# CS 2102-01 Logic Design Fall 2010 Midterm exam 1
## Sample Answers

1.

(a) The main difference is the value continuity. Analog devices represent continuous value while digital devices represent discrete value. Note that the similar answers are also correct.

(b) Analog: 3, 4 Digital: 1, 2

2.

(a) 10010100110111

(b) 22467

(c) 10111001 10110101 00110010 00110111

3.

(a) $f = A'C'+BC+ABC'+B'C' = C'(A'+AB+B')+BC = C'(A'(1+B)+AB+B')+BC = C'(A'+A'B+AB+B')+BC = C'(A'+(A'+A)B+B')+BC = C'(A'+B+B')+BC = C'(A'+1)+BC = \underline{C'+BC}$

(b)(c)

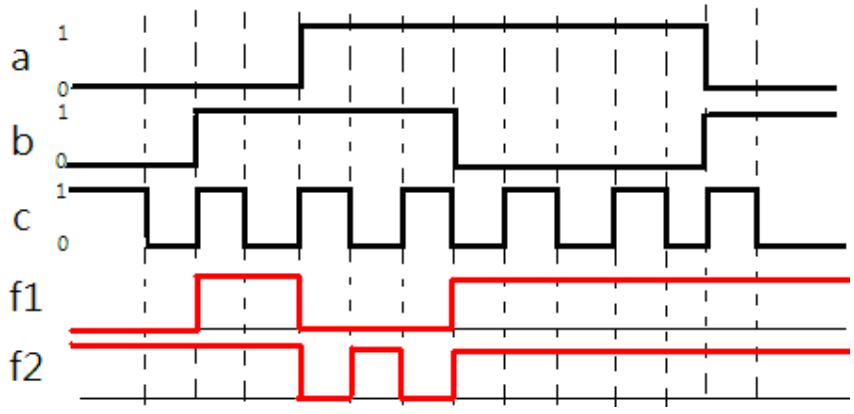
| AB \ C | 0 | 1 |
|---|---|---|
| 00 | 1 | 0 |
| 01 | 1 | 1 |
| 11 | 1 | 1 |
| 10 | 1 | 0 |

*Simplest* $f = C'+B$

(d) $f(A,B,C) = \sum(0,2,3,4,6,7) = \Pi(1,5)$

4.

(a)



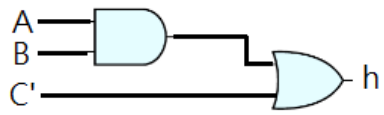
(b)

| a | b | c | f1 | f2 |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 | 0 |

(c) f1: XOR  f2: NAND

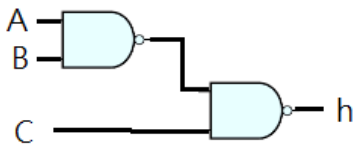
5.

(a) This sub-problem can use inverted signal.




(b) h' = (AB+C')' = (AB)'(C')' = <u>(AB)'C = (A'+B')C</u>

(c) A NAND gate can be thought as (XY)'. Since h' = (A'+B')C = (AB)'C, h = (h')' = ((AB)'C)' and hence two NAND gates.




6.

(a)

| x | y | z | xyz | xz' | y'z | x'yz | *xyz+xz'+y'z+x'yz* | x+z |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |

By truth table, we can verify that f1 = f2.

(b)

$xyz+xz'+y'z+x'yz$

$= (x+x')yz+xz'+y'z$

$= yz+xz'+y'z$

$= (y+y')z+xz'$

$= z+xz'$

$=z+xz+xz'$

$=z+(z+z')x$

$=z+x$

$=x+z$

*Hence, f1 = f2.*

7.

(a) y

(b) x, f

(c) w, g