COA - May 2024

Q.1] Ans-C]

Given number = -20.25

Converting to IEEE single precision floating point standard.

Sign bit = 1 (-ve)

→ • Step 1:

Converting the given number to binary format

2	20	
2	10	0
2	5	0
2	2	1
	1	0
		1

$0.25 \times 2 = 0.5 \quad 0$

$0.5 \times 2 = 1 \quad 1$

$[-20.25] = \underbrace{10100}_{20} \; \underbrace{01}_{0.25}$

• Step 2:

Normalising the binary numbers

$[10100.01]_2$

$[1.\underbrace{010001}_{\text{Mantissa}} \times 2^4]$

• Step 3:

finding the value of e'

$e' = E + 127$

$= 4 + 127$

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$\therefore \boxed{E' = 131}$

Note: E = Exponent & we got the value of exponent by shifting the ~~deel~~ decimal to the left while normalising. Then we got the value [24]

- Step 4:
  Converting the value of E' to binary format

2	131	
2	65	1
2	32	1
2	16	0
2	8	0
2	4	0
2	2	0
	1	0
		1

$\therefore E' = 10000011$

- Step 5:
  Single precision format (32-bit)

Sign bit

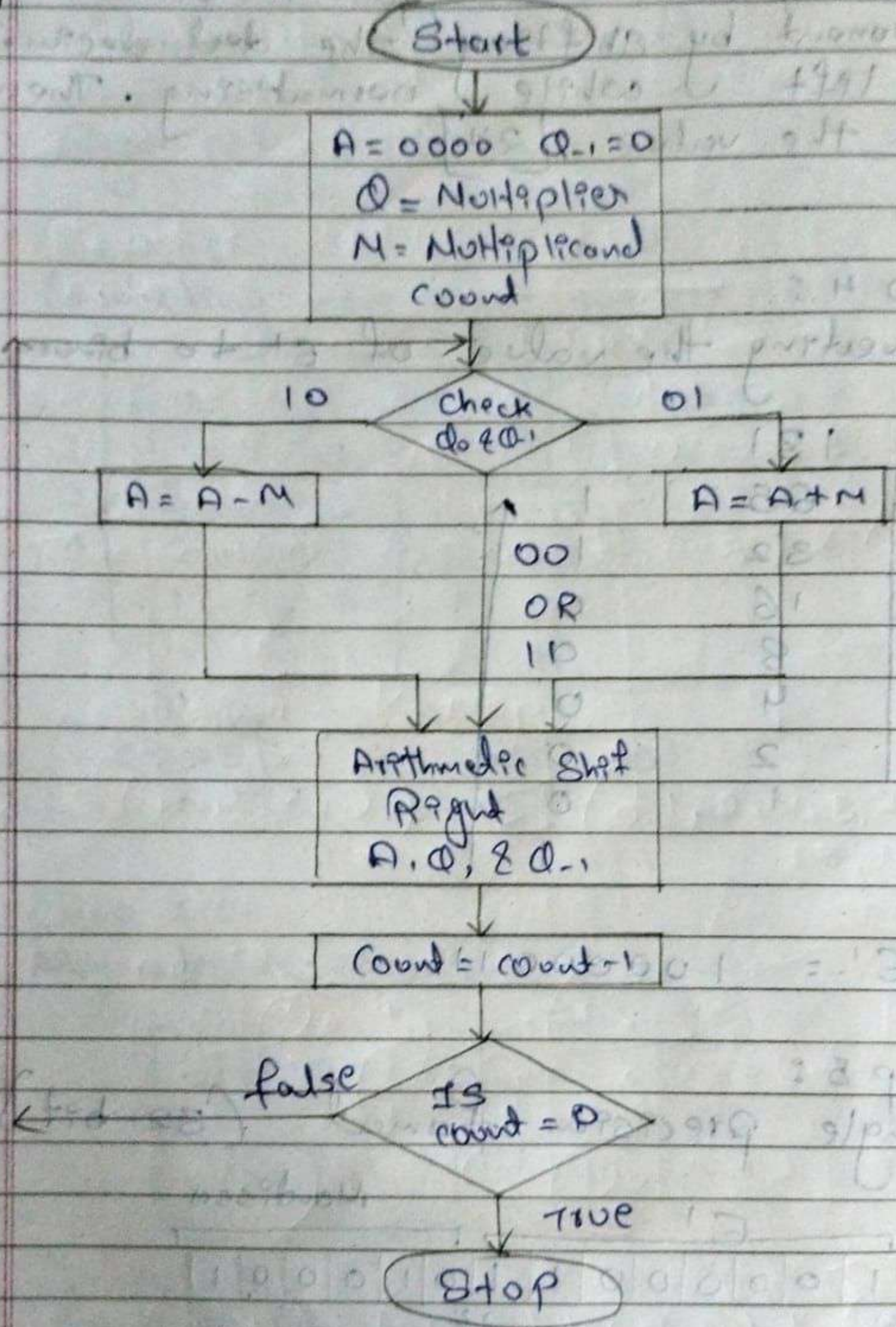
E'

