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1. −62981

   1. take absolute value
      62981
   2. substract 1
      62980
   3. Binary representation
      01111 011 00000010
   4. Flip all the bits
      1000 0100 1111 1101

procedure

62980/2 = 31490 ⋯ 0
31490/2 = 15745 ⋯ 0
15745/2 = 7872 ⋯ 1
7872/2 = 3936 ⋯ 0
3936/2 = 1968 ⋯ 0
1968/2 = 984 ⋯ 0
984/2 = 492 ⋯ 0
492/2 = 246 ⋯ 0
246/2 = 123 ⋯ 0
123/2 = 61 ⋯ 1
61/2 = 30 ⋯ 1
30/2 = 15 ⋯ 0
15/2 = 7 ⋯ 1
7/2 = 3 ⋯ 1
3/2 = 1 ⋯ 1
1/2 = 0 ⋯ 1
extra 0

2. We can represent 34.90625 as 1117/32, which is equivalent to

$$0100\ 0101\ 1101 / 2^5$$
$$= 0100\ 0101\ 1101 \cdot 2^{-5}$$
$$= 0100\ 010.1\ 1101 \cdot 2^0$$
$$= 1.000\ 1111\ 01 \cdot 2^5$$

Fraction: 0000 0000 0000 0000 0111 101
Exponent: 5 + 127 = 132 = 1000 0100 → procedure
Sign: 1

procedure

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

3.

F	1	0	0	F	B	0	1
15	1	0	0	15	11	0	1
8+4+2+1	1	0	0	8+4+2+1	8+2+1	0	1
1111	0001	0000	0000	1111	1011	0000	0001

4. CAB005E5

$5\times16^0+14\times16^1+5\times16^2+0+0+11\times16^5+10\times16^6+12\times16^7$

$= 5+224+1280+11534336+167772160+3221225472$

$= 3400533477$

5. We could use the same circuit for add and substraction in this case. For example, we can calculate 5+3 using an adder. Similarly, we can use the same add gate to calculate 5-3 by taking the 2's complement of 3, which gives us -3. Thus we have 5+(-3)=5-3. Therefore it is efficient.

