Minterms, Maps, and Simplification

Tom Kelliher, CS 240

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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: Some of the Boolean manipulation problems are tricky — start early.

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	B = 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?