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CSCI 3130

Homework 3

Due: Tuesday Feb. 7, 10:00 PM

1. (2 points each) Simplify the following Boolean expressions using algebraic manipulation.

   a. F(a,b) = a'b' + ab + ab'

   $= a'b' + a(b+b')$

   $= a'b' + a$

   $= (a+a')(a+b')$

   $= a+b'$

   b. F(r,s,t) = r' + rt + rs' + rs't'

   $= r' + t + s' + s't'$

   $= r' + t + s' + s'$

   $= r' + t + s'$

   c. F(x,y,z) = (x + y)'(x' + y')'

   $= (x'y')(xy)$

   $= 0$

   $x'xyy'$

   Note that ' means -not- (i.e. the same as a bar over a variable or expression)

2. (2 points each) For each of the following compact truth tables, use a Karnaugh map to obtain a simplified expression.

   a. F(A,B,C) = $\sum m(1,3,5,7)$

   b. F(A,B,C) = $\sum m(0,2,4,5,6,7)$

3. (5 points) Design a simple combinational circuit which calculates the result of the function F(n) = 5n + 4, where n is any 2-bit unsigned integer. In designing the circuit, draw a **truth table**, derive **expressions** for each of the outputs, and draw the **circuit**. You should **not** need a K-map.

$F(n) = 5n+4$

n	A	B	F(n)	V	W	X	Y	Z
0	0	0	4	0	0	1	0	0
1	0	1	9	0	1	0	0	1
2	1	0	14	0	1	1	1	0
3	1	1	19	1	0	0	1	1

V: AB

W: $(A'B)+(AB') = A \oplus B$

X: $(AB')+(AB') = B'(A'+A) = B'$

Y: $(AB')+(AB) = A$

Z: $(A'B)+(AB) = B$