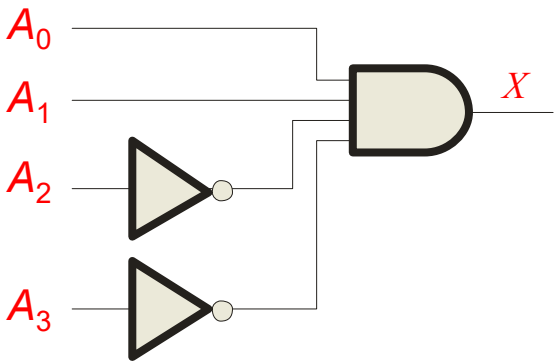
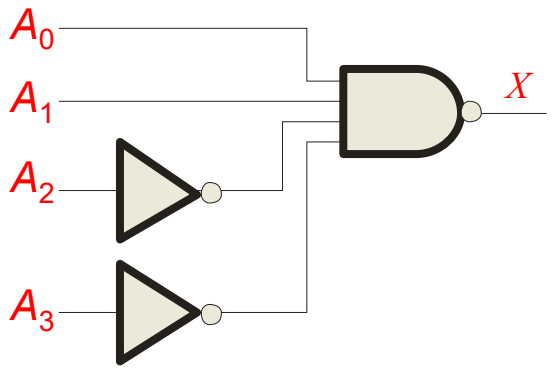
Summary

Decoders

A **decoder** is a logic circuit that detects the presence of a specific combination of bits at its input. Two simple decoders that detect the presence of the binary code 0011 are shown. The first has an active HIGH output; the second has an active LOW output.



Active HIGH decoder for 0011



Active LOW decoder for 0011

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Summary

Decoders

Question

Assume the output of the decoder shown is a logic 1. What are the inputs to the decoder?

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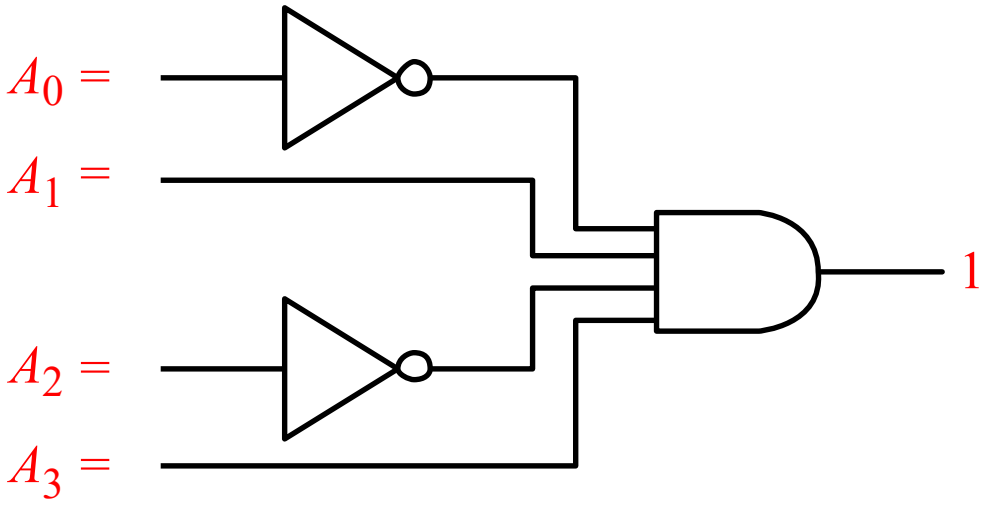
Summary

Decoders

Question Assume the output of the decoder shown is a logic 1. What are the inputs to the decoder?



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Summary

Decoders

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Summary

Decoders

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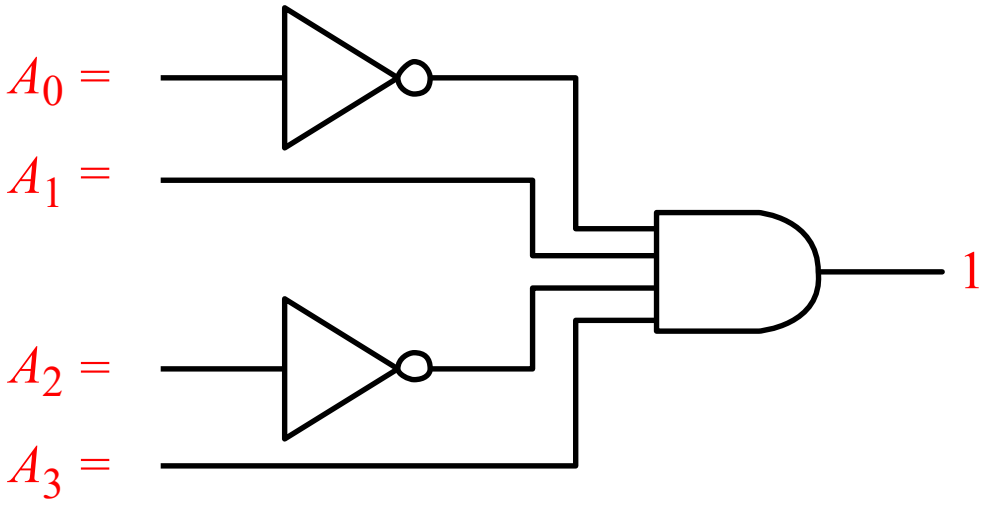

