COMP30660 Assignment 1. By Student 22203536

1. Convert numbers to binary first

Double dabble method to convert 105 to binary
2 num remainder
2 105
2 52 1
2 26 0
2 13 0
2 6 1
2 3 0
2 1 1
2 0 1

Answer is 1101001

Double dabble method to convert 114 to binary
2 num remainder

2 114
2 57 0
2 28 1
2 14 0
2 7 0
2 3 1
2 1 1
2 0 1

Answer is 1110010

Add the binary numbers

1101001
1110010
11011011
11011011
Convert back to base 10

Double	dabble	add next digit
1	2 + 1	3

3	6 + 0	6
6	12 + 1	13
13	26+ 1	27
27	54 + 0	54
54	108 + 1	109
109	218 + 1	219

Sum is 219

b) 77 113

77/8 9 5
9/8 1 1
⅛ 0 1

Octal Answer is 115

113/8 14 1
14/8 1 6
1/8 0 1

Octal answer is 161

Add the numbers

115
<u>161</u>
2 7 6

Convert back to decimal
6(8^0) plus 7(8^1) plus 2(8^2)
6 plus 56 plus 128 =
190

2.

a) Signed 00101001
   1s complement 00101001
   2s complement 00101001

b) Signed 10101001
1s complement 11010110
2s complement 11010111

c) Signed 00100000
1s complement 00100000
2s complement 00100000

d) Signed 10100000
1s complement 11011111
2s complement 11100000

e) Signed 01100101
1s complement 01100101
2s complement 01100101

f) Signed 10100111
1s complement 11011000
2s complement 11011001

g) Signed 10000000
1s complement 11111111
2s complement 10000000

h) Signed
1s complement
2s complement

3.

a) 0(5^0)+ 1(5^1)+ 4(5^2)+ 3(5^3)+ 2(5^4)=

= 1730

b) 3(7^0)+1(7^1)+2(7^2)+5(7^3)+4(7^4)+6(7^5)= 112269

c) 5(9^0)+2(9^1)+1(9^2)+6(9^3)+5(9^4)+8(9^5)= 509675

d) 12(16^0)+10(16^1)+4(16^2)+2(16^3)+11(16^4) = 730284

4.

a) 1(2^0)+0(2^1)+1(2^2)+0(2^3)+
   1(2^4)+1(2^-1)+0(2^-2)+1(2^-3)+0(2^-4)+1(2^-5)= 21.65625

   1(2^0)+1(2^1)+1(2^2)+1(2^-1)+1(2^-2)+0(2^-3)+1(2^-4)= 7.8125

   Sum is 29.46875 or 11101.01111 in base 2

b) Using same method above
   1010.10011 = 10.59375 in base 10
   0.1101= 0.8125 in base 10
   Sum of numbers 11.40625 base 10 or 1011.01101 in base 2

c) Using the method above
   11.3203125 base 10 plus 19.65625 in base 10 = 30.9765625 in base 10
   Or 11110.1111101 in base 2

d) 23.78125 plus 5.5 = 29.28125 or 11101.010001

5.

a) A914 = 43284 in base 10 and BC12A = 770346 in base 10
Sum of number is 813630 or C6A3E in base 16.

b) 19D114
c) 111121 base 7
d) 578350 base 9
e) 1A0D7F
F) 12431 base 5
g) 331EDF base 16

6.

(a) $(\overline{A}B)(B+C)$

(b) $(BC)\left((AB)+(BC)\right)$

(c) $\left((\overline{A}B)\oplus(\overline{C+D})\right)+\left((\overline{A}B)(\overline{C+D})\right)$

(d) $C \oplus \overline{AB} \oplus \overline{CD}$

Equations shown in figure above

(a)

A	B	C	W
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Truth table for a above

B(b)

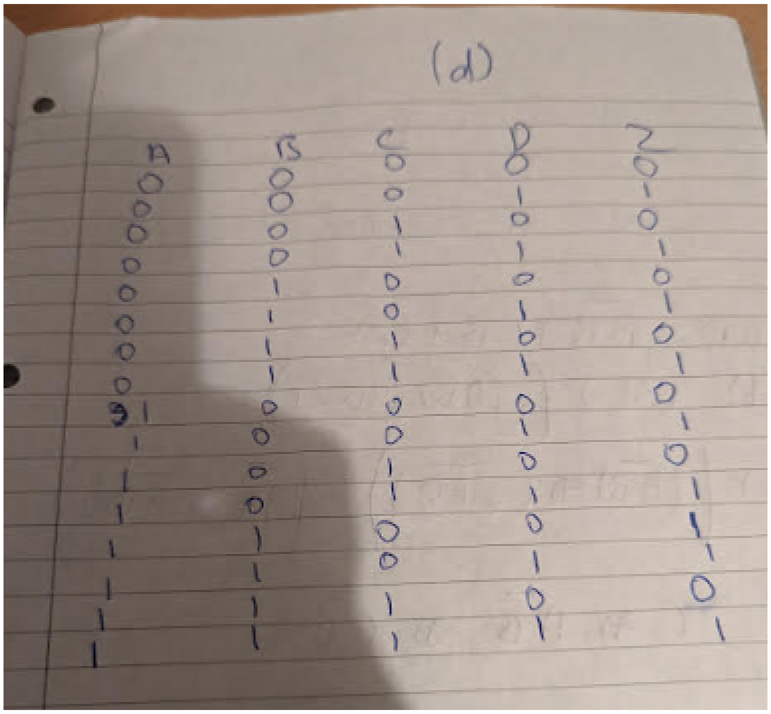
A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Truth table for b above

(C)

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Truth table for c above



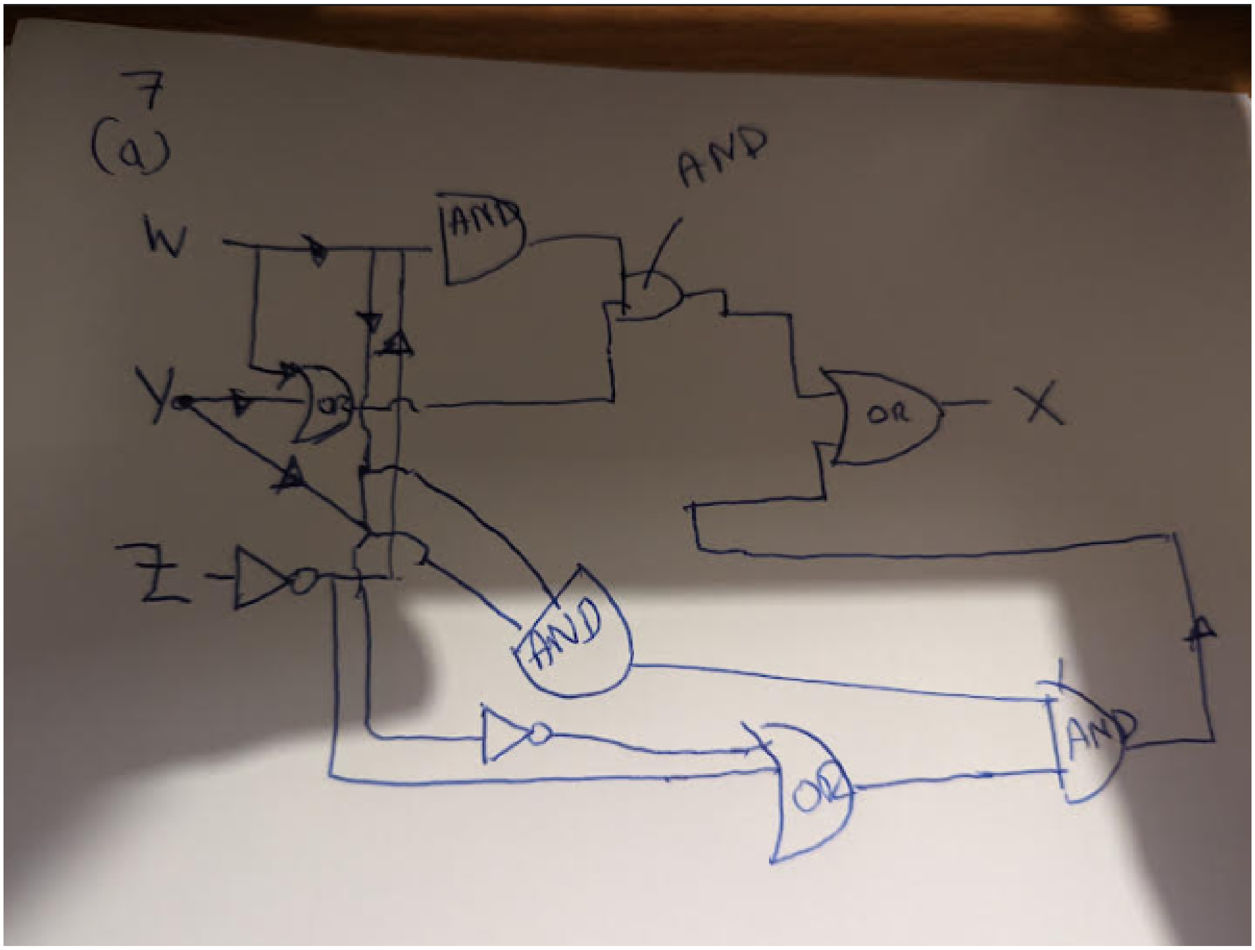
(d)