Mantissa

1	1	0	0	0	0	0	1	1	0	1	0	0	0	1		
32	31							23								0

Q.2]
Ans-a]

Flow-Chart of Boothe Algorithm



→ Multiplying (-5) and (6) using Booths Algorithm.

[5] in binary bits (M) = $\boxed{0101}$

0101
1010 → 1's compliment
+ 1
1011 → 2's compliment

[-5] in binary bits (-M) = $\boxed{1011}$

Q or (6) in binary bits = $\boxed{0110}$

A = 0000 , Q_{-1} = 0 , count = 4

A	Q's	Q_{-1}	Count	Remark
0000	0110	0	4	Initialize
0000	0011	0	3	Shift Right
+1011				
1011				A + (-M)
1101	1001	0	2	Shift Right
+1011				
1000				A + (-M)
1100	0100	0	1	Shift Right
1110	0010	0	0	Shift Right

* Process Control Block

- Contains the process elements
- Created and managed by OS
- Allows support for multiple process.

Result : 1110 0010
(AQ)

0001 1101 → 1s complement
+ 1
0 0 0 1 1 1 1 0 → 2s complement
16 8 4 2
30

The answer is correct $(-5) \times (6) = (-30)$

Q.3] Solving K-Map

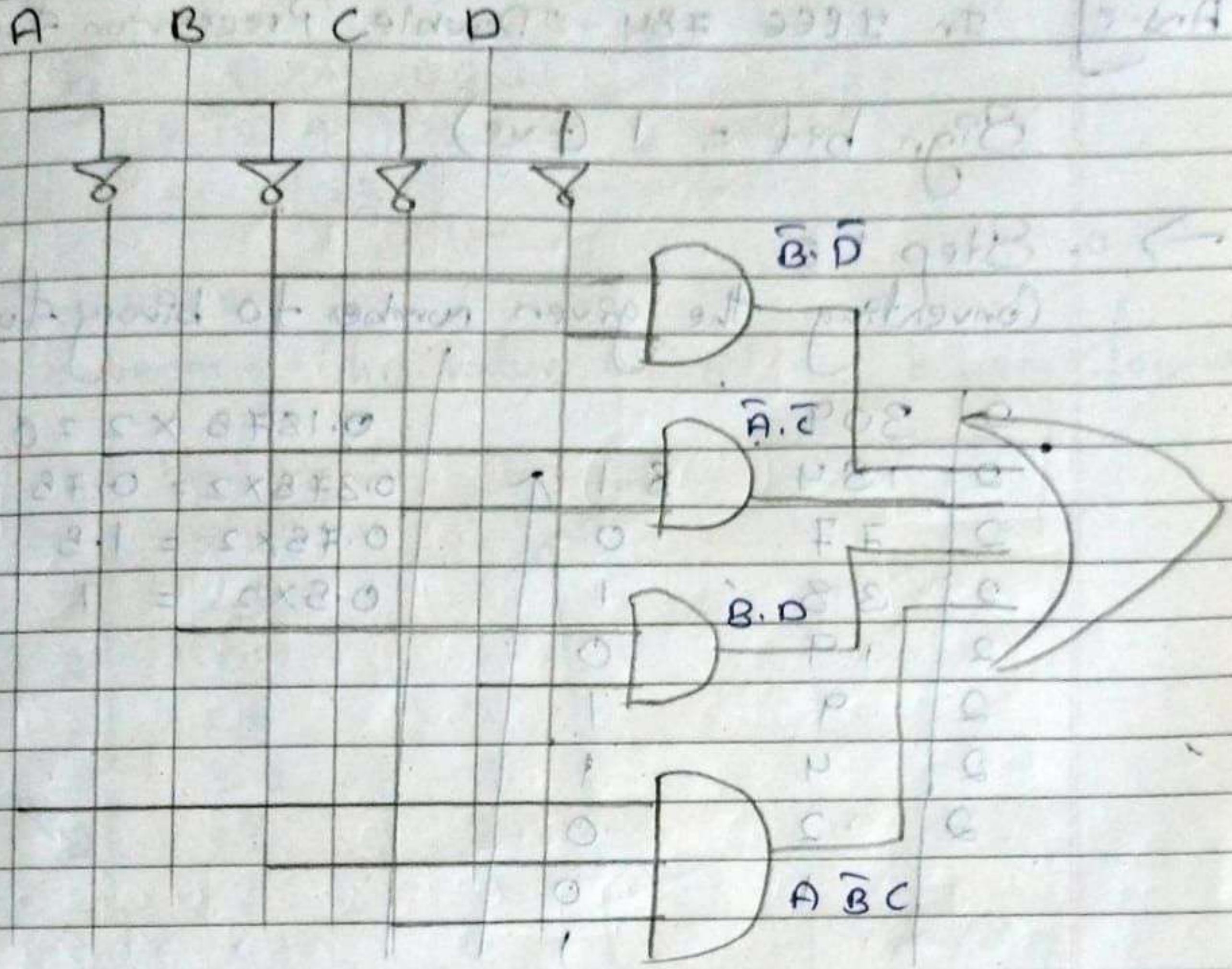
Ans-a] $f(A,B,C,D) = \Sigma(0,1,2,4,5,7,8,10,11,13,15)$