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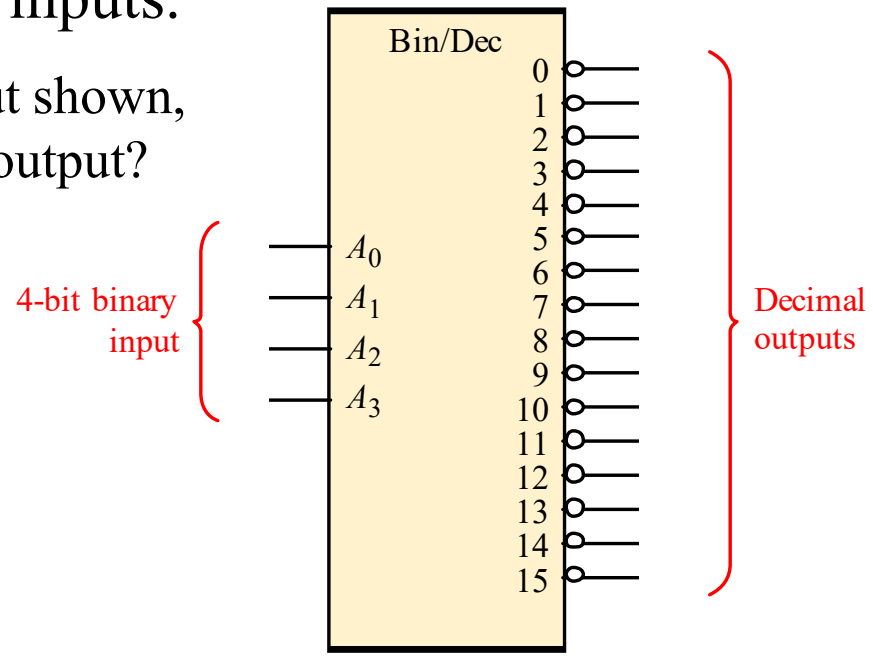
Summary

Decoders

IC decoders have multiple outputs to decode any combination of inputs. For example the binary-to-decimal decoder shown here has 16 outputs – one for each combination of binary inputs.

Question

For the input shown, what is the output?



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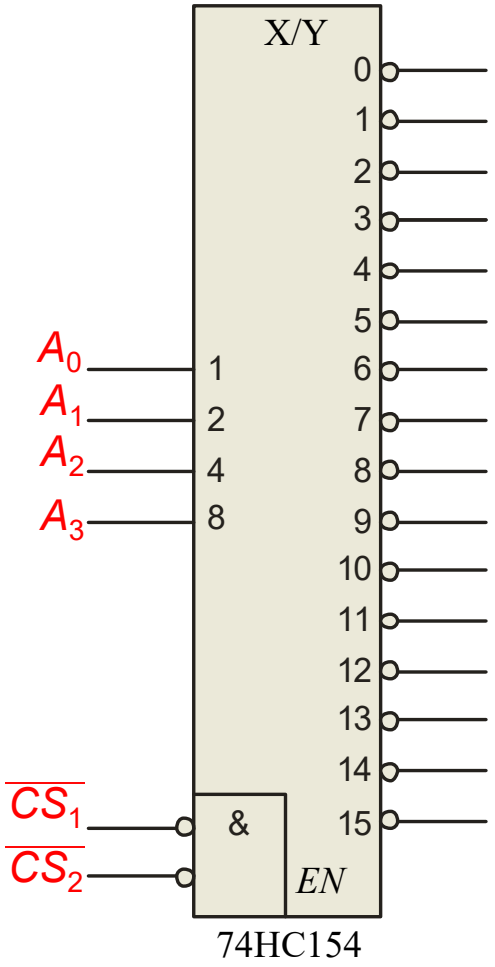
Summary

Decoders

A specific integrated circuit decoder is the 74HC154 (shown as a 4-to-16 decoder). It includes two active LOW chip select lines which must be at the active level to enable the outputs. These lines can be used to expand the decoder to larger inputs.