A	B	C	D	Z
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

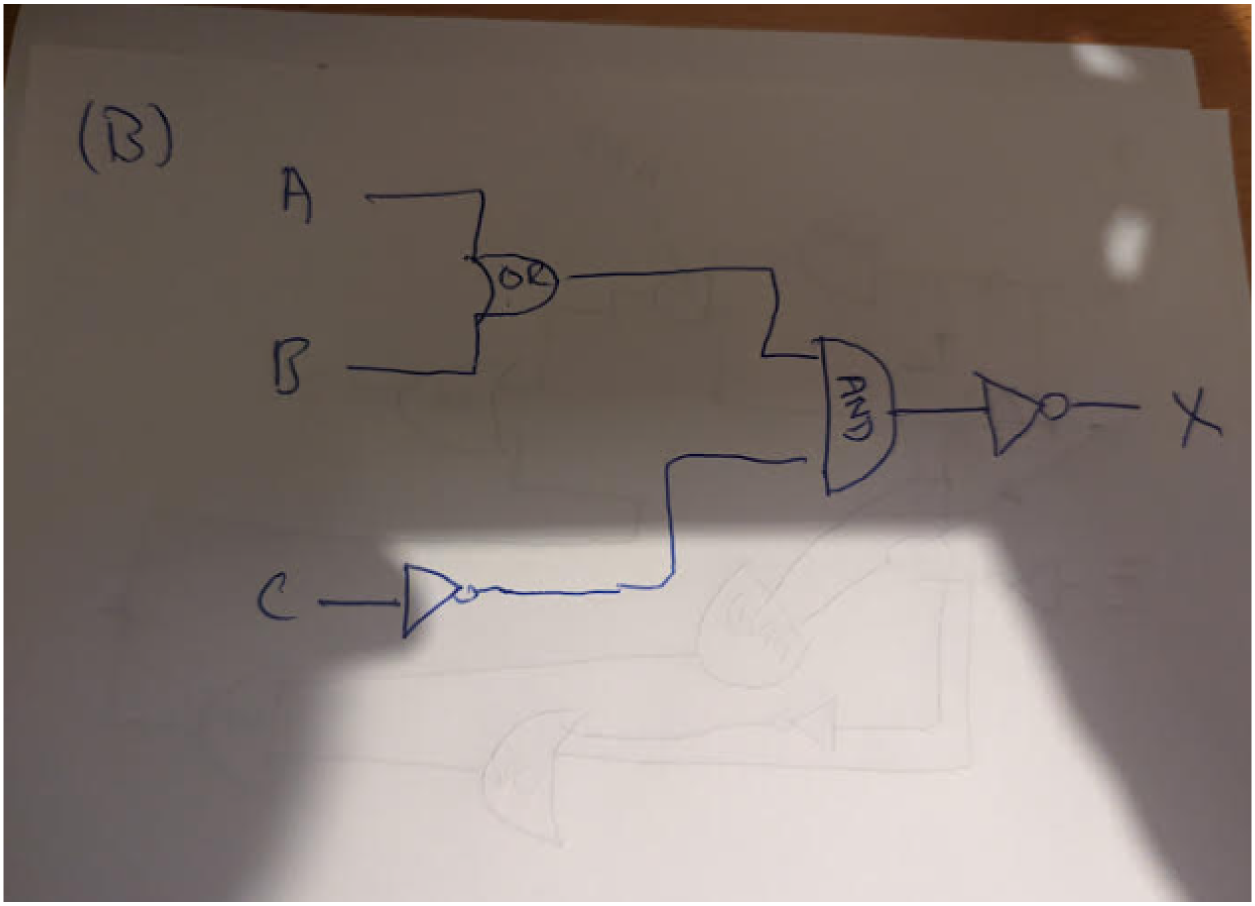
Truth table for d above.

Question 7.

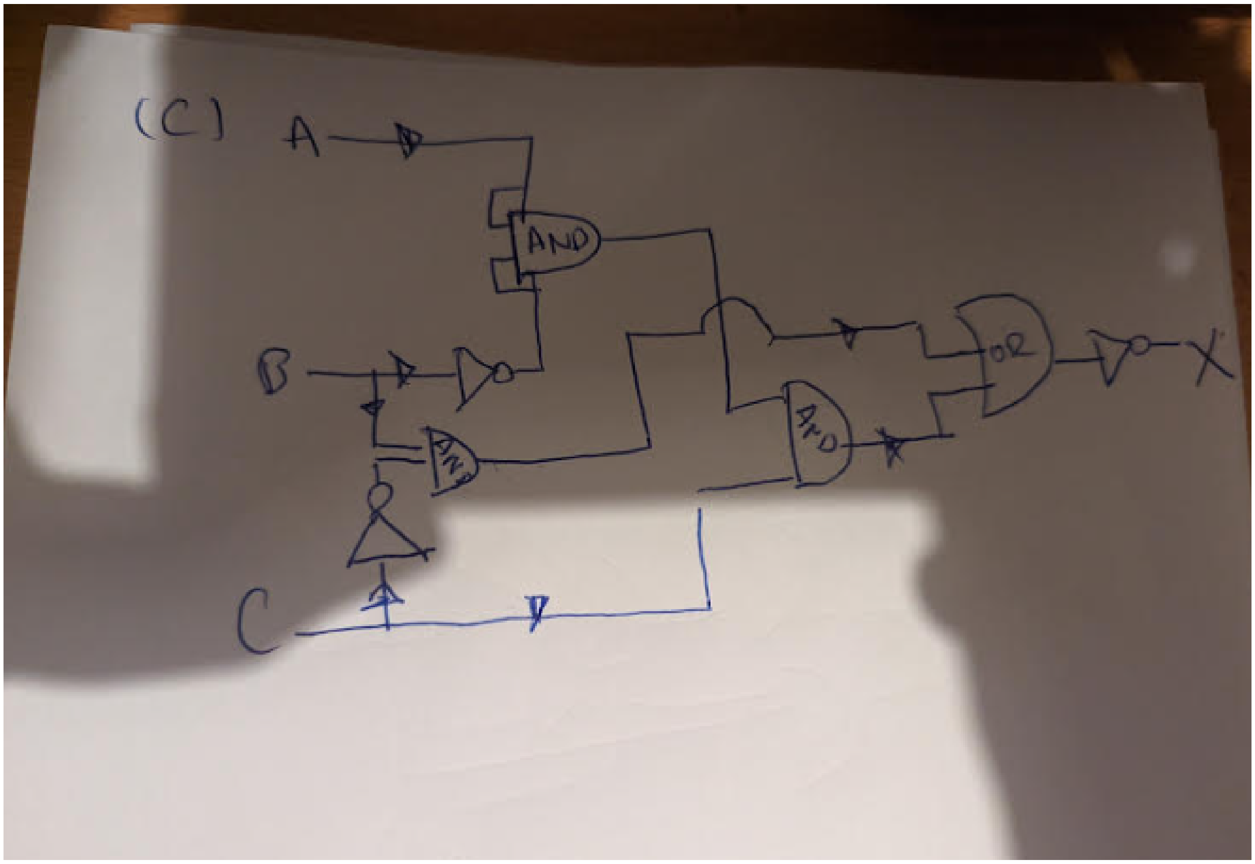
a)



