1. Objectives:

1. Understanding the construction and operational principles of digital decoders and encoders.

2. Theory:

Decoders:

A decoder is a logic circuit that will detect the presence of a specific binary number or word. The input to the decoder is a parallel binary number and the output is a binary signal that indicates the presence or absence of that specific number.

It is a combinational circuit that converts binary information from n input lines to a maximum of 2^n unique output lines.

- **2-to-4 decoder:**

Inputs		Outputs			
B	**A**	**F1**	**F2**	**F3**	**F4**
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

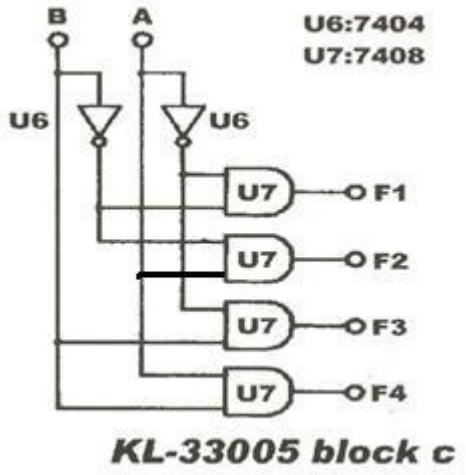
o

F1 = A.$\overline{B}$. o

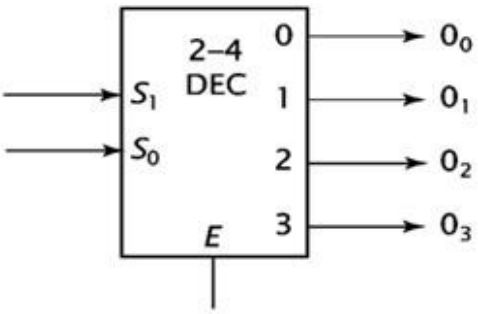
F2 = A.B. o

F3 = A.$\overline{B}$. o

F4 = A.B.