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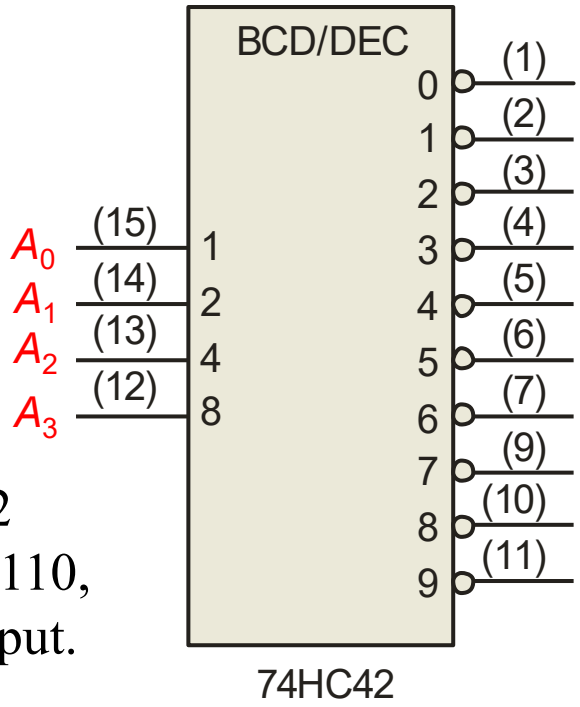
Summary

Decoders

BCD-to-decimal decoders accept a binary coded decimal input and activate one of ten possible decimal digit indications.



Example

Assume the inputs to the 74HC42 decoder are the sequence 0101, 0110, 0011, and 0010. Describe the output.

Solution

All lines are HIGH except for one active output, which is LOW. The active outputs are 5, 6, 3, and 2 in that order.

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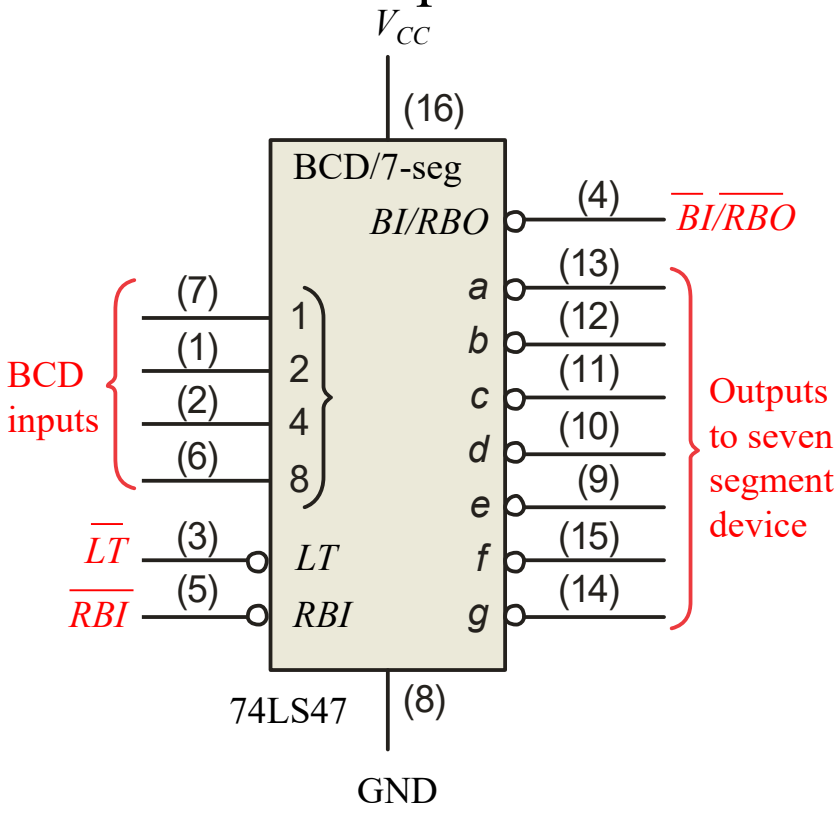
Summary

BCD Decoder/Driver

Another useful decoder is the 74LS47. This is a BCD-to-seven segment display with active LOW outputs.

The *a*-*g* outputs are designed for much higher current than most devices (hence the word driver in the name).