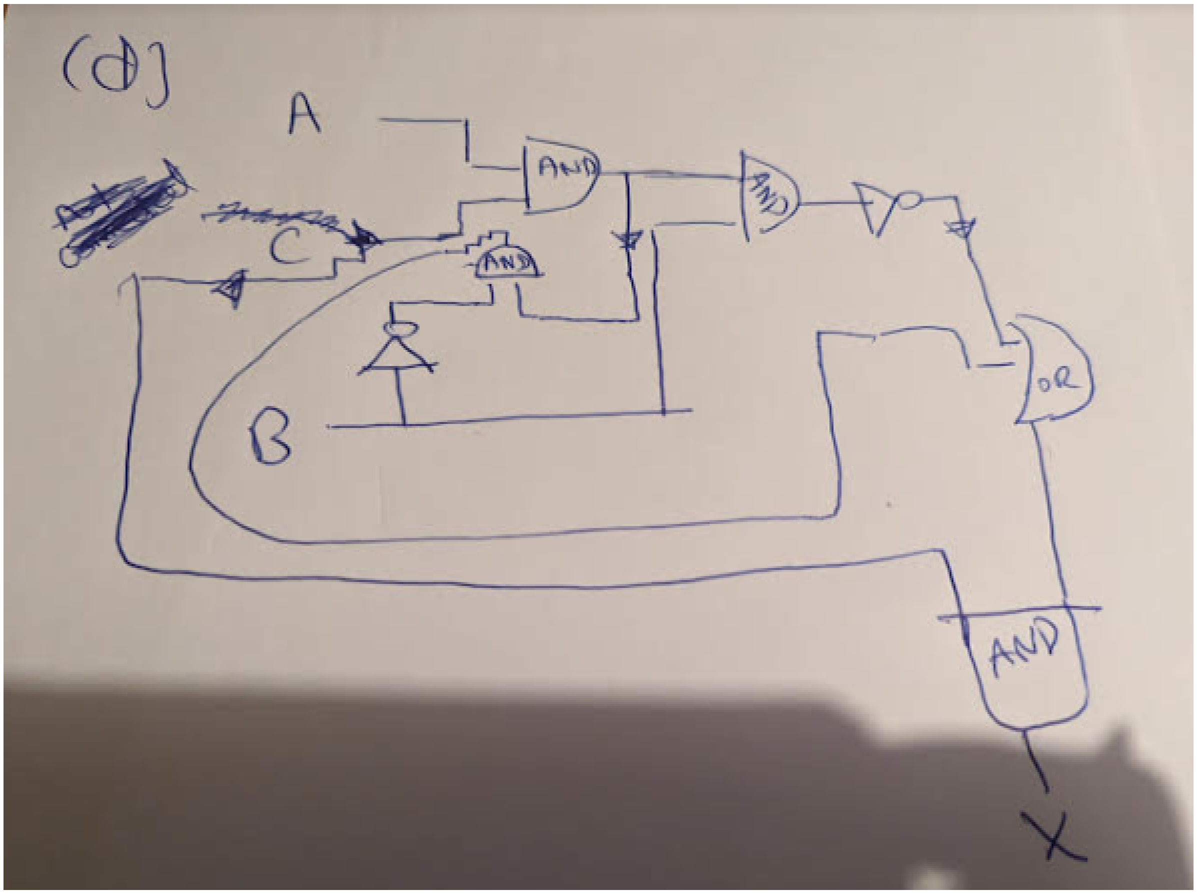
b)



c)



d)



PART B

7

(b) $X = \overline{(A+B)(\bar{C})}$

$X = \overline{(A+B)} + \overline{(\bar{C})}$

$X = (\overline{A+B}) + C$

(c) $X = \overline{A\bar{B}C + B\bar{C}}$

$$X = \overline{A\bar{B}C} \cdot \overline{B\bar{C}}$$

$$X = \cancel{\bar{A} + \bar{\bar{B}}}$$

$$(\overline{A\bar{B}} + \bar{C}) \cdot \overline{B\bar{C}}$$

$$X = ((\bar{A}+B) + \bar{C}) \cdot (\bar{B}+C)$$

Part d

(d)

