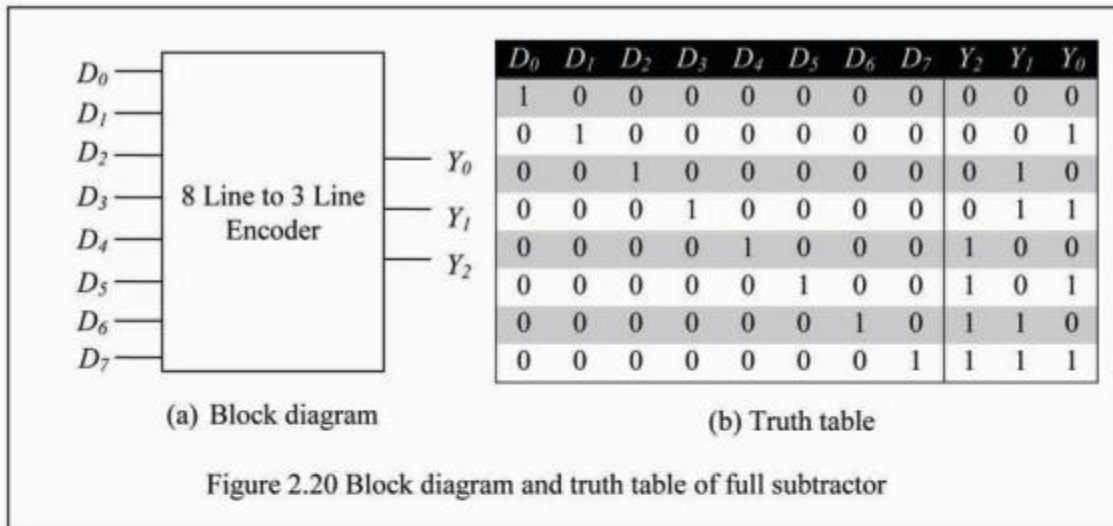


2.2.2.1 Encoder

An encoder is a combinational circuit which generates a coded output signal in response to an active input signal. If an encoder has n number of output lines, it can have 2^n or lesser number of input lines. Encoders are typically used to convert a decimal keyboard, like that of a calculator into a binary or BCD output. Figure 2.20 shows the block diagram and truth table of an 8 line to 3 line encoder which is also known as octal to binary encoder.



The Boolean expressions for the encoder can be determined by careful examination of the truth table. Output line Y_2 is at logic '1' when D_4 or D_5 or D_6 or D_7 is at logic '1'. Similarly we can determine the expressions for Y_1 and Y_0 as well and can be written as

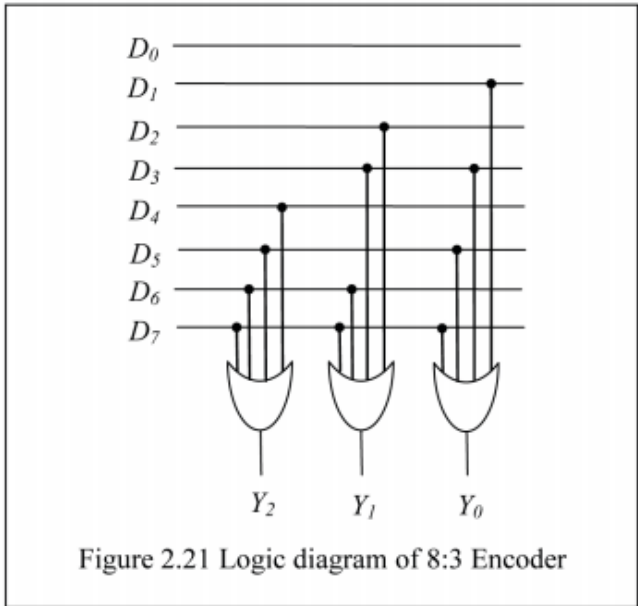
$$Y_2 = D_4 + D_5 + D_6 + D_7$$

$$Y_1 = D_2 + D_3 + D_6 + D_7$$

$$Y_0 = D_1 + D_3 + D_5 + D_7$$

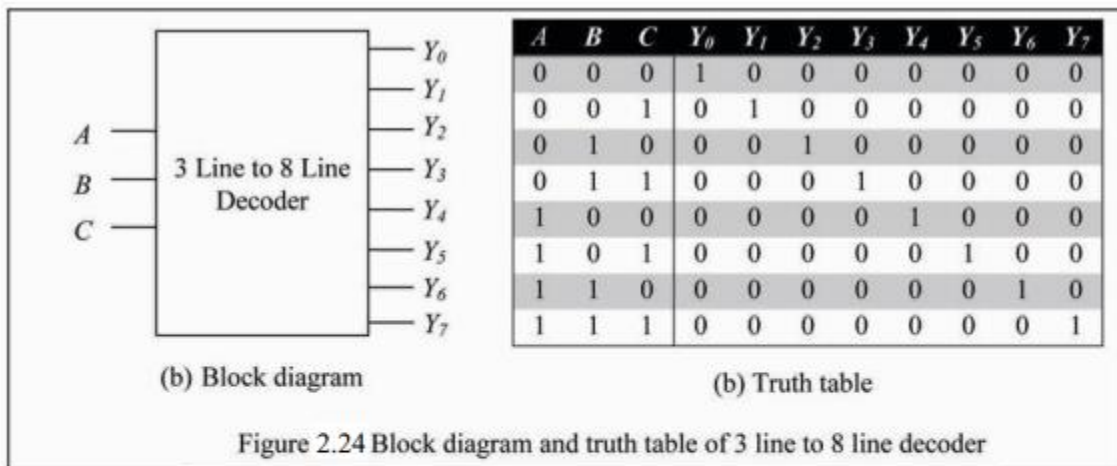
Implementation of expression for Y_2 , Y_1 and Y_0 is shown in Figure 2.20 which basically describes the octal to binary encoder.

Other popular encoders are 10 line to 4 line encoder (i.e. decimal to BCD encoder) and 16 line to 4 line encoder (i.e. hexadecimal to binary encoder).



2.2.2.2 Decoder

A decoder is a combinational circuit which generates 2^n or lesser unique output lines from coded information received on n-bit input lines. It is used to decode the binary state contained in a piece of coded information. Decoders can be used in chip select logic of memory ICs, making one of the output line active at a time etc. Figure 2.24 shows the block diagram and truth table of a 3 line to 8 line decoder (also known as binary to octal decoder).



The Boolean expression for each output can be derived from the truth and can be written as

$$\begin{aligned}
 Y_0 &= \bar{A}\bar{B}\bar{C} & Y_2 &= \bar{A}B\bar{C} & Y_4 &= A\bar{B}\bar{C} & Y_6 &= AB\bar{C} \\
 Y_1 &= \bar{A}B C & Y_3 &= \bar{A}\bar{B}C & Y_5 &= A\bar{B}C & Y_7 &= ABC
 \end{aligned}$$

In order to implement the above expressions, we need the hardware shown in Figure 2.25 and is termed as binary to octal decoder.