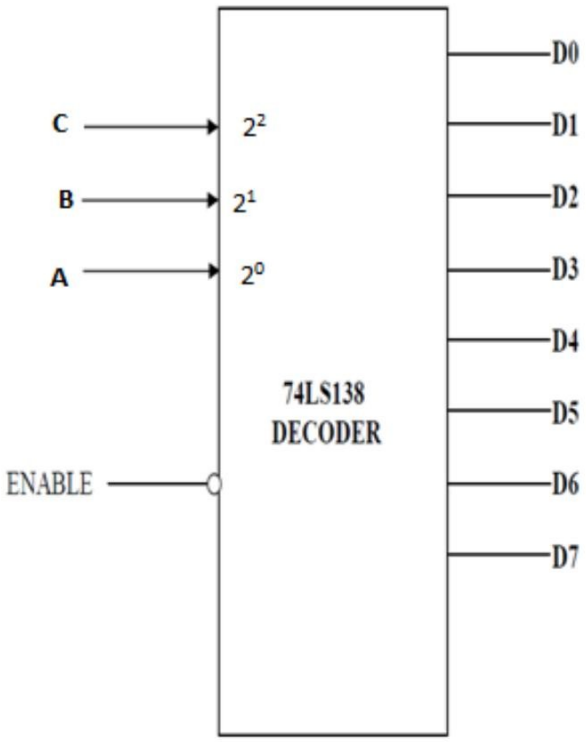


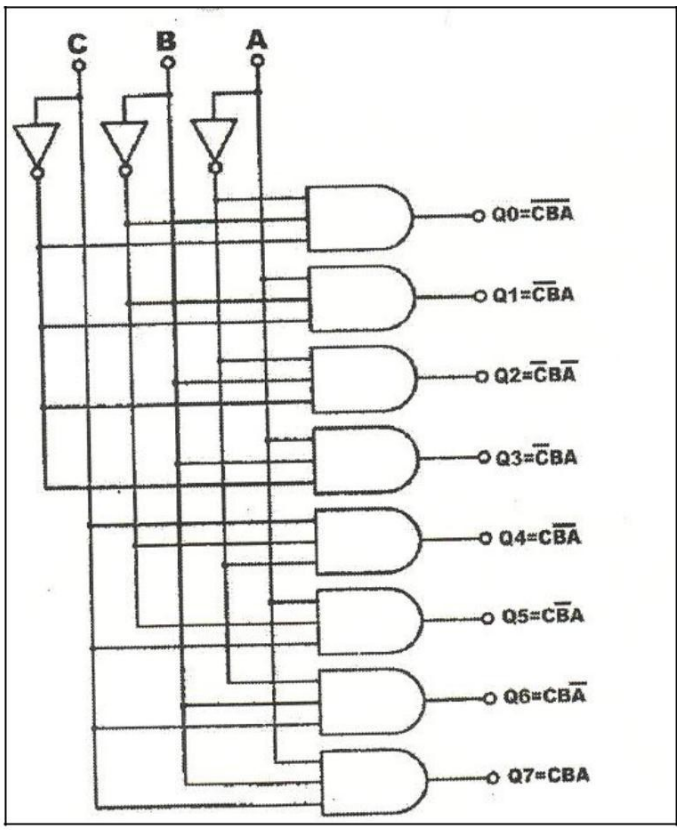
KL-33005 block c



S_1	S_0	E	0_0	0_1	0_2	0_3
X	X	0	0	0	0	0
0	0	1	1	0	0	0
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	1

- **3-to-8 decoder:**





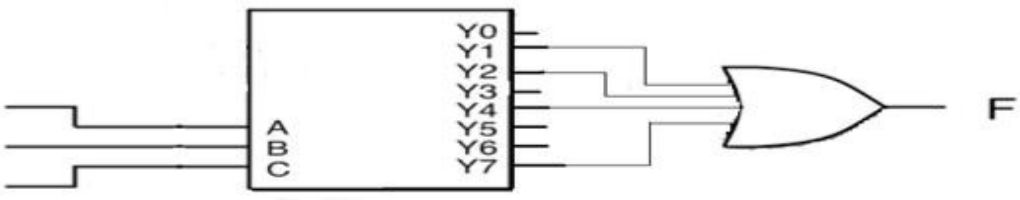
Example:

Implement the following truth table using a decoder and OR gate.

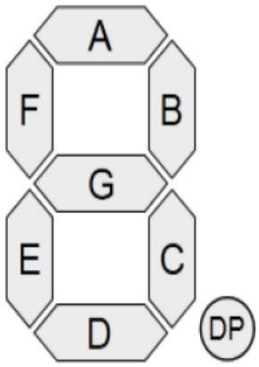
Inputs			Output
A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

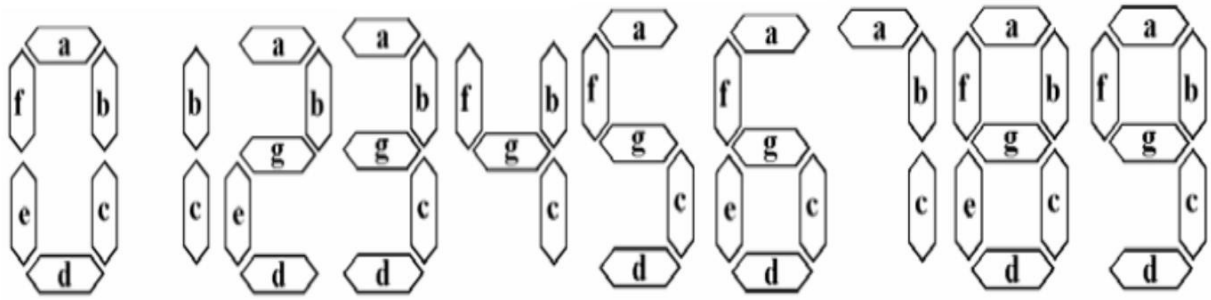
Solution:

F (A,B,C) = ∑(1,2,4,7)