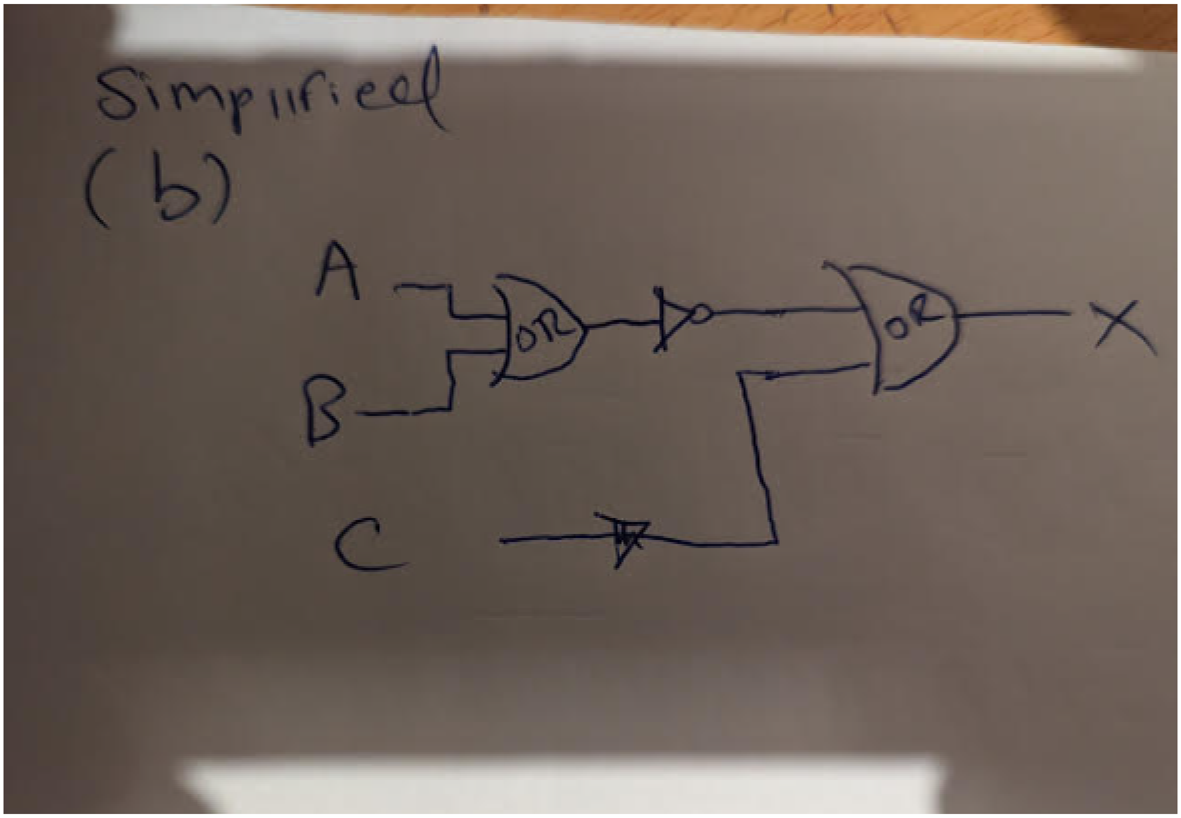
$$X = (A\bar{B}C + \overline{ABC})(C)$$

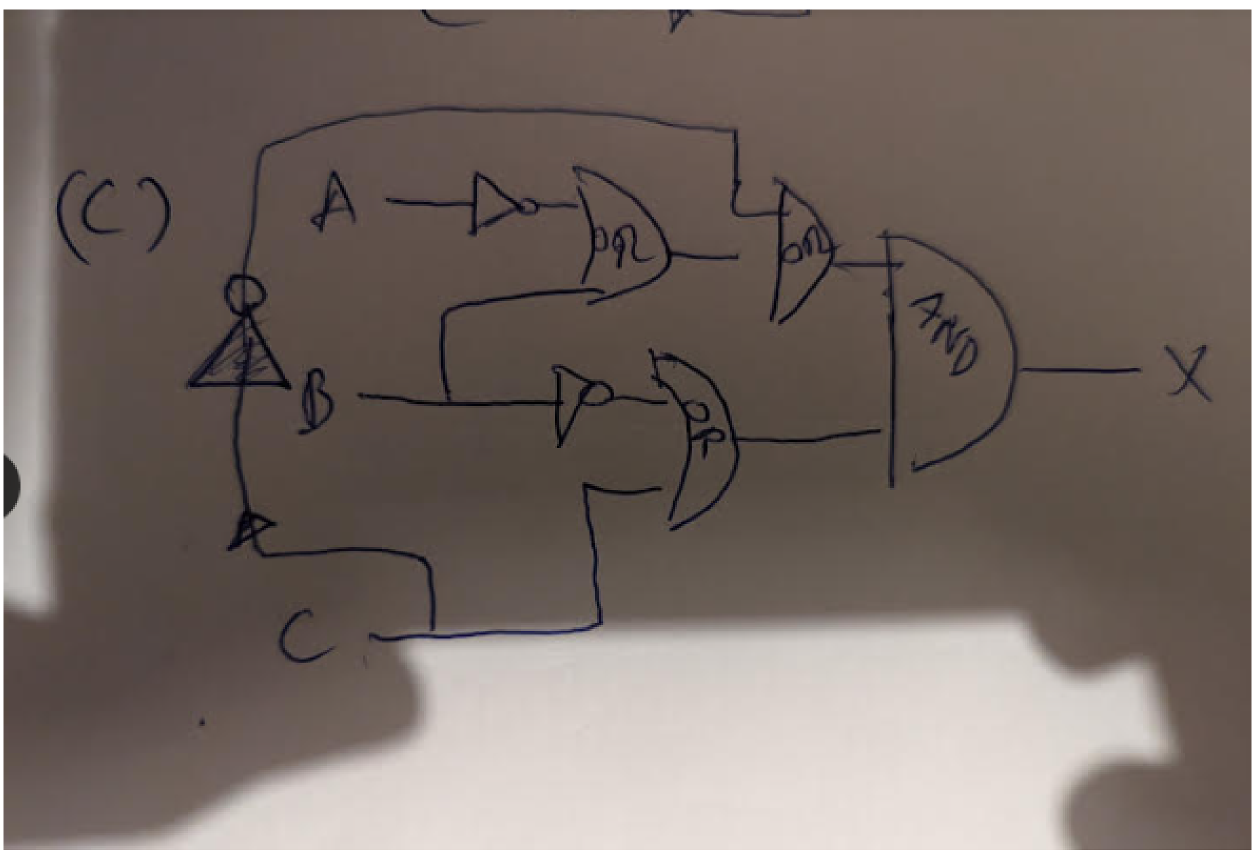
$$X = (A\bar{B}C + (\bar{A}B + \bar{C}))(C)$$

$$X = (A\bar{B}C + ((\bar{A} + \bar{B}) + \bar{C}))(C)$$

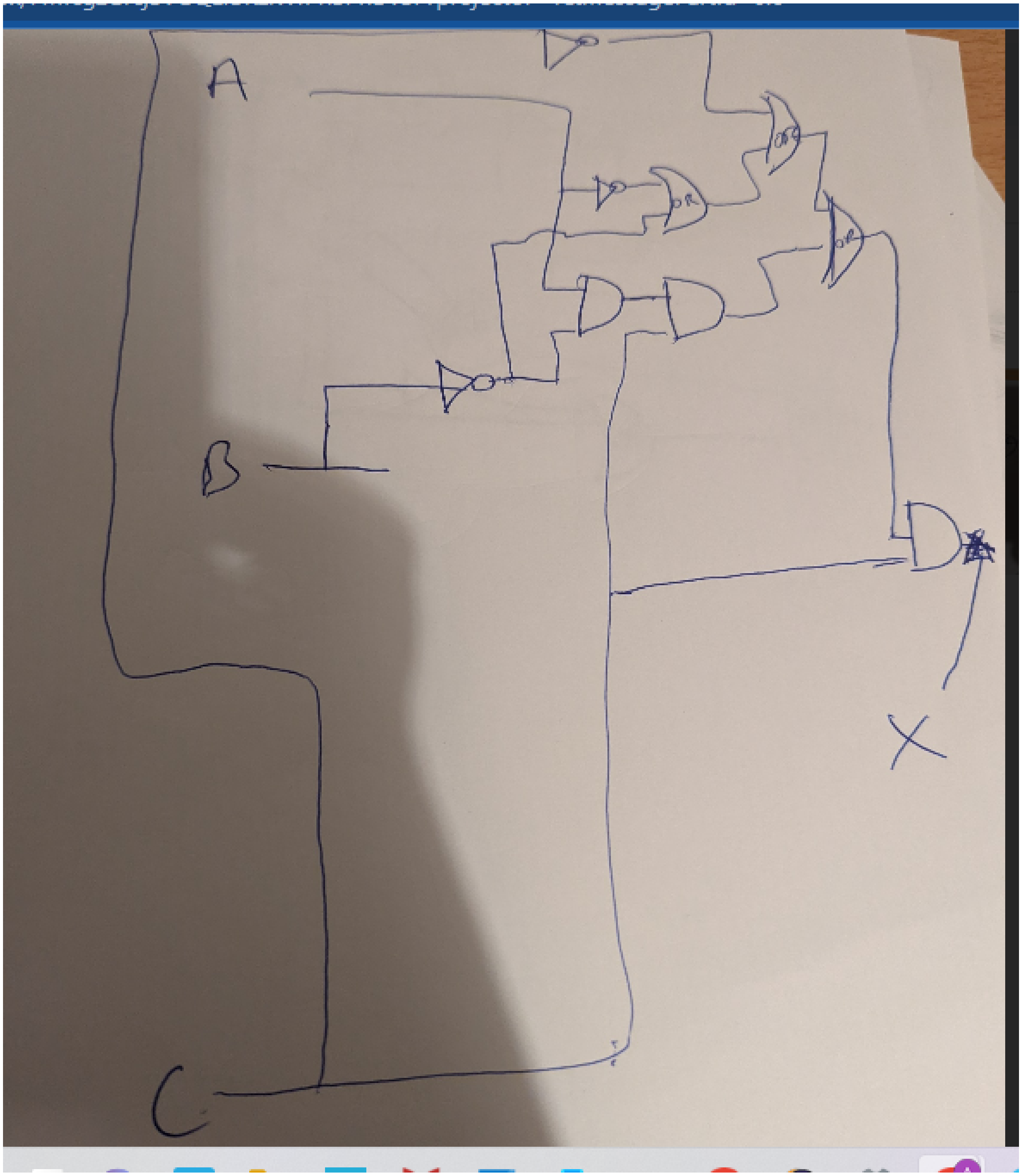
$$X = (A\bar{B}C + ((\bar{A}+\bar{B}) + \bar{C})(C)$$

