

Simplifying Boolean Expressions

CS 350, Lab 4 Due Fri Feb 17 (2400 hrs)

A. Why?

- Simplifying boolean expressions can make them more readable and require less hardware to implement.
- Karnaugh maps are a good way to find a simple logical expression for a truth function.

B. Outcomes

At the end of this lab, you should:

- Be able to simplify a truth function using a Karnaugh map.

C. Problems [100 points total]

1. [10 pts] Find a simplest boolean expression for the truth function described by the truth table below: (a) Rearrange the table so that it's in Karnaugh map form. (b) Draw rectangles to find a set of prime implicants; and (c) Translate the prime implicants into DNF form.

		<i>YZ</i>			
		00	01	10	11
<i>X</i>	0	0	1	0	1
	1	1	1	1	0

2. [20 pts] Repeat Problem 1 on the truth table below.

		<i>YZ</i>			
		00	01	10	11
<i>VX</i>	00	1	0	1	0
	01	1	1	0	1
	10	1	0	1	0
	11	0	1	0	1

3. [30 pts] Repeat Problem 1 on the truth table below. (R is the result.) Note that rearranging this table into Karnaugh map form involves more work than the table in Problem 2.

V	X	Y	Z	R
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

4. [40 pts] Find a simplest boolean expression equivalent to R below: (a) Form a Karnaugh map for the expression, (b) Select prime implicants, and (c) Translate the prime implicants into DNF form.

$$R = V X \neg(V X \neg Y Z) + X \neg Z + V X Y + \neg Y \neg(X Z) + V Y \neg Z + \neg V \neg Z$$

(You can — but aren't required to — give a regular truth table for R before creating the Karnaugh map.)

(No programming assignment this week.)