital IC.

Lab Task (b):

Construct a 3x8 decoder using two 2x4 decoders and verify its operation. Its block diagram is as follows:

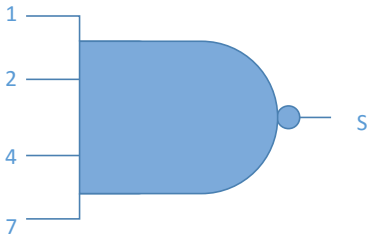


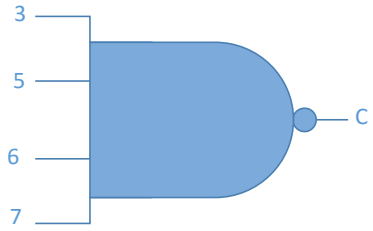
Inputs			Outputs							
A_2	A_1	A_0	O_0	O_1	O_2	O_3	O_4	O_5	O_6	O_7
0	0	0								
0	0	1								
0	1	0								
0	1	1								
1	0	0								
1	0	1								
1	1	0								
1	1	1								

Lab Task (c):

Implement a full adder using 3x8 decoder you made. See that outputs are active low.

$$S = \sum (1, 2, 4, 7) \qquad C = \sum (3, 5, 6, 7)$$





Comments:

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Assignment:

- Construct a 4x16 decoder using 2x4 decoders and verify its operation.
- Implement 2x2 multiplier using 4x16 decoder.

Lab Instructor: _____

Dated: _____