→

AB \ CD	00	01	11	10
00	1 0	1 1	3	1 2
01	1 4	1 5	1 7	6
11	12	1 13	1 15	14
10	1 8	9	1 11	1 10

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

Logic Gates



COA May-2023

Q.1 Ans-e

Given number = −309.1875

In IEEE 754 "Double Precession format"

Sign bit = 1 (−ve)

→ Step 1:

Converting the given number to binary format

2	309	
2	154	1
2	77	0
2	38	1
2	19	0
2	9	1
2	4	1
2	2	0
	1	0
		1

$0.1875 \times 2 = 0.375$ 0

$0.375 \times 2 = 0.75$ 0

$0.75 \times 2 = 1.5$ 1

$0.5 \times 2 = 1$ 1

309 = 100110101 & 0.1875 = 0011

• Step 2:

Normalising the binary number

$$[100110101.0011 \times 2]$$

$$[1.\underbrace{001101010011}_{\text{Mantissa}} \times 2^8] \rightarrow E/\text{Exponent}$$

- Step 3:
  finding the value of E':

$$E' = E + 1023$$
$$= 8 + 1023$$
$$\boxed{E' = 1031}$$

- Step 4:
  Converting the value of E' to binary format

2	1031	
2	518	1
2	257	1
2	128	1
2	64	0
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
	1	0
		1

