[CS M51A FALL 18] Solution to QUIZ 1

Duration: 30 minutes

10/19/2018

Problem 1 (15 Points)

a. Give a binary code to represent a month of the year.

b. How many bits is the minimum needed to represent the date(month, day,year)? Use a vector of three components and represent each component in binary number system. Consider dates upto the year 2500.

c. Find y :

$(987)_{13} + (310)_5 = (y)_8$

Solution

a. Just take 4 bits (ceil of log 12 with base 2), then:

Jan is 0000, Feb is 0001, March is 0010, and so on till December which is 1011

b. For date, max max can be 31, hence we need 5 bits (ceil of log 31 with base 2)

Similarly for year, we need 12 bits (ceil of log 2501 with base 2)

Hence, in total we need 4+5+12 i.e. 21 bits

c. $(987)_{13} = (1632)_{10}$

$(310)_5 = (80)_{10}$

Hence, sum = $(1712)_{10}$

Hence, ans = $(3260)_8$

Problem 2 (10 points)

Show that ab'c + b + bd' + abd' + a'c = b + c

Solution

= ab'c + b + bd' + abd' + a'c = ab'c + a'c + b(1+d'+ad')
= c(a' + ab') + b
= c(a' + a)(a'+b') + b
= ca' + cb' + b
= (b + c)(b + b') ca'
= b + c + ca'
= b + c(1 + a')
= b + c

Problem 3 (10 points)

You have a circuit in your hand. On experimenting with input and output signals you obtain the following timing diagram (output is f signal).

