[CS M51A FALL 19] Solution to QUIZ 1

Duration: 30 minutes. Total: 40 points

TAs

10/11/2019

Problem 1 (15 Points)

a. What is the minimum number of bits needed to represent the date (month, day, year) if the dates go up to the year 2100? Use a vector of three components and represent each component in binary number system.

Represent November 15, 2076 in binary:

b. Find y : $(937)_{13} + (314)_5 = (y)_8$

Solution

a. For months: 4 bits. For days, max 31, hence we need 5 bits (ceil of log 31 with base 2);
For year, we need 12 bits (ceil of log 2100 with base 2) Hence, in total we need $4 + 5 + 12 = 21$ bits.

November 15, 2076 is represented as 1011 01111 100000011100

b. $(937)_{13} = (9 * 13 + 3) * 13 + 7 = (1567)_{10}$

$(314)_5 = (3 * 5 + 1) * 5 + 4 = (84)_{10}$

Their sum is $(1651)_{10}$

Convert to radix 8:

1651 = 206*8 + 3
206 = 25*8+6
25 = 3*8+1
3 = 0*8+3
Thus $y = (3163)_8$

Problem 2 (10 points)

Show that $a' + a(a'b + b'c)' = a' + b + c'$.

Solution

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

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

$= a' + ab + ac' + bb' + b'c'$

$= a' + b + c'$

Problem 3 (15 points)

You have a digital circuit with three inputs a, b, and c, and one output f. You need to determine its function f(a,b,c) by trying all input combinations and recording the output f. After experimenting with input and output signals you obtain the following table.

a	1	1	1	1	0	0	0	0
b	1	1	0	0	1	1	0	0
c	1	0	1	0	1	0	1	0
f	1	0	0	1	0	1	0	1

Obtain the minterm expression for the function f, find a simple sum of product expression, and draw a circuit diagram using gate symbols.

Solution

$f(a, b, c) = \sum m(0, 2, 4, 7)$. A simpler Sum of Products is $f(a, b, c) = a'c' + b'c' + abc$. This is implemented by the following gate network:

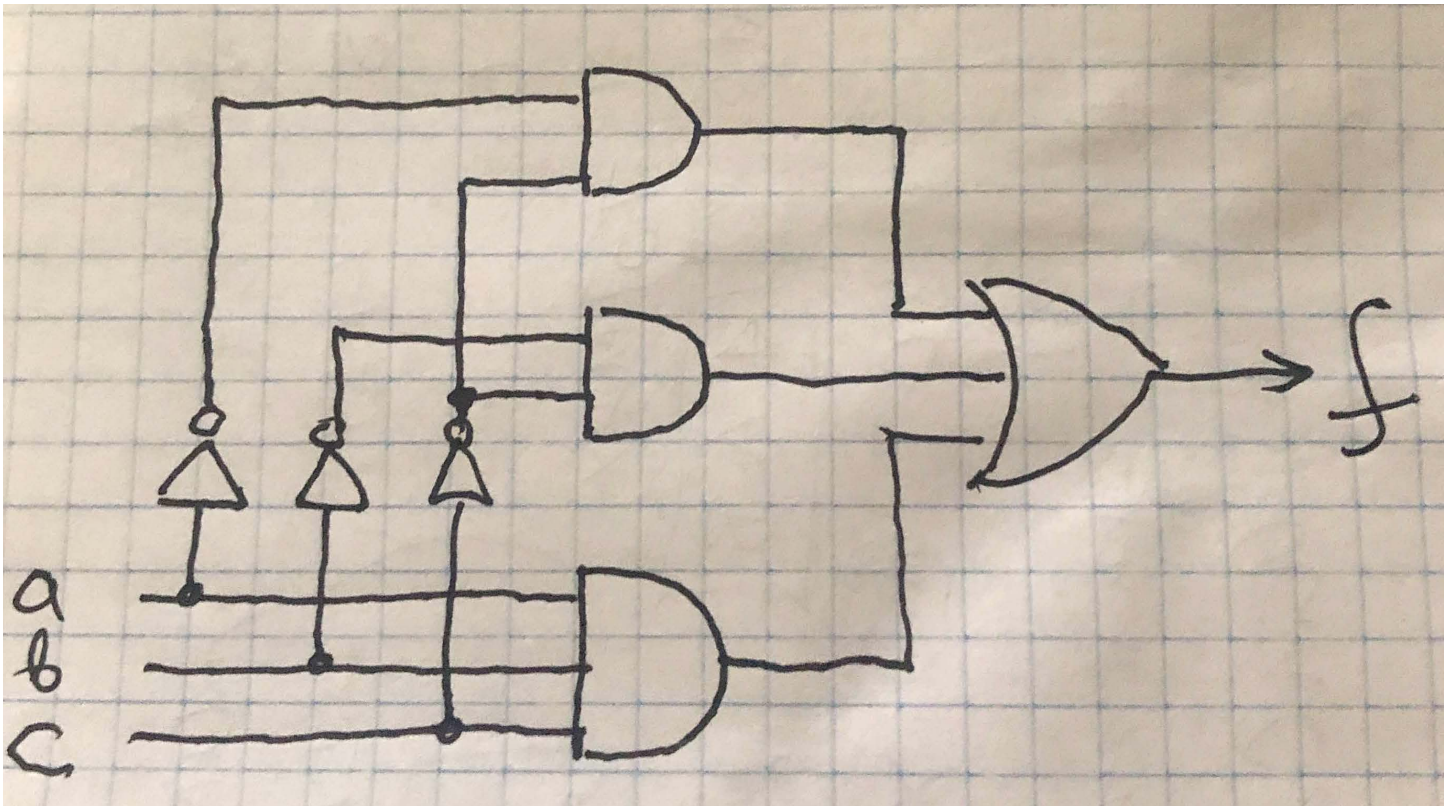

Figure 1: Gate network