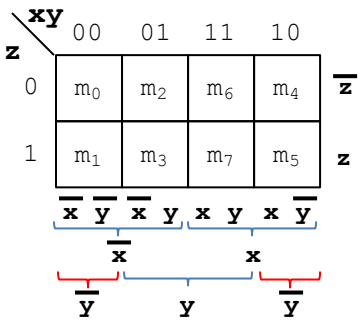
Solutions - Quiz 1

(September 12th @ 9:30 am)

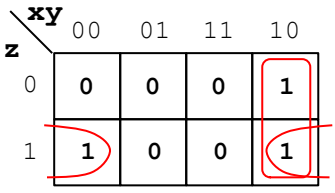
PROBLEM 1 (20 PTS)

Complete the truth table for a circuit that activates an output (f = '1') when the decimal value of the 3 input bits is equal to 1, 4, or 5. Then, simplify the function using Karnaugh maps.

x	y	z	f
0	0	0	m_0
0	0	1	m_1
0	1	0	m_2
0	1	1	m_3
1	0	0	m_4
1	0	1	m_5
1	1	0	m_6
1	1	1	m_7



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

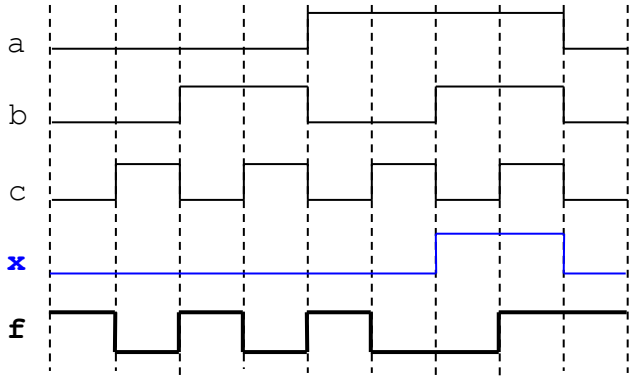


$f = x\bar{y} + z\bar{y}$

PROBLEM 2 (30 PTS)

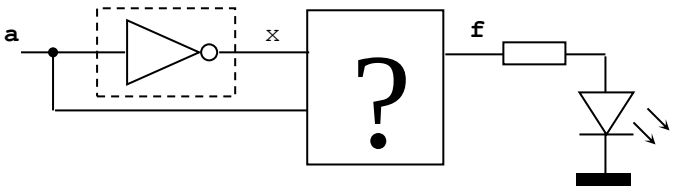
Complete the timing diagram of the logic circuit whose VHDL description is shown below:

```
library ieee;
use ieee.std_logic_1164.all;

entity circ is
  port ( a, b, c: in std_logic;
         f: out std_logic);
end circ;

architecture st of circ is
  signal x: std_logic;
begin
  x <= a and b;
  f <= x xnor c;
end st;
```



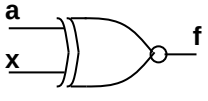
PROBLEM 3 (20 PTS)

Design a circuit that verifies the logical operation of a NOT gate. f = '1' (LED ON) if the NOT gate works improperly. Assumption: when the NOT gate is not working, it generates 1's instead of 0's and vice versa.