SIMPLIFIED CIRCUITS


Simplified
(b)
A
B
C
OR
OR
X

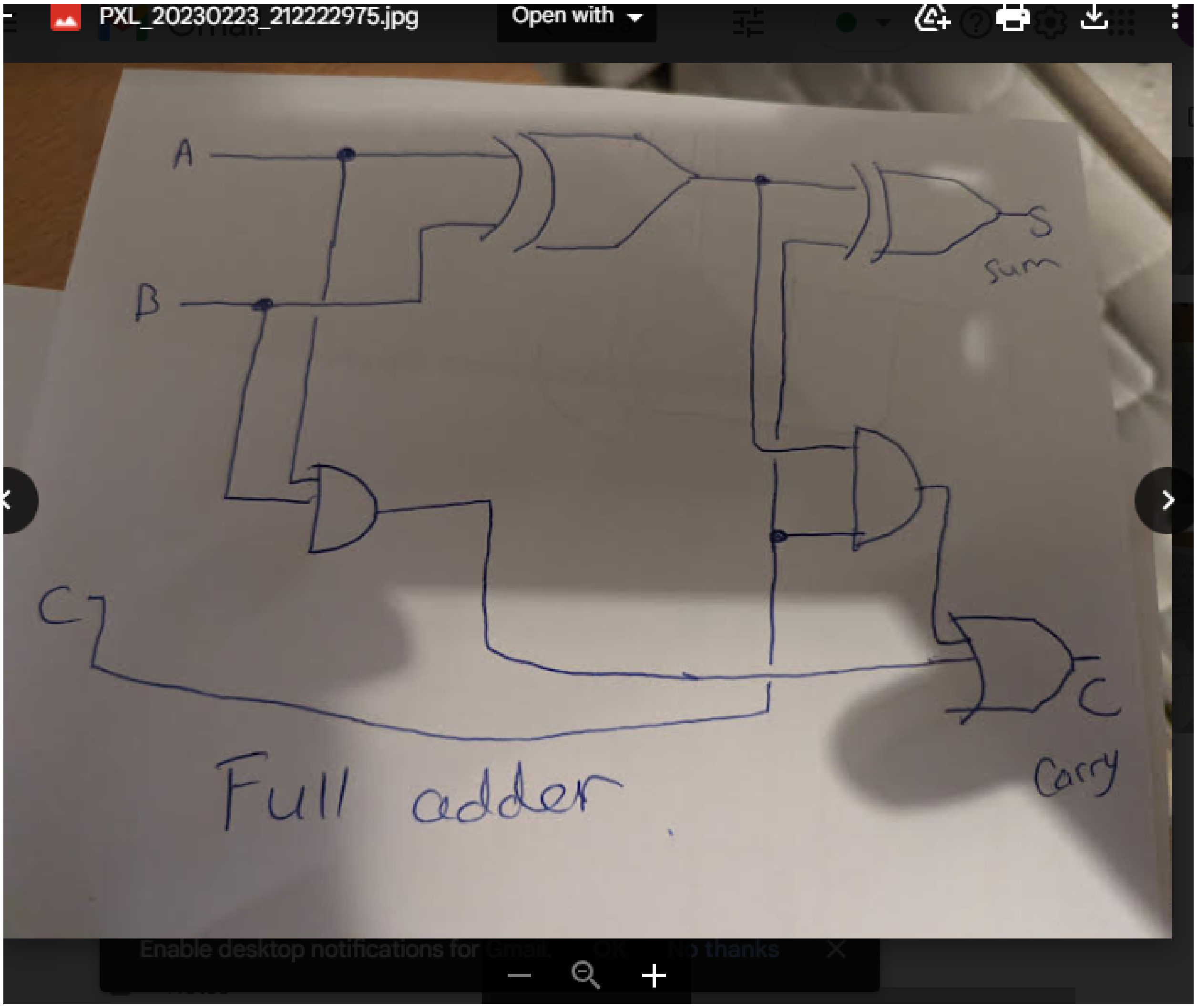

(C)
A
B
C
OR
OR
OR
AND
X

SIMPLIFIED CIRCUIT FOR PART D



QUESTION 8.

