Question 1: Number System Conversion [3 points]

a. $(11001)_2 = (1\times2^4 + 1\times2^3 + 0\times2^2 + 0\times2^1 + 1\times2^0\ (\ )$ $)_{10}$

0.5

b. $(3210)_4 = (3\times4^3 + 2\times4^2 + 1\times4^1 + 0\times4^0 = (\ ) \ )_2$

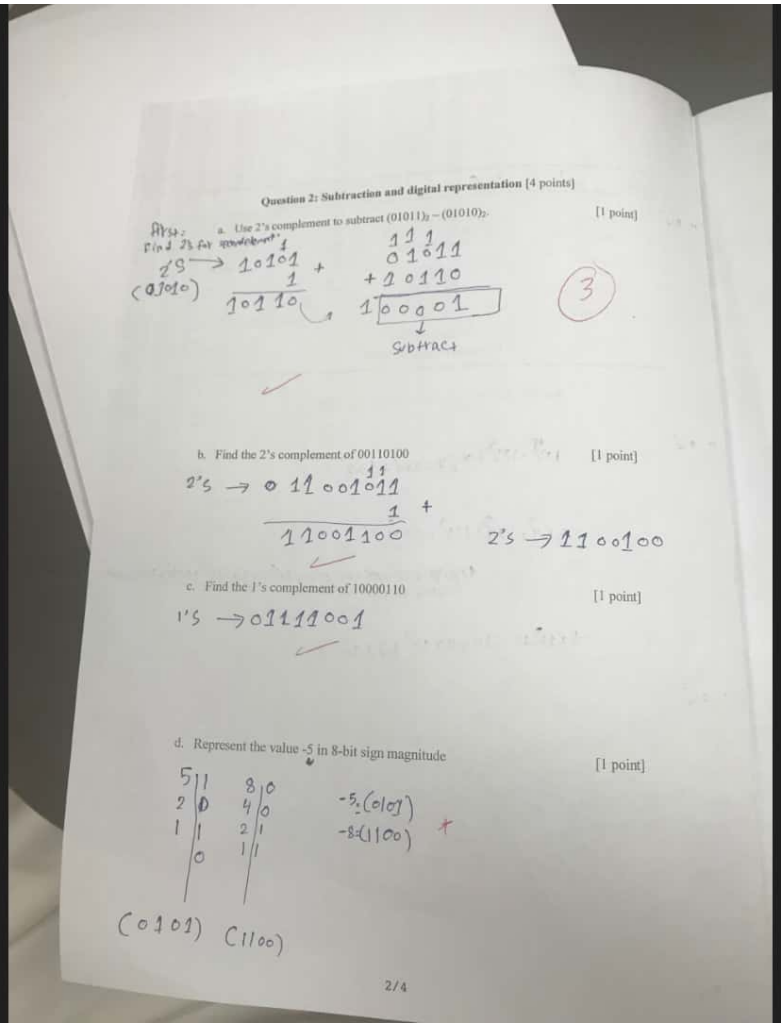
✗

c. $(111000101010100001)_2 = (\qquad)_{16}$

d. $(6012)_8 = (6\times10^3 + 0\times10^2 + 1\times10^1 + 2\times10^0 = (\ ) \ )_{16}$

✗

e. $(21.25)_{10} = (\qquad)_2$ [1 point]



Question 2: Subtraction and digital representation [4 points]

a. Use 2's complement to subtract $(01011)_2 - (01010)_2$. [1 point]

Find 2's for subtrahend

2's → 10101 + 1 = 10110

(01010)

11 1
01011
+10110
1 00001

Subtract

3

b. Find the 2's complement of 00110100 [1 point]

2's → 0 11 00 10 11 + 1 = 11001100

2's → 11001100

c. Find the 1's complement of 10000110 [1 point]

1's → 01111001

d. Represent the value -5 in 8-bit sign magnitude [1 point]

5 | 1
2 | 0
1 | 1
0

8 | 0
4 | 0
2 | 1
1 | 1

-5: (0101)
-8: (1100)

(0101) (1100)