6. $\bar{A}*(A+B)+(B+A*A)*(A+\bar{B})$

$= \bar{A}*(A+B)+(B+A)*(A+\bar{B})$ → idempotent Law

$= \bar{A}*A+\bar{A}*B+(B+A)*(A+\bar{B})$ → Distribution

$= 0+\bar{A}*B+(B+A)*(A+\bar{B})$ → Complement Law

$= \bar{A}*B+(B+A)*(A+\bar{B})$ → Identity Law

$= \bar{A}*B+(A+\bar{B})*B+(A+\bar{B})*A$ → Distribution

$= \bar{A}*B+B*A+B*\bar{B}+(A+\bar{B})*A$ → Distribution

$= \bar{A}*B+B*A+0+(A+\bar{B})*A$ → Complement Law

$= \bar{A}*B+B*A+(A+\bar{B})*A$ → Identity Law

$= B*(\bar{A}+A)+(A+\bar{B})*A$ → Distributive Law

$= B*1+(A+\bar{B})*A$ → complement Law

$= B+(A+\bar{B})*A$ → Identitit Law

$= B+A*A+A*\bar{B}$ → distributive

$= B+A+A*\bar{B}$ → idempotent

$= B+A$ → absorption Law

7. Truth Table $X*Y*Z + X*Y*\bar{Z} + \bar{X}*Y + \bar{Z} + \bar{X}*\bar{Y}*Z$

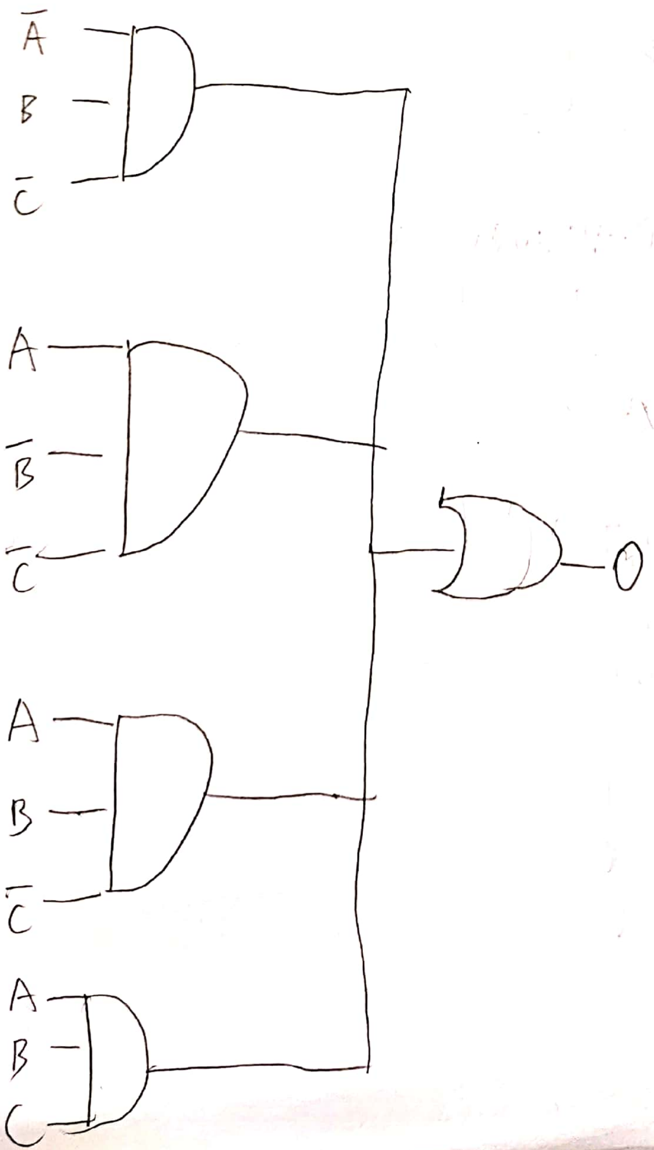
X	Y	Z	output
0	0	0	F
0	0	1	T
0	1	0	T
0	1	1	F
1	0	0	F
1	0	1	F
1	1	0	T
1	1	1	T

XY \ Z	0	1
00	0	T
01	T	F
11	T	T
10	F	F

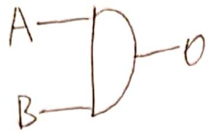
$\bar{Z}*Y + Y*X + \bar{X}*\bar{Y}*Z$

8. $\bar{A}*B*\bar{C} + A*\bar{B}*\bar{C} + A*B*\bar{C} + A*B*C$

9.



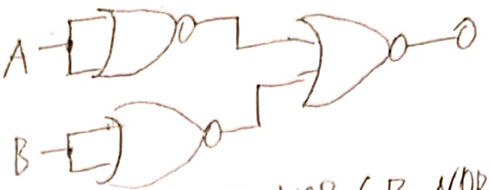
10.
And



O = A*B

Truth table

A	B	O
0	0	0
0	1	0
1	0	0
1	1	1



O = (A NOR A) NOR (B NOR B)

Truth table

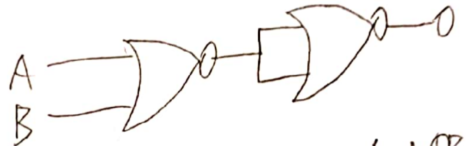
A	B	O
0	0	0
0	1	0
1	0	0
1	1	1

OR

O = A+B

Truth table

A	B	O
0	0	0
0	1	1
1	0	1
1	1	1



O = (A NOR B) NOR (A NOR B)

Truth Table

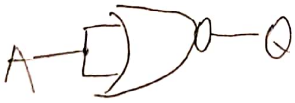
A	B	O
0	0	0
0	1	1
1	0	1
1	1	1

NOT

$O = \overline{A}$

Truth table

A	B	O
0	0	1
0	1	1
1	0	0
1	1	0



B O = A NOR A

Truth Table

A	B	O
0	0	1
0	1	1
1	0	0
1	1	0