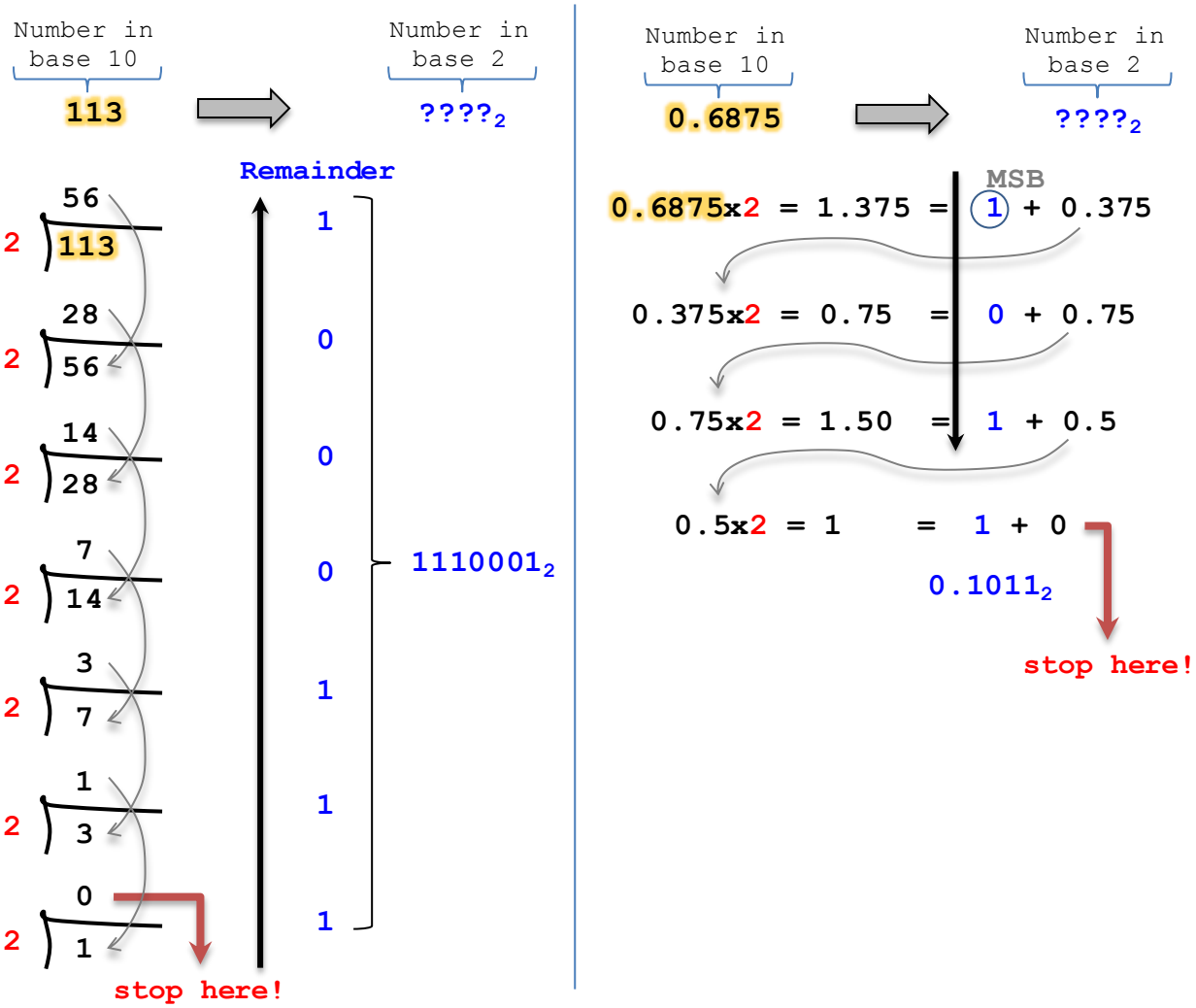
a	x	f
0	0	1
0	1	0
1	0	0
1	1	1

$f = \bar{a}\bar{x} + ax$



PROBLEM 4 (30 PTS)

a) Convert the following decimal number to i) binary, and ii) hexadecimal. You MUST show your procedure.
- 113.6875



$\therefore$ $113.6875 = 1110001.1011_2 = 0x71.B$

b) A microprocessor is able to handle memory addresses from 0x0000 to 0x3FFF. How many bits do we need to represent those addresses?

Note that we want to cover all the cases from 0x0000 to 0x3FFF.

```
0x0000: 00 0000 0000 0000
                        ...
                        ...
                        ...
0x3FFF: 11 1111 1111 1111
```

The range from 0x0000 to 0x3FFF is akin to all the possible cases with 14 bits. So we need **14 bits**.