$\therefore E' = 10000000111$

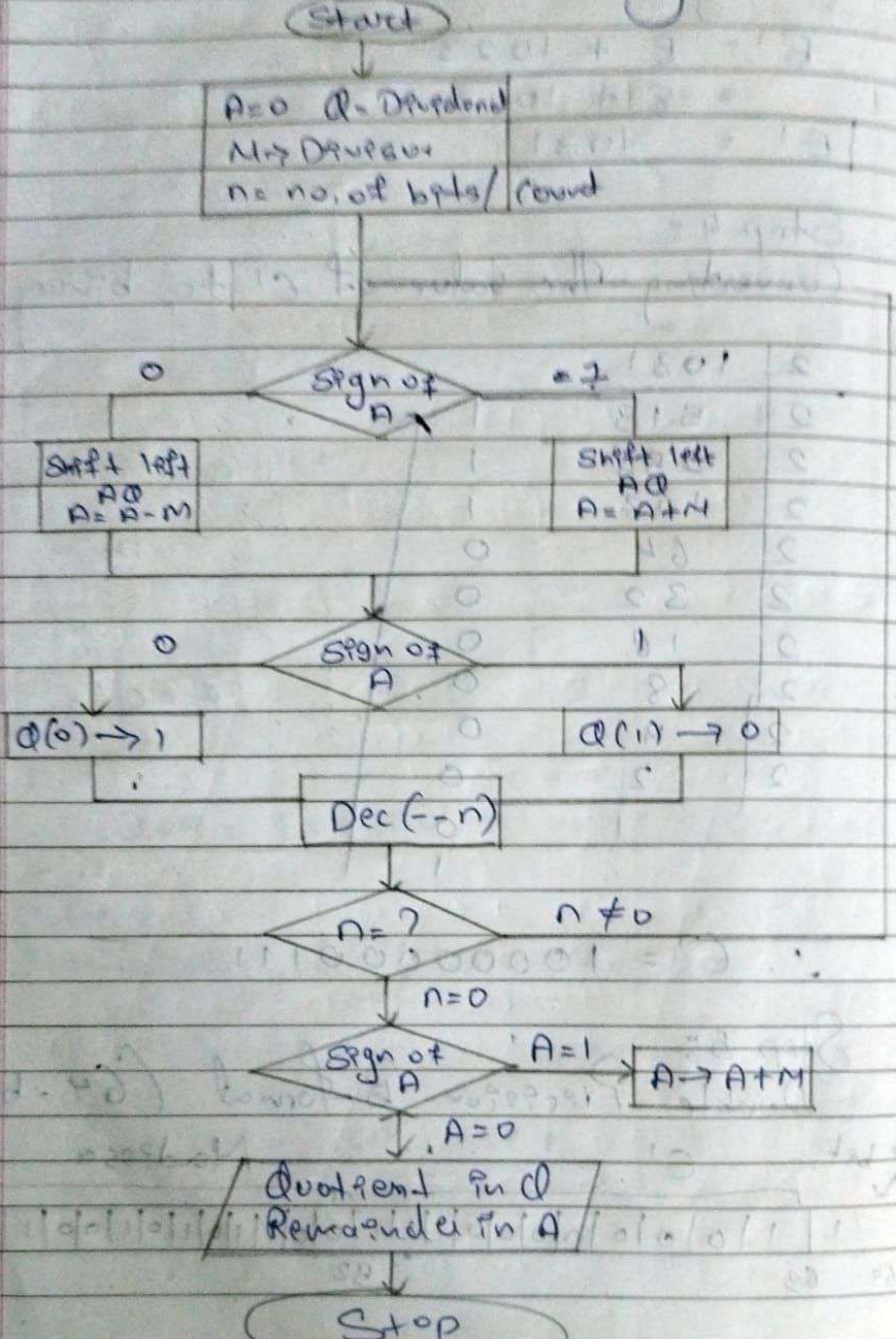
- Step 5:
  Double Precision B format (64-bit)

sign bit, E', Mantissa

sign bit	E'											Mantissa											
1	1	0	0	0	0	0	0	0	1	1	1	0	0	1	1	0	1	0	1	0	0	1	1

64 63 52 0

Q.3] Flow-chart of Non-Restoring Division.
Ans-a]



12 (Dividend) (Q) = 1100
4 (Divisor) (M) = 0100
4 (Divisor) (-M) = 1100

0100
1011
+ 1
1100

→ Dividing 12 by 4

Operations	A	Dividend (Q)	Count
Initialize	0 0 0 0 0	1 1 0 0	4
1. Shift left	0 0 0 0 1	1 0 0 _	
	+ 1 1 1 0 0		
A + M (-M)	1 1 1 0 1	1 0 0 0	3
2. Shift left	1 1 0 1 1	0 0 0 _	
	+ 0 0 1 0 0		
A + M	1 1 1 1 1	0 0 0 0	2
3. Shift left	1 1 1 1 0	0 0 0 _	
	+ 0 1 0 0		
A + M	0 0 0 1 0	0 0 0 1	1
4. Shift left	0 0 1 0 0	0 0 1 _	
+ (-M)	+ 1 1 1 0 0		
A - M	0 0 0 0 0	0 0 1 1	0

