The University of Azad Jammu and Kashmir, Muzaffarabad

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Encoders & Decoders

Encoder

- An **encoder** is a device or circuit that **converts information from one form to another (usually into a coded form).**
- It takes **2^n input lines** and gives an **n-bit binary output**.
- Example:
  - A **decimal-to-binary encoder** converts decimal input (like 0–9) into binary code.
  - If you press key "5" on a keypad, the encoder outputs 0101 (binary for 5).

Purpose: Reduce many input lines into fewer coded output lines.

Example: ***8-to-3 Encoder***

Keyboard key pressed → binary code sent to computer.

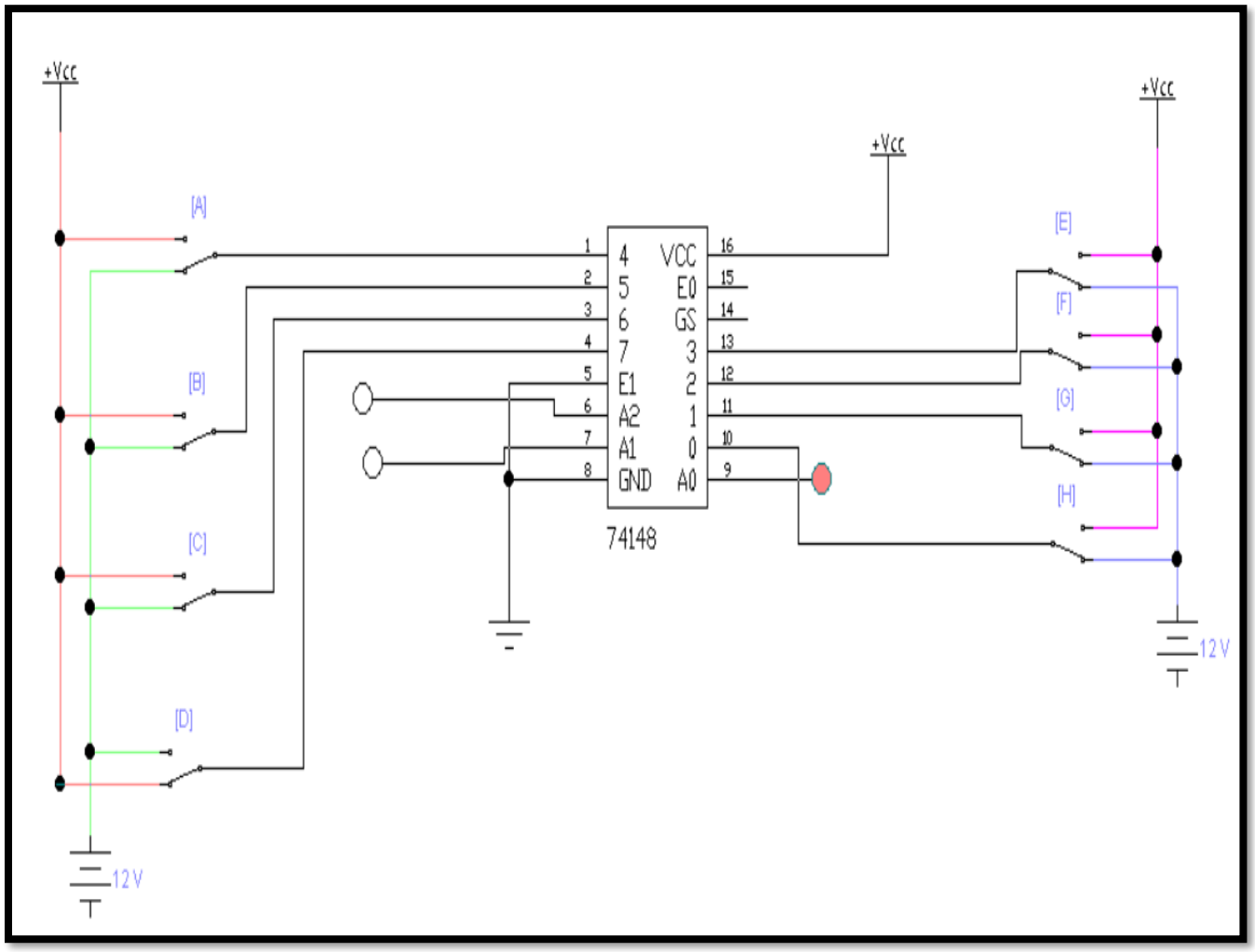
Truth Table:

D7	D6	D5	D4	D3	D2	D1	D0	C	B	A
0	0	0	0	0	0	0	**1**	0	0	0
0	0	0	0	0	0	**1**	0	0	0	1
0	0	0	0	0	**1**	0	0	0	1	0
0	0	0	0	**1**	0	0	0	0	1	1
0	0	0	**1**	0	0	0	0	1	0	0
0	0	**1**	0	0	0	0	0	1	0	1
0	**1**	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1

Output Expression: -

C =D4+D5+D6+D7
B =D2+D3+D6+D7
A =D1+D3+D5+D7

Encoder Diagram using EWB



Decoder

A decoder does the opposite of an encoder.

It takes **n-bit binary input and converts it into 2^n outputs.**

Example: ***3-to-8 Decoder***

A binary-to-decimal decoder takes binary 0101 and activates only output line 5.

Used in devices like 7-segment displays (to show numbers on digital clocks/calculators).

TV remote signal (binary) → decoded into commands (volume up, channel change).

Purpose: Expand coded input into its original unique output.

Truth Table:

C	B	A	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
0	0	0	0	0	0	0	0	0	0	**1**
0	0	1	0	0	0	0	0	0	**1**	0
0	1	0	0	0	0	0	0	**1**	0	0
0	1	1	0	0	0	0	**1**	0	0	0
1	0	0	0	0	0	**1**	0	0	0	0
1	0	1	0	0	**1**	0	0	0	0	0
1	1	0	0	**1**	0	0	0	0	0	0
1	1	1	**1**	0	0	0	0	0	0	0

Output Expressions
Y0=EB'A'
Y1=EB'A
Y2=EBA'
Y3=EBA

Decoder Diagram using EWB