FULL ADDER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Open with
A
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Sum
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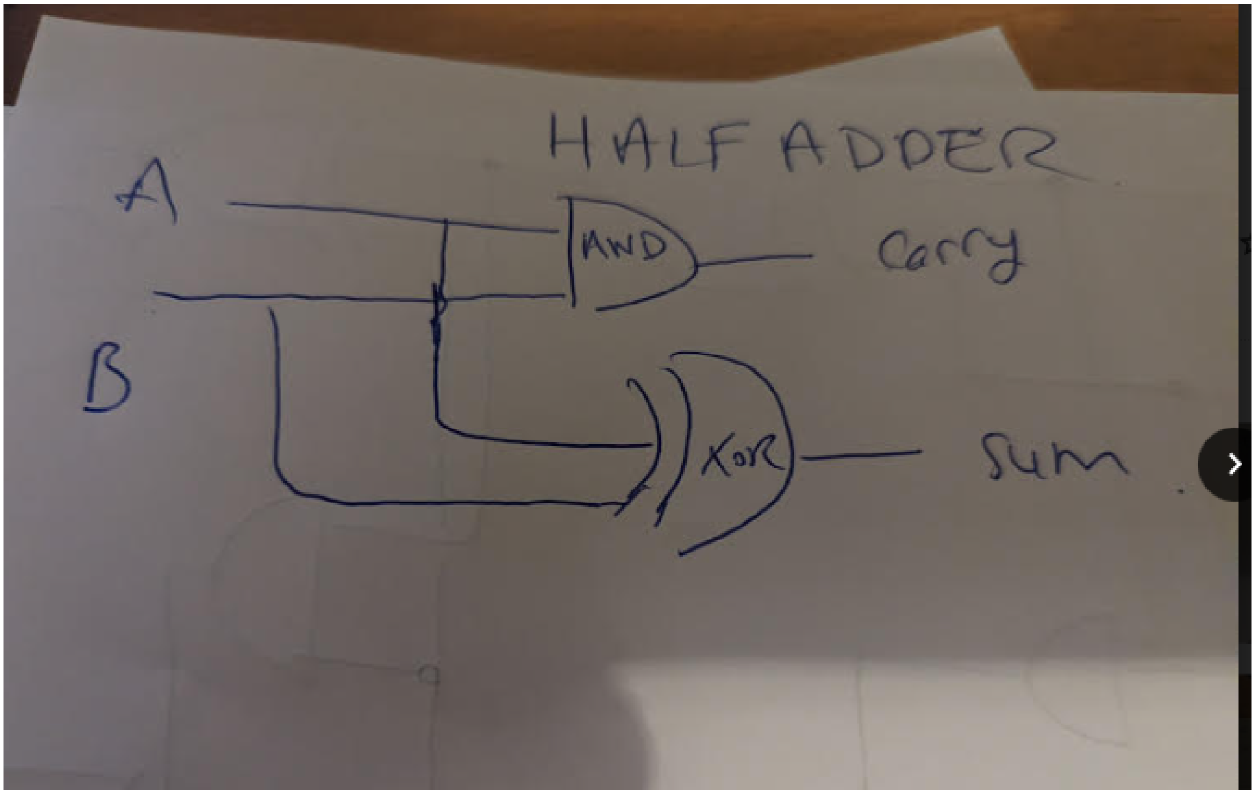
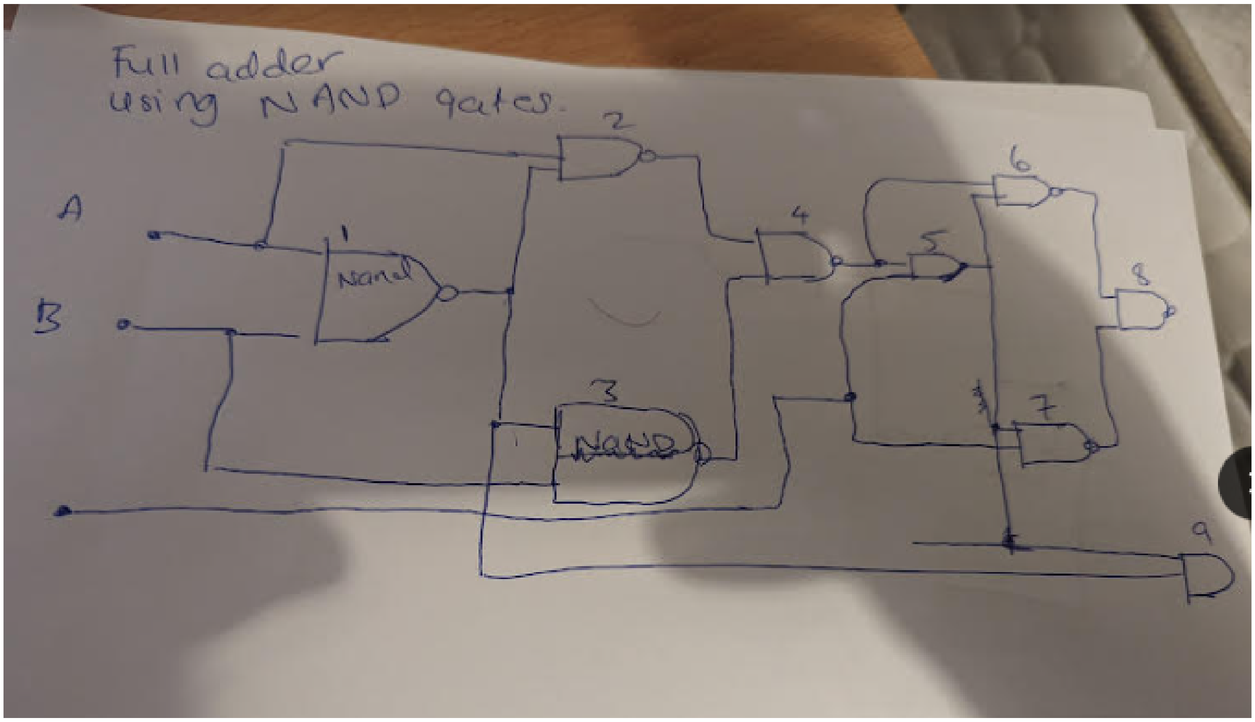
Carry
Full adder
Enable desktop notifications for Gmail.
OK
No thanks