Result:

A (Remainder) = 0000

Q (Quotient) = 0011 → 3

Ans: This matches 12/4 = 3

Q.5]

Ans-a Multiplying (-15) and (3) using booths algorithm

2's compl of 15

[-15] in binary bits (M) = 110001

[-15] in binary bits (-M) = 001111

[3] in binary bits (Q) = 000011

A = 000000, Q_{-1} = 0 Count = 6

A	Q.s	Q_{-1}	Count	Remar
000000	000011	0	6	Initializ
+ 001111				
001111				A+(-M)
000111	100001	1	5	Shift Righ
000011	110000	1	4	Shift Righ
+ 110001				
110100				A+M
111010	011000	0	3	Shift Righ
111101	001100	0	2	Shift Righ
111110	100110	0	1	Shift Righ
111111	0100011	0	0	Shift Righ

$A = 111111$
$Q = Qd\ 010011$

Result $(A+Q)$ = $\boxed{111111\ 010011}$

$$\begin{array}{r} 000000\ 101100 \\ +\qquad\qquad 1 \\ \hline \boxed{101101} \\ {\scriptstyle 32\ 16\ 8\ 4\ 2\ 1} \end{array}$$

→ 1's compliment

Since MSB = 1 (-ve)

Ans final result is (-45)

Q.6] Given:

Ans. a-] $F(A,B,C,D) = \Sigma m(0,2,7,10,15) + \Sigma d(3,14)$

→

AB \ CD	00	01	11	10
00	1_{0}	$_{1}$	X_{3}	1_{2}
01	$_{4}$	$_{5}$	1_{7}	$_{6}$
11	$_{12}$	$_{13}$	1_{15}	X_{14}
10	$_{8}$	$_{9}$	$_{11}$	1_{10}

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

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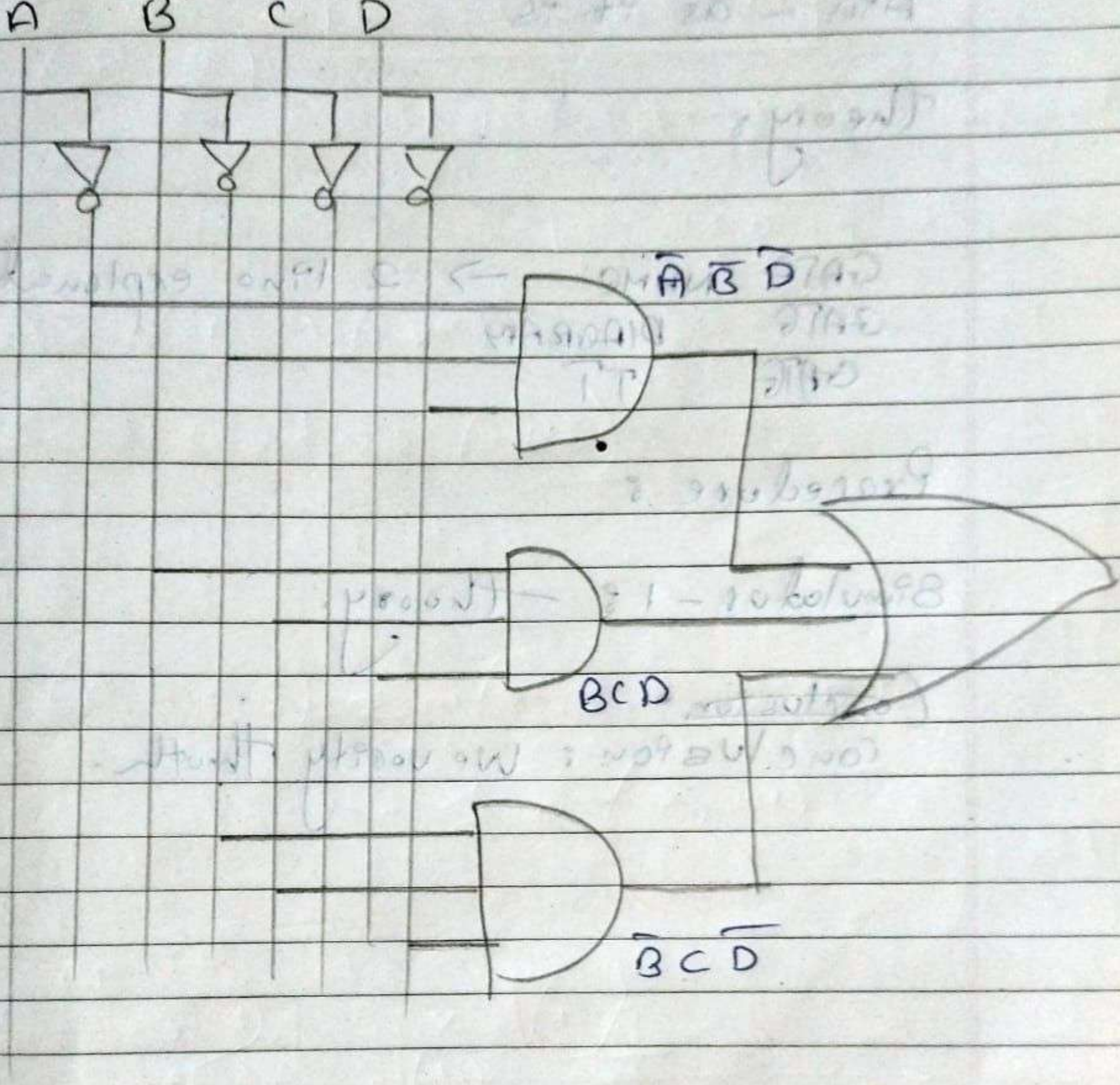
Logic Gates