Question 3: Simplifications [6 points]

a. Simplify the following function:
$F(w, x, y, z) = \sum(1, 2, 4, 5, 6, 8, 10, 13, 15)$ [2 points]

b. Simplify the following Boolean expressions to a minimum number of literals:
I. ABC'D + A'BD + ABCD
II. A'C' + ABC + AC' [2 points]

c. Simplify the function F represented in the following truth table. [2 points]

WX \ YZ	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	X0	X0	X1	X1
10	1	1	X1	X1

F = f = C + A'BD + B'D'

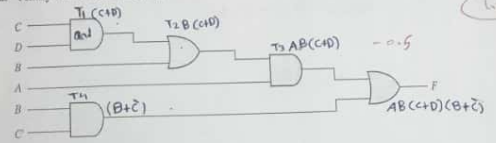
w	x	y	z
A	B	C	D

1.5

Question 4: Analysis and Design of Circuits [5 points]

a. Analyze the following digital circuit to know it task. [2 points]

1.5



-0.5

$f = AB(C+D)(B+\bar{C})$ $T_4 = (B+\bar{C})$ $T_3 = AB(C+D)$ $T_2 = B(C+D)$ $T_1 = C(C+D)$

0	0	0	
0	1	0	
1	0	0	
1	1	1	

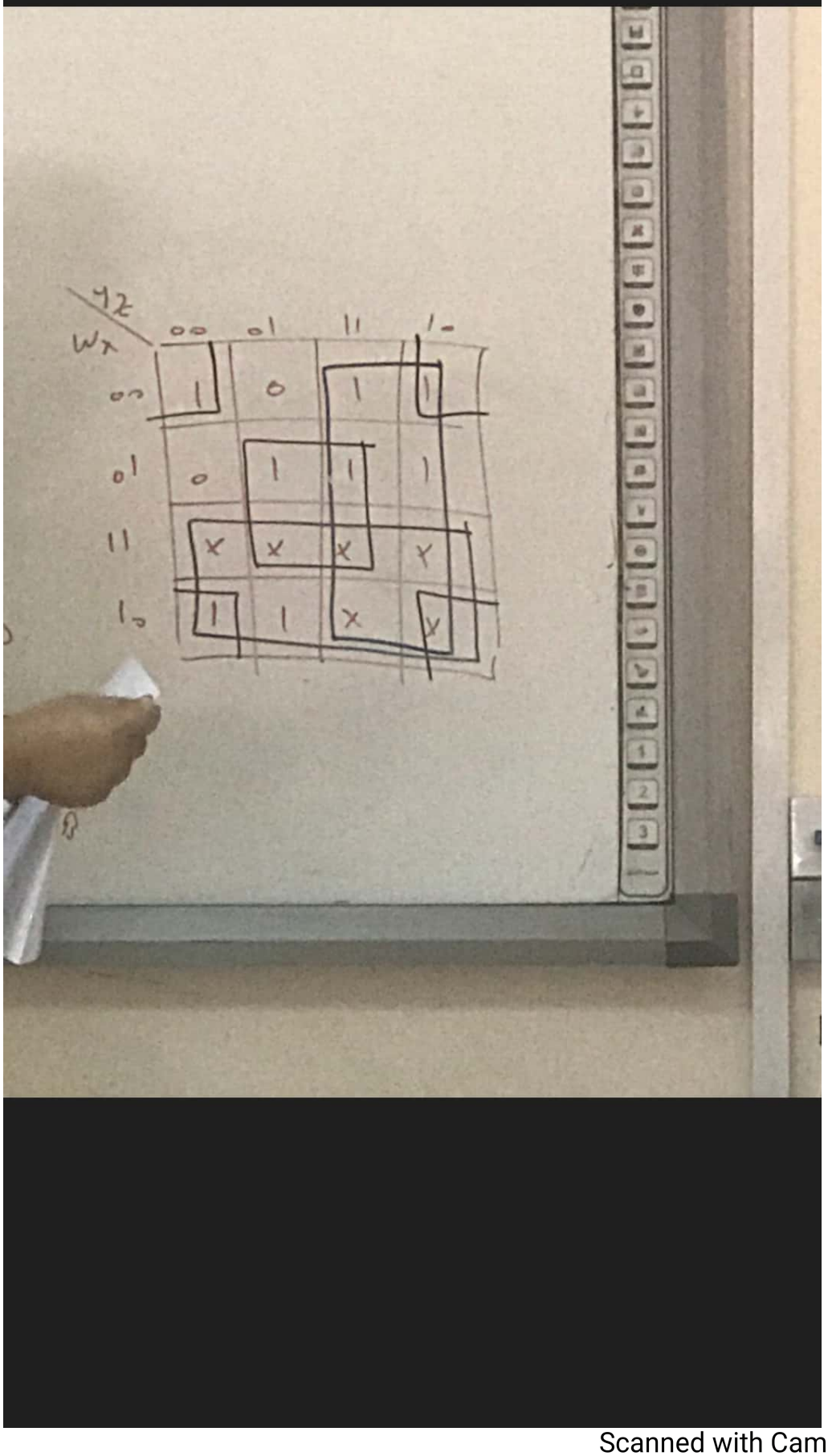
b. Design a combinational circuit that detects the even number of zeros assuming that the circuit can accept input up to 7. [3 points]