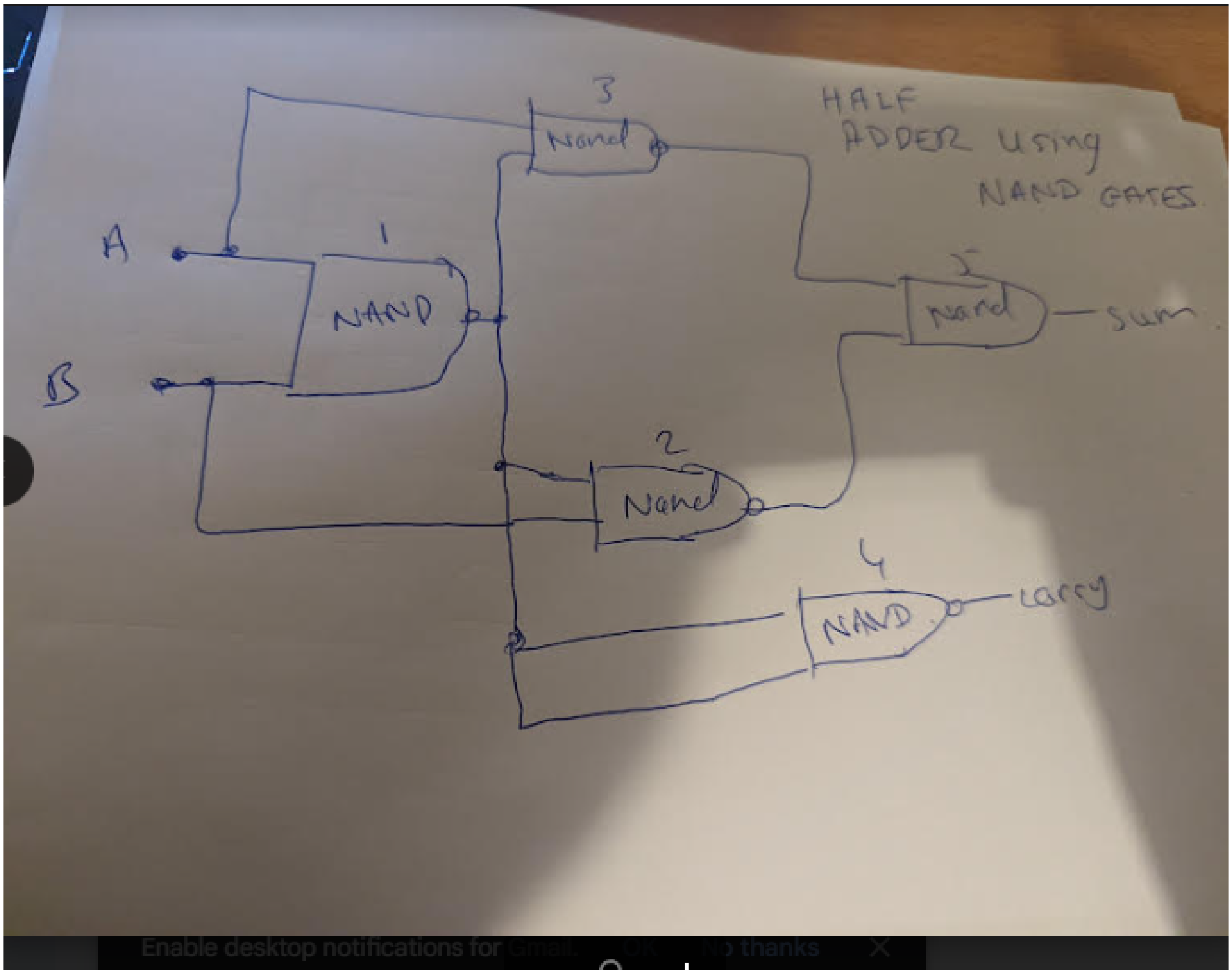
Half adder



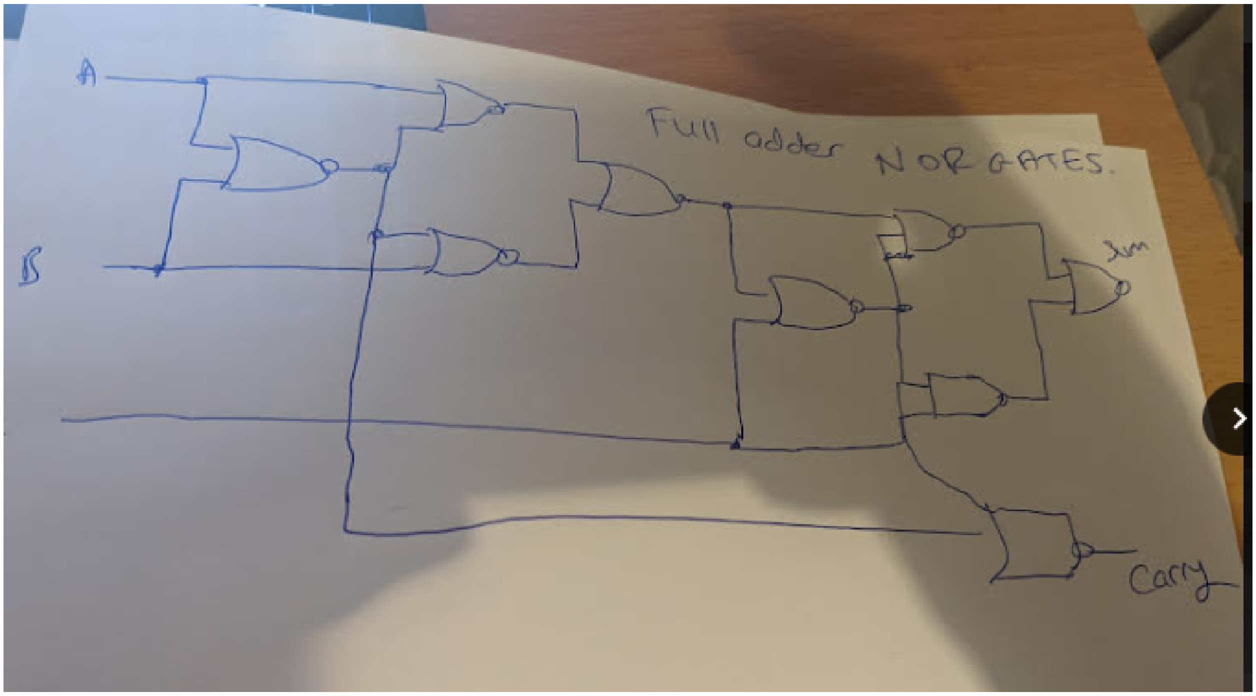
Full adder NAND gates



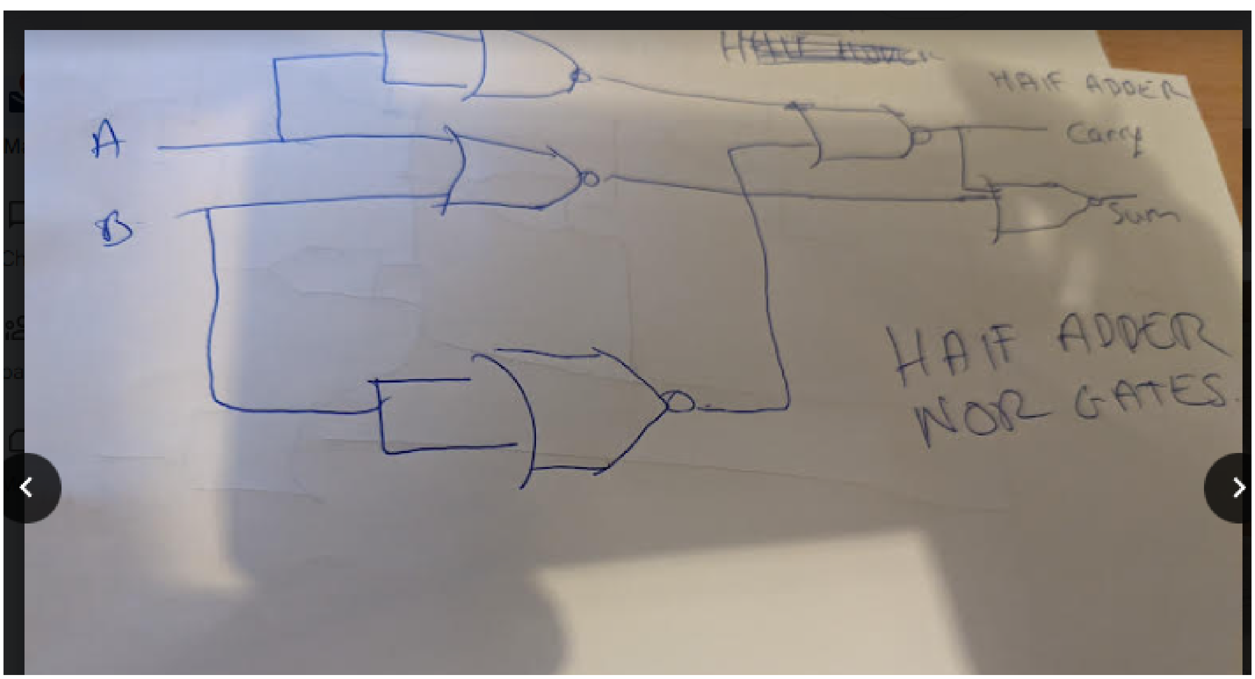
Half adder NAND gates



Full adder nor gates

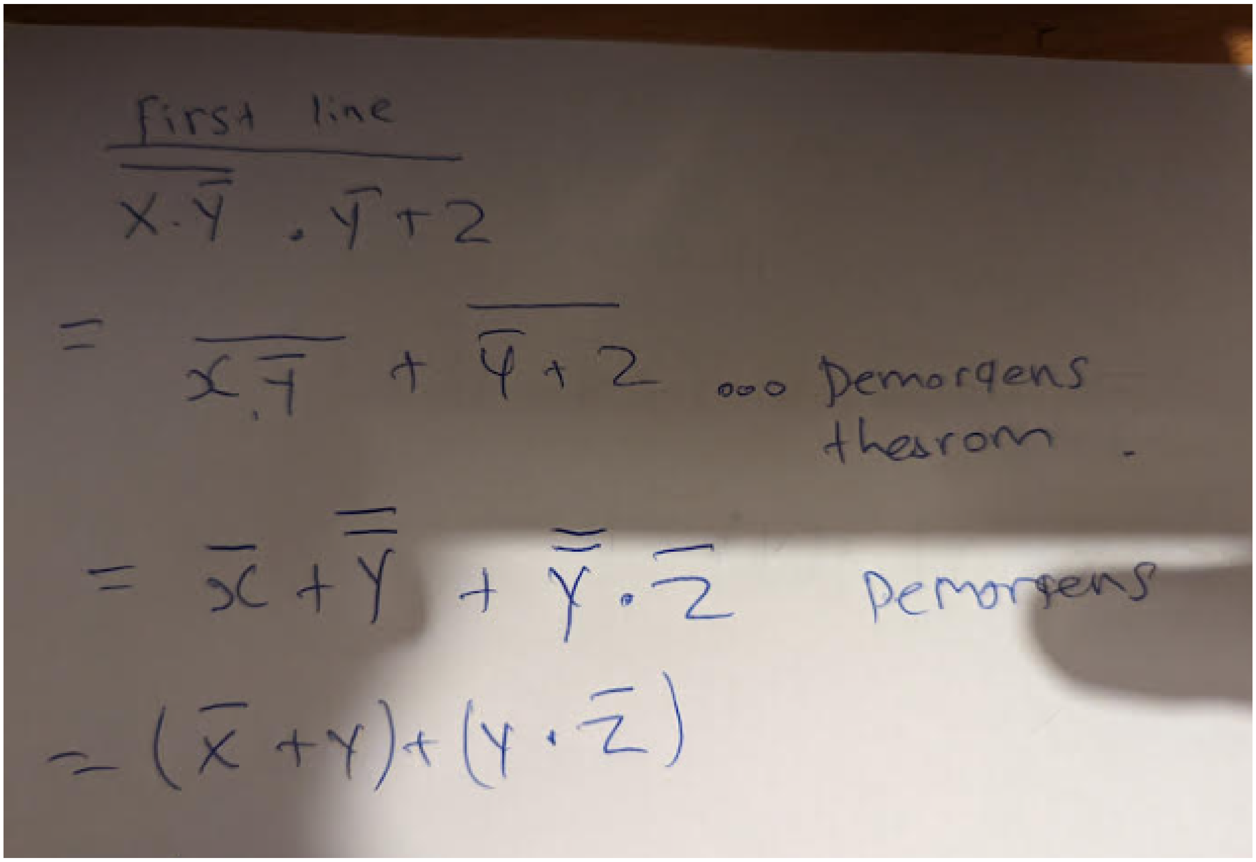


Half adder nor gates



Question 9.

LINE 1.



First line

$\overline{\overline{X \cdot \bar{Y}} \cdot \bar{Y} + Z}$

$= \overline{x \cdot \bar{y}} + \overline{\bar{y} + z}$ ... Demorgens theorom.

$= \bar{x} + \bar{\bar{y}} + \bar{\bar{y}} \cdot \bar{z}$ Demorgens

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

LINE 2

Second line

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

$= \overline{\bar{x}+z} + \overline{\overline{xy}}$ Demorgens...

$= x\cdot\bar{z} + xy$ Demorgens...

