HW #2

CSc 137, Harvey

Total (16 pts)

1.6 What is the biggest positive FP number (in Decimal) that can be represented in 16-bit format using 1-bit sign, 4-bit biased exponent, and 11-bit fraction, where bias offset is 7? **(4 pts)**

$$\underbrace{0}_{\text{sign bit}}\ \underbrace{1110}_{\text{largest exponent}}\ \underbrace{111\ 1111\ 1111}_{\text{mantissa fractional bits}} \times 2^{7}$$

(1111 reserved for ∞)

bias exp − bias offset
= 14 − 7
= 7

Binary$_2$ to Decimal$_{10}$

$(1.\underline{111\ 1111\ 1111})_2 \times 2^7$

↖ eleven fractional bits

$2^0 + 2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6} + 2^{-7} + 2^{-8} + 2^{-9} + 2^{-10} + 2^{-11}$

$1 + 0.5 + 0.25 + 0.125 + 0.062,500 + 0.031,250 + 0.015,625 + 0.007,812,500$
$+ 0.003,906,250 + 0.001,953,125 + 0.0009765625 + 0.00048828125$

$= 1.99951171875 \times 2^7$

$= 255.9375$

1.8 Do the following assuming 16-bit FP numbers with 4-bit bias exponent, bias offset = 7, and 11-bit fraction: **(4 pts)**

a) What real number does an FP number with sign= 0, bias exponent =1 and fraction = 0 represent? (Answer in 4 decimal places)

biased exp = unbiased exp − biased offset
1 = unbiased exp − 7
unbiased exp = −6

$(1)_2 \times 2^{-6}$

$(0.\underbrace{000001}_{-6})_2$

binary$_2$ → decimal

$(0.000\ 001)_2$

$= 0 + 0 + 0 + 0 + 0 + 2^{-6}$

$= 0.015625$

≈ 0.0156

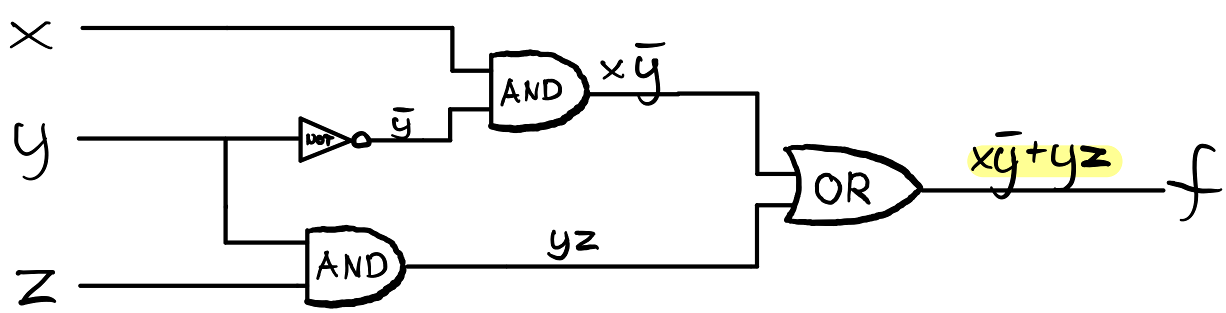
2.4 Proof Demorgan's Theorem $\overline{x+y} = \bar{x}\,\bar{y}$ by creating truth tables for $f = \overline{x+y}$ and $g = \bar{x}\,\bar{y}$. Are the two truth tables identical? **(4 pts)**

DeMorgan's: $(\overline{x+y}) = \bar{x} \cdot \bar{y}$

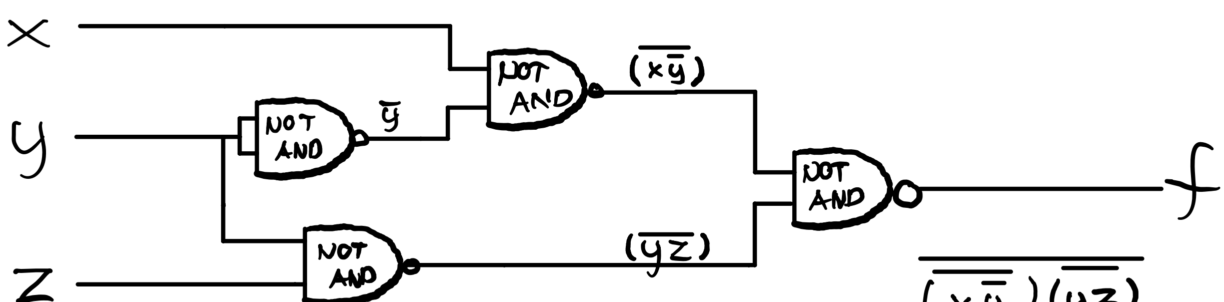
x	y	$\bar{x}$	$\bar{y}$	$x+y$	$\overline{x+y}$	$\bar{x} \cdot \bar{y}$
0	0	1	1	0	1	1
0	1	1	0	1	0	0
1	0	0	1	1	0	0
1	1	0	0	1	0	0

2.5 **(4 pts)** Draw the circuit schematic for $f = x\bar{y} + yz$ and then convert the schematic to NAND gates using the steps illustrated in the textbook.

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



convert to NAND gates



$\overline{(\overline{x\bar{y}})(\overline{yz})}$

$= \overline{(\bar{x}+y)(\bar{y}+\bar{z})}$

$= x\bar{y} + yz$