INF2270, repetitions: equivalence of Boolean expressions and making a decoder from a demultiplexer

.

March 26, 2012

Abstract

Equivalence of two boolean expressions

In the figure 1 there is an example Karnaugh map shown (conveniently grouping the 1's already). Two simple functional expression can been derived from it, a) using regions of 1's in the K-map and b) using regions of 0's. The results are two different Boolean expressions, which necessarily define the same function, since they have been derived from the same truth table.

Task 1

Derive the two expressions.

Task 2

Show that those two expressions define the same function by step-wise applying rules for equivalency of Boolean expression to the expression derived using the 1's until you get the expression derived from the 0's (or vice versa)?

Building a decoder from a demultiplexer

In the lecture and (compendium, section 5.1.2) we discussed one implementation variant of a decoder and a demultiplexer. The 3-bit decoder implementation that was shown was composed of 3 inverters and 8 three-port AND gates (figure 2). The demultiplexer (compendium, section 5.1.4) implemenatation then made use of the decoder, with additional 8 AND gates (figure 3). Note, that these are by no means the only ways to implement these two circuits.

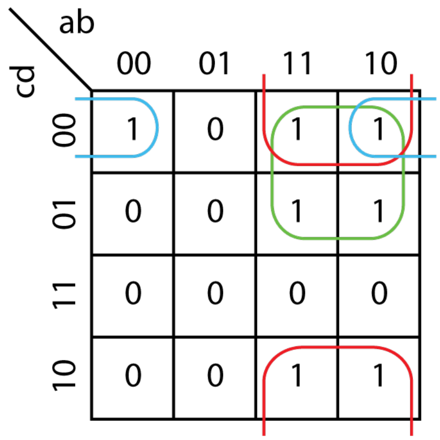

Figure 1: Example Karnaugh map

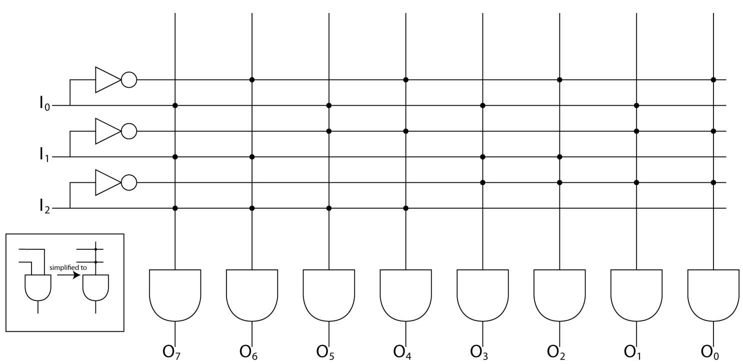

Figure 2: 3-bit decoder, possible implementation

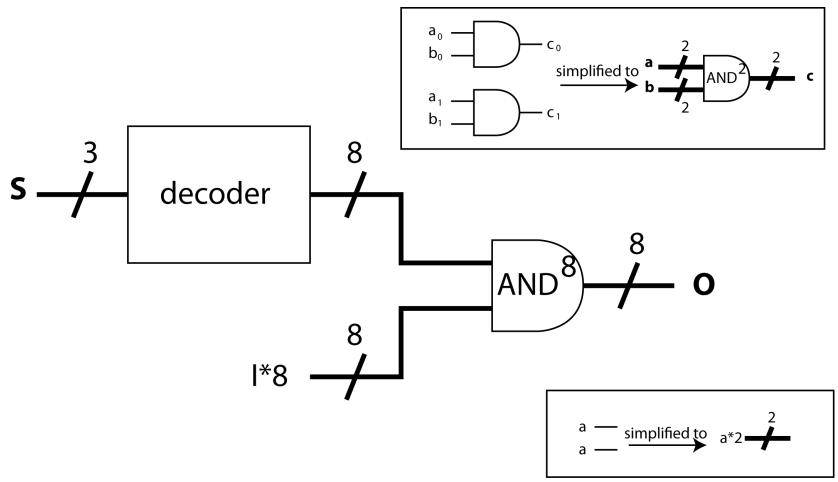

Figure 3: 3-bit demultiplexer, possible implementation

Task 3

Thus, it is also possible to implement a 3-bit decoder quite compactly by assuming that one has a functional 3-bit demultiplexer as a building block, i.e. the other way round than presented in the lecture. Can you show how?