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

LINE 3

Line 3.

- $AB + AC + ABC$
- $= A(B + C + BC)$

~~Since $B(1+C) = B$~~

- $B + C = B(1+C)$ ... Distributive law

Thus

- $A(B(1+C) + BC)$
- since $A(B+C) = AB + AC$ .... Distributive law

$A(B+C)$

LINE 4

Line 4

~~AB + AC + ABC +~~

$AB + A(\bar{B} + C) + AB\bar{C} = A$.

$A(\bar{B} + C) = A\bar{B} + AC$ ... Distributive law

thus

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

$= A(B + \bar{B} + \cancel{A}C + \cancel{A}B\bar{C})$

$= A(B + C + B\bar{C})$

Since $B + C + B\bar{C} = 1$

$= A(1) = A$

Line 5

Line 5

$(A + B)(A + C)$

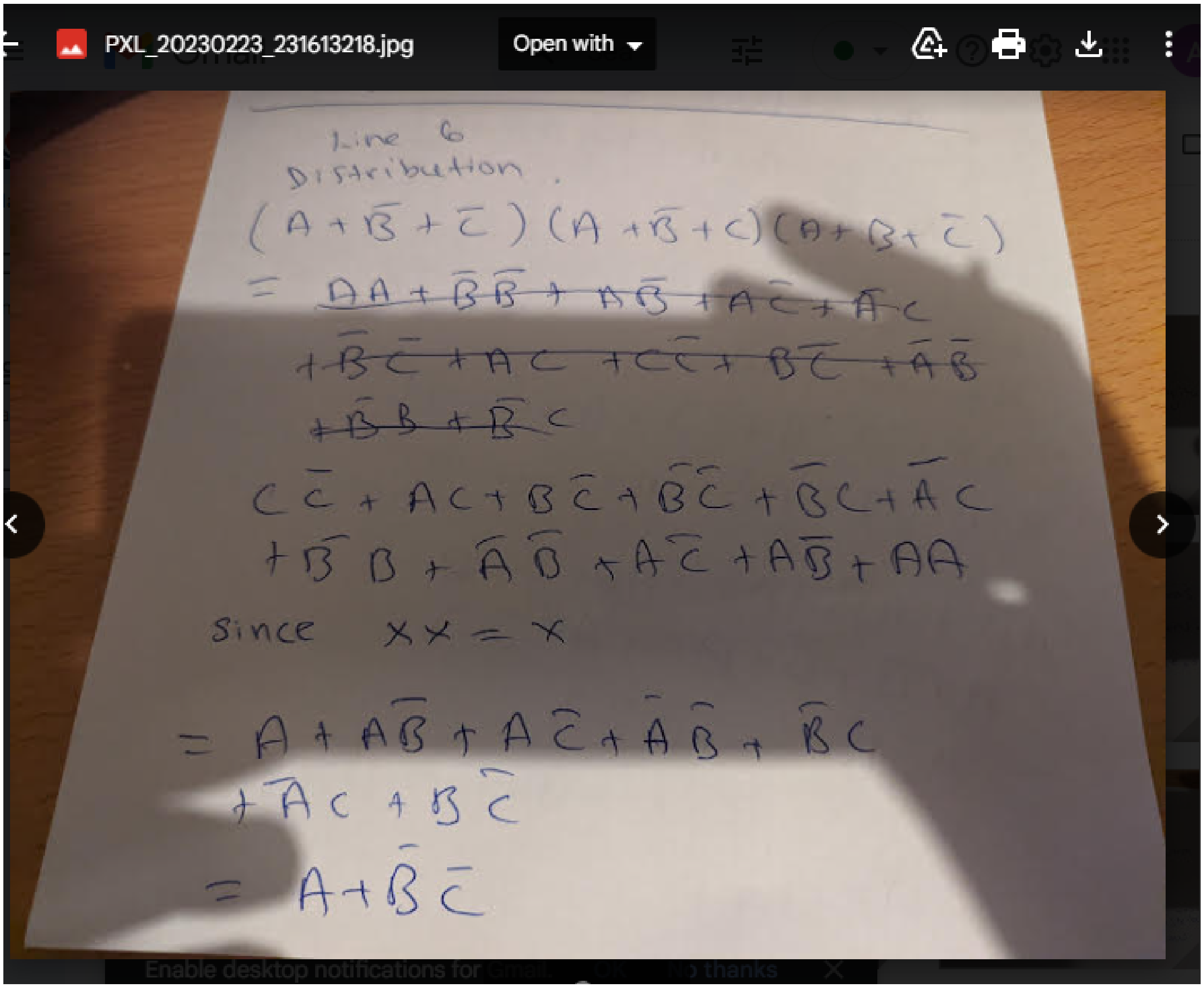
$AA + AC + AB + BC$

$= A + B(\cancel{B+} A + C)$

since $A + C = 1$

$= (A + B)(1) = (A + B)$

Line 6



Question 10.

a) b1111
b) 5fa
c) c4
d) 5A