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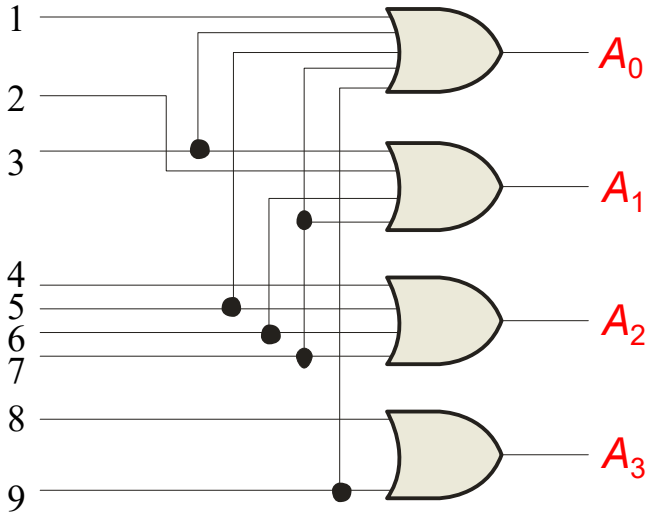
Summary

Encoders

An **encoder** accepts an active logic level on one of its inputs and converts it to a coded output, such as BCD or binary.

The decimal to BCD is an encoder with an input for each of the ten decimal digits and four outputs that represent the BCD code for the active digit. The basic logic diagram is shown. There is no zero input because the outputs are all LOW when the input is zero.



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Summary

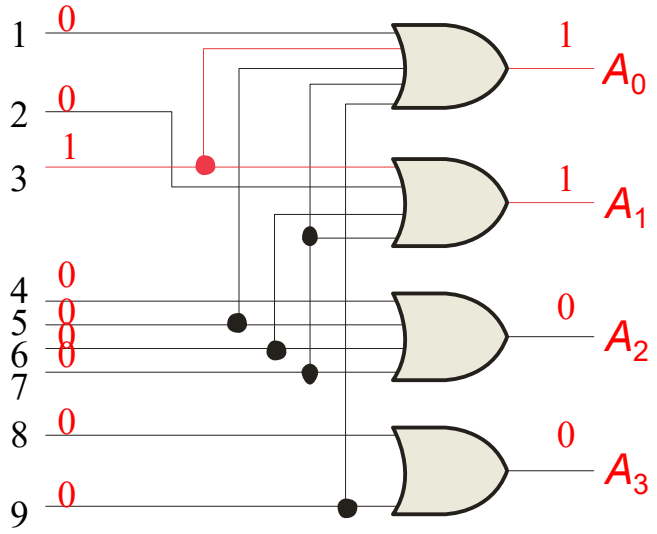
Encoders

Example

Show how the decimal-to-BCD encoder converts the decimal number 3 into a BCD 0011.

Solution

The top two OR gates have ones as indicated with the red lines. Thus the output is 0111.



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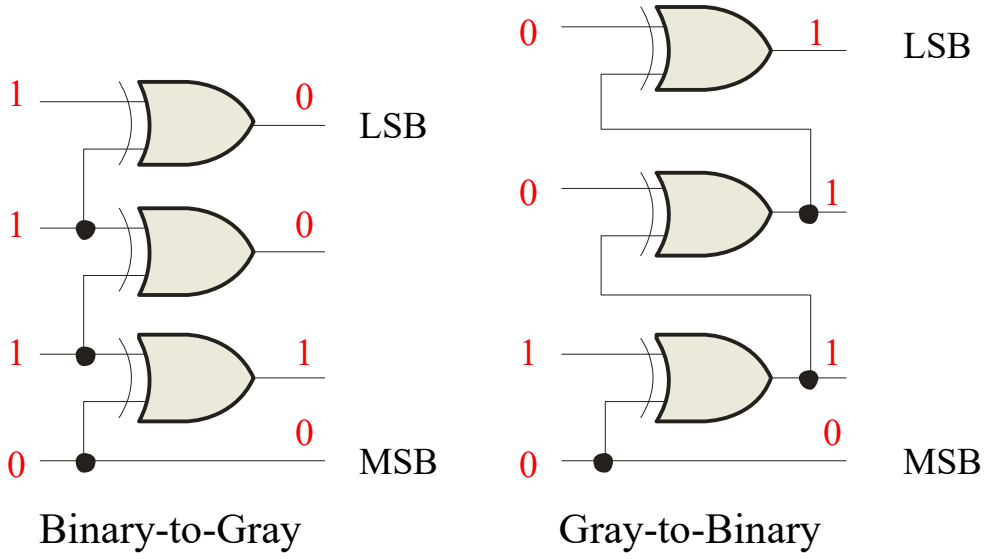
Summary

Code converters

There are various code converters that change one code to another. Two examples are the four bit binary-to-Gray converter and the Gray-to-binary converter.

Example Show the conversion of binary 0111 to Gray and back.

Solution



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