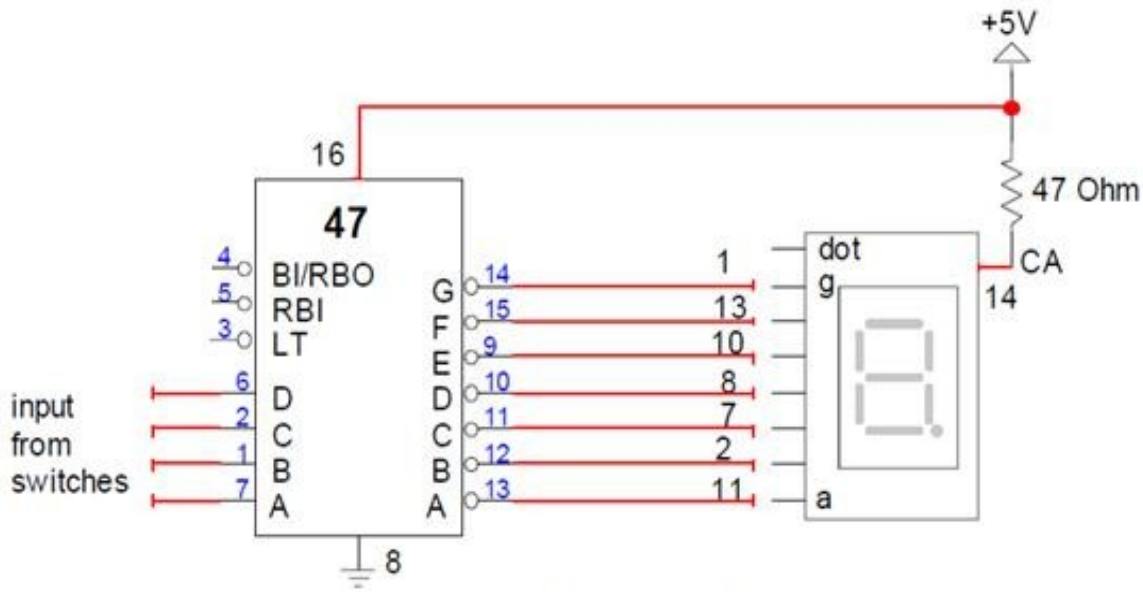


- **BCD-to-Seven Segment decoder:**
  A seven segment LED display contains 7 LEDs. Each LED is called a segment and they are identified as (a, b, c, d, e, f, g) segments.

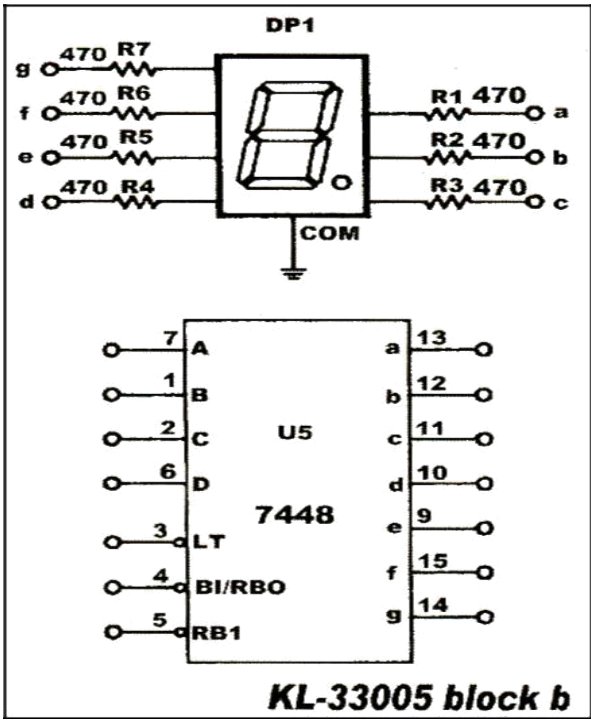




For example if decimal 9 is to be displayed a, b, c, d, f, g must be 0 and the others must be 1 (For common anode type display units), if decimal 5 is to be displayed then a, f, g, c, d must be 0 and the others must be 1.



BCD-to-Seven Segment Decoder and 7-segment display



KL-33005 block b