Digital Logic Design (EL-1005)

LABORATORY MANUAL

Spring-2022

LAB 09

Binary Encoder

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MARKS AWARDED: /03

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Lab Session 09: Binary Encoder

OBJECTIVES:

After completing this lab, you would be able to know

- To study the basic operation and design of the Encoder circuits
- Explain the working principle of 3-8 line Octal to Binary Encoding
- Understand the usage of Priority Encoder

APPARATUS:

- Logics Trainer, Logics works

INTRODUCTION:

An encoder is a combinational circuit that performs the inverse operation of a decoder. An encoder has a maximum of ***2^n*** input lines and ***n*** output lines. The encoder generates binary code at its output lines that represents which input line is active at a given time. In encoder, it is assumed that only one input is active high at a time, if more than one inputs are high simultaneously then ambiguous output is generated. In order to resolve this ambiguity, there must be some input priority function to ensure that only one input is encoded at a time.

A priority encoder is a combinational circuit that encodes the input using priority function i.e., if more than one inputs are high simultaneously than the input having the highest priority will take precedence. Each input line is assigned priority. The most significant input line may be given highest priority and least significant input line the lowest or vice versa. The priority encoder has an additional output to ensure that at least one input line is active high and the binary code at the output lines is valid. Figure 7-2 shows the block diagram of **2^nxn** priority encoder.

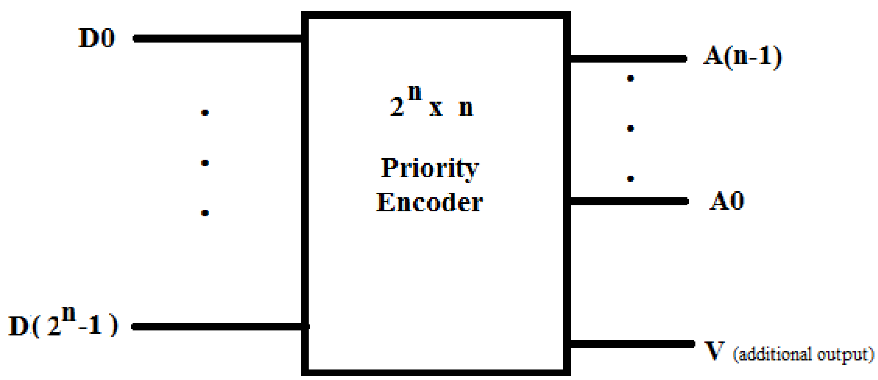

Figure 1. Encoder Block Diagram

74148 (8 x 3) Octal to Binary Priority Encoder

The 74148 is a priority encoder with active-low inputs for decimal digits. There are nine inputs lines (including an enable input) and five output lines, of which three represents the binary code for the octal digit.

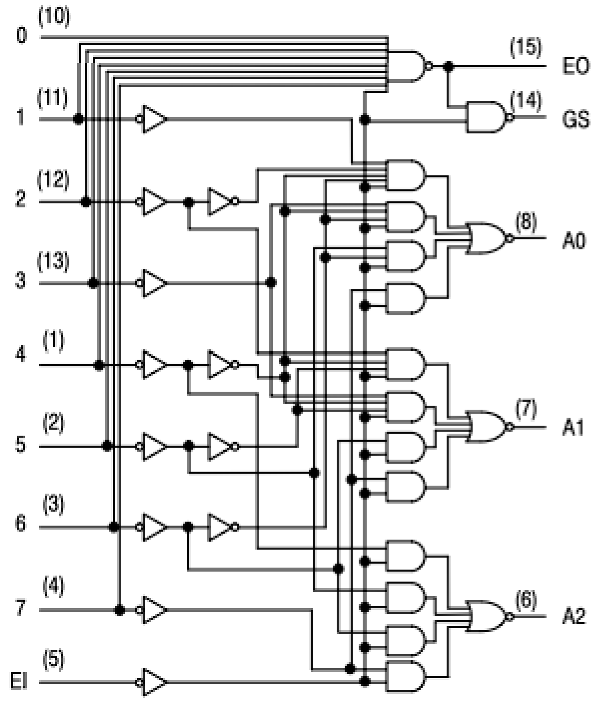

Figure 2. Functional block diagram 74LS148

Function of various pins of this IC is described below:

0 through 7: Active low data inputs representing the octal digits
A2, A1, A0: Active low output lines representing the binary code
E1: Active low enable Input
E0: Active low output indicating none of the inputs is high
GS: Active low output indicating any of the inputs is high
VCC and GND: Supply connections lines.

