Lab 07: Hamming Code

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CSE 2301: Principles and Practice of Digital Logic Design
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Coded in LaTeX

Theory

What is a Multiplexor?

A Multiplexor allows the designer to choose from several possible inputs based on the value of a *select* signal. The output is selected by the select signal. For example, for a 4:1 MUX has four data inputs and one output.

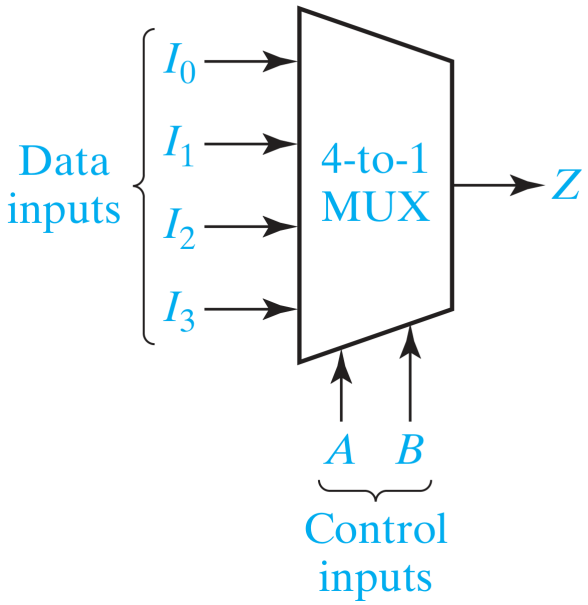

Figure 1: 4:1 MUX

Essentially, these IC's act as switches which select one of the inputs that is connected to them. In general,

n control inputs can be used to select one of 2^n data inputs.

$$Z = \sum_{k=0}^{2^n-1} m_k \cdot I_k$$

Where m_k is the k-th minterm of the select signals and I_k is the respective data input.

The select lines can also be tied to a clock counter sort of signal in order to cycle through the inputs. This is useful in analog circuits where a waveform can be "compressed" into many cycles and decoded such that input 1 has a certain frequency and amplitude and input 2 has another. This can introduce a lot of noise however and makes it difficult to troubleshoot.

Why just half of a 74153?

The lab has us design a circuit to implement two MUX's as a lookup table. In this orientation, because each input MUX has two select states, and we only utilize one output per MUX, we only need one of the two MUX's in the 74153.

Since we are using Shannon's expansion to convert the inputs to a function that depends on the last input, each three person voting machine has select lines assigned to two people, W and X in this case, and Y is used to be the input to the mux as needed. By doing this, the inputs are limited to $1, 0, Y$ or $\overline{Y}$ and the output is a function of Y.

Discussion

Practice Questions