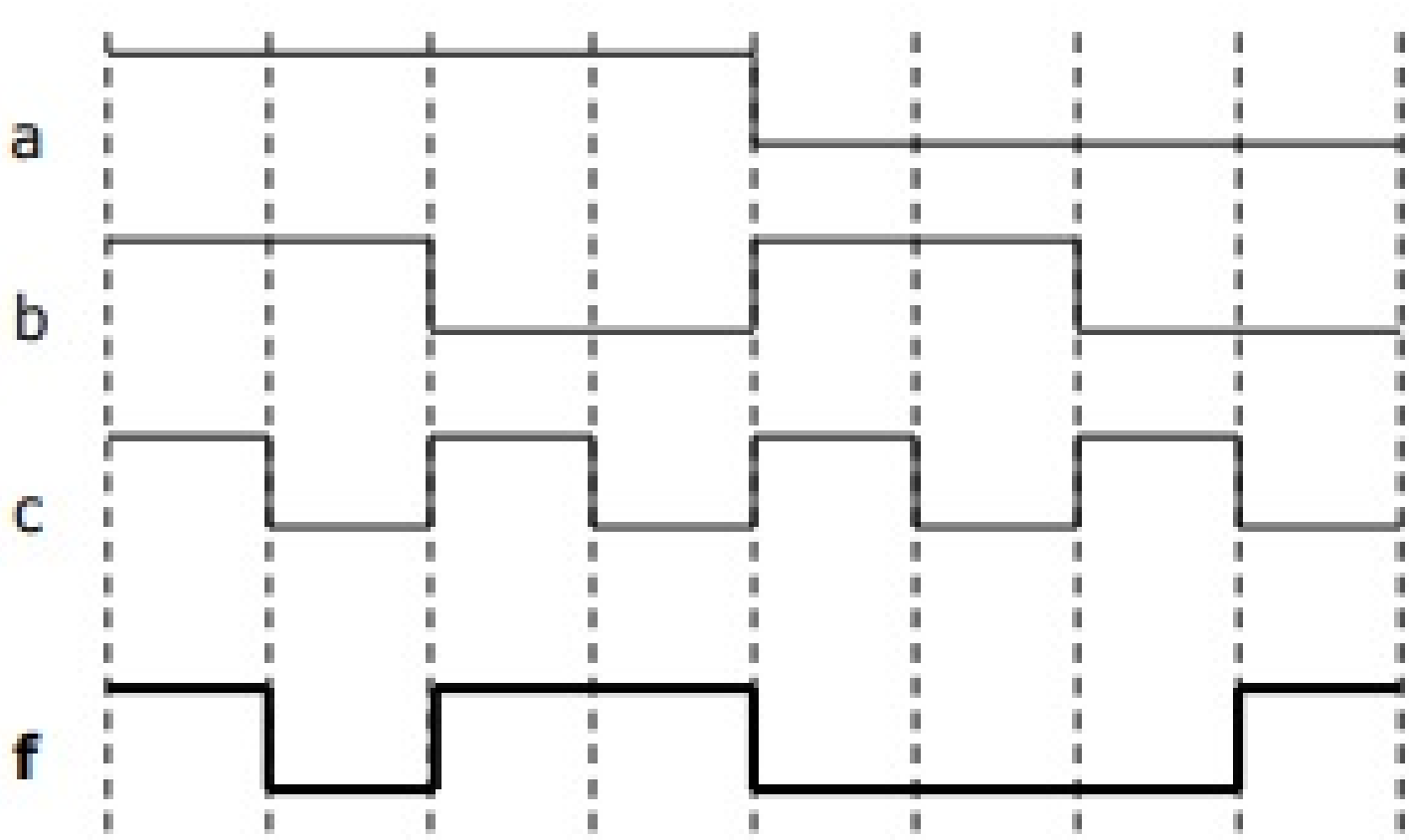

Figure 1: Timing Diagram

Provide a simple expression for the formula computed by the circuit and draw the circuit diagram.

Solution From Shannon Expansion observe $f = 1 \cdot abc + 1 \cdot a\bar{b}c + 1 \cdot a\bar{b}\bar{c} + 1 \cdot \bar{a}\bar{b}\bar{c}$ which is $f = ac(b+\bar{b}) + \bar{b}\bar{c}(a+\bar{a}) = ac + \bar{b}\bar{c}$. This is implemented by

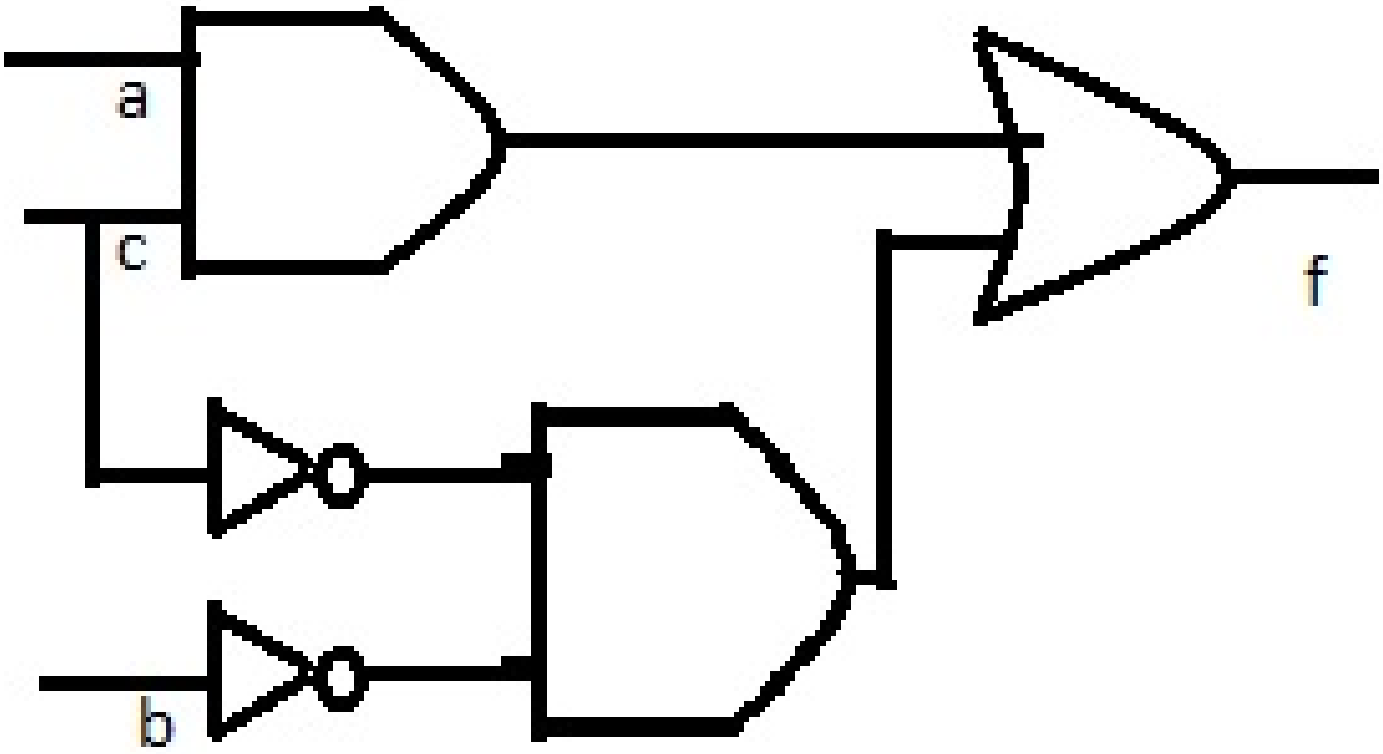

Figure 2: Circuit Realization