AC \ B	00	01	11	10
0	0	1	1	0
1	0	1	1	0

A	B	C	f
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

3

Good Luck



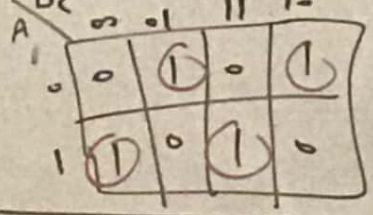
even # of 3s

7 inputs

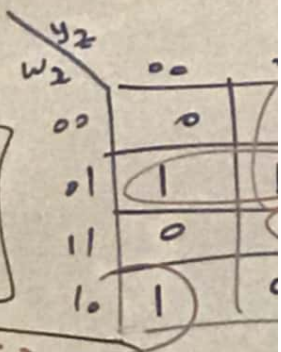
3 inputs: A, B, C

output:

A	B	C	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1



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



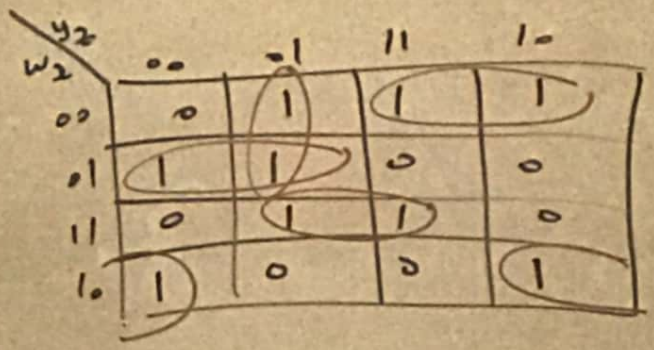
$f(w,x,y,z) = \Sigma$

① $A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}D + A\bar{B}$

② $\bar{A}\bar{C} + AB\bar{C} + A\bar{C}$

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

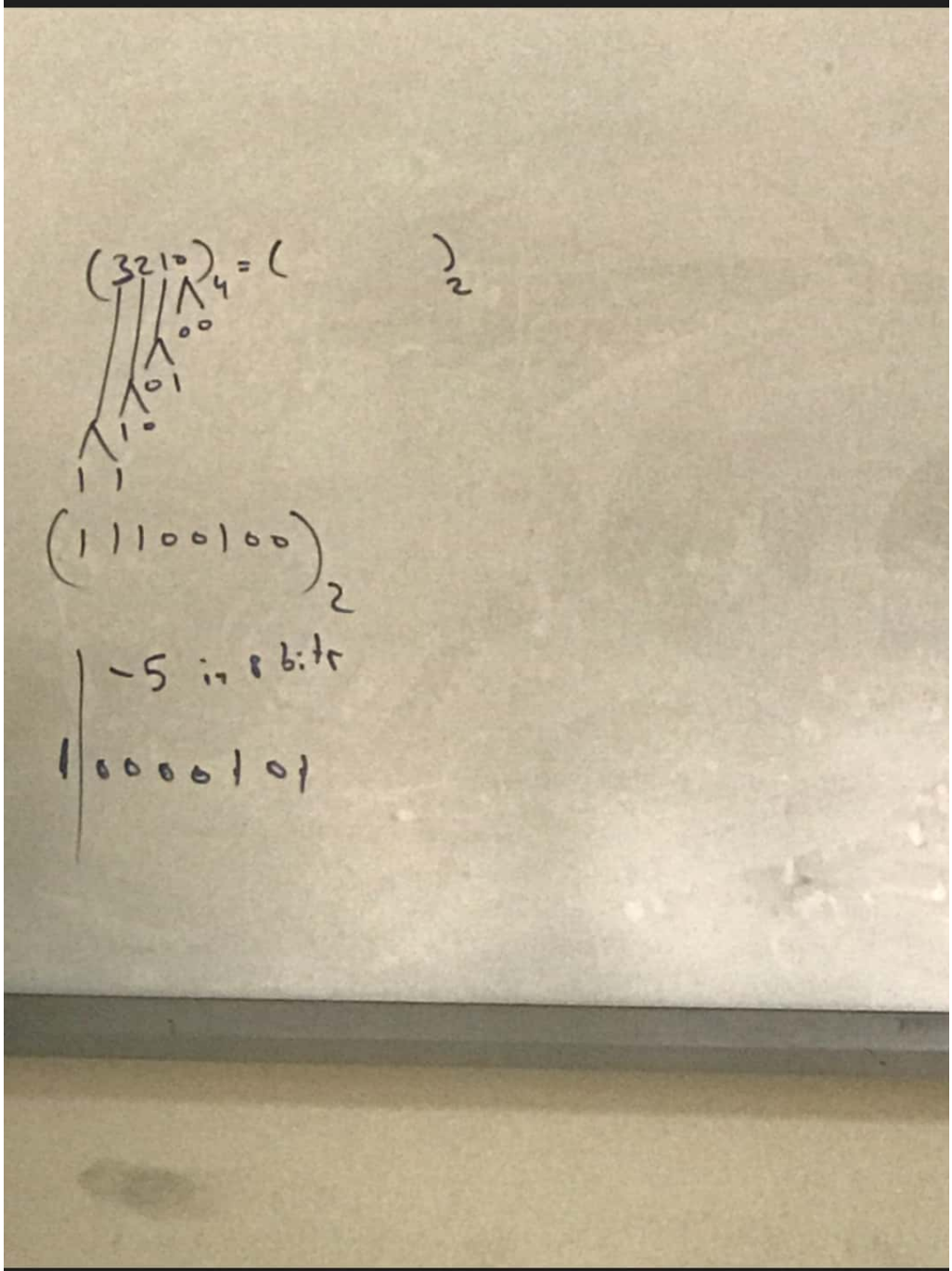
2) $f(w,x,y,z) = \sum(1,2,4,5,6,8,10,13,15)$