COA Dec 2024

Q.1] Ans-c]

Given number : -10.125

IEEE 754 "single precision method"

Sign bit = 1 (-ve)

→ Step 1:

Converting the given numbers to binary format

2	10	
2	5	0
2	2	1
	1	0
		1

$0.125 \times 2 = 0.25 \quad 0$

$0.25 \times 2 = 0.5 \quad 0$

$0.5 \times 2 = \quad 1$

$$[10.125] = \underbrace{1010}_{10}\ \underbrace{001}_{0.125}$$

ii. Step 2:

Normalising the binary number:

$\rightarrow [1010.001]_2$

$\rightarrow [1.\underbrace{010001}_{\text{Mantissa}} \times 2^{3}] \rightarrow E$

iii. Step 3:

finding the value of E'

$E' = E + 127$

$= 3 + 127$

$\boxed{E' = 130}$

iv. Converting the value of E' to binary format

2	130	
2	65	0
2	32	1
2	16	0
2	8	0
2	4	0
2	2	0
	1	0
		1

$\therefore E' = 10000010$

v. Step 5:
Single Precision format (32-bit)

sign bit, E', Mantissa

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

32 31 23 0

Q.2] Ans-a] Multiplying (-8) and (5) using Booth's algo.

[-8] in binary format (M) = 01000

1's compliment → 10111

$+ \quad 1$

2's compliment 11000

$\therefore M = 11000$

$-M = 01000$

Q [multiplier] = 00101

A = 00000

$Q_{-1} = 0$ Count = 5

A	Q's	Q_{-1}	Count	Remark
00000	00101	0	5	Initialize
+01000				
01000				A+(-M)
00100	00010	1	4	Right Shift
+11000				
11100				A+M
11110	00001	0	3	Right Shift
+01000				
00110				A+(-M)
00011	00000	1	2	Right Shift
+11000				
11011				A+M
11101	10000	0	1	Right Shift
11110	11000	0	0	Right shift

Result (A) = 11110 & (Q) = 11000

(AQ) = $\boxed{1111011000}$

Discarding the redundant and extra sign bit at MSB.

