

Written Assignment #1

Digital Logic

CS222 Spring 2023

19 points

due Monday, Feb. 6th, 11:59 pm

Boolean Expressions

Part one

Here's a truth table that shows the value f_1 of a function of the four inputs x, y, z, w :

x	y	z	w	f_1
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1

x	y	z	w	f_1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Use a Karnaugh map to write an expression for f_1 in simplest form, as a sum of minterms. Group as many values together in each case, to make each term as small as possible. Remember that only one variable should change from column to column or from row to row in a Karnaugh map, and that the number of terms in a group must be a power of two. (Six points)

Then, give an expression for f_1 in terms of the variables x, y, z, w . (two points)

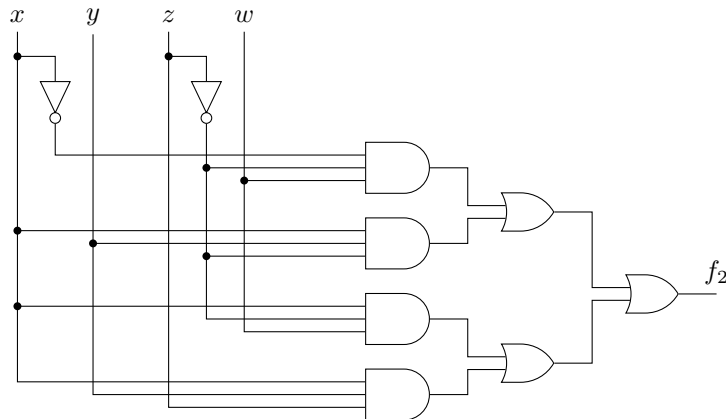
(Part two is on the second page.)

	$\bar{z}\bar{w}$	$\bar{z}w$	zw	$z\bar{w}$
$\bar{x}\bar{y}$	1	0	0	0
$\bar{x}y$	0	1	1	0
xy	1	1	1	0
$x\bar{y}$	1	1	1	0

$$f_1 = yw + x\bar{z} + \bar{y}\bar{z}\bar{w}$$

Part two

Draw the truth table for the function f_2 shown below, then simplify using a Karnaugh map (six points); and then draw the resultant simplified logic circuit that implements f_2 (three points); and give an expression for f_2 in terms of the variables x, y, z, w (two points). Crossing wires connect only if they have a dot at their intersection.



What to Submit

Show all of your work. Clearly label the groups on your Karnaugh maps, and show which minterms come from which groups.

You can turn in a hardcopy version of your work, or you can submit a scan or photo of your work to Blackboard.

x	y	z	w	f
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

	$\bar{z}\bar{w}$	$\bar{z}w$	zw	$z\bar{w}$
$\bar{x}\bar{y}$	0	1	0	0
$\bar{x}y$	0	1	0	0
xy	1	1	1	1
$x\bar{y}$	0	1	0	0

$$f_2 = \bar{z}w + xy$$