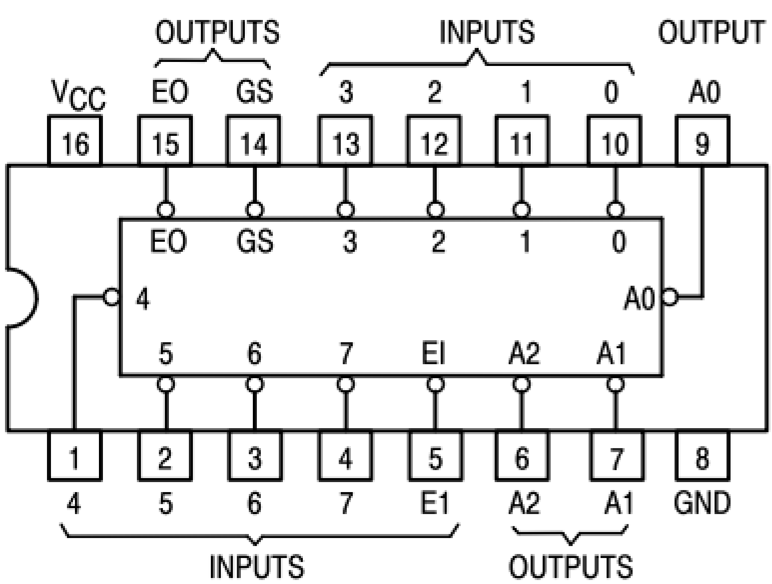

Figure 3. 8to3 Priority Encoding

INPUTS									OUTPUTS				
EI	0	1	2	3	4	5	6	7	A2	A1	A0	GS	EO
H	X	X	X	X	X	X	X	X	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	X	L	H	L	L	H	L	H
L	X	X	X	X	X	L	H	H	L	H	L	L	H
L	X	X	X	X	L	H	H	H	L	H	H	L	H
L	X	X	X	L	H	H	H	H	H	L	L	L	H
L	X	X	L	H	H	H	H	H	H	L	H	L	H
L	X	L	H	H	H	H	H	H	H	H	L	L	H
L	L	H	H	H	H	H	H	H	H	H	H	L	H

Figure 4. Functional Table 74LS148

Decimal to BCD Priority Encoder (74147)

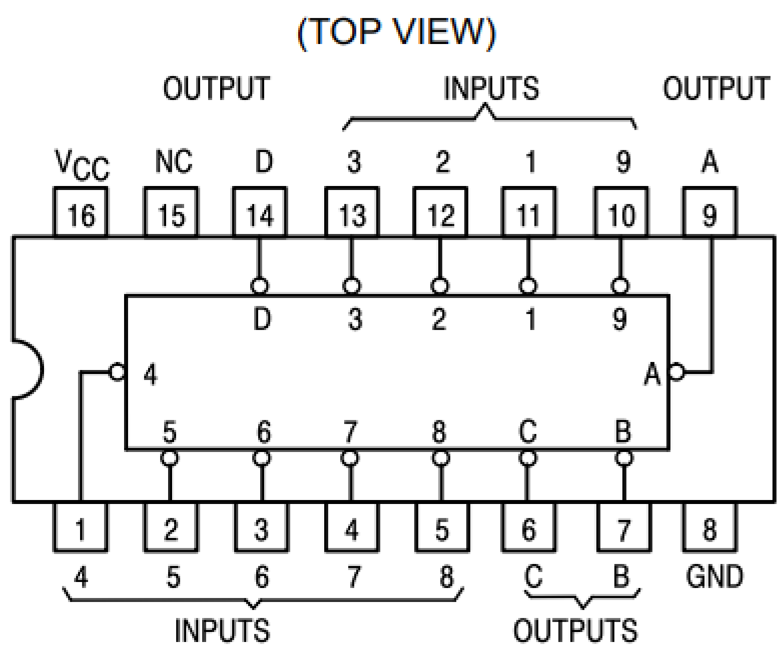

Figure 5. 74LS147 IC

Encoders are the opposite of decoders. They are used to generate a coded output from a single active numeric input. To illustrate this in a simple manner, let's take a look at the simple decimal-to-BCD encoder.

INPUTS									OUTPUTS			
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**D**	**C**	**B**	**A**
H	H	H	H	H	H	H	H	H	H	H	H	H
X	X	X	X	X	X	X	X	L	L	H	H	L
X	X	X	X	X	X	X	L	H	L	H	H	H
X	X	X	X	X	X	L	H	H	H	L	L	L
X	X	X	X	X	L	H	H	H	H	L	L	H
X	X	X	X	L	H	H	H	H	H	L	H	L
X	X	X	L	H	H	H	H	H	H	L	H	H
X	X	L	H	H	H	H	H	H	H	H	L	L
X	L	H	H	H	H	H	H	H	H	H	L	H
L	H	H	H	H	H	H	H	H	H	H	H	L

H = high logic level, L = low logic level, X = irrelevant

Figure 6. Functional Table 74LS147 IC

Experiment 09

Name______________Student ID______________Section____________________

Exercise # 01

Design and Implement Octal to Binary Priority Encoder by Using 74148 IC.

INPUTS								OUTPUTS		
D7	D6	D5	D4	D3	D2	D1	D0	Z2	Z1	Z0

Exercise # 02

Design and Implement Decimal to BCD Priority Encoder by Using 74147 IC

Active LOW Decimal Inputs									Outputs			
1'	2'	3'	4'	5'	6'	7'	8'	9'	Q3	Q2	Q1	Q0

Exercise # 03 MCQs

(i) **If two inputs are active on a priority encoder, which will be coded on the output?**

a) The higher value
b) The lower value
c) Neither of the inputs
d) Both of the inputs

(ii) **How is an encoder different from a decoder?**

a) The output of an encoder is a binary code for 1-of-N input
b) The output of a decoder is a binary code for 1-of-N input
c) The output of an encoder is a binary code for N-of-1 output
d) The output of a decoder is a binary code for N-of-1 output