So the Result becomes = $\boxed{111011000}$ → 9 bits

000100111 → 1st compliment

+ 1

$\boxed{000101000}$

32 16 8 4 2 1

note = 32 + 8 = $\boxed{40}$

The answer is correct for (-8) × 5 = 40

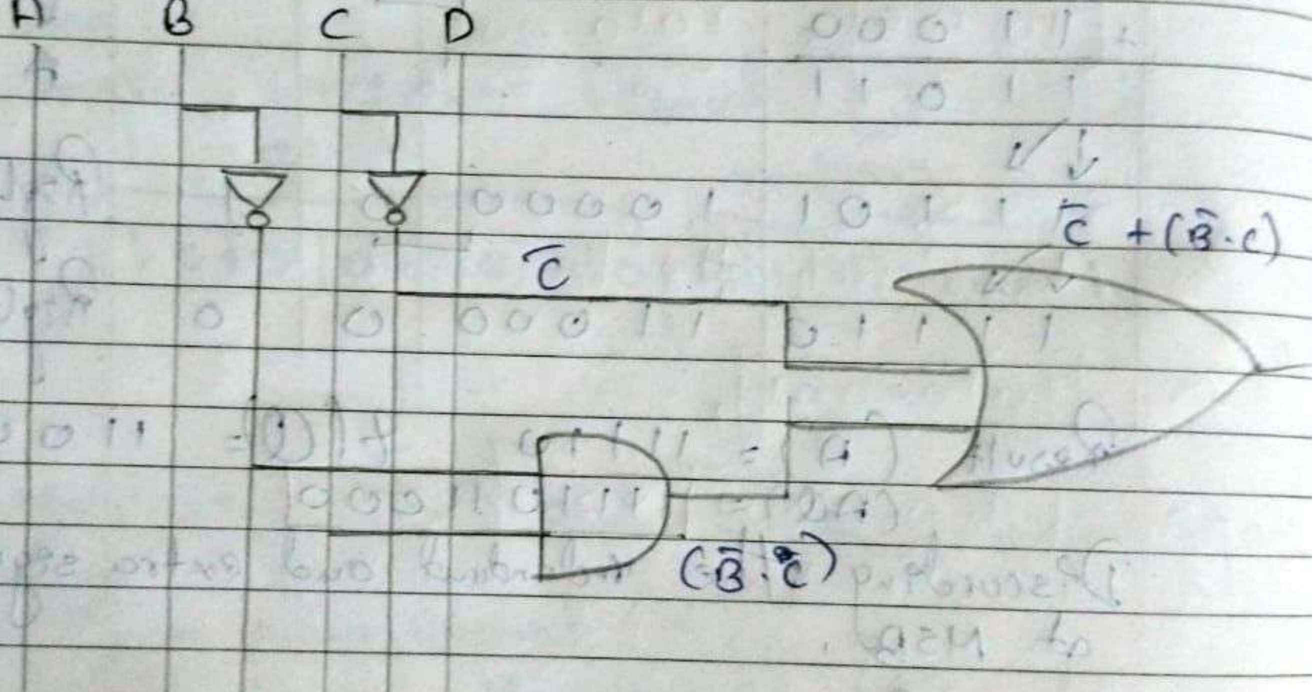
Q.3] Ans]

→ $f(A,B,C,D) = \sum (0,1,2,3,4,5,8,9,10,11,12,13)$

AB \ CD	00	01	11	10
00	1 (0)	1 (1)	1 (3)	1 (2)
01	1 (4)	1 (5)	(7)	(6)
11	1 (12)	1 (13)	(15)	(14)
10	1 (8)	1 (9)	1 (11)	1 (10)

