Minterms, Maps, and Simplification

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1 Administrivia

Announcements

How to order the rows of a truth table: 0 at the top; $2^n - 1$ at the bottom. Example: two-input AND.

Assignment

Read 2.5.

Written assignment due Friday.

From Last Time

Logic gates and Boolean algebra.

Outline

1. Minterms and products
2. Simplification using Karnaugh maps.

Coming Up

Karnaugh map manipulation; don't cares.

2 Minterms and Products

1. What is a product? A sum?

2. Definition of a minterm: A product term containing all literals, complemented or not complemented.

   Examples in three variables (X, Y, Z). Identify which are minterms and which are not: XYZ, $X\overline{Y}Z$, Z, XZ.

3. Sum of minterms. Can be derived directly from a truth table.

   Example: sum output of a full binary adder. Derive truth table and sum of minterms equation. Observe $F(a, b, c_i) = \sum m(1, 2, 4, 7)$ and relationship to even parity (exclusive or).

4. Product of sums form and difference from sum of minterms (products).

3 Karnaugh Maps

1. A graphical tool for minimizing sum of minterm expressions.

2. Two-variable maps:

   (a) Structure; literal and value labels.

   (b) Theory: Show simplification of $F(A, B) = \sum m(0, 1)$ given

		B	
		0	1
A	0	$\overline{A}\,\overline{B}$	$\overline{A}B$
	1	$A\overline{B}$	AB

Actual Karnaugh map:

		B	
		0	1
A	0	1	1
	1	0	0

3. Three-Variable maps:

   (a) Structure and connectivity.

   (b) Examples: Sum and carry-out of full binary adder.

4. Four-Variable maps:

   (a) Structure and connectivity.

   (b) Example: Product bit 1 of two-bit multiplier. (Start with “product” table and then produce truth table for bit 1.)

5. Five-Variable maps? Higher?