Nick McCullough - 950337388 - Lab 7

CprE 281 QUIZ 5
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Initial Stuff and Basics
Assigned Date: Week 07

Instructions
Complete the question below to the best of your ability. Once complete, upload a PDF of your work to canvas.

Questions

P1. Number Conversion (3 x 20p each = 60p)

- **a)** Find the 32-bit floating point representation for the real number **42_{10}**.
- **b)** Find the 32-bit floating point representation for the real number **-9_{10}**.
- **c)** Convert **$10E90000_{16}$** (a 32-bit float stored in IEEE 754 format) to decimal.

P2. (40 points). Implement the following functions using Shannon's expansion:

- **a.** Implement $F(a,b,c) = a.b + a.\bar{c} + a.\ b.\ \bar{c}$ using only 2-to-1 MUXs
- **b.** Implement $F(a,b,c) = a.b + a.\bar{c} + a.\ b.\ \bar{c}$ using only 4-to-1 MUXs

P1) a) 42_{10}

42/2 = 21 0
21/2 = 10 1
10/2 = 5 0
5/2 = 2 1
2/2 = 1 0
1

$42_{10} = 101010$

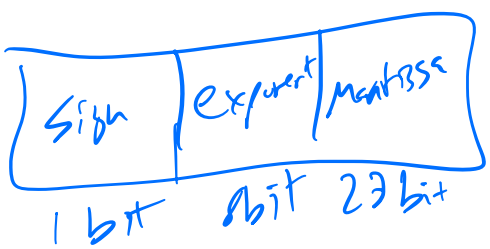
1.01010×2^5

5 + 127 = 132

132/2 = 66 0
66/2 = 33 0
33/2 = 16 1
16/2 = 8 0
8/2 = 4 0
4/2 = 2 0
1

1000100_2

$0\ 1000100.01010 = 42_{10}$



p1) b) -9_{10} — sign bit

$9/2 = 4\ 1$
$4/2 = 2\ 0$
$2/2 = 1\ 0$
1

$\rightarrow 1001_2$

$= 1.001 = 1.001 \times 2^3$

3 decimal places

$3 + 127 = 130$

$130/2 = 65\ 0$
$65/2 = 32\ 1$
$32/2 = 16\ 0$
$16/2 = 8\ 0$
$8/2 = 4\ 0$
$4/2 = 2\ 0$
$2/2 = 1\ 0$
1

$10000010_2 =$

1	1000010	00100000000000000000000 $= -9_{10}$
sign	exponent	mantisa

p1) c) $10E90000_{16}$ stored in IEEE 754 to decimal.

$E = 14$

$14/2 = 7\ 0$
$7/2 = 3\ 1$
$3/2 = 1\ 1$
1

1110_2

$9 = 1001 \quad 1 = 0001 \quad 0 = 0000$

sign | exponent | mantissa

0 | 0001 0000 | 1101 0010 0000 0000 0000 0000 $_2$

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

1 0 E 9 0 0 0 0

positive

$0010\,0001_2 =$

$_{S\ 7\ 6\ 5\ 4\ 3\ 2\ 1\ 0}$

$2^0 \times 1 = 1$

$2^5 \times 1 = 32 + 1 = 33$

exponent $= 33_{10}$

$33 - 127 = -94$

$m = 0.1101\,0010\,0000\,0000\,0000\,0000$

$\hookrightarrow 2^{-1} + 2^{-2} + 2^{-4} + 2^{-7}$

$\frac{1}{2} + \frac{1}{4} + \frac{1}{16} + \frac{1}{128} = 0.820312\,5$

$-1(1 + 0.820312\,5) \times 2^{-94}$

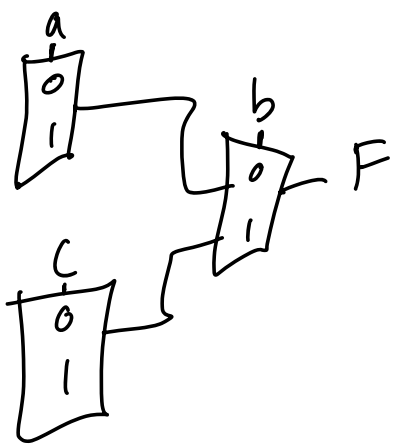
$= -1.820312\,5 \times 2^{-94}$ in decimal $_{10}$

P2) a) $a.b + a.\bar{c} + a.b.\bar{c}$ 2 to 1 MUXs

b) $a.b + a.\bar{c} + a.b.\bar{c}$ 4 to 1 MUXs

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

$= A\bar{B}\bar{C} + AB\bar{C} + ABC$



b)