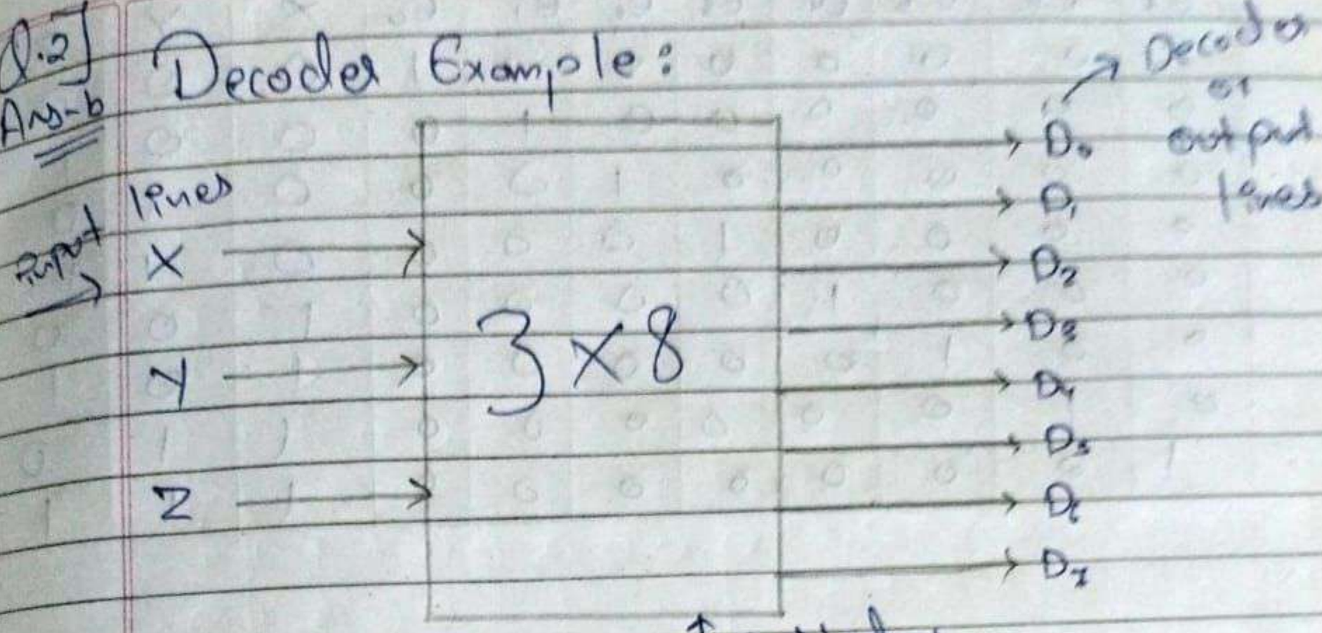
$f = \bar{C} + (\bar{B} \cdot C)$

Logic Gates



Q.2] Ans-b

Decoder Example:

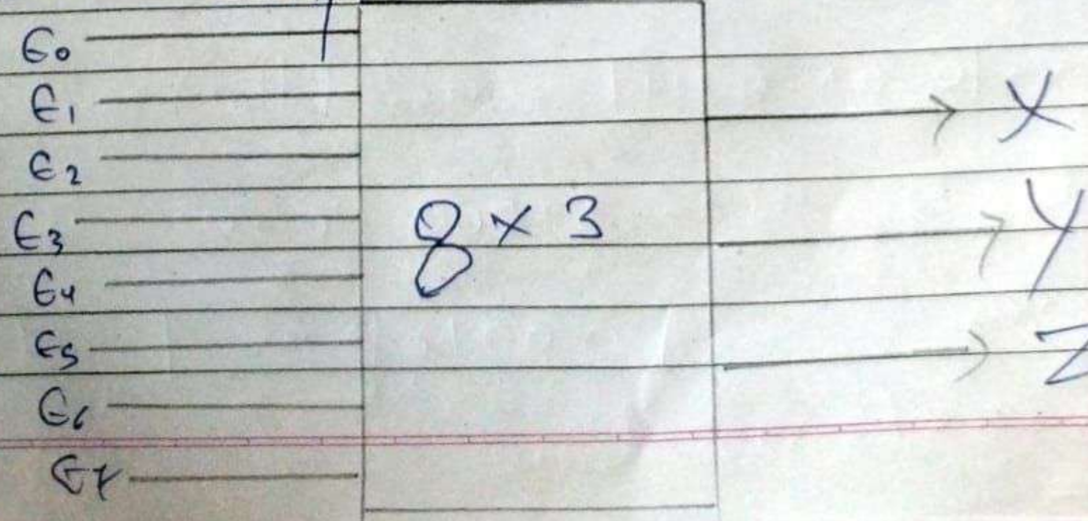


$\boxed{n : 2^n}$

Input lines — output lines

X	Y	Z	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	1	0	0	0	0	0	0	1	0	0
0	1	1	0	0	0	0	1	0	0	0
1	0	0	0	0	0	1	0	0	0	0
1	0	1	0	0	1	0	0	0	0	0
1	1	0	0	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

Encoder Example:



E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0	X	Y	Z
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1