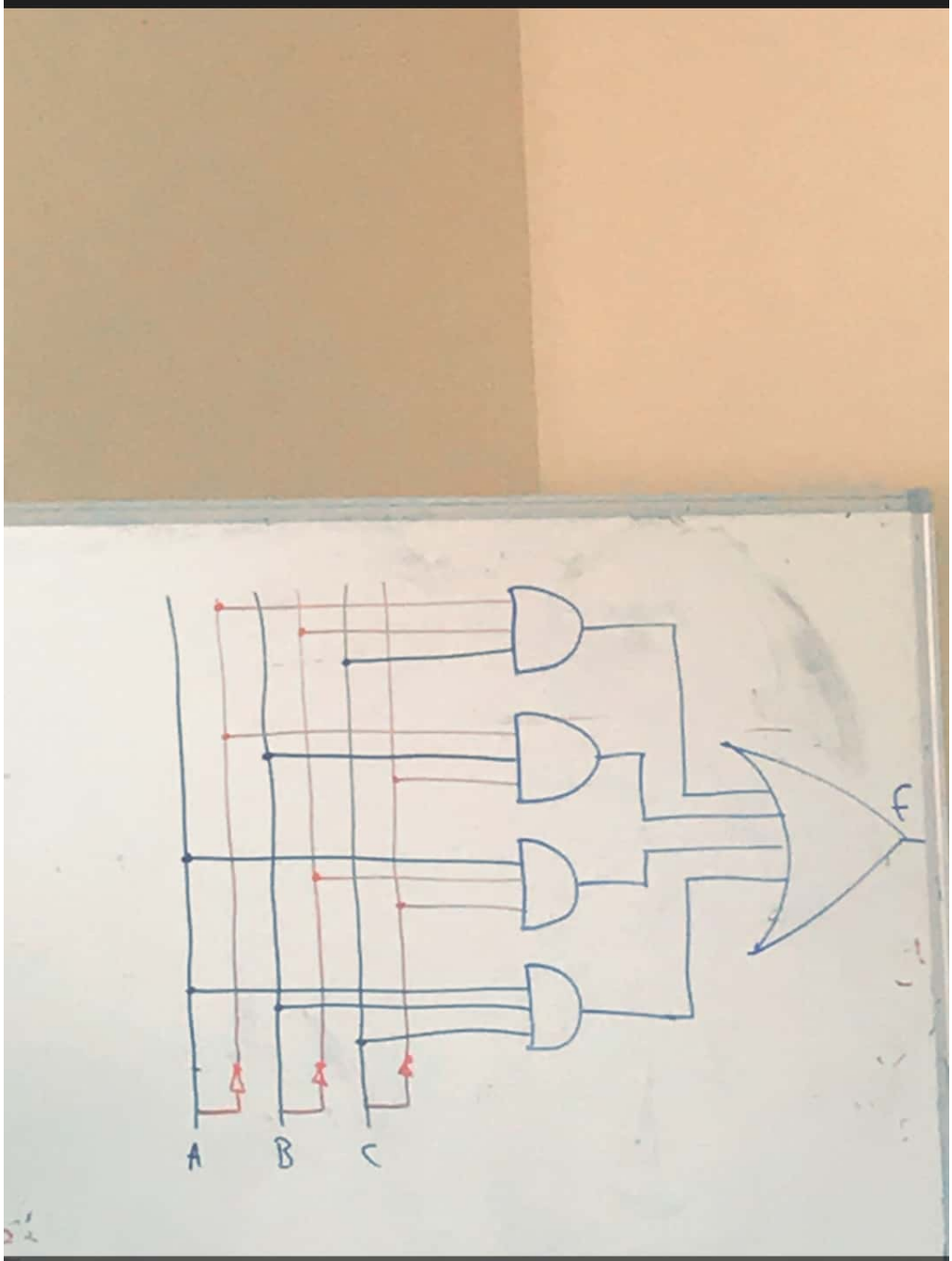


① $\underline{AB\bar{C}D} + \bar{A}\bar{B}D + \underline{AB\bar{C}D} = \bar{A}BD + ABD = BD$

② $\bar{A}\bar{C} + AB\bar{C} + A\bar{C}$

$\bar{C}(\bar{A}+A) + AB\bar{C} = \bar{C} + AB\bar{C} = (\bar{C}+AB)(\bar{C}+1) = \bar{C} + AB$





تصميم اخر سؤال بعد التلخيص
^A^B^C+A^BC^+AB^C^+ABC

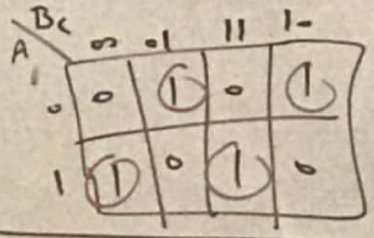
even # of 3ones

3 inputs

3 inputs: A, B, C

output:

A	B	C	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1



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

